WFUMB 2017 TAIPEI

The 16th World Federation for Ultrasound in Medicine and Biology Congress in 2017 in conjunction with the 9th Asian Conference on Ultrasound Contrast Imaging and Chinese Taipei Society of Ultrasound in Medicine Annual Convention

ABSTRACTS

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October 13-17
2017

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Convention Center(TICC)

Taipei, Taiwan

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ULTRASOUND IN MEDICINE AND BIOLOGY

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Taipei, Taiwan

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AIMS AND SCOPE

Ultrasound in Medicine and Biology is the official journal of the World Federation for Ultrasound in Medicine and Biology. The journal publishes original contributions that demonstrate a novel application of an existing ultrasound technology in clinical diagnostic, interventional and therapeutic applications, new and improved clinical techniques, the physics, engineering and technology of ultrasound in medicine and biology, and the interactions between ultrasound and biological systems, including bioeffects. Papers that simply utilize standard diagnostic ultrasound as a measuring tool will be considered out of scope. Extended critical reviews of subjects of contemporary interest in the field are also published, in addition to occasional editorial articles, clinical and technical notes, book reviews, letters to the editor and a calendar of forthcoming meetings. It is the aim of the journal fully to meet the information and publication requirements of the clinicians, scientists, engineers and other professionals who constitute the biomedical ultrasonic community.

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T1. Basic Science, Instrumentation, Quality Control and New Tech

Symposium

T1-15-IN01

Ultrasound Guided Procedures in the Point of Care Setting

Michael Blaivas, MD, MBA
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Ultrasound guidance is revolutionizing clinicians' abilities to perform procedures in the point of care setting. Many established procedures are made safer and more precise by decreasing complication rates and time to perform the procedure. However, ultrasound guidance is allowing many clinicians to perform invasive procedures which they would not traditionally attempt, such as regional anesthesia under ultrasound guidance. The expansion of point of care procedures performed by clinicians improves patients' access to safe and timely procedures which decrease morbidity, pain and sometimes save lives. Yet, despite the incredible ability ultrasound provides for direct visualization and guidance of various needles, wires and devices, clinicians should not become emboldened that mistakes with ultrasound cannot be made. Additionally, there are signs of misunderstanding by some that complications cannot occur when ultrasound is used for procedural guidance, despite the fact that studies indicate proper care and training are still required.

T1-15-IN02

Ultrasound Elastography Principles & Application in Liver

Giovanna Ferraioli
Ultrasound Unit, Department of medical sciences and infectious diseases, Fondazione IRCCS Policlinico San Matteo, University of Pavia, Pavia, Italy

Elastography shows the biomechanical properties of the tissues whereas B-mode ultrasound shows their acoustic properties. These properties are not related to each other. Elastography can be considered a virtual palpation: under a stress, stiffer tissues show less longitudinal displacement and higher speed of transverse displacement.

Elastography techniques are based or on the assessment of the longitudinal displacement of the tissue induced by a stress, as in strain elastography and acoustic radiation force impulse (ARFI) imaging, or on the assessment of the speed of the transverse displacement of the tissue as in shear wave elastography. In strain elastography a part of the body is compressed axially by pressing across its surface and the internal tissue displacement is converted to a strain image (percentage of deformation), because the percentage of deformation will be constant whereas displacement decays with depth. In the ARFI imaging the acoustic radiation force generates a localized displacement of a few microns in the ultrasound axial direction. ARFI generates also shear wave displacement at one point (point shear wave elastography) or along several lines (2D-shear wave elastography).

Liver stiffness is directly related to liver fibrosis. Several studies and meta-analyses have assessed the accuracy of the available shear wave elastography (SWE) techniques, i.e. vibration controlled transient elastography (VCTE), point SWE and 2D-SWE, for the staging of liver fibrosis. VCTE was the first technique available and it needs a dedicated device that doesn't give a morphological assessment of the liver parenchyma. The advantages of the SWE techniques incorporated in ultrasound systems are that the same system can be used for the evaluation of morphologic changes or the detection of focal liver lesions and the B-mode image is a guidance for the stiffness assessment. Confounding factors should always be taken into account in the interpretation of the results, that should be evaluated in the clinical setting. In fact, liver stiffness increases in cases of acute hepatitis or transaminase flares, congestive heart failure, feeding and extrahepatic cholestasis. In patient with liver cirrhosis, liver stiffness is associated with the risk of decompensation, liver cancer, and death.

Elastography could give additional information for the characterization of focal liver lesions, however the large overlap between values observed in benign and malignant lesions limits the use of the technique.

T1-15-IN03

Fusion Imaging for RF Ablation of HCC

Won Jae Lee
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As is known, radiofrequency (RF) ablation is one of major treatment options for small hepatocellular carcinomas (HCCs), and is performed mostly under the ultrasound (US) guidance. However, it is not infrequently encountered when small HCCs are inconspicuous during US-guided RF ablation. The main purpose to develop fusion imaging of US with CT/MRI was to overcome this drawback of US in order to perform successful RF ablation. Currently, different types of fusion imaging techniques have been developed, and their usefulness in performing RF ablation of HCCs have been described as well. Besides, fusion imaging can be used together with contrast-enhanced US, which sometimes plays an important role to facilitate successful RF ablation of HCC. In this lecture, we introduce essential principles of some fusion imaging techniques, demonstrate various fusion imaging methods for performing RF ablation of HCC with or without contrast-enhanced US, and finally describe published results of fusion imaging–guided RF ablation of HCC.

T1-15-IN04

Ultrasound System Development and Elastography

Yu-Hsin Wang
Biomedical Technology and Device Research Laboratories, Industrial Technology Research Institute, Hsinchu County, Taiwan

Shear wave elastography (SWE) is an ultrasound imaging modality which can estimate the tissue elasticity by measuring the speed of the ultrasound-induced shear wave and thus assesses the biomechanical information. To obtain accurate the assessment, the ultrasound system first has to be designed with high data transmission rate and bandwidth to capture the transient shear wave propagation in the soft tissue. Effective push wave is the other factor to achieve sufficient signal-to-noise ratio for computational processing. In the study, we investigate the challenges in the system design and compare the push wave for the SWE. As real-time SWE is

implemented with the GPU acceleration, we apply the technology to monitor the thermal treatment process of radio frequency ablation. Hopefully, the technology can help to delineate the thermal-damaged region and avoid unnecessary treatment in normal tissue.

T1-15-IN05

Effect of Low-Intensity Ultrasound Stimulation on the Attenuation of Mechanical Properties of Fibrous Tissue

Chun-Feng Lai, Jaw-Lin Wang
Institute of Biomedical Engineering, National Taiwan University, Taipei, Taiwan

The effect of low intensity ultrasound on the mechanical properties of soft tissue such as tendon is not well understood. In this study, the rat tail tendons were used to determine the effect of ultrasound on the mechanical properties of tendon fiber. Twenty two collagen fibers were extracted from rat tail tendon fibers. The collagen fibers were separated into two groups, one with and one without ultrasound stimulations. Cyclic loading test within toe-region of collagen fibers were conducted in degassed water. The intensity and frequency of the ultrasound was 70 mW/cm^2 and 1 MHz respectively. The results showed the tangent modulus of the collagen fiber in the ultrasound group was reduced from 300 MPa to 250 MPa in comparison to the control group. Further mechanical test and analysis of mathematical model should be done to understand the mechanism and reaction between ultrasound and the stiffness of the soft tissue.

Free Paper

OPT1-001

The Influence of Ventilation on Pulmonary Capillary Hemorrhage Induced by Diagnostic Ultrasound

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Objectives: Pulmonary capillary hemorrhage (PCH) can be induced by diagnostic ultrasound, presenting a potential risk of patient lung injury. Diagnostic ultrasound pulses generate small acoustical radiation pressures on the blood-air barrier, a possible physical mechanism for PCH. The influence of reduced or increased trans-capillary stress on PCH during ventilation was assessed.
Methods: Rats anesthetized with ketamine and xylazine were intubated by tracheostomy for ventilation at 75 bpm and 15 cm H2O with zero or ±4 cm H2O end expiratory pressures (EEPs). Rats were imaged at 7.6 MHz during ventilation in a warm water bath using a CL15-7 probe on a Philips HDI 5000 ultrasound machine. A low Mechanical Index (MI) was used for aiming and then was raised to 0.37, 0.52, 0.7, 0.9 or 1.1 for 5 min to asses exposure responses in different groups with n=6. The PCH area was measured on the lung surface.
Results: PCH was revealed in real time by growing comet tail artifacts in the image. For MI=1.1, PCH was 8.0±6.5 mm2 for 0EEP, 1.7±3.8 mm2 for +4EEP ($p<0.001$), and 25.7±6.5 mm2 for -4EEP ($p<0.001$). MI Thresholds (mean of MIs with $p<0.05$ and $p>0.05$ relative to shams) were 0.6 for 0EEP, not determinable for +4EEP ($p=0.2$ at MI=1.1) and 0.45 for -4EEP.
Conclusions: +4EEP virtually eliminated, but -4EEP increased the PCH during ventilation. These small EEPs apparently subtract or add to trans-capillary stress from acoustical radiation pressure generated by diagnostic ultrasound pulses, reducing or enhancing the induction of PCH.

OPT1-002

Why We Need Infection Control Guidelines for Ultrasound Practice

Susan Campbell Westerway,[1] Jocelyne Basseal[2]
[1]Council member, WFUMB Council, ASUM and Charles Sturt University, Australia, [2]ASUM Head Office, Australasian Society for Ultrasound in Medicine

Objectives: The routine ultrasound examination is considered as a non-invasive and safe procedure but a recent worldwide survey on infection control indicated that ultrasound practitioners do not comply with basic disinfection practice. Transducer reprocessing protocols in ultrasound departments vary significantly, from almost non-existent to comprehensive. Ultrasound practitioners undergo extensive training to use the ultrasound technology however most education programs do not cover training in infection prevention and control. It is common that the infectious status of patients is not disclosed prior to an ultrasound procedure, which ultrasound involves contact between an ultrasound transducer and the patient's skin or mucous membranes. The failure to adhere to minimum infection control standards, including the proper cleaning and reprocessing of the equipment and transducers, increases the risk of pathogen transmission and subsequent infection to the operator and to the next patient.
Methods: A search of recent literature revealed many examples of transducer contamination post-scan. These pathogens were assessed for risk factors such as ease of cross-contamination and health related risks.
Results: Pathogens that are found on transducers include MRSA, Enterococcus faecium, Acinetobacter lwoffii, Pseudomonas stutzeri and Clostridium difficile amongst others.
Conclusions: Ultrasound procedures contaminated with pathogenic bacteria can cause disease and may lead to further spread of these organisms.

OPT1-003

Artificial Intelligence for Ultrasonography: Japanese Government Policies

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Objectives: Recently, Deep learning (DL) is attracting attention as a breakthrough in advancing artificial intelligence (AI). DL can be applied to many image processing and computer vision problems with great success. One of its biggest successes has been in computer vision. The Japanese government planned to promote the development of AI technology in cooperation with other entities especially for use in medical industry. From 12th January to 29th March 2017, the Ministry of Health, Labour and Welfare (MHLW) of Japanese government held round-table conferences for the utilization of AI in healthcare. The objectives of this conference were as follows: 1) understanding and selection of AI related technology applicable to medical field, 2), how to utilize AI to healthcare field, 3) to discuss the essential handling for utilization of AI in medical field.
Methods: 10 members of this conference consisted of AI computer scientists, researchers of medical informatics, and medical doctors. The author participated in this committee as a representative of radiologists. Some special AI experts and senior officials of the MHLW were invited to this conference.
Results: DL has been a large impact on medical image analysis applications including ultrasonography, such as computer-aided diagnosis.

The regulatory guidance of the MHLW for AI applications of medical devices would be required. The MHLW would support the construction of multi-center database for supervised learning of AI including ultrasonography.

Conclusions: This conference concluded that diagnostic imaging including ultrasonography has high priority for utilization of AI.

OPT1-004

Remote Breast Ultrasound Image Interpretation System for Multicenter Study (Jabts Bc04 Study)

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Objectives: As interpretation of ultrasound images is often subjective, multicenter studies are conducted to collect more objective data. Centralized image interpretation by ultrasound experts is important to enhance the credibility of diagnosis in multicenter studies. However, it is difficult to control the influence of the interpretation, on the reviewers in a face-to-face meeting. Also, interpreters have a limited amount of time as they perform the study tasks between daily medical practices. To solve these problems, we developed a remote interpretation system for multicenter studies in which multiple assessors could perform the interpretation and discuss the results with each other.

Methods: The system was introduced for the investigator-initiated multicenter study in Japan (JABTS BC04). We, Data Manager set up the system for each interpreter, and the imaging data were randomly allocated to several pairs of image interpreters. First, each interpreter individually evaluated the images on their site and submitted the results to the Data Center cloud. Secondly, we compared the results of each paired interpreters and gave feedback through the internet to them. The interpreters checked the results of their own partner and reconsidered the interpretation results, and submitted the final decision as a pair to the Data Center again.

Results: Independent evaluation was kept systematically. Also, interpreters could perform their tasks when they had time. This reduced time and cost of conducting the Centralized image interpretation.

Conclusions: The remote interpretation system is helpful to perform ultrasound multicenter studies.

OPT1-005

Ultrasonic RF Time Series for Early Assessment of Tumor Response to Chemotherapy: First in Vivo Studies on Mice Breast Cancer Model

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Objectives: To evaluate whether ultrasonic radio-frequency (RF) time series allows assessing early changes in tumor microstructures in early prediction of tumor response to chemotherapy.

Methods: Experiments were approved by the regional animal care committee. Fifty MCF-7 breast cancer bearing nude mice were treated either with cisplatin and paclitaxel or sterile saline. Sequential ultrasound imaging was performed on days 0, 3, 6 and 8 after the treatment to simultaneously collect B-mode images and RF data. The ultrasonic RF data was analysized with MATLAB-based software to extract 6 RF time series features including slope, intercept, S1, S2, S3, S4. The changes in RF time series features were compared to microstructures changes in histopathology.

Results: Treatment with cisplatin and paclitaxel significantly reduced tumor growth in comparison with the control tumors on day 6 and 8 ($P < 0.05$) while there was no significantly change between the control and treated tumors on day 0 and 3 ($P = 0.442$, $P = 0.429$, respectively). Intercept, S1 and S2 were significantly increased and slope was significantly decreased in the treated tumors on day 3, 6 and 8 as compared with day 0 ($P < 0.01$), but not in the control tumors ($P > 0.05$). On day 3, 6 and 8, intercept, S1, S2, S3 and S4 were significantly increased and slope was significantly decreased in treated tumors as compared with control tumors ($P < 0.01$). Tumor cell density was significantly decreased 3 days after treatment as compared with control tumors ($P < 0.01$).

Conclusions: Ultrasonic RF time series analysis provided a simple way to noninvasively assess early tumor response to chemotherapy without injection of any contrast agents.

OPT1-006

Preparation of Phase-Transition Perfluoropentane Nanodroplets Modified by Folate for Ultrasound Molecular Imaging in Ovarian Cancer

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Objectives: This study aimed to develop a hybrid platform based on folate-modified phospholipid-shell and perfluoropentane nanodroplets (FA-NDs), which could in vitro and in vivo target ovarian cancerand enhance ultrasound imaging after acoustic droplet vaporization (ADV) induced by low-intensity focused ultrasound (LIFU).

Methods: The nanodroplet was fabricated with HSPC, DSPE-PEG (2000)-folate, DPPG, cholesterol and perfluoropentane using lipid film hydration method and rotary evaporation method. The nanodroplet stability was evaluated at 4°C and 37 °C respectively. The in vitro targeted efficiency were tested with SKOV3 cells and in vitro ADV was appraised in jellium model with LIFU. The in vivo targeted efficiency and acoustic droplet vaporization were evaluated with SKOV3 tumor-bearing nude mice.

Results: The nanodroplets were successfully prepared with good size uniformity (particle size 321±67 nm). The nanoparticles remained stable for 48 h at 4°C and 1 h at 37 °C. In vitro targeted experiments exhibited a perfect binding efficiency of FA-NDs to SKOV3 cells. In vitro ADV profiles displayed obvious ultrasound enhancement in both B-mode and CEUS-mode when LIFU power was elevated to 5 W. In vivo and ex vivo fluorescence imaging displayed that FA-NDs possessed outstanding specificity to targeted solid tumor. Both the qualitative and quantitative results of in vivo ADV in mice tumor nodule manifested that FA-NDs underwent phase transition upon the LIFU exposure.

Conclusions: The results demonstrated that the FA-NDs system is a potential platform for targeted conjunction and enhancing ultrasound imaging via ADV using LIFU.

OPT1-007

Indocyanine Green and Perfluorocarbon Based Liposome for Multi-Modal Imaging Guided Photothermal Therapy

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Objectives: Due to poor diagnostic rate and therapeutic efficiency, breast cancer is still the death-leading disease for women. And developing single multifunctional nanoparticle that can simultaneously impart both diagnostic and therapeutic functions is urgent.
Methods: Indocyanine green (ICG) and perfluorooctylbromide (PFOB) based liposomes(LIP-PFOB-ICG) were prepared by a two-step emulsion method. Their imaging properties and therapeutic property of photothermal effect were tested in vitro and vivo respectively.
Results: The all-in-one liposomes can facilitate simultaneous fluorescence, photoacoustic, computer tomography and ultrasound imaging. Upon 808nm laser irradiation, the nanoparticles showed obvious photothermal effect and suppressed tumor growth completely.
Conclusions: A versatile liposome is successfully fabricated to realize multi-modal imaging guided therapy of breast cancer. In terms of its precise diagnosis, high therapeutic efficiency and biocompatibility, it shows much potential in the clinical application.

OPT1-008

A Wide Field-of-View Microvascular Imaging based on Diverging Wave Excitation Using a Curved-Array Transducer

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Objectives: Ultrafast Doppler Imaging enables high-sensitivity small vessel imaging using the large amount of spatial and temporal samples within a short acquisition time (Demene C. et al, 2015). However, the ultrafast microvascular imaging using plane-wave excitation may not be suitable for abdominal applications such as hepatic or kidney vessels due to limited field-of-view (FOV) and imaging depth. In this study, we present a wide FOV microvascular imaging method using diverging transmit beams in a curved array transducer.
Methods: For the diverging wave excitation in the curved array transducer, virtual sources for transmit delays are located following the circular arc of the curved shape. In addition, the diverging beam allows a full transmit aperture regardless of the steering angle whereas plane-wave is limited due to beam directivity and curved structure. Therefore, diverging beam based coherent compounding can provide a wider FOV and higher SNR than plane-wave compounding. To compare the performances of the microvascular imaging based on diverging-wave and plane-wave, a kidney was scanned using a C5-2 curved array transducer and each data was acquired with same parameters (10 angles, ±9 degree and 250 ensemble).
Results: In the kidney experiment, the B-mode image using diverging beam produced wider FOV and higher sensitivity due to increased fully overlapping beam regions. The microvascular imaging using diverging beams also showed wider FOV and increased signal-to-clutter ratio compared to the plane-wave imaging (i.e., 11.9 vs. 9.9 dB) at the small vessel region.
Conclusions: The diverging-wave excitation is of great advantage for the ultrafast microvascular imaging in a curved-array transducer.

OPT1-009

Targeted Pegylated Plga-Coated Prussian Blue Nanocomposite for Dual-Modality Pa/Mr Imaging and Synergistic Chemothermal Tumor Therapy

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Objectives: To prepare a PEGylated poly (lactic-co-glycolic acid) (PLGA) targeting with folic acid (FA) coated Prussian blue nanoparticles (PB NPs) and paclitaxel (PTX), to construct multifunctional PLGA-PB-PTX-PEG-FA nanocomposite for both photoacoustic (PA) imaging, magnetic resonance imaging (MRI) and synergistic chemothermal tumor therapy.
Methods: Paclitaxel (PTX)-loaded Folic acid (FA) targeted PEGylated PLGA nanoparticles encapsulating Prussian Blue (PB) (PLGA-PB-PTX-PEG-FA) nanocomposite was fabricated by a modified double emulsion (water/oil/water) evaporation process. The morphology, size, UV–vis–NIR absorbance spectra, Fourier transfer infrared (FTIR) spectrum were tested to evaluate the structural characterization of PLGA-PB-PTX-PEG-FA. Drug Loading and releasing of PLGA-PB-PTX-PEG-FA nanocomposite were assessed by high performance liquid chromatography (HPLC). Additionally, in vitro cell targeting and in vivo tumor targeting were verified by confocal laser scanning microscopy (CLSM) and vital fluorescence imaging (VFI) to assess the targeting effect of PLGA-PB-PTX-PEG-FA nanocomposite. The efficacy of the contrast agent for PA imaging and MRI was evaluated by in vitro and in vivo imaging of subcutaneous MDA-MB-231 tumor-bearing mice following tail intravenous injection of the contrast agent. Finally, to visualize the photothermal cytotoxicity of PLGA-PB-PTX-PEG-FA nanocomposite, MDA-MB-231 cells were incubated with PLGA-PB-PTX-PEG-FA nanocomposite in 96 well-plate for 2 h and were irradiated with or without NIR laser. CCK8 method was used to measure the viability of the cells. To study the photothermal effect and synergistic therapeutic efficacy, PLGA-PB-PTX-PEG-FA nanocomposite suspensions of various concentrations nanoparticle dispersions were exposed to a laser with the wavelength of 808 nm and the output power of 0.647W/cm2 for 10min in vitro or in vivo after vein intravenous injection.
Results: The highly dispersed PLGA-PB-PTX-PEG-FA nanocomposite with spherical morphology has good uniformity with an average hydrodynamic diameter of 236.6±55.04nm. Both PB and PLGA-PB-PTX-PEG-FA nanocomposite displayed a broad absorption band with a strong absorption peak at ~702 nm. While the IR spectrum of the PLGA-PB-PTX-PEG-FA nanocomposite showed both the corresponded peaks of PLGA- PEG-FA and PB NPs. The results of drug loading efficiency and drug loading capacity tested by HPLC were 77.82% and 7.22%. The fast drug release from the nanocomposite in vitro with laser irradiation indicated the great potential as a controlled-release system for the anticancer drug. In vitro cell targeting and in vivo tumor targeting results, targeted group had obvious difference from non-targeted group and blank control group, which showed that good targeting effect to tumor cells or tumor in vivo. After the tail intravenous injection of the PLGA-PB-PTX-PEG-FA nanocomposite, the PA images and MR images of tumor of nude mice were significantly enhanced, while there were almost no distinct enhancement in non-targeted group and blank control group. The result of the photothermal cytotoxicity

of PLGA-PB-PTX-PEG-FA nanocomposite showed that the viability of the cells of PLGA-PB-PTX-PEG-FA nanocomposite+Laser group was lowest. The results of photothermal conversion property of PLGA-PB-PTX-PEG-FA suggested the character of photothermal effect was positively correlated with the heating power and the nanoparticles concentration and exhibited good photostability. Upon near-infrared laser irradiation, the PLGA-PB-PTX-PEG-FA nanocomposite showed an enhanced synergistic photothermal and chemical therapeutic efficacy for breast cancer.

Conclusions: In conclusion, we prepared highly dispersed core-shell structure PLGA-PB-PTX-PEG-FA nanocomposite by coating PB NPs with PLGA-FA shell and then modifying with PEG. The prepared PLGA-PB-PTX-PEG-FA nanocomposite has good biocompatibility, excellent photo-thermal transformation capacity, and can enhance both PA imaging and MR imaging in vitro and in vivo. Furthermore, PLGA-PB-PTX-PEG-FA nanocomposite acts as a multifunctional drug delivery system with higher drug loading capacity and excellent drug controlled release-system. Finally, our result confirmed that PLGA-PB-PTX-PEG-FA nanocomposite has the ability of the synergistic therapeutic efficacy combined photothermal and chemical therapy effect, which further enhances the therapeutic efficacy to breast cancer.

OPT1-010

A Laser-Activated Biocompatible Theranostic Nanoagent for Targeted Multimodal Imaging and Photothermal Therapy

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Objectives: To fabricate Herceptin-conjugated poly (lactic-co-glycolic acid) (PLGA) theranostic nanodroplets (designated as HER-DIR-SPIO-PLGA/PFP), with 1,1'-dioctadecyl-3,3,3',3'-tetramethylindotricarbocyanine iodide (DIR) and superparamagnetic iron oxide (SPIO) nanoparticles encapsulated in the shell, phase-changeable perfluoropentane (PFP) in the core, for the imaging and treatment of HER2-positive breast cancer.

Methods: HER-DIR-SPIO-PLGA/PFP nanocapsules were prepared by a double emulsion process and Carbodiimides method. We evaluated the multimode imaging capabilities of the nanoparticles in vitro using agar-based phantoms. The targeting performance and cytotoxicity of the nanoparticles were examined in cell culture using SKBR3 (over-expressing HER2) and MDA-MB-231 (HER2 negative) cells. We then tested the US/MR/PA/NIRF multimodal imaging properties of the nanoparticles in vivo using a SKBR3 breast xenograft model in nude mice. PTT was conducted both in vitro and in vivo.

Results: The nanoparticles exhibited a well-defined spherical morphology with SPIO evenly distributed in the shell. The average nanoparticle diameter without Herceptin was 278 nm and the Herceptin coating increased the diameter to 298 nm. The zeta potential with and without Herceptin was similar at -1.78 mV and -2.61 mV, respectively. The absorption peak of the nanoparticle constituents is at 764 nm in the near-infrared (NIR) region. The temperature increase of the nanoparticles when irradiated by a near-IR laser (808 nm) is shown, where a steady temperature of 60°C (at 0.5 mg/ml) up to nearly 90°C (at 2.0 mg/ml) was achieved over 10 minutes. All the materials used in this study showed high encapsulation and loading rates. Conjugation of herceptin provided the ability to specifically target SKBR3 cells for both imaging and therapy. The resulting microsized bubbles provide treatment validation through ultrasound imaging. Localization of DIR and SPIO in the tumor region facilitate photothermal therapy for targeted tumor destruction. We demonstrate the imaging and therapeutic capabilities in vitro using cell culture and phantoms, and in vivo using HER2 positive mouse xenograft tumors. The mice treated with HER2 targeted nanoparticles had a nearly complete response to treatment, while the controls showed continued tumor growth.

Conclusions: The HER-DIR-SPIO-PLGA/PFP can be used as an excellent MRI/US/PA/NIRF imaging contrast agent to simultaneously guide and monitor photothermal therapy (PTT), which may provide better diagnostic imaging and therapeutic potential than current methods for treating HER2-positive breast cancer.

OPT1-011

An Integrated De-Speckling Approach for Medical Ultrasound Images Based on Wavelet and Trilateral Filter

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Objectives: Speckle noise is a granular artifact in medical ultrasound images. It causes serious problems and hinders the development of automatic diagnosis technology. A novel and integrated approach is proposed to address the de-noising problem by using wavelet transformation and trilateral filter.

Methods: Firstly, a dynamic additive model is developed to account for the medical ultrasound signal with speckle noise.Secondly, in accordance with the statistical property of the additive model, an adaptive wavelet shrinkage algorithm is applied to the noisy medical signal. Particularly, the algorithm is significant to the high-frequency component of the speckle noise in the wavelet domain. Thirdly, but most importantly, the low-frequency component of the speckle noise is suppressed by a trilateral filter. It simultaneously reduces the speckle and impulse noise in real set data. Finally, a lot of experiments are conducted on both synthetic images and real clinical ultrasound images for authenticity.

Results: Experimental results show the proposed method not only guarantees noise reduction, but also performswell on edge sharpening and offers greater flexibility.

Conclusions: Compared with other existingmethods, experimental results show that the proposed algorithm demonstrates an excellent denoising performance, offers great flexibility and substantially sharpens the desirable edge.

OPT1-012

Identification of Jam-A as a Vulnerable Plaque Marker and Its Implication in Ultrasound-Based Plaque Stability Assessment

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Objectives: Identification of vulnerable atherosclerotic plaques by imaging the molecular characteristics is intensively studied recently. In this study, we aimed to identify novel markers for vulnerable plaques and then develop targeted ultrasound microbubbles for plaque stability assessment.

Methods: Vulnerable and stable plaques were created in rabbits with high cholesterol diet with or without partial ligation of carotid artery respectively. Expression of Junctional Adhesion Molecule –A (JAM-A) at mRNA and

protein levels between vulnerable and stable plaques were compared by qPCR and Western blot. JAM-A antibody conjugated microbubbles (MBJAM-A) or control IgG-conjugated microbubbles (MBC) were developed by conjugating the biotinylated antibodies to the streptavidin modified microbubbles, and visualized by contrast-enhance ultrasound (CEUS).
Results: Significant higher JAM-A expression was found in vulnerable plaques than that in stable plaques. Furthermore, JAM-A was not only expressed in the endothelium, but also abundantly expressed in CD68-positive area. Signal intensity of MBJAM-A was substantially enhanced and prolonged in the vulnerable plaque and some of the MBJAM-A was found colocalized with CD68 positive macrophages. In vitro cell model revealed that some MBJAM-A were able to be phagocytized by activated macrophages.
Conclusions: Our study has found that increase of JAM-A serves as a marker for vulnerable plaques and targeted CEUS would be possibly a novel non-invasive molecular imaging method for plaque vulnerability.

OPT1-013

Diagnostic Algorithm of Cystic Echinococcosis in Rural Setting of Mongolia

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Objectives: Ultrasonography has developed into a powerful tool for diagnosing and staging CE. WHO-CE cyst classification dividing cysts into active (CE1, 2, 3a, 3b) and inactive (CE4,5) is the basis for tailoring the four treatment options albendazole, surgery, percutaneous methods and watch & wait to patients. The classification is still grossly underused in most epidemic countries including Mongolia. Our objective was to explore the knowledge and use of WHO-CE cyst classification and current clinical management in Mongolia.
Methods: A questionnaire on the WHO-CE cyst classification and CE patient management was issued to clinicians of rural health care centres in charge of ultrasound services and a Focus Group Discussion conducted with health professionals.
Results: The ultrasonography doctors in rural health centers have a pivotal role in clinical decision making. However, an unstandardized diagnostic approach and an uncertainty of available treatment in local hospitals are the main challenges, leading to a lack of diagnostic confidence. The majority (90%) of the clinicians did not know about the WHO-IWGE algorithm and 100% willing to participate in the training program.
Conclusions: The majority of the CE patients are from remote, rural areas and have great difficulty in accessing health services. An optimization or standardization of the current CE clinical management in rural hospitals can largely prevent the clinical and financial burden of patients. The training of ultrasonography doctors with WHO-IWGE is the key step for standardization of the clinical management.

OPT1-014

Strain Elastography System with Quality Control - Auto Strain Ratio System

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Objectives: Strain elastography (SE) and shear wave speed imaging provide us with tissue stiffness information that reflects the pathological information, important for breast diagnosis and treatment. And Strain Ratio is a popular diagnosis method of strain elastography evaluation. However, it can be associated with operator bias in image formation, scanning technique, the selection of the appropriate elastography frame, and ROI setting for strain ratio measurement. To overcome these problems, we have developed an "Auto Strain Ratio System (ASRS)", which requires no manual compression whilst scanning, with full auto frame selection on freeze and fully automatic ROI target setting. And a preliminary prospective clinical study was performed in 2015.
Methods: 232 breast masses assessed as BI-RADS Category 3 or above by B-mode images, were scanned using SE. The ASRS values was compared to conventional manual strain ratio measurement (MSR) values by experienced doctors and the diagnostic performance and quality evaluated.
Results: There was a significant correlation between the MSR and ASRS with $R=0.79$ ($p<0.001$). The MSR (cut-off=3.8) had a sensitivity of 89%, a specificity of 75%, an accuracy of 78%, a positive predictive value (PPV) of 52%, and a negative predictive value (NPV) of 96%. The ASRS (cut-off=3.9) had a sensitivity of 82%, specificity of 89 %, an accuracy of 87%, a PPV of 69%, and a NPV of 94%. The AUCs were 0.88 on MSR and 0.89 on ASRS.
Conclusions: We have demonstrated that it is possible to quantify SE and control its accuracy. The ASRS is expected to contribute to the standardization of breast elastography.

OPT1-015

Modeling of the Nonlinear Field Produced by Diagnostic Ultrasound Arrays in Plane Wave Mode

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Objectives: Tissue harmonic imaging (THI) improves images and reduces clutter in diagnostic ultrasound. Plane wave imaging (PWI), enables high frame rates facilitating such innovations as shear wave elastography and new Doppler capabilities. Nonlinear PWI may offer improvements in aberration and reverberation artifacts of synthetic imaging and 3D THI. Our objective is to model the nonlinear field of ultrasound arrays in PWI. Such a field has not been modeled before.
Methods: A numerical solution of the KZK equation was used to model diagnostic ultrasound arrays. In PWI, the full aperture is used without focusing in the azimuthal direction while a fixed lens is used in elevation. We considered the L9-3 (Philips) array (38.2x9mm), elevation focus 20 mm, operating at 3.5MHz. The coefficient of nonlinearity was 5.5 and attenuation 0.3dB/cm-MHz.
Results: Our numerical solution was in agreement with Field II when considering linear propagation (differences $\sim$ 5%). The second harmonic was maximized in the azimuthal plane around 20mm due to the influence of the elevation focus. For MI=1.5 the second harmonic component was within 12dB of the fundamental but decreased with depth after 20mm. The 2nd harmonic of PWI mode was within 8dB of that from a conventional focused field.
Conclusions: The nonlinear field of a diagnostic ultrasound array operating in PWI mode was successfully modeled. Combining PWI and nonlinear propagation will be beneficial in synthetic imaging and 3D THI, where frame rate and image quality is important.

OPT1-016

Disinfection and Hygiene Practice in Medical Ultrasound: WFUMB Survey Results

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Objectives: As ultrasound technology rapidly evolves and is used more frequently in every area of medical diagnosis and treatment, it is overlooked as a potential vector in the transmission of a health care associated infection.
Methods: A survey on the disinfection and hygiene practice in medical ultrasound was disseminated via WFUMB to its 6 member federations and associated ultrasound societies globally. Questions related to transducer disinfection, transducer cover usage, environmental cleaning and basic hygiene practices. Open ended questions provided an opportunity for respondents to discuss further issues with the ultrasound unit.
Results: A total of 1029 responses were obtained, of which 67% comprised of sonographers and the remainder from specialist areas. Alcohol based wipes were used by 30% of respondents to clean external transducers and 12% of respondents to clean intracavity transducers. A total of 71% of respondents used transducer covers every time to scan open wounds, 61% when blood and bodily fluids were present and 76% for an interventional procedure. Open ended responses indicated that a large case load hindered the time required for cleaning and clear guidelines would be beneficial.
Conclusions: Global survey results indicate that users do not comply with basic disinfection practice and there is a gap in knowledge on basic infection control education within the ultrasound unit. As the infectious status of a patient is not often disclosed prior to an ultrasound examination, training on recommended cleaning and disinfection of ultrasound equipment is imperative to mitigate the risk of potential infection.

OPT1-017

Electrode Displacement Strain Imaging for Monitoring Radio-Frequency Ablation

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Objectives: Percutaneous radiofrequency ablation (RFA) is a minimally invasive treatment to thermally destroy tumors, and the success of RFA is highly dependent on adequate ablation zone monitoring. Ultrasound-based electrode-displacement strain imaging is an emerging technique to delineate ablation boundaries, in which the electrode displacement is driven by an external stepper motor and an associated control system. In order to embed this imaging technique in RFA procedures with the least alterations of the RFA system, we conducted this feasibility study to carry out the electrode displacement by miniaturized electronics.
Methods: In our implementation, tiny vibration motors commonly used for vibration alerting in communication devices is attached to the handle of ablation electrodes to drive submillimeter displacements of the electrode, which result in localized tissue deformation within the ablation zone that provides the mechanical stimuli required for strain imaging. Agar phantoms embedded with ablated meatball inclusion in vitro (2.5 cm in diameter) is used in experiments. Initial and displaced ultrasound backscattered signals are obtained and analyzed by one-dimensional cross-correlation to measure tissue displacement for imaging tissue strains.
Results: Electrode-displacement strain imaging implemented with vibration motors can visualize the ablated meatball inclusion similar to that with the use of external stepper motor systems, in terms of sensitivity and accuracy of ablation boundaries.
Conclusions: The implementation of electrode-displacement strain imaging for ablation monitoring with vibration motors is feasible and reliable.

OPT1-018

Preparation of Phase-Change Nanodroplets and an Experimental Study

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Objectives: To investigate the vaporization threshold of perfluoropentane encapsulated lipids nanodroplets and their feasibilities in assessing radio-frequency ablation margins in vitro.
Methods: The nanodroplets with lipids shell and perfluoropentane (PFP) kemel was prepared by a Homogenization/emulsion method of which the size and zeta potential were measured by dynamic light scattering instrument (DLS). The phase change of perfluoropentane (PFP) nanodroplets (PFPNDs) stimulated by temperature rise was observed with the inverted optical microscope and ultrasonography. Echo intensity of bubbles generation from nanodroplets was calculated at different temperature points to plot the temperature-intensity curve. The temperature at the margins of hyperechogenicity zones generated from radiofrequency ablation (RFA) under ultrasonic guidance in tissue-mimicking phantom were measured with a thermocouple probe.
Results: The mean diameter of PFPNDs was 479.9±18.8nm. A few bubbles were observed at 50°C for PFPNDs with the inverted optical microscope, while a mass of bubbles generated rapidly from PFPNDs at 60°C, partly coalesced and ruptured ,and most of them ruptured at a higher temperature. No bubbles were observed in the Control group. With the ultrasonography, weak echo intensity of bubbles generated from PFPND at 50°C was detected. And when temperature rose to 60°C for PFPNDs or higher, the echo intensity reached peak value. Echo intensity in the Control group was not enhanced. The hyperechogenicity zones in the tissue-mimicking phantom dispersed with PFPNDs presented as elliptic shape along with the RFA needle, and the mean temperature at margin was 60.4°C. Little hyperechogenicity zones irregularly occurred in the Control group.
Conclusions: The prepared PFPNDs can vaporize at given temperature. PFPNDs, with the vaporization threshold closed to the temperature threshold of tissues coagulative necrosis caused by RFA, is potential to assess the radiofrequency ablation margins in real time.

Poster Session

PPT1-001

A Pilot on Radiographers' Audit at Ultrasound: What Is the Passing Score?

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Objectives: 1) To determine the baseline passing score for future audit programme; 2) To determine the inter-rater reliability between the auditors.
Methods: All Doppler ultrasound scans performed by trained radiographers during January to April 2015 were retrospectively reviewed. Non-Doppler scans were excluded. Two radiographers with 20 and four years experiences in Ultrasound performed audit based on specific criteria. Differences in scoring between the auditors were resolved via consensus. One hundred Doppler studies were selected using computerised random number generator. Each study comprised of 14 categories-total scan time, transducer type, contrast and density, depth, calipers, focal zone, artefacts, scale and overall gain, colour box size, Doppler angle, gate size and location, image documentation, findings documentation and discrepancy against histology and imaging tests. Each category was scored 1, 2 or 3. Score 3 implied all criteria were met, score 1 did not meet criteria. The summation score of the 14 categories for each study was documented. Perfect score of 42 (14 categoriesx3) denoted all criteria were met. The median score was defined as the passing score.
Results: The median was 35 and the calculated passing score was 83% (35/42 x100%=83%). The overall inter-rater reliability between the auditors was 0.56.
Conclusions: Our preliminary findings showed that 83% is the objective passing score for audit of Ultrasound radiographers' compliance to standard departmental protocol, clinical and technical competencies. The agreement between the auditors was moderate. The outcome of this audit might be affected by the subjective interpretation of the auditors. However this reflects the inherent nature of the modality.

PPT1-002

Co-Registration Methods for 2D Ultrasound and Nuclear Magnetic Resonance Images

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Objectives: Our study aimed to develop an algorithm for co-registering intra-operative ultrasound images with high-resolution magnetic resonance images recorded pre-operatively.
Methods: The sample consisted of 20 patients with brain tumors undergoing surgery. For each patient, a pre-operative T1-weighted magnetic resonance image recorded on a 1.5 tesla scanner and a set of bi-dimensional trans-operative ultrasound images were recorded prior to the opening of the dura mater. The co-registration algorithm developed to combine both sets of data involved both, the pre and trans-operative stages.
Results: In all patients, the developed algorithm identified, with an error below 5 mm, those NMR image slices corresponding to the ultrasound images. No effect of the variable type of lesions on the percentage of correct algorithm co-registration was detected. The time required for a complete processing cycle ranged between 20 and 45 seconds, closely dependent from the size of the lesions.
Conclusions: Our co-registration algorithm proves to be an efficient tool for continuous intraoperative monitoring of both the anatomy of the tumor and the surrounding brain structures. The algorithm is fully applicable in surgical procedures involving the most common types of brain tumors. Finally, the algorithm's time consumption values are entirely compatible with the requirements and demands from the operating room procedures.

PPT1-003

Deep-Level Controllable Multi-Trap of Acoustic Vortices Generated by Directional Sources

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Objectives: Characterized by the pressure circle and phase spiral, acoustic vortex (AV) can be used to manipulate objects with its orbital angular momentum and rotation torque. Acoustic wave can go into media non-destructively with deeper penetration depth, which makes it possible to manipulate particles inside object using AV. However, the point source based model is not practical for directional sources with big ka values, which are influenced by beam patterns with obvious side lobes.
Methods: Based on the radiation theory of planar piston source and coded initial phase, the physical mechanism of AV is theoretically investigated. The principles of main-AV (M-AV) and vice-AVs (V-AVs) generated by the main lobes and the side lobs of the sources are analyzed. The number and locations of the formed M-AV, V-AVs and the corresponding vortex valleys (VVs) are calculated for different ka values. The proposed theory is verified by numerical studies and experimental measurements for different ka values at the frequency of 1 MHz.
Results: Corresponding to the 8-source experimental system for ka=29.32, the measured axial profiles and the cross-sectional distributions at different heights show good agreements with the simulated ones, and obvious phase spirals of M-AV and V-AVs are also demonstrated. Several VVs with almost pressure zero are also observed on the center axis to form axially controllable multiple traps.
Conclusions: It is demonstrated that, corresponding to the radiation angles of press valleys between the main lobe and the side lobes of sources, VVs with almost pressure zero can be generated on the central axis to form axially controllable multiple traps with the locations controlled by ka adjustment. The results provide the feasibility of deep-level control of AV inside object and suggest the application potential of multiple traps for particle manipulation in biomedical engineering.

PPT1-004

Development and Estimation of the Quality Control Program for Breast Ultrasound in Must-Be Trial: Initial Results

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Objectives: The purpose of this study was to develop a quality control program for breast ultrasound equipment and evaluate the effect and its management status.

Methods: Ultrasound equipment from eight institutions participating in the Mammography and Ultrasonography STudy for Breast cancer screening Effectiveness (MUST-BE) trial were targeted. The phantom image test was performed about linear array transducer with standard phantom for breast ultrasound (ATS-550). Safe and clean inspection consisted of the equipment factors (transducer, monitor, touch panel / keyboard, cord / cable, wheel, air filter) and environmental factors (lighting, ventilation, temperature and noise).

Results: All 17 breast ultrasound equipment underwent quality control test. Uniformity was observed in 14 units (82%) while slightly non uniformity was observed in 3 (18%). The measured values in each item were compared with reference values (RV). In accuracy, mean axial diameter was 55.8±1.6mm (RV, 55mm) and mean lateral diameter was 5.0±0.4mm (RV, 5mm). Contrast resolution of anechoic sphere was 102.1±5.6% (RV, 100%) and echogenic sphere was 99.5±4.3% (RV, 100%). Axial and lateral spatial resolution in both proximal and distal groups was 0.6±0.2mm (RV, ≤ 1.0mm). Near field resolution was 1.1±0.2mm (RV, 3.0mm). Sensitivity was 6.1±0.3cm (RV, ≥5cm) in filaments and 5.7±0.6cm (RV, ≥5cm) in spheres. Clean and safe inspection was managed very well made in all equipment.

Conclusions: Breast cancer screening ultrasound equipment is well maintained with quality control including phantom image test. It is expected that it will be able to maintain efficient management as a standardized breast ultrasound quality control program.

PPT1-005

Effect of a Hypoxic Microenvironment after Radiofrequency Ablation on Residual Hepatocellular Cell Migration and Invasion

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Objectives: RFA can cause the formation of a transition zone between normal liver tissues and necrotic coagulation, where residual carcinoma were exposed to a hypoxic microenvironment. The aim of this study was to investigate the effects of hypoxia microenvironment after RFA on the epithelial-mesenchymal transition (EMT) of residual HCC cells.

Methods: HCC cells underwent heat treatment and were cultured under hypoxic conditions to mimic the aforementioned situation. The expression of HIF-1α, EMT markers and related genes was detected. The cancer stem cells (CSCs) marker and the concentration of TGF-β1 in cell medium were examined. The subcutaneous tumor growth and metastatic ability of the HCC cells were observed.

Results: Compared with their parental cells, hypoxic HCC cells showed changes that include enhanced invasive, metastatic, chemoresistant abilities and the mesenchymal characteristics. There was also a higher percentage of stem-like cells. However, either improving the hypoxic microenvironment or silencing HIF-1α signaling significantly reduced the invasive, metastatic, and chemoresistant potential and reversed the EMT to varying degrees.

Conclusions: A sustained hypoxic microenvironment after RFA may exert a negative impact on the prognosis of HCC patients, minimizing exposure to a hypoxic microenvironment and targeting HIF-1α signaling might be effective strategies for patients who experience insufficient RFA therapy.

PPT1-006

Evaluate Energy Loss Changes within Left Ventricle in 4 Patients with Obstructive Hypertrophic Cardiomyopathy after Modified Morrow Procedure Using Vector Flow Mapping

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Objectives: To evaluate the changes of left ventricle energy loss (EL) in patients with obstructive hypertrophic cardiomypoathy (HOCM) after modified morrow procedure using vector flow mapping (VFM), and to explore its clinical value in evaluating the operation effect.

Methods: Retrospectively analyzed the data from four patients with HOCM treated by modified morrow procedure. Measure the echocardiographic parameters before and after surgery, respectively, and EL of LV was analyzed frame by frame using color Doppler images of a standard apical three-chamber dynamic view on an offline VFM workstation. The average EL of LV isovolumetric contraction phase, ejection phase, isovolumetric relaxation phase and filling phase were calculated.

Results: Compared with preoperative condition, 1). echocardiographic parameters: the left ventricular outflow tract (LVOT) diameter and left ventricular end-systolic volume were obviously increased, the LVOT gradient and the thickness of ventricular septum were significantly decreased, the differences were obviously significant ($P < 0.05$). Systolic anterior motion (SAM) disappeared in all cases. 2). EL value changes: During isovolumetric contraction phase and filling phase, averaged EL values were markedly increased in patient 1 and patient 2 and markedly decreased in patient 4, in patient 3 it was increased a little. During isovolumetric relaxation phase and ejection phase, averaged EL values were markedly increased in patient 1 and patient 2 and markedly decreased in patient 3 and patient 4. As a whole the variation trend was that the EL values in patient 1 and patient 2 increased greatly, but decreased greatly in patient 3 and patient 4.

Conclusions: After modified Morrow procedure, even the normal conditions and echocardiographic parameters were significantly improved in HOCM patients, an increased energy loss may lead to worse outcomes, EL might be an new index for precise and quantitative assessment of intracardiac flow dynamics under different pathophysiology conditions.

PPT1-007

H2O2-Loaded Acoustic Phase-Change Nanoparticles Ehancing Coronary Micro-Circulation Thrombolysis: An in Vitro Study by Low Intensity Focused Ultrasound Irradiation

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Objectives: Thrombolysis and oxygen (O2) supply in coronary microcirculation are crucial for the treatment of acute myocardial infarction (AMI). The biochemical reaction synergized as cavitation effect of perfluoropentane (PFP) nanoparticles has the potential of targeted thrombolysis by ultrasound irradiation while H2O2 in the hydrogen peroxide solution provides O2 in coronary micro-embolization. Therefore, we sought to explore the clinical implication of hydrogen peroxide solution with PFP loaded nanoparticles to develop a novel plan for the treatment of coronary micro- embolization.

Methods: Artery thrombosis was collected by carotid artery injury and stasis in 10 rabbits. H2O2/PFP nanoparticles (group A) were experimented in an in-vitro vascular system with Low Intensity Focused Ultrasound (LIFU) irradiation, comparing with PFP nanoparticles only (group B) and PBS buffer solution as control (group C). Group A, B and C circulated into the system where the thrombosis was placed in the middle. Thrombolysis ratios and pathological slides were analyzed. Dissolved Oxygen Detector (DOD) inspected the volume of O2 in the vascular system after LIFU exposure.

Results: The mean diameter and charge of the nanoparticles were (432.7± 26.8) nm and (-43.87±3.12) mV respectively, which showed uniform size and regular shape under the microscope. When the nanoparticles sonicated by LIFU, they changed phase gradually and transformed into microbubbles (MB). The results showed the highest efficiency of thrombolysis when the irradiation power and time were 5 w, 15 min. The dissolution ratios in group A (42.18±7.4) % was significantly larger than those in group B (29.26±3.2) % and C (7.24±2.63) % ($p < 0.05$). The pathological changes showed that in group A, a significant decrease of red blood cell in the thrombus was observed, and the structure of platelet were disorganized. Compared with group A, there was still considerable amount of red blood cells inside the thrombus with compact structure of platelet trabeculae in group B and C. The DOD showed that along with the increase of H2O2 concentration, the amount of O2 release was rising. For the sake of biosecurity and efficiency, 5% H2O2 was engaged in the experiment which can release (12.2±0.79) mg/L O2.

Conclusions: H2O2/PFP nanoparticles with LIFU performed thrombolysis and provided O2 in coronary micro-circulation, which may establish a novel non-invasive primary treatment protocol of AMI.

PPT1-008

Maternal Exosomes Contribute to the Fetal Cardiac Development Deficiency in Mother with Pre-Existing Diabetes: A Fetal Echocardiography Based Animal Study

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Objectives: Maternal diabetes mellitus induces an increased risk of congenital heart defects (CHD), however, the exact mechanisms are still not fully illustrated. In this study, we explored the possible role of exosomes in the process by combinatory use of fetal echocardiography and cellular biology methods in diabetic mouse model.

Methods: Diabetic pregnant C57BL/6 mice were induced by injection of streptozotocin (STZ) before mating. Circulating exosomes from the diabetic pregnant mice or the control mice were harvested before purification for further analysis and in vivo delivery. MiRNAs inside the exosomes were analyzed by RNA-seq. Exosomes or the analogue gold nanoparticles were fluorescently labeled before tail vein injection for in vivo distribution analysis. To explore the roles of diabetic maternal exosomes in cardiac development, the exosomes from diabetic pregnant mice were delivered into normal pregnant mice and cardiac development was analyzed by echocardiography or histology.

Results: Pre-existing diabetes significantly induces high rate of cardiac developmental deficiency in the mouse model. Compared with the control normal mice, diabetic pregnant mice displayed significant changes of the exosomal contents in the blood, which correlate with the increased cardiac developmental defect. RNA-seq analysis revealed that multiple miRNAs changed more than 10 folds, and bioinformatics revealed their implication in regulating Wnt and other developmental pathways. Moreover, fluorescence labeled exosomes and gold nanoparticles could cross the placenta barrier and infiltrated into the embryonic organs/tissues, including the heart, especially during the early stages of embryonic development. Injection of diabetic maternal exosomes strikingly increased the risk of CHD in the normal recipient pregnant mice.

Conclusions: Phenotyping with small animal ultrasound is a powerful strategy for cardiac developmental biology. Maternal exosomes, at least miRNA components, in diabetes could cross the maternal-fetal barrier and the aberrant miRNAs in the exosomes may contribute to the cardiac development deficiency. Our study would provide new insights in CHD prevention and treatment.

PPT1-009

Myocardium-Targeted Transplantation of Phd2 Shrna-Modified Mesenchymal Stem Cells by Ultrasound-Targeted Cationic Microbubble Destruction Improves Cardiac Function in Myocardial Infarction of Rats

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Objectives: Mesenchymal stem cell therapy has been proposed as a promising therapy for acute myocardial infarction (AMI). However, some studies showed little effect of MSCs on AMI. One of the limitations are low homing efficiency of MSCs at the site of injury. We hypothesis that Ultrasound targeted microbubble destruction (UTMD) technique combined with PHD2 shRNA-modified MSCs enhances the homing efficiency of transplanted stem cells and improves cardiac function in myocardial infarction of rats.

Methods: ①Cationic lipid microbubble was prepared by filming-rehydration and machine vibration. Its concentration, average diameter and zeta potential were measured. The binding capacity with plasmid and contrast-enhanced ultrasound effect was also assessed. ② The plasmid that silence PHD2 gene and carry GFP gene was constructed. Firstly, the cultured MSCs were divided into three groups, including Plasmid, Plasmid + Ultrasound and Plasmid + UTMD to prove that UTMD enhances gene transfection and find optimal transfection parameters by UTMD. Then, to demonstrate that shPHD2-EGFP silence PHD2 gene and induce HIF-1α and angiogenic factor gene, the experimental regimens included Control, EGFP and shPHD2-EGFP; to prove that PHD2 silencing enhances MSCs survival, the MSCs were divided into four groups, including Control, BMSC, BMSC-EGFP and BMSC-shPHD2-EGFP. ③ Rat myocardial infarction models were conducted. Firstly, 30 rats were divided into three groups, including MI, MI-MSCEGFP and MI-MSCshPHD2-EGFP. The MSCs transplantation effect was tested. Then, other 120 rats were divided into four groups, including Control, MI-PBS, MI-BMSCsEGFP and MI-BMSCsshPHD2-EGFP. The echocardiography, histological character and myocardial apoptosis were evaluated.

Results: ① The concentration of CMB was (4.12±0.29) × 109/ml. Its average diameter and zeta potential was (1.67±0.32) μm and (29.18±1.36) mV respectively. The saturated DNA loading capacity for 1×108CMB was (3.56±0.31) μg. And enhancement effect in rat heart was good. ② Compared with Plasmid and Plasmid + Ultrasound groups, the gene transfection efficiency was highest. US intensity

(1.0W/cm2) and exposure time (30s) were relative optimal transfection parameters. The shPHD2-EGFP down-regulated PHD2 and up-regulated HIF-1α after it was delivered into MSCs by UTMD. Meanwhile, the shPHD2-EGFP decreased MSC apoptosis. ③ The number of MSCs for transplantation in MI-Plasmid + UTMD group was higher than MI-Plasmid and MI-Plasmid + ultrasound groups. Four weeks after transfection, compared with the other groups, myocardial apoptosis and scar size at the infarct area reduced in the MI-BMSCsshPHD2-EGFP group ($P<0.05$). Capillary densities in MI-BMSCsshPHD2-EGFP group were increased and left ventricular function had improved ($P<0.05$) over other groups.

Conclusions: UTMD successfully promoted transfection efficiency of plasmid DNA in vitro and increased marrow stem cell homing in vivo, thus improving the efficacy of therapeutic angiogenesis and myocardial function.

PPT1-010

Myocardium-Targeted Transplantation of Phd2 Shrna-Modified Mesenchymal Stem Cells by Ultrasound-Targeted Cationic Microbubble Destruction Improves Cardiac Function in Myocardial Infarction of Rats

Li Zhang
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Objectives: Mesenchymal stem cell therapy has been proposed as a promising therapy for acute myocardial infarction (AMI). However, some studies showed little effect of MSCs on AMI. One of the limitations are low homing efficiency of MSCs at the site of injury. We hypothesis that Ultrasound targeted microbubble destruction (UTMD) technique combined with PHD2 shRNA-modified MSCs enhances the homing efficiency of transplanted stem cells and improves cardiac function in myocardial infarction of rats.

Methods: ① Cationic lipid microbubble was prepared by filming-rehydration and machine vibration. Its concentration, average diameter and zeta potential were measured. The binding capacity with plasmid and contrast-enhanced ultrasound effect was also assessed. ② The plasmid that silence PHD2 gene and carry GFP gene was constructed. Firstly, the cultured MSCs were divided into three groups, including Plasmid, Plasmid + Ultrasound and Plasmid + UTMD to prove that UTMD enhances gene transfection and find optimal transfection parameters by UTMD. Then, to demonstrate that shPHD2-EGFP silence PHD2 gene and induce HIF-1α and angiogenic factor gene, the experimental regimens included Control, EGFP and shPHD2-EGFP; to prove that PHD2 silencing enhances MSCs survival, the MSCs were divided into four groups, including Control, BMSC, BMSC-EGFP and BMSC-shPHD2-EGFP. ③ Rat myocardial infarction models were conducted. Firstly, 30 rats were divided into three groups, including MI, MI-MSCEGFP and MI-MSCshPHD2-EGFP. The MSCs transplantation effect was tested. Then, other 120 rats were divided into four groups, including Control, MI-PBS, MI-BMSCsEGFP and MI-BMSCsshPHD2-EGFP. The echocardiography, histological character and myocardial apoptosis were evaluated.

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Conclusions: UTMD successfully promoted transfection efficiency of plasmid DNA in vitro and increased marrow stem cell homing in vivo, thus improving the efficacy of therapeutic angiogenesis and myocardial function.

PPT1-011

Ultrasound-Targeted Microbubbles Combined with a Peptide Nucleic Acid Binding Nuclear Localization Signal Mediates the Transfection of Exogenous Genes by Improving both Cytoplasmic and Nuclear Import

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Objectives: The development of an efficient delivery systems is critical for non-viral gene therapies used to treat cardiovascular diseases. The cytoplasmic and nuclear membrane barriers reduce delivery efficiency by impeding the import of foreign genes. Thus, a gene delivery system capable of transporting exogenous genes could improve gene therapies. We have employed a novel strategy involving ultrasound-targeted microbubbles and a PNA (Peptide Nucleic Acid) binding NLS (Nuclear Localization Signal).

Methods: Ultrasound-targeted microbubble delivery (UTMD) and the PNA binding NLS were utilized to improve the cytoplasmic import of plasmids and the nuclear intake of the plasmid from the cytoplasm, respectively. We conducted experiments using antibody-targeted microbubbles that specifically recognize the SV40T antigen receptor expressed on the membranes of 293t cells so that ultrasound microbubbles could be gathered around the 293t cell membranes. Furthermore, we inserted the PNA containing the nuclear localization signal (NLS) in the egfp-n3 plasmid DNA, which increased nuclear localization. The nuclear import and gene expression efficiency of the antibody-microbubbles with the PNA binding NLS were then compared with antibody-targeted microbubbles alone or a PNA binding NLS. We specifically investigated the effect of the antibody-targeted microbubbles containing the PNA binding NLS on transfection.

Results: The results indicate that ultrasound and antibody-targeted microbubble delivery (UTMD) significantly enhanced the cytoplasmic intake of exogenous genes and maintained high cell viability. We found the nuclear import and gene expression of combined microbubble and PNA transfected cells were significantly higher than cells transfected with antibody-targeted microbubbles or DNA with only the PNA binding NLS.The quantity of pEGFP-N3 plasmids present in the nucleus increased by more than 3.2-fold relative to the control mircrobubbles and NLS-free plasmids.The data indicate that the gene expression was 2.0-fold greater.

Conclusions: These results demonstrate that UTMD combined with antibody-targeted microbubbles and a PNA binding NLS plasmid significantly improved transfection efficiency by enhancing both cytoplasmic and nuclear DNA import. It's a very promising method for noninvasive and effective delivering target genes or drugs to the targeted to treat cardiovascular diseases.

T2. Breast Ultrasound

Pre-Congress Workshop/Symposium

T2-13-IN01

Contrast-Enhanced Breast Ultrasonography

Toshikazu Ito
Department of surgery, Rinku General Medical Center

SONAZOID® (perflubutane, Daiichi Sankyo) is a ultrasound contrast agent. It is a freeze-dried product for injection that consists of perflubutane gas microspheres stabilished by a membrane of hydrogenated egg phosphatidylserine. By adding water for injection to this product before administration, a suspension of microbubbles with a mean diameter of 2-3 μm is formed

SONAZOID® has been used for the differential diagnosis of focal liver lesions and the detection of malignant tumors in the liver which lack Kupffer cells.

For the screening of breast cancer, inspection and palpation are performed initially, and imaging modalities such as mammography and an unenhanced ultrasound, are also conducted. For a differential diagnosis between benign and malignant lesions and for assessment of the extent of invasion, contrast-enhanced MRI and contrast-enhanced CT are performed, although a definitive diagnosis requires pathological examination.

Compared with contrast-enhanced MRI and contrast-enhanced CT, contrast-enhanced ultrasound (CEUS) has the advantages of excellent spatial, temporal, and contrast resolution as well as the ability to perform continuous real-time monitoring of images during wash-in and wash-out of the contrast agent through the tumor vessels.

The blinded reviewers assessed the lesions of interest for differential diagnosis according to following enhancement pattern (Fig. 1), that one or a few would be enough to make the diagnosis.

Benign: Strong homogenous enhancement of the entire lesion; Weak homogenous enhancement of the entire lesion; No enhancement of the entire lesion

Malignant: Heterogeneous enhancement without clear defect; Heterogeneous enhancement with clear defect(s); Rapid wash-out from the lesion compared with wash-out from the surrounding mammary tissues; Enhancement extending outward beyond the expected borders of the lesion.

Two clinical studies (Phase 2 and Phase 3) were performed to assess the efficacy and safety of contrast-enhanced ultrasound using SONAZOID® for differential diagnosis of breast lesions compared with unenhanced ultrasound and ontrast-enhanced MRI.

A total of 151 patients were enrolled at 5 centers in Japan. Unenhanced ultrasound, contrast-enhanced ultrasound, and contrast-enhanced MR images were independently assessed by three blinded reviewers, who viewed the different images in a randomized sequence and were also blinded to subject characteristics. The observation period for safety assessment was 3 days after contrast administration.

Among 140 patients included in the diagnostic analysis, the accuracy of contrast-enhanced ultrasound (86.7%) was significantly higher than that of unenhanced ultrasound (66.9%) and contrast-enhanced MRI (69.5%) (both $p<0.001$). Sensitivity and specificity of contrast-enhanced ultrasound (92.9%, 84.0%) were also superior to unenhanced ultrasound (86.5%, 58.5%) and contrast-enhanced MRI (86.5%, 62.2%) (sensitivity: $p=0.177$ and $p=0.160$) (specificity: both $p<0.001$). The incidence of adverse events was 9.9%, with adverse drug reactions in 3.3% (all mild).

Compared with unenhanced ultrasound and contrast-enhanced MRI, contrast-enhanced ultrasound using SONAZOID® achieved significantly better diagnostic accuracy and specificity for breast lesions without causing serious adverse reactions.

T2-13-IN02

What is the Best Indication of Breast Contrast-Enhanced Ultrasound?

Keitaro Kamei
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Recently, contrast-enhanced ultrasound (CEUS) exams using perfluorobutane have been found to provide more accurate results than either MRI or conventional ultrasound imaging. Generally, an indication of CEUS include the following: Differential diagnosis of malignant and benign, Decision about target and procedure of intervention, Subsequently to second look US for MRI-detected lesions, Assessment of the spread of breast cancer, and Assessment of response to chemotherapy. CEUS could be a potentially effective method for differential diagnosis of benign and malignant breast lesion. However, the best indication is unknown. CEUS which was performed after Second look US was the best indication in our hospital. Assessment of response to chemotherapy will increase in future.

T2-13-IN03

2nd Look CE-US After MRI

Fumihiro Terasaki, MD
The department of General Surgery, Ogaki Municipal Hospital, Gifu, Japan

It is difficult to identify whether the tumor is malignant or not when the tumor having the high contrast effect in MRI (Magnetic Resonance Imaging). 2nd look CE-US (Contrast Enhanced Ultrasound) after MRI is an effective way to detect the nature of the tumor combined with biopsy. Though, careful scanning technique was needed for successful MRI-ultrasound correlation, 2nd look CE-US of MRI-detected lesions was useful for decision making as part of the diagnostic workup. To verify the efficacy of 2nd look CE-US, we reviewed our cases in the past 5 years retrospectively.

T2-13-IN04

Noninvasively Delivering Therapeutic Monoclonal Antibodies into the Brain–Opportunity in Primary Brain Tumor/ Breast Cancer Brain Metastasis Treatment

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Focused ultrasound with the presence of microbubbles has been noticed to be capable of locally and reversibly disrupting blood-brain barrier (BBB) without causing neuronal damage, and has proven its potential to enhance the delivery of therapeutics into CNS. For those therapeutic agents not being able to naturally cross the barrier into brain, this noninvasive procedure brings new and bright hopes for brain disorder treatments, particularly for these macromolecular antibodies. For example, Avastin is the monoclonal antibodies (mAb) that block the angiogenic pass way and has the potential and clinically approved for brain tumor therapy, however, current clinical treatment is significantly hampered by the BBB. Herceptin is another clinically approved mAb that can effectively block the Her-2 positive breast cancer progression, but again cannot be delivered into the brain once it occurred to

metastasis into brain. Recently, the feasibility of enhanced mAb delivery of Avastin and Herceptin via the focused ultrasound BBB opening has been investigated and showed great promise. In this presentation, the recent status and future perspective of using focused ultrasound to deliver the therapeutic mAbs are overviewed.

T2-13-IN05

Superb Microvascular Imaging for Breast Lesions

Hidemitsu Yasuda
Department of Breast Surgery, National Center for Global Health and Medicine

Superb micro-vascular imaging (SMI) is a new ultrasound technique for vascular examination. Using special filters, SMI can reduce motion effects and preserve high resolution, high frame rate and slow-velocity flow. SMI can detect fine blood flow small than 0.2mm clearly by 14MHZ matrix array probe. It is possible to visualize single blood flow running through the stalk of intraductal papilloma. Increased blood flow around ducts with intraductal spread, which are useful information for breast conservative surgery. Integrated image mode may enable to detect regular distributed blood flows network, which is a feature of benign fibroadenoma, and dense heterogeneous tortuous blood flows which suggest malignant lesions. SMI is an innovative method that has the potential comparable with contrast-enhanced ultrasonography.

T2-13-IN06

Automated Breast Ultrasound Scanner and Computer Aided Diagnosis

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Ultrasound examination of the breast is commonly performed by hand held transducer. The procedure is operator dependent and the examiner will be tired to do screening for many candidates. Automatic scanner of ultrasound is necessary for breast mass screening. It is important to design scanner, image recorder, viewer with computer-assisted detection (CAD) as a system. The authors developed an automatic scanner which scans unilateral breast within 30 seconds. An electric linear probe visualizes width of 6 cm, the probe moves 3 paths for unilateral breast. Ultrasonic images are recorded as volume data by DICOM. Special viewer was created for easy reading. Doctors can diagnose by digital rapid viewing with 3D function. It is possible to show unilateral or bilateral images on the monitor. The viewer is considered enough capability to perform ultrasonic breast cancer mass screening.

This system will contain computer aided tumor detection scheme being developed. Ultrasonic images are handled as volume data, if physician checks the tumor, the tumor location can be checked automatically on digital mark sheet. This is helpful for both screening doctors and for those of further examination site. Dual display of bilateral breast ultrasonic images is also effective for comparative diagnosis of laterality. With all these functions, the system can be used widely for ultrasonic breast cancer mass screening.

T2-13-IN07

Image Quality and Artifact of ABUS

Sung Hun Kim
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3D automated breast ultrasound system (ABUS) was approved in the USA and Europe to conduct screening studies for breast cancer detection as an adjunct to mammography and for screening symptom-free women with increased density of the breast tissue.

Image quality is essential for proper diagnosis and patient management. It should be quaranteed for the use in the practice. Artifacts can interfere with the visibility of abnormalitie and reduce overall image quality. In Mammography Quality Standards Act (MQSA) mammography must meet the highest possible quality standards. However, there is no QSA for ABUS. US FDA advises only 8 hours of training for ABUS.

Image quality in order of image acquisition, comparison with hand-held US and artifacts are introduced. Multilateral effort into improving the image quality and reducing the artifacts should be put forth.

Radiologists need to be familiar with these problems.

T2-13-IN08

Utilities and Interpretation of ABUS (New Vesion, Invenia) for Breast Ultrasound Screening

Dr. Kazutaka Nakashima
Kawasaki Medical School

Automated Breast Ultrasound (ABUS) system was sold by U-systems Inc. from several years ago. And then, the system have developed to Invenia by GE healthcare at 2012. On this year the new Invenia with new workstation system was supplied by GE healthcare. The workstation have a capability to make complete free cross section images by user hope. We can get almost same cross section ultrasound images for all breast area after the examination finished, as that by hand-held ultrasound (HHUS) equipment during examination. Furthermore, we can interpretate the images not only by AP view (as a b-mode by HHUS images) but also CP views. CP view make us to consider the whole breast images and localization the lesion to be diagnosis easily.

On the way of the interpretation of Invenia, we think CP view-first and AP view-second is better, because of the good recognition of speculation and architectural distortion, which are some of most important feature for malignancy. And on CP view, I recommend to look for distortion on first, mass on second, other features third.

In this presentation, I will show the image of ABUS and HHUS and some pathological images together, to know the utilities and interpretation of ABUS.

We think the development of ABUS will change the quality control of breast ultrasound screening.

T2-13-IN09

Reader Study of Sonologist' Performance in Reading Automated Breast Ultrasound (ABVS) Images with the CAD System

Lingyun Bao, MD
Hangzhou First People's Hospital, Zhejiang, China

Purpose: We investigated the effectiveness of using a CADe system as an aid for radiologists in reading ABVS images (Siemens).

Method and materials: A total of 1000 cases were selected from ABVS exams acquired in our institution in 2012. 9 sonologists participated in the study. The CADe system used was the QVCAD System from QView Medical, Inc, Los Altos, California, USA. It is designed to aid sonologist in searching for suspicious areas in the ABVS images. The study employed a cross-over paradigm. The readers read cases in randomly assigned orders, reading 50% of the cases with the aid of CAD and reading the other 50% without

the aid of CAD. After a 1-month washout period, the readers reread with the aid of CAD those cases that were previously read without the aid of CAD and reread without the aid of CAD those cases that were previously read with the aid of CAD.ROC analysis was used to compare the area under the ROC curve (AUC) of the CAD aided readings to those of the un-aided readings. Additionally, the reading time per case for each reader was recorded.

Results: The AUC were 0.78 for reading with the aid of CAD and 0.74 for reading without the aid of CAD. This difference is statistically significant ($p = 0.015$). Furthermore, the average reading time per case was 9% faster with the aid of CAD.

Conclusion: CAD improves radiologist performance in both accuracy and reading time for the detection of breast cancer using ABVS.

T2-13-IN10

Clinical Experience and Future of ABUS

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Hand held US (HHUS) is very useful in the diagnostic setting such as palpable lump, however lack of reproducibility and operator dependency was known to be drawbacks. Automated breast US (ABUS) is designed to make up the weak point of HHUS and was approved to conduct breast cancer screening as an adjunct to mammography.

ABUS is also useful for diagnostic setting as well as for screening setting. However, ABUS has limitation of interventional procedure and application of elastography and these drawbacks will be improved in future.

Current clinical use and the anticipated features of the future for ABUS are introduced: ABUS screening, second look ABUS, microcalcifications detection, cancer extent evaluation, ductal abnormality and computer aided detection.

T2-13-IN11

Ultrasonography for Non-Mass Breast Lesion (Abnormalities)

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There are various images of breast lesions. The counter of breast tumors are not always clearly defined. Japan Association of Breast and Thyroid Sonology (JABTS) categorized breast lesion into masses and non-mass abnormalities. A non-mass abnormalities refer to lesions that are difficult to recognize as a mass in ultrasound images, which may coexist with mass.

A non-mass abnormality may be able to identify by checking for the following five findings.

1st. Abnormalities of the ducts
2nd. Hypoechoic areas within the mammary gland
3rd. Clustered microcysts
4th. Architectural distortion
5th. Echogenic foci without a hypoechoic area

If the distribution of abnormalities is diffuse, bilateral, or multisegmented, the lesion is classified as category 2. While the distribution is segmented or localized, the lesion is classified as category 3 or higher.

When microcalcifications, increased vascularities and increased stiffness are observed in the same region, the lesion is classified as category 4 or higher.

These findings could lead to diagnose non-invasive ductal carcinoma, intraductal papilloma, fibrocystic changes, inflammation disease, and invasive carcinoma.

T2-13-IN12

Criteria of Diagnostic Accuracy of US for Tumor Less Than 1 cm

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Because breast tumors less than 1cm are usually asymptomatic and found in screening or incidentally, diagnosing lesions as suspicious or not suspicious is important.

To avoid false-positives and overdiagnosis, tumors equal to or less than 5mm do not need further examinations except the lesions showing very suspicious findings such as invasive features or containing echogenic foci. So the main target is tumors between 5mm to 10mm. Cancers of this size show less suspicious features such as irregular shape and even benign lesions are seen somewhat irregular. We attach importance to D/W ratio as an objective indicator. The cut-off level of the D/W ratio is 0.7. Tsukuba Elastography Scores (ES) and comparison with the previous studies and the age of the examinees are also important factors.

T2-13-IN13

How to Reduce False Positive Rates in Breast Ultrasound Screening?

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Ultrasound detects cancers in about 0.40% of women with mammography-negative dense breasts, with a higher contribution in women younger than 50 years. However, false positives are a major concern in screening ultrasound. Several approaches to ultrasound interpretation and breast imaging management have been developed that substantially reduce the frequency of false-positive cases, involving both recall examinations and biopsies, without meaningfully reducing the detection of nonpalpable favorable-prognosis cancers.

Successful methods to reduce the recall rate for screening ultrasound involve (1) obtaining clinical history and physical examination information, (2) confidently and correctly identifying some normal structures and artifacts, and (3) learning to ignore subtle sonographic findings of doubtful significance. Procedure-related changes including fat necrosis and foreign body can be ignored with the proper history. Fat lobule often mimics solid nodule and Cooper's ligament produces architectural distortion and shadowing. Dilated ducts without intraductal masses are incidental benign findings. Complicated cysts can mimic solid nodules. They are nonparallel orientation and often show curvilinear bright line of anterior wall. Oval circumscribed solid masses less than 1cm in size can be followed.

Doppler ultrasound and elastography can help distinguish normal or benign from suspicious solid masses. When a breast lesion categorized as BI-RADS 3 or 4 shows a normal strain on elastography and no vascularity on color Doppler ultrasound, biopsy can be averted. Physicians performed the screening ultrasound could directly evaluate lesions in real-time and reduce patient anxiety and discomfort. By applying these approaches successfully, we will be able to demonstrate convincingly that the benefits of ultrasound far outweigh the risks of false-positive interpretations.

T2-13-IN14

Differential Diagnosis of Pre-Invasive Tumor on Ultrasonography

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The majority of pre-invasive breast cancer is well known as ductal carcinoma in situ (DCIS), which is also the most frequently detected disease in screening mammography. The capability of screening mammography to detect high percentage (usually > 30%) of DCIS, is almost the same capability in detecting suspicious microcalcifications. Although ultrasound is not as good as mammography in detecting microcalcifications, other ultrasound imaging features may help us to detect DCIS without microcalcifications. Carefully inspect the ultrasound images are crucial to detect these pre-invasive breast cancers. By separating the normal heterogeneous glandular tissue versus abnormal proliferative glandular disease or non-mass lesions, we can thus diagnose not only the DCIS, but also papillary carcinomas and other intraductal tumors.

T2-13-IN15

The Potential of Ultrasonography to Detect and Localize Calcifications

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About 10% of calcifications in screening mammography were classified as segmental distribution. The BI-RADS 5th edition (2013) classified the morphology of calcifications into 3 categories based on degree of cancer suspiciousness but not for calcifications distribution. The malignancy rate of segmental calcifications were ranged widely (10∼60%), and problems after core or vacuum assisted biopsy (VAB) for segmental calcifications on screening mammogram are certain percentage of underestimate and progressive histologic changes with subsequent cancer risk. The limitations of stereotactic biopsy (STB) to achieve adequate sample were poor lesions visualization after bleeding in the procedure, patients uncomfortable in maintaining the long time prone position and radiation exposure.

The calcifications retrieval rate was only 71% if the calcifications received ultrasonography (US) guide VAB with 20% underestimate rate. US guide excision of segmental calcifications have some advantages, such as reduce underestimate, relief patient's anxiety of residual proliferative calcifications, especially for ADH and papillary tumor and possible eliminate the future cancer development.

We retrospectively reviewed 2 cohort data of STB and US-guided excision for segmental calcifications in CGMH, the malignancy rate were 17.1% and 30.8%; underestimate rate were 33.3% and 0 %, respectively. The secondary open surgical biopsy in STB was 12.8 %. For grouped calcifications, the malignancy rates after STB and US-guided excision were 17.9%, 18.9%, the upgrade rates were 13.5% and 0%, respectively.

In conclusion, combining the morphology and distribution of calcifications will improve the diagnostic accuracy of calcifications. US guided excisional biopsy still necessary if segmental calcifications presented on US.

T2-13-IN16

Pitfall of Ultrasonographic Diagnosis of Axillary Node before Sentinel Biopsy

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A sentinel lymph node (SLN) is defined as the first lymph node to which cancer cells are most likely to spread from a primary tumor. SLN biopsy is a procedure in which the SLN is identified, removed, and examined to determine whether cancer cells are present. If the resected SLN does not contain metastases, the draining nodal basin is highly unlikely to harbour metastases and complete nodal dissection is not required. Therefore, the SLN status would be a prognostic indicator for patients with breast cancer.

SLN often exists in the axillary region, but it is unknown whether the axillary lymph node observed with B-mode image is a true SLN or not. SLN has usually been detected and diagnosed using radioisotopes and/or dyes practically. But SLN can also be identified with not B-mode but contrast-enhanced ultrasonography (CEUS). Our diagnostic method using CEUS with Sonazoid®, which is a second-generation ultrasound contrast agent and visualized clearly with real-time, would been introduced.

T2-13-IN17

Can Shear Wave Elastography Variables Predict the Pathological Response to Neoadjuvant Chemotherapy in Patients with Invasive Breast Cancer?

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Purpose: This study was designed to evaluate the performance of shear wave elastography (SWE) parameters inin predicting the pathological response of invasive breast cancer to neoadjuvant chemotherapy (NAC).
Methods: The prospective study recruited 25 eligible patients from August 2016 to August 2017. SWE was performed 1 d before biopsy (time point t0, elasticity E0), after the first and second, fourth cycles of anthracycline-based or anthracycline/taxane-based NAC, and compared to a pre-NAC baseline scan. Tumour stiffness was assessed by quantitative SWE velocity. SWE parameters measured included changes in bidimensional tumour size on SWE time, quantitative SWE velocity, the relative changes in them after the first and second, fourth NAC cycles were considered as the variables [Δt1, Δt2, Δt4]. The pathological response was classified according to the residual cancer burden (RCB) protocol, RCB-0 (pCR,0); RCB-I (minimal residual disease, 0-1.36); RCB-II(moderate residual disease, 1.36-3.28); and RCB-III(extensive residual disease, >3.28). The responsive group include RCB 0 and RCB-I, the unresponsive group included RCB II and RCBIII. Correlations between SWE variables and RCB scores were evaluated. The predictive diagnostic performances of SWE parameters, and the predictive RCB (predRCB) score determined by a linear regression model were compared.
Results: SWE variables were significantly different among the RCB 0/I and RCBII/III groups. The SWE variables of Δt2had significantly better diagnostic performance than other variables regarding predicting the pathological.
Conclusions: Our results suggest that SWE can be potentially used as an early predictor of tumor therapy response during NAC for invasive breast cancer.

T2-13-IN18

Ultrasonographic-Guided Clip-Replacement on Breast and Axillary Node

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In recent decades, many breast imaging modalities and treatment options for breast cancer have been widely developed. However, breast investigation has become more complex due to popular breast cancer

screening, the development of several supplemental imaging methods and percutaneous breast biopsy systems, and the sheer multiplicity of treatment options for breast cancers. Herein, the importance of performing an appropriate biopsy with accurate targeting and precise localization of the biopsy site cannot be emphasized enough. Clip placement after breast biopsy is clearly useful, not only for radiologic correlation or follow-up, but also for oncological and surgical planning. As minimizing surgical volume is a goal of not only breast but also axillary surgery, a clip placed after biopsy could be a key to optimal patient management and become a main navigator for targeted therapy. This talk will cover the necessity and indications of clip replacement and relevant issues.

Keynote Speech

T2-14-IN01

Role of Ultrasonography in Breast Cancer Screening: Adjunct or Essential?

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In women younger than 50 years, the reduced benefit of mammographic screening is attributed to increased breast density. Ultrasound (US) detects cancers in about 0.40% of women with mammography-negative dense breasts, with a higher contribution in women younger than 50 years. Actually, cancer detection rate with US is comparable with mammography, with a greater proportion of invasive and node-negative cancers among US detections. False positives, however, are more common with US screening. Several approaches to US interpretation and breast imaging management have been developed that substantially reduce the frequency of false-positive cases, involving both recall examinations, short-term follow-ups and biopsies, without meaningfully reducing the detection of favorable-prognosis cancers. Another barrier to implementing screening US is manpower. Automated breast US (ABUS) systems are designed to resolve these problems and provides reproducible images with 3D planes. ABUS combined with a computer-aided detection and diagnosis (CAD) system can improve radiologist reading time and accuracy. A clinical trial comparing US (either Hand-held or ABUS) and digital mammography can be considered to screen breast cancer in women $<$ 50y or women at elevated risk of breast cancer in East Asia.

T2-14-IN02

Achieving Standardization in Breast Ultrasonography Screening

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The complementary role of hand-held ultrasound for breast cancer screening has been demonstrated in many studies. As hand-held breast ultrasound screening is operator-dependent and a real-time examination, standardization and quality control of hand-held ultrasound screening is difficult. Automated breast ultrasound (ABUS) could separate image acquisition from image review. In addition, the scanning procedure can be standardized. Therefore, ABUS has the advantage of being operator-independent and is feasible for breast ultrasound screening. So far there are, commercial supine and prone ABUS systems including U-systems (now GE), Siemens, Aloka, and iVu systems. We have developed a hand-held ultrasound whole-breast magnetic tracking system. This system is an US image recoding system developed by the Medical Image Processing Lab of National Taiwan University. With the sensor response in the magnetic field, the probe position can be tracked and recorded in the system. During the scanning, the probe position relative to the nipple is specified with the degree, clock, and distance. The tracking images and routes are also shown on the screen for real-time reference and are stored for retrospective examination. As a physician still need a lot of time to review the large ABUS images, misdetection might occur. In order to reduce the review time and misdetection by the physician, the computer-aided detection (CADe) for ABUS images has been developed. A region-based tumor detection method is adopted to provide fast tumor detection.

T2-14-IN03

Implementation of Ultrasonography as Screening Tool-After J-START in Japan

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In November 2015, the results of J-START, the first large scale randomized control trial to examine usefulness of mammography(MG) and adjunctive ultrasound(US) screening for women aged 40-49 were published in the Lancet. In the intervention group which had both MG and US and mostly clinical breast examination (CBE), more cancers, especially invasive small cancers, were detected and interval cancers were less compared to the control group which had MG and mostly CBE. No cancers were detected by CBE in the intervention group. However specificity was low in the intervention group.

In 2016, the Japanese Ministry of Health, Labour and Welfare excluded CBE as the modality of breast screening and MG has become the only modality for screening. The Ministry did not include US because they thought that the base structures and qualified man-power resources were not enough to apply US to papulation based screening.

To perform high quality ultrasound screening, the Japan Central Organization on Quality Assurance of Breast Cancer Screening has been organized two-day ultrasound training course for both technologists and doctors and is going to publish the names of the participants who achieved the prescribed level in the test held at the end of the course. To improve specificity, combined judgement criteria for US and MG results were proposed and the teaching program to broaden the criteria has been held several times.

Based on those efforts, ultrasound screening has becoming popular especially in individual based screening,

Among Japanese women, the concern on the problems of "dense breast" is spreading after press report. There are many problems relating "dense breast", such as imaging definition and inter-observer differences.

We are now trying to solve these problems and to implement high quality ultrasound screening to appropriate objectives.

T2-14-IN04

Verification of Recall Criteria for Masses Detected on Ultrasound Breast Cancer Screening

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Mammography is the only modality for breast cancer screening demonstrated to reduce the mortality rate. However ultrasonographic screening has been already widely performed as the opportunistic screening in Japan. The recall criteria for masses are very important as quality controls. The Japanese recall criteria were made by the consensus of experts. We verified these criteria at multiple institutions and introduce

the result of the verification. Screening performed by the 5 institutions in the various regions in Japan. The total number of cases screened at all 5 institutions was 10,519. The findings that can be concluded as benign are cystic pattern and 3 features of the solid pattern. Cystic pattern was noted in 6,512 cases, typical fibroadenoma was in 1,483 cases and typical complicated cyst was in 70 cases. Only 3 of these 8,065 cases were cancers, so the negative predictive value was 99.9%. Solid pattern with obvious malignant features which are masses with echogenic halo and/or interruption of the interface and mass with multiple echogenic foci were noted in 33cases. Twenty out of 33 cases were malignancy. So the positive productive value was 66.7%. Conclusion Although some part of the criteria should be considered further for verification and revision, the current recall criteria are mostly valid.

T2-14-IN05

Can MRI Be a Screening Tool for Asian High Risk Population?

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Mammography (MMG) has been established as a standard method of breast screening. Ultrasound (US) is expected as supplemental modality of MMG. The other hands, MMG and/or US is not accurate to detect early stage breast cancer in BRCA1/2 mutation carriers. BRCA1/2 mutation carriers tend to have high grade breast cancers in younger age at a high rate, which are rapidly progressing and associated with interval cancers. BRCA1/2 mutation in Asia is proved to exist at the similar rate as in western countries, and the rate of dense breast in Asia is higher than in western countries. Breast MRI has been demonstrated to be useful for such high risk population. So, we need to establish specific models for selecting women at high risk in Asia and perform the screening programs including MRI. Breast MRI as a screening tool should be performed using an abbreviated protocol, which minimizes occupation of the MRI system, reading time and the participant stress.

T2-14-IN06

Integral Multimodality Imaging in Breast Cancer Diagnosis

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Breast cancer had been a common killer of women in worldwide. Breast imaging is an important examination for detecting and evaluating the breast abnormalities, no matter for cancer screening or diagnosis. Conventional mammography and sonography are commonly used in clinical practice, however certain cases of breast lesions could not been displayed due to the technical issue or the lesions' characteristics. Otherwise, portion of lesions were unable be differentiated with morphologic interpretation. Over-diagnosis or under-diagnosis therefore becomes a discussable debate topic that relating to the efficacy of cancer diagnosis. With the recent revolution of computerization, tomosynthesis and contrast-enhanced dual energy mammography were developed and both of them had been proved to provide additional help for cancer detection or diagnosis as compared to conventional mammography. Additionally, enhanced breast MRI is the most sensitive examination for cancers and can solve the problematic cases for the aims of clinical purposes. Understanding the benefits and limitations of the imaging modalities was essential in order to build up the concept of clinical usage of multimodality in cancer diagnosis. Herein, I like to share my clinical experiences in the topic of multimodality for breast cancer diagnosis.

T2-14-IN07

Women with Dense Breasts: Tomosynthetic Mammography or Ultrasonography?

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Conventional 2D mammography is a common modality for the early breast cancer detection. Dense breast tissue is associated with increased risk of breast cancer and decreased mammographic sensitivity (about 40% sensitivity on extremely dense breast). Adding breast tomosynthetic mammography (also called 3D mammogram) or breast ultrasonography to dense-breast mammography can detect more cancers. Advantages of ultrasonography screening for dense breasts are convenient procedure and inexpensive tests, pain-free and no radiation. Disadvantages of ultrasonography involve labor intensive works, higher false-positive rate and not reliable for detecting malignant microcalcifications. High false positive results of ultrasonography may induce more invasive procedure and follow-ups, which can be stressful and scary for patients. In a comparison study of mammography-negative dense breasts, ultrasonography does better than tomosynthetic mammography for mammography occult breast cancer. Ultrasonography needs additional time for a separate test after finding dense breast on mammogram. However, tomosynthetic mammography can immediately carried out as part of the screening mammogram. Disadvantages of tomosynthetic mammography include less sensitivity for breast cancer showing no desmoplastic reaction with overlapping fibroglandular tissue and missed iso-dense cancer in even thin-slice images. Physicians could discuss with screening women with dense breast about the pros and cons of various tests.

T2-14-IN08

AWBUS: Can It Be a Screening Modality?

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Automated whole breast ultrasound system (AWBUS) was approved in the USA and Europe to conduct screening studies for breast cancer detection as an adjunct to mammography and for screening symptom-free women with increased density of the breast tissue.

Several studies have shown that breast cancer detection rates have increased with combination of ultrasound and mammography. Screening ultrasound was presented as the solution to detect the mammographically occult cancer. Recently, studies of screening AWBUS were reported. However, high false positive rates and biopsy rates are problems. There has been no standardized desirable goal of screening ultrasound.

Benefits and harms of screening AWBUS are included in this lesson.

T2-14-IN09

A Multi-Center Study of ABUS for the Diagnosis of Breast Cancer in China

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Purpose: Breast cancer is the most common cancer in women in China and worldwide. Mammography (MAM) is the first choice of breast

screening. However, its practicability is limited in Asian due to dense breast mostly among Chinese women and the younger age of onset. Meanwhile, hand held ultrasound (HHUS) has obvious operator dependent and poor repeatability. Automated Breast Ultrasound System (ABUS) is a potential method to alleviate current challenges in accessible breast cancer screening. This study aims to evaluate the initial effectiveness of ABUS by comparing it with Hand Held Ultrasound (HHUS) and Mammography (MAM) in a hospital-based multicenter study.

Materials and Methods: Women between the ages of 30 to 69 who visited breast surgeons for the first time without visible, suspicious signs of breast cancer were eligible for our study. All participants underwent HHUS and ABUS, and women in the older group (40 to 69 years old) also received MAM. Using the Breast Imaging Reporting and Data System (BI-RADS) lexicon, the images of the lesions were interpreted independently. Image interpretations were done without knowledge of clinical or other imaging results. Lesions classified as BI-RADS 4 or 5 were considered to be "suspicious", and BI-RADS 1 to 3 lesions were assessed as "benign". So far, 1010 eligible women have been enrolled and 656 in the older group. Taking breast as the unit of analysis, we have acquired 2020 HHUS results, 2020 ABUS results and 1312MAM results. The consistency rates and Kappa statistics were calculated to assess the reliability of ABUS compared with HHUS or MAM.

Results: The average subject age was 45.32 (SD 9.756) in the whole group and 50.82 (SD 7.489) in the older group. Of all the 2020 breasts, HHUS detected 395 suspicious lesions and ABUS detected 356 suspicious lesions. Among the 395 suspicious lesions detected by HHUS, ABUS detected 327; In the older group, ABUS detected 275 suspicious lesions and MAM detected 259 suspicious lesions. Among the 259 suspicious lesions detected by MAM, only 41 lesions were undetected by ABUS. Among the 275 lesions detected by ABUS, only 57 were not detected by MAM. The reliability of ABUS and the other two modalities were quite good. Specifically, the consistency rate between HHUS and ABUS was 95.2%, and that between ABUS and MAM was 92.53%. The Kappa value between ABUS and HHUS was 0.8414 and that of ABUS and MAM in the older group was 0.7696.

Conclusions: Fairly good reliability was observed in comparisons between ABUS and HHUS or MAM in our initial analysis. As ABUS is operator independent and it is feasible for all the radiologists with a short term of training to have similar lesion interpretation as HHUS or MAM by specialists. As a result, ABUS is a promising modality in breast imaging.

Free Paper

OPT2-001

Breast Ultrasound Examination Combining B-Mode, Color Doppler and Elastography -Jabts Bc-04 Study Part 5-

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Objectives: In this part of the JABTS BC-04 study, we evaluated the utilities of combining B-mode (B), color Doppler (CD) and strain elastography (E) of the breast.

Methods: Pathology-confirmed breast masses were registered from 16 institutions in Japan. Findings of B, CD, and, if available E, as well as clinical data, were collected. The images obtained were then evaluated by a Centralized Image Interpretation Committee.

Results: In total, 674 solid masses, all of which had been examined using B, CD and E, were analyzed (malignant: 415, benign: 259). Mean ages of patients with malignant and benign masses were 58.6 ±12.5 (mean ± SD) and 44.3 ± 12.5, respectively. Sensitivity and specificity for the Elasticity Score (ES) were 91.3% and 71.4% (ES 1,2 vs 3,4,5). Sensitivity and specificity for B alone, the combination of B and CD (B+CD) and the combination of B, CD and E (B+CD+E) were 98.8%/42.1%, 99.0%/39.0%, and 98.6%/52.9%, respectively. The specificity of B+CD+E was significantly improved relative to the sensitivity of B alone (p=0.014). In premenopausal patients, if vascularity was 3+ or an incident angle near 0° was observed, the B-mode category was increased by one. In patients younger than 40 years of age with oval or lobulated masses, if there was no penetrating flow and vascularity was 0-2+, the B-mode category was reduced by one. We call this a modified evaluation method for CD results. When this was applied, the specificity of B+CD was estimated to improve significantly from 39.0% to 52.1% (p=0.013). Furthermore, using this modified CD evaluation method, the estimated specificity of B+CD+E was 63.3%.

Conclusions: Specificities of benign/malignant diagnosis improved significantly with elastography. Furthermore, specificity is anticipated to improve further with modification of the CD evaluation method in premenopausal women.

OPT2-002

Contribution of the High Resolution Ultrasonography in the Diagnosis of Non-Palpable Breast Cancer with Calcification

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Objectives: In diagnosis of non-palpable calcificated breast cancer (NPCBC), stereo-guided mammotome (ST-MMT) serves as the standard. However, ultrasound resolution has improved dramatically recently. We hypothesized that through ultrasonography, it will become possible to diagnose NPCBC by US guided examination such as fine needle aspiration cytology (FNAC) and core needle biopsy (CNB) with much less invasion than ST-MMT.

Methods: (Study1) The results of ultrasonic detection ability and USGE were examined among the benign lesions of 35 cases and 90 NPCBC patients histologically diagnosed in our facilities from 2010 to 2012. Of the 90 histological types, 74 (82%) were DCIS, and 16 (18%) were invasive carcinoma. (Study 2) The results of 193 progress observation cases from 2008 to 2012 with Birads Category 3 and 4a calcification were examined.

Results: Using ultrasonography (Toshiba Aprio XG), calcification was detected in 88 of the 90 NPCBC lesions as echogenic foci. Two non-detectable lesions were DCIS of Van Nuys 1 and Van Nuys 2. The results of the FNAC were 80% positive and 20% indeterminate (there were no negative cases). In the 88 cases of possible calcified substance extracted through FNAC, 99% were confirmed under microscopic observation. (Study 2) 163 of 193 cases were able to be followed-up every six months

for two to four years. An increase in calcification was observed in nine cases. Five of these cases were diagnosed with DCIS: Four were Van Nuys 1; one was Van Nuys 2. All five cases were of low-grade-malignancy.

Conclusions: The diagnostic method using FNAC to visualize calcification using high-resolution ultrasonography is an effective method to reduce the non-efficient, invasive breast cancer detecting method of ST-MMT. The few low-grade DCIS cases included were not detected with ultrasound. However, we believe it is not a diagnostic error. As a result, we stopped using the ST-MMT from 2010. In spite of this, in the MMG screening performed in our facilities from 2010 to 2012, the detection rate of only a NPCBC without mass on MMG was 0.17 %. This detection rate is excellent in our country.

OPT2-003

Computer Aided Detection of Breast Cancer on Ultrasound Imaging Using Deep Learning

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Objectives: Although breast ultrasound imaging is powerful and effective tool to detect breast lesions and have been widely performed worldwide, it is an operator-dependent test, hence the accuracy for detection and diagnosis of breast lesions depend on the operator. We develop a computer-aided detection system for masses in ultrasound image using deep convolutional neural network.

Methods: A data set containing 818 ultrasound images were collected from our institute. Breast lesions on these images were cropped as 256x256 pixel images manually. All images were flipped horizontally and were collected to make new images. After data augmentation, a total of 2604 images were obtained. These images were labeled and classified by histological tissue type: cyst, concentrated cyst, ductal carcinoma in situ, fibroadenoma, intraductal papilloma, lymph node, invasive lobular carcinoma, mastitis, mastopathic change, mucinous carcinoma, invasive papillotubular carcinoma, phyllodes, tumor, invasive scirrhous carcinoma or invasive solidtubular carcinoma. For training and testing, the data set was randomly divided into a training set and an independent test set with a ratio of 80:20. Classification of data set images were trained using convolutional neural network(CNN) with ten hidden layers including convolutional layers and pooling layers. Its accuracy of classification was evaluated. Data set was also classified as either benign or malignant, and trained using CNN. Its accuracy, sensitivity and specificity were also evaluated.

Results: Images were classified as 14 tissue type and trained. The accuracy for classification of each tissue type was 86.9%. Images were classified as either benign or malignant. The accuracy, sensitivity and specificity were 95.4%, 93.2% and 96.4%, respectively.

Conclusions: We achieved 95% of accuracy for classification from ultrasound imaging using CNN. Deep learning could potentially help detecting and diagnosing the breast cancer, improving accuracy and productivity of diagnosing breast cancer by physician.

OPT2-004

Color Doppler Findings of Malignant Breast Masses -Jabts Bc-04 Study Part 2-

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Objectives: The JABTS BC-04 study was conducted to assess the usefulness of color Doppler. In this part of the study, color Doppler findings of malignant masses were analyzed.

Methods: Breast masses examined by ultrasound between October 2013 and December 2015 were registered from 16 institutions in Japan. We collected B-mode images, color Doppler images and clinical data on these breast masses. A Centralized Image Interpretation Committee evaluated collected images. Vascularity, vascular pattern (penetrating flow, surrounding marginal flow), incident angle and disruption of penetrating vessels on color Doppler were evaluated.

Results: In total, 839 solid malignant masses were analyzed. The mean age of breast cancer patients was 57.7±13.7 years (mean±SD). Vascularity was classified as: 0, 1+, 2+, 3+. The frequency of each class was: 0: 37 (4%); 1+: 220 (26%); 2+: 398 (48%); 3+: 184 (22%). Vascularity was higher in masses with ER-negative ($p<0.001$), PgR-negative ($p<0.001$), HER2-positive ($p<0.001$) and high Ki-67 ($p<0.001$). The vascularity of malignant masses increased as the tumor diameter increased ($p<0.001$). Age and histological type did not impact vascularity. Regarding vascular patterns, only penetrating flow was recognized in 489 masses (58%). Although both penetrating and surrounding marginal flows were recognized in 236 masses (28%), in 146 penetrating flow was dominant. Incident angle frequencies were: 45°≤: 55 (7%); <45°: 409 (49%); near 0°: 186 (22%). Penetrating flow and low incident angle were found significantly more frequently in breast cancers ($P<0.001$).

Conclusions: Vascularity was associated with factors related to the malignancy of breast cancer.

OPT2-005

Minimal Breast Cancer (≤ 5Mm): Ultrasonographic Features with Clinicopathological and Immunohistochemical Characteristics

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Objectives: To investigate ultrasound (US) features, clinicopathological and immunohistochemical characteristics of minimal (pathologic size ≤ 5mm) breast cancers.

Methods: A total of 528 lesions from 475 invasive breast cancer patients were enrolled. US features with clinicopathological and immunohistochemical characteristics were evaluated according to the pathological size (≤ 5mm vs. > 5mm). BI-RADS US final assessments and findings were recorded for each lesion. Final standard references were based on surgical pathologies.

Results: In 528 lesions, 62 lesions were minimal breast cancers (≤ 5mm). On multivariate analysis, an irregular shape, a parallel orientation, a microlobulated margin, an isoechogenicity, absence of posterior feature, and minimal vascularity on US were independent factors predicting minimal breast cancers (all US features $p \leq 0.003$, except irregular shape $p = 0.959$). Final assessment of category 4B was also a predicting factor of minimal breast cancer ($p < 0.001$). Early stage,

no symptom, extensive intraductal carcinoma, and intermediate grade tumor were associated with minimal invasive breast cancers ($p < 0.05$). However, there is no significant association between molecular subtypes ($p > 0.05$).

Conclusions: Minimal breast cancers showed different US findings. Although the minimal breast mass, if a breast mass on US shows an irregular shape, a parallel orientation, a microlobulated margin, an isoechogenicity, absence of posterior feature, a minimal vascularity, and/or the final assessment as category 4B, biopsy may be required.

OPT2-006

"Striped-Strain Features" of Subcutaneous Layer Ensure Appropriate Pre-Load Compression on Breast Us Elastography

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Objectives: Strain US elastography improves specificity and accuracy in breast diagnosis, however, the variations of elasticity image (EI) depending on the manner of manipulation for EI acquisition have been highlighted as a technical issue. Pre-load compression (PLC), defined as the amount of pressure initially applied with the US probe, is one of the factors that influences quality of US elasticity image (EI). In this study, we investigate clinical indication of EI under appropriate PLC.

Methods: Subject comprised of 30 patients with 33 breast lesions who had undergone surgery followed by EI assessment using RTE. An analytical approach to tissue elasticity based on the stress-elastic modulus (Young's modulus) relationship was adopted. The slice sample including the lesion and the surrounding breast tissue was obtained from patient's surgical specimen immediately after resection. Young's modulus of each region was measured ex vivo under constant pre-load compression. The relation between image variations of EI in vivo and magnitude ofstress was investigated as well.

Results: Young's moduli were directly measured ex vivo in surgical specimens ranging from 2.60 kPa (fat) to 16.08 kPa (invasive carcinoma) under the weak-stress condition (0.2–0.4 kPa), which corresponds to the manipulation with appropriate pre-load compression in EI acquisition. In this manner, EIs reveal specific features of "red- and green striped fat" and "blue pectoral muscle" on RTE. The contrast (ratio) of lesion to fat in elasticity ex vivo gradually decreased as the stress applied increased (around 1.0 kPa) on the background of significant non-linearity of the breast tissue.

Conclusions: Our results from ex vivo and in vivo assessment indicate that the differences in non-linearity in elasticity under minimal stress conditions are closely related to the variation in EI quality."Striped-strain features" of subcutaneous layer is simple and helpful as a measure of appropriate pre-load compression in clinically evaluating tissue elasticity.

OPT2-007

Diagnostic Accuracy of Abus with and without Computer-Aided Detection

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Objectives: To measure performance of automated breast ultrasound (ABUS) with and without computer-aided detection (CAD) software.

Methods: ABUS images of 606 women were retrospectively collected. This dataset included malignant lesions (n= 270) that histologically proved by biopsy or surgery, benign (n = 157) lesions that were either biopsied or remained stable and normal cases (n= 179) with >1 year of follow up. All cases were randomly assigned to 3 readers in both 2 groups (experienced group and novice group). First part, 6 readers interpreted AUBS images firstly, and then with CAD to evaluate the two sessions. Second part, the novice readers used CAD only to interpret. Overall accuracy, sensitivity, specificity, positive predictive value(PPV) and interpretation time per case were compared.

Results: Without CAD, the overall accuracy measured by AUC was 0.86 and improved with CAD to 0.90. For novices, was 0.83 without CAD, 0.89 with CAD ($p< 0.05$); for experienced, 0.90 without CAD and 0.91 with CAD ($p>0.05$). The increase in sensitivity and specificity was statistically higher for novices (85.3% to 90.3%, 82% to 86.7%). The PPV of novices and experienced was increased by 4% ($p<0.05$) and 1.1% ($p>0.05$). For novices with CAD only, the overall accuracy was 0.88, and mean interpretation time without CAD was 6 minutes $\pm$1.8, for with CAD only was 3 minutes $\pm$1.3.

Conclusions: CAD for ABUS has the potential to improve the accuracy for breast cancer, especially in novice readers. And with CAD only, a significantly shorter interpretation time can be expected with high accuracy for novices.

OPT2-008

Analysis of Hand Held Ultrasound, Automated Breast Ultrasound System and Mammography in Detecting and Diagnosing Breast Lesions

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Objectives: Our aim of this study is to evaluate the diagnostic value of ABUS comparing with hand held ultrasound (HHUS) and Mammography (MAM).

Methods: Women aged 30-69 in our hospital during February, 2016 to January, 2017 were enrolled and divided to 2 groups (the younger and the older). Women aged 30-39 were received ABUS and HHUS, additionally MAM if the age was over 40. All images were interpreted by eligible doctors to classify according to Breast Imaging Reporting and Data System (BI-RADS) with blind method. BI-RADS Category 3 cases were selected to accept Magnetic Resonance Imaging (MRI) to make sure they were benign. Core biopsy was operated in all BI-RADS Categories 4-5 lesions.

Results: Finally, 226 aged 30-39 years and 394 aged 40-69 years women (totally 620 women) were enrolled. ABUS, HHUS exhibited high sensitivity (97.6% and 96.0%, $P>0.05$) and high specificity (97.5% and 98.5%, $P>0.05$) in the whole group, and the diagnostic accuracies were 97.3 and 98.4% ($P>0.05$). ABUS, HHUS and MAM exhibited high sensitivity (94.5%, 96.0% and 83.8%, $P<0.05$) and high specificity (97.7%, 98.7% and 98.8%, $P>0.05$) in the older group as well.

Conclusions: Good reliability was observed in comparisons between ABUS and HHUS or MAM. As ABUS is an automated system, images can be collected by technicians and interpreted later by qualified doctors, it may be an alternative modality in breast cancer screening in remote or low-resource areas.

OPT2-009

Do We Have to Suffer Pain in Breast Exams? -Compare the Pain Between Digital Screening Mammography, Automated Breast Ultrasound and Hand-Held Ultrasound

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Objectives: Mammography (MAM) and Hand Held Ultrasound (HHUS) are the most common method to screen breast cancer, while Automated Breast Ultrasound System (ABUS) is a new exam for screening. This study aims to compare patients' satisfaction and comfort associated with ABUS, HHUS and MAM. Explore its relationship with BMI, bra size, existence of nodules, nodule shape and breast density, and to evaluate the diagnostic agreement between ABUS and MAM or HHUS.
Methods: Retrospective analysis the satisfaction and pain score of 528 women who performed ABUS, HHUS and the elder women received mammogram examination. These women were asked to estimate the level of pain on a scale of 0-10 (0: no, 10: highest pain). We use non-parametric statistic and Spearman correlation analysis to access the pain score difference in three methods and the relationship with some factors, including BMI (Body Mass Index), bra size, breast density, existence of masses, location and size of masses. Finally, we calculate the sensitivity and specificity of MAM, HHUS and ABUS.
Results: The average age was 51.0±10.9, and the average BMI index was 23.0±2.9. Among them, nearly half of the participants were B cups (45.5%). In this three inspection methods, the highest pain score was MAM [4.0 (2.0, 6.0)], which much higher than ABUS [2.0 (1.0, 4.0)]. And the pain score of ABUS was higher than HHUS [2.0 (1.0, 4.0) vs. 0.0 (0.0, 0.0)], comparison with statistical difference ($P<0.05$). The 92.4% cases were preferred to accept ABUS examination which was similar to accepting of HHUS is 94.7%, but this acceptability was much higher than mammography (45.5%). After statistical analysis, we found that BMI can affect the pain score of ABUS. The correlation coefficient of BMI and ABUS is 0.351 ($P<0.01$), that the heavier the more pain. Bra size is positively correlated with pain of mammography and ABUS (CC=0.120, 0.268; $P<0.05$). But bra size cannot affect the pain score of HHUS. Besides that, the other four factors don't have effect on the pain degree of these three methods. Of all the 528 subjects, HHUS detected 71 suspicious lesions, MAM detected 67 and ABUS detected 70 lesions. The Kappa value between ABUS and MAM was 0.560 ($P<0.05$) and that of ABUS and HHUS was 0.694 ($P<0.05$).
Conclusions: The results show that routine use of ABUS will be well tolerated by patients than mammography and ABUS can be used as a tool in screening for breast cancer.

OPT2-010

Silicone Mastopathy: Correlation Between Ultrasound and Computed Tomography Scan Findings in Silicone Injection of Breasts and Gluteal Regions

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Objectives: Over many decades silicone injections have been used globally for cosmetic breast and buttock augmentations. We present a case report on ultrasound and Computed Tomography (CT) scan findings in a 39-year-old woman. She initially presented with history of gestational trophoblastic disease, underwent CT Thorax and Abdomen for staging. On further clinical history, she claimed to have approached an aesthetic practitioner and received silicone injections in both breasts and gluteal region 10 years ago.
Methods: Case report and literature review
Results: A 39-year old woman, diagnosed with gestational trophoblastic disease, had undergone total hysterectomy, came to Radiology Department for CT Thorax and Abdomen for staging purpose. Ultrasound images demonstrated multiple anechoic cystic lesions surrounded by extensive echogenic regions with acoustic shadowing, giving rise to "snowstorm" appearance. CT scan showed multiple isodense soft tissue nodules of various sizes with surrounding fat streakiness, evenly distributed in both breasts and both gluteal regions.
Conclusions: This case report emphasizes the importance of clinical history and radiological findings of silicone injections in order to avoid misinterpretation of images as tumor/metastasis, which could cause patient discomfort and subjected to unnecessary biospy procedure.

OPT2-011

Twinkling Artifact of Microcalcifications in Breast Ultrasound

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Objectives: In general, twinkling artifact (TWA) is recognized in color Doppler during abdominal ultrasongraphy such as gall stones, pancreatic stones and urolithiasis. In breast disease, TWA is only reported in a few cases with the apocrin cyst and with cholesterol granuloma. Recently, several cases were found in which TWA was observed when the color Doppler was applied to the microcalcifications of various breast diseases. Therefore, we examined the cases with TWA in microcalcifications of category 3 in mammography screening.
Methods: In January 2016 - February 2017, we examined 44 cases of category 3 microcalcifications using color Doppler. Nine cases were biopsied, 7 benign lesions, 2 malignant lesions.We used Aplio 500 or 300 with 14L5 probe.With color Doppler, the speed range was set to MAX so that almost no blood flow information was found, and ROI was set widely so that the whole mammary gland was included. The area considered to be included microcalcifications was scanned to determine the presence or absence of TWA.
Results: In preliminary examinations of microcalcifications in breast diseases, we found TWA can be seen with MAX speed range and with wide ROI. The FFT analysis showed no wave curves of blood flow but only noises in TWA.Among 44 cases, TWA was seen in 28 cases, 63.6%.All nine cases biopsied were positive for TWA.
Conclusions: If TWA is seen, it can be confirmed that echogenic foci are true calcifications.TWA can identify the site of micorcalcifications of category 3. And the core needle biopsy can be done under the color Doppler with TWA.Applications of TWA for microcalcifications in breast disease should be widely used.

OPT2-012

Accurate Measurement of Breast Volume Using Combined Ultrasonographic and Mammographic Parameters by Semi-Ellipsoidal Equation in Median Size Breast

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Objectives: Accurate breast volume (BV) measurement is an essential part for preoperative planning in conserving surgery and oncoplastic breast surgery. Most studies of BV measurement using equations based on cone or elliptical cone shape of breast in western women that usually over-estimate the volume in the oriental small and median size breasts.

Methods: A total of 177 breast cancer specimens weight after skin or nipple sparing mastectomy were collected retrospectively.In current study, we using both mammographic and ultrasonographic parameters to measure breast volume based on the semi-ellipsoidal equation(BV=2/3πRcc*Rmlo*Hus;π:-Pi,Rcc: radius of cranio-caudal(CC), Rmlo: radius of medio-lateral oblique (MLO) views on mammography; Hus: height of breast thickness on ultrasonography).The Hus was measured from nipple projection to the fascial plane of pectoralis major muscle on supine position. The elliptical cone shape volume calculations with all mammographic parameters are, BV1=1/3πRcc*Rmlo*Tcc ; BV2=1/3πRcc*Rmlo*Tmlo, where Tcc, breast thickness on CC view, Tmlo: breast thickness on MLO view. Specimen volume was calculated using specimen weight divided by breast density (0.958)

Results: The mean volume of 177 specimen was 372 cm3 (range 76.6∼1245.4). The thickness of breast on CC view, MLO view of mammogram and ultrasonography were 6.3±2.0 cm, 7.5±21 cm and 1.8±5.7 cm, respectively. The mean error of estimated BV using elliptical cone equation using Tcc and Tmlo were 214 and 289 cm3, with Pearson correction coefficient of 0.859 and 0.84, respectively. The mean error is -27.1 cm3 with Pearson correlation coefficient 0.863 while using ultrasonographic height with semi-ellipsoidal equation.

Conclusions: Combination of ultrasonographic height and mammographic parameters using semi-ellipsoidal equation can more accurate measure the BV in small and median size breasts.

OPT2-013

Color Doppler Findings Differentiating between Benign and Malignant Breast Masses -Jabts Bc-04 Study Part 1-

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Objectives: To conduct a multicenter prospective observational study evaluating the usefulness of color Doppler for differentiating benign from malignant breast masses.

Methods: Pathology-confirmed breast masses examined by breast ultrasound between October 2013 and December 2015 were registered from 16 institutions in Japan. Masses showing no significant change in more than two years were also registered as benign, in this study. B-mode images (static images and video clips), color Doppler images (video clips), elastography (if available) and clinical data on breast masses were collected. Collected images were evaluated by a Centralized Image Interpretation Committee. Color Doppler features such as vascularity, vascular pattern (penetrating flow, surrounding marginal flow) and incident angle were evaluated.

Results: In total, 1578 masses were registered. Of these, 222 masses were excluded for various reasons. Data on 1408 solid masses (malignant: 839, benign: 569) were analyzed. Mean ages of patients with malignant and benign masses were 57.7±13.7 (mean±SD) and 44.8±12.8, respectively. Findings significantly impacting malignancy by multivariate analysis were vascularity 3+ (odds ratio: 4.94), penetrating flow (4.96) and incident angle near 0° (4.34). The frequency of malignancy correlated with the number of these findings. If none of these findings were present, the frequency of malignancy was 28.5%; 1 finding: 73%; 2 findings: 91%; all 3 findings: 96%.

Conclusions: Color Doppler may be useful for benign/malignant diagnosis of breast masses.

OPT2-014

Clinical Analysis of the Outcome of Breast Ultrasound after Screening Mammography as Breast Imaging Reporting and Data System (Bi-Rads) Category 0

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Objectives: To analyze the outcome of further work-up image study as breast ultrasound after the ACR Breast Imaging Reporting and Data System (BI-RADS) category 0 of screening mammography

Methods: Retrospective analysis of a cohort of 38178 average risk women who underwent screening mammography in Chang Gung Memorial Hospital between 2010 and 2012 was performed.

Results: A total of 2207 (5.78%) women were categorized as BI-RADS 0 after undergoing screening mammography. Relative higher percentage of dense breasts were found in 82.8% women under age 40∼50 and 68.6% under age 50∼60. Ultrasound was then followed in 1831 patients (82.9%). Total cases of final assessment BI-RADS Categories 4 and 5 after additional imaging evaluation in BIRADS Category 0 were 223 (10.1%). 98% tissue diagnosis was performed by ultrasound-guided in patients as BIRADS 0. 179 patients was assessed as BI-RADS 4 and 5 after breast sonography. 35 patients (21.1%) as BI-RADS 4 by breast ultrasound were diagnosed to have breast cancer whereas 12 patients (92.3%) with BI-RADS 5 by breast ultrasound had breast cancer. Breast cancer was detected in 52 patients (detection rate 2.35%). No significant difference between mass, microcalcifications and asymmetry or distortion. In total patients with BI-RADS category 0, more invasive cancers were found as 71.2% whereas ductal carcinoma in situ were 28.8%. 14 patients (0.6%) developing internal cancers within 2 year follow-up were observed.

Conclusions: Higher percentage of BI-RADS Category 0 and higher percentage of dense breast were observed in our study. Cancer detection rate was 2.35% in BI-RADS 0 and 98% tissue diagnosis was performed by breast ultrasound guided and very low incidence of interval cancer was found after assessment of breast ultrasound after screening mammography BI-RADS 0.

OPT2-015

Predicting Malignant Invasion of Nipple Areolar Complex Using Preoperative Ultrasound Exam

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Objectives: To retrospectively review ultrasonographic imaging and clinicopathological data to determine which factors are able to predict malignant invasion of the nipple-areolar complex.

Methods: We retrospectively reviewed the medical records of 667 patients with breast cancer who underwent mastectomy between March 2008 and May 2016 at our institution. Of these, the records of 123 patients with breast cancer within 2 cm of the nipple areolar complex were included in this study. Clinicopathological data of the primary tumor and imaging findings from ultrasonography were used to compare the cases with nipple involvement by cancer with those that did not show nipple involvement. The tumor involvement pattern to nipple areolar complex on ultrasonography was categorized to four types; subareolar type, duct dilatation type, abutting type and involving type.

Results: Twenty of the 123 patients had nipple involvement by cancer. Tumor involvement pattern on ultrasnography showed subareolar, duct

dilatation, abutting and involving type in 2, 2, 8 and 8 patients. Perineural invasion, lymphovascular invasion, lymph node metastasis and tumor involvement pattern on ultrasonography were statistically significant factors associated with nipple involvement by cancer.
Conclusions: Preoperative image findings on ultrasonography appear to be effective predictors for nipple involvement by cancer.

OPT2-016

Second-Look Us Using Real-Time Virtual Sonography, A Coordinated Us and Mri System, Improves Detection of Conventional B-Mode Occult Mri-Detected Breast Lesions

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Objectives: Our aim was to evaluate the utility of second-look ultrasound (US) using real-time virtual sonography (RVS) for detection of conventional B-mode (cB-mode) occult MRI-detected breast lesions.
Methods: Between July 2011 and May 2015, 53 consecutive patients who underwent second-look US to identify lesions detected by prone MRI were enrolled in this study. Second-look US using RVS was performed for cB-mode occult MRI-detected breast lesions after an additional supine MRI.
Results: In the 53 patients, 59 lesions were initially detected by prone MRI, followed by second-look US. Of the 59 lesions, 20 (34%) were identified by second-look US using cB-mode. Of the 39 (66%) cB-mode occult lesions, 38 (97%) were detected in supine MRI and 33 (85%) were detected by second-look US using RVS. MRI morphology types of the 33 lesions were as follows: mass, 16; non-mass enhancement, 5; and focus, 12. US-guided biopsy under RVS or excisional biopsy demonstrated that of the 33 lesions, 8 (24%) were malignant, and the remaining 25 (76%) were benign. A total of 53 (90%) MRI-detected lesions were sonographically identified using both cB-mode and RVS ($p < 0.001$). All five remaining US-occult lesions could be followed up under RVS after the enhancing area was marked on the breast surface using RVS.
Conclusions: The findings of our pilot study suggest that second-look US using RVS with additional supine MRI improves the sonographical and histopathological detection rate of cB-mode occult MRI-detected breast lesions.

OPT2-017

Comparison of the Diagnostic Accuracy of Magnetic Resonance Imaging with Sonography in the Prediction of Breast Cancer Tumor Size: A Concordance Analysis with Histopathologically Determined Tumor Size

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Objectives: In order to effectively treat patientswith breast cancer, it is important to know the precise tumor size. We compared the rates of concordance of magnetic resonance imaging (MRI)-derived and sonography-derived breast cancer tumor size with histopathologically determined tumor size.
Methods: Accuracy of MRI and sonography in establishing tumor size was evaluated by comparing preoperative images with postoperative pathologic findings. The accuracy of MRI and sonography was graded as concordance, underestimation, or overestimation and was compared in different subgroups.
Results: A total of 682 patients comprised the study cohort. Mean tumor size was 3.64 ± 1.8 cm via MRI, 2.12 ± 1.0 cm via sonography, and 2.78 ± 1.7 cmvia pathologic examination. The difference between breast sonography and MRI to pathologic tumor field size was -0.68 ± 1.4, and 0.85 ± 1.25 cm, respectively (P\0.001). Sonography had a concordance rate of 54.3 %, an overestimated rate of 9.8 %, and an underestimated rate of 35.9 %. ForMRI, the concordance rate was 44.1 %, the overestimated rate was 52.5 %, and the underestimated rate was 3.4 %. In subgroup analysis, breast MRI had a higher concordance rate in patientswith T3 (5 cm) lesions.When the results of MRI and sonography were considered together, the concordance rate increased from 54.3 to 62.2 %.
Conclusions: MRI tends to overestimate the actual tumor size, while sonography frequently underestimates it. Combined sonography and MRI increases the accuracy of tumor size prediction.

OPT2-018

Are Echogenic Foci on Breast Ultrasound Calcifications or a Suspicious Finding?

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Objectives: We aimed to examine the frequency of breast cancer when echogenic foci were observed in breast screening by ultrasound and whether echogenic foci correspond to calcifications on mammography.
Methods: From April 2011 to March 2012, 68 cases were described as having multiple echogenic foci by ultrasound in breast screening at Tsukuba Total Health Examination Center. The incidence of breast cancer and existence of calcifications on mammography among these cases were retrospectively examined.
Results: Of 68cases, 63cases had either histopathological examinations or follow-ups of more than two years. Breast cancer was diagnosed in 10 cases (16%), and breast cancer frequencies were high when echogenic foci were observed in masses or hypoechoic areas. Among the 52 cases who had mammograms simultaneously or metachronically, 33 cases (57%) were found to have calcifications. In all breast cancer cases calcifications were observed in mammography.
Conclusions: Although echogenic foci observed in breast ultrasound are not necessarily findings strongly suspected of breast cancer, not necessarily calcifications, more accurate diagnosis can be obtained by referring to background mammary features on ultrasound or mammographic findings.

OPT2-019

Assessing the Appropriateness of Our Color Doppler Breast Ultrasound Evaluation Method -Jabts Bc-04 Study Part 4-

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Objectives: Initial JABTS BC-04 study results showed vascularity to differ between benign and malignant masses. Although the vascularity of

malignant masses did not vary with age, that of benign masses was increased in younger patients. We did not consider patient age in our evaluation of color Doppler (CD) results. Our method of CD evaluation in younger patients may thus have yielded overestimates. The purpose of this analysis was to examine the appropriateness of our CD evaluation method.
Methods: JABTS BC-04 study data were used for this analysis. We set certain conditions for CD evaluation, and then calculated sensitivity and specificity.
Results: In total, 1408 solid masses (malignant: 839, benign: 569) were analyzed. B mode sensitivity and specificity were not significantly improved by CD in this study (sensitivity: 97.5%→97.9%, specificity: 38.3%→41.4%). Specificity was lower in premenopausal (<50 years, 39.8%) than in postmenopausal (45.7%) patients. The optimal conditions for CD evaluation were as follows. In premenopausal patients, if vascularity was 3+ or an incident angle near 0° was observed, the B-mode category was increased by one. In patients younger than 40 years of age with oval or lobulated masses, if there was no penetrating flow and vascularity was 0-2+, the B-mode category was reduced by one. Employing this evaluation method, specificity in premenopausal patients was estimated to improve from 39.8% to 48.4% (p=0.013).
Conclusions: The CD evaluation method should be modified to improve specificity.

OPT2-020

Color Doppler Findings of Benign Breast Masses -Jabts Bc-04 Study Part 3-

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Objectives: To evaluate the usefulness of color Doppler (CD), we conducted JABTS BC-04 study. In this part, CD findings of benign masses was analyzed.
Methods: Pathology-confirmed breast masses on which breast ultrasound examination was performed and masses which showed no significant change in more than two years were also registered from October 2013 to December 2015. B-mode images, CD images and clinical data were collected. Collected images were evaluated by a Centralized Image Interpretation Committee.
Results: A total of 569 solid benign masses were analyzed. Mean age of the patients was 44.8±12.8 (mean±SD). Vascularity was classified as 0, 1+, 2+, 3+. The frequency of each class was as follows: 0: 114 (20%); 1+: 241 (42%); 2+: 187 (33%); 3+: 27 (5%). There are two types of benign masses, two year follow-up masses (176, 31%) and biopsied masses (393, 69%). In the follow-up masses, the frequency of typical benign masses (oval shape and circumscribed margin) was high. Furthermore, frequency of low vascularity (p<0.001), penetrating flow (p=0.013) and high incident angle (p=0.026) was low in the follow-up masses. Vascularity increased as tumor diameter increased (p<0.001) and younger age (p<0.001). The mean age of vascularity 0, 1+, 2+, 3+ was 52.0, 44.6, 41.5, 38.5, respectively. However, in malignant masses, the vascularity did not change with age.
Conclusions: In relatively young women, vascularity often increases even in benign masses. This may cause low specificity in relatively young women.

OPT2-021

Is Axillary Scanning Necessary with Negative Finding on Both Mammography and Subsequent Breast Ultrasound?

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Objectives: The purpose of our studywas to assess cancer detection rate and positive predictive value (PPV) for incidentally detected abnormal axillary lymph nodes (LNs) with negative findings on both mammography and subsequent breast ultrasound (US).
Methods: We retrospectively reviewed 13,573 records for screened patients from January 2012 to March 2015 with negative mammography and subsequent breast US results. We reviewed medical charts for US-guided axillary LN biopsy and cytopathological results, records of follow-up US for at least 12 months, family history, and previous operation and past cancer history. We calculated cancer detection rate, PPV for biopsy, axillary biopsy performed, and cancer rate for patients by family history, previous operation, and past cancer history.
Results: We included 7,039 patients (mean age, 52 years) with positive results from US-guided LN biopsy (n=2), or follow-up US (n=7,037). In two patients with positive LNs, none of them from breast malignancy, but endometrial cancer or follicular lymphoma. The calculated cancer detection rate was 0.3 per 1,000 axillary US, PPV for biopsy was14.3%, and axillary biopsy performed rate was 0.2%. Cancer rates were 0% for patients with a family history or previous operation history, 0.1% with past cancer history, and 0.2% for no family, operation or cancer history.
Conclusions: Our results indicated that cancer detection rate and PPV for US were too low to recommend routine axillary scanning including screening breast US in patients with negativefindings on both mammography and subsequent breast US, especially without past history of any cancers.

OPT2-022

Bi-Rads 3 Lesions in Screening Automated Breast Volume Scanner: Comparison with 6-Months Follow-Up Hand-Held Breast Us

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Objectives: To assess the value of automated breast volume scanner as a screening tool for diagnosing BI-RADS category 3 lesions, compared with 6-months follow-up hand-held breast US.
Methods: In this study, total 1117 patients with first screening breast ultrasound examination by ABVS from September 2014 to December 2015 were retrospectively evaluated. We included patients with at least one BI-RADS category 3 lesions and a 6 months follow-up hand-held breast ultrasound exam. BI-RADS category assigned at a 6months follow-up hand-held breast US and pathologic findings in cases undergoing biopsy were collected. Using the BI-RADS lexicons, the images of the category 3 lesion detected by ABVS were analyzed and reasons for changing the BI-RADS category at follow-up hand-held breast ultrasound exam were discussed.
Results: Among the 213 patients was diagnosed as BI-RADS category 3, 41 patients had a 6 months follow-up hand-held breast ultrasound exam. In 41 patients, 62 BI-RADS category 3 lesions were identified. After 6 months, category was downgraded to BIRADS 1/2 in 15/62 (24%) and upgraded to BI-RADS category 4 in 2/62 (3%). BI-RADS category 1 was assigned to 8 cases of misdiagnosed fat lobule and to 4 lesions which were no more detectable. BI-RADS category 2 was assigned to 3 lesions that received a subsequent diagnosis of simple cyst. Biopsy was performed in 2 lesions

which presented size increased at the 6 months follow-up. Pathologic diagnosis of two lesions was non-proliferative change and sclerosing adenosis.
Conclusions: The downgrade rate of BI-RADS category 3 lesion diagnosed by ABVS was high, but a missed cancer had not occurred at 6months follow up. ABVS is a reliable screening tool for diagnosing BI-RADS category 3 lesions.

OPT2-023

The Characteristics of Breast Cancer Detected in Screening Automated Breast Volume Scanner

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Objectives: To evaluate the clinicopathologic factors and ultrasonographic findings of breast cancer detected in screening automated breast volume scanner.
Methods: A total of 15 breast cancer was identified in screening automated breast volume scanner from February 2011 to December 2016. Image findings in automated breast volume scanner were retrospectively evaluated by two radiologists in consensus following the BI-RADS Lexicon. Clinicopathologic data of breast cancers were also collected.
Results: Of the 15 breast cancers, 11 (50.6%) were invasive ductal carcinoma, two were ductal carcinoma in situ, one was tubular carcinoma and one was invasive lobular carcinoma. 15 breast cancers showed irregular shape (12/15, 80%), hypoechoic (9/15, 60%), microlobulated margins (7/15, 46.6%), parallel orientation (11/15, 73.3%) and no posterior feature (9/15, 60%) on automated breast volume scanner. Among the 13 patients underwent surgery in our institute, pathologic tumor size was all T1 stage. Lymphnode metastasis was presented in one patient and metastasis was not reported in all patients.
Conclusions: Automated breast volume scanner is an effective screening tool to detect early stage-breast cancer.

OPT2-024

A Case of Granular Cell Tumor of the Breast

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Objectives: Granular cell tumor of the breast (GCTB) is a rare neoplasm. GCTB is usually benign, but it mimics invasive carcinoma clinically and in image. Ultrasound usually reveals a solid mass with indistinct margin and posterior shadowing suggestive of carcinoma. We present here the unique ultrasound findings obtained.
Methods: Case report and literature review
Results: A 65 year old woman presented with a palpable induration with poor mobility in the upper-inner quadrant of her right breast. The mammogram showed a high density mass with indistinct border in the upper-inner area. Sonography showed a focal lesion, which had an irregular shape with heterogeneous internal echo, i.e., hyperechoic and hypoechoic. The lesion had an indistinct margin, which seems like having an echogenic halo at the boundary. The posterior echo was shadowing so that it was difficult to define the margin between the lesion and the pectoralis major muscle.The elastography showed that the lesion was harder than the surrounding adipose tissue; however the range of hardness was same as that of the lesion. We suspected the possibility of invasive carcinoma; thus, we needed to diagnose the lesion. Therefore, the lesion was diagnosed as a GCTB by using the core needle biopsy. At first she declined to excise the lesion, but 3 years later it grew larger, thus she underwent lumpectomy and it was diagnosed as GCTB.
Conclusions: We experienced GCTB that showed rare findings in sonography. We report this case including the pathological images.

OPT2-025

Fluorescence Imaging Combined with Ultrasound in SLN Biopsy of Breast Cancer

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Objectives: To evaluate the accuracy of preoperative locating sentinel lymph node(SLN) of breast cancer by indocyanine green (ICG) fluorescence imaging combined with ultrasound, and the feasibility of ultrasound-guided core needle biopsy (CNB) of SLN replacing SLNB.
Methods: A total of 89 early breast cancers with negative axillary lymph nodes(by clinical physical and imaging) were preoperative located SLNs by ICG fluorescence imaging combined with ultrasound during Apr 2015 and Jun 2017. The SLNs were underwent ultrasound-guided CNB and marked with breast cancer tissue marker. During the operation, SLNB was performed by blue dye tracer.
Results: 1.The preoperative detection rate of SLN was 100% (89/89) by ICG fluorescence imaging combined with ultrasound. 2. The consistency of preoperative marked SLN and SLN detected in the surgical procedure was 97.8% (87/89). 3.There were 4 metastasis by HE stain and 6 metastasis by CK stain in CNB. Frozen and paraffin pathology showed 15 and 17 cases with metastasis respectively, including 9 cases with micrometastasis in SLNB. The consistency between preoperative CNB of SLN and postoperative pathologic is poor after Kappa consistency test.
Conclusions: 1. ICG fluorescence imaging combined with ultrasound could accurately preoperative determine and locate SLNs with high detected rate. 2. The preoperative marked SLN by ICG fluorescence imaging combined with ultrasound is highly consistent with that by blue dye tracer. 3. This technology may help sonographers to locate the area of SLN rapidly and observe the SLNs carefully. 4. Preoperative diagnosis accuracy of SLN by CNB is slightly worse than that by blue dye. CK stain contributes to finding metastasis in lymph nodes.

Poster Session

PPT2-001

A Questionnaire Survey on Working Environments for Sonographers Engaged in Breast Ultrasonographic Screening in Japan

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Objectives: In Japan, mammography is currently being performed as a population-based screening procedure. However, breast ultrasonography is also being widely used for opportunistic screening. In the Japanese system, ultrasonographers mainly perform handheld ultrasonography and the images are interpreted using static images by physicians. The Japan Association of Breast and Thyroid Sonology (JABTS) and The Japan Central Organization on Quality Assurance of Breast Cancer Screening (COQABCS) jointly conducted a nationwide online survey on working environments for ultrasonographers engaged in breast ultrasonographic screening. The results were compared between ultrasonographers performing breast ultrasonography in facilities (Group-A) and those performing it on mobile screening in remote areas (Group-B) in order to clarify and improve problems.

Methods: The survey was conducted on the JABTS and COQABCS websites after notification between February and April 2016, and responses were collected through the Internet.
Results: A total of 280 ultrasonographers responded. Males and females accounted for 13.3% and 86.7%, respectively. The percentage of each category of occupation was as follows: physiological technologist: 83.8%; radiological technologists: 7.6%; doctors: 7.6%; and nurses: 0.3%. The length of experience was <10 years (46.7%), followed by 5-10 years (26.6%), while those with experience shorter than 1 year accounted for 5.1%. To participate in a 2-day educational and training program for breast ultrasonographic screening, 71.9% answered Yes, while 28.1% answered No. Among the former, 95.8% had passed the certification examination as part of the program. On grouping, 66.7% of the respondents only worked in facilities, while 5% worked only in remote areas; the remaining 28.3% answered that they worked in both. The median number of examinations /hour/sonographer was 5 in Gr-A and 7 in Gr-B. The median number of examinations /day/ sonographer was 13 in Gr-A and 30 in Gr-B. A report was created immediately after each case by 70.3% of Gr-A members, while 69.2% of Gr-B members wrote all reports at the end of screening. Other conditions in Gr-A and -B were as follows: the room light was adjustable: 73.5% and 19.2%; the room temperature was adjustable: 62.4% and 46.2%; the chair seat height was adjustable: 85.1% and 69.2%; examinees personal information was entered using electronic systems, such as barcodes: 51.5% and 15.4%; and comparison between previous and present images was possible: 92% and 60%, respectively.
Conclusions: In Gr-B, a single sonographer tended to perform breast ultrasonography in a remote area, so the number of cases per sonographer was higher. In addition, the conditions, such as room temperature, lighting, and chair were inappropriate; these may adversely affect their health. The medical society in Japan must seriously address this issue.

PPT2-002

Clinical Applicationo of the Automated Breast Volume Scanner (ABVS) in the Diagnosis of Breast Lesions: Single Center Experience

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Objectives: To explore the feasibility of the application of the Automated Breast Volume Scanner (ABVS) in the diagnosis of breast lesions.
Methods: The data of handheld ultrasound (HHUS) scans and ABVS volume three-dimensional (3D) reconstruction were collected from our Women Health Center cases with breast lesions. We include intraductal or subareolar lesions, non-mass lesions, large tumor (> 4 cm), and multicentric breast lesions. Additionally, the sonographic features of the lesions on ABVS imaging were evaluated.
Results: Automatic 3D reconstruction and high-resolution images from the coronal and sagittal planes were obtained using the ABVS. Although the ABVS is similar to HHUS in terms of 2D view (X- and Y- planes). Furthermore, reformatted coronal view (C-plane) presents clear anatomical breast features. Not only perilesional features but also relative locations between lesions could be delineated clearly. Nevertheless, intraductal or subareolar lesions reveal the same features as HHUS. Too large lesion may affect ABVS scanning in positioning, which may cause imaging artifacts easily.
Conclusions: Automatic 3D reconstruction and high-resolution images from three vertical planes can be displayed by the ABVS.

PPT2-003

Comparison of Ultrasound and MR Imaging of Non-Calcified Ductal Carcinoma in Situ with Pathologic Correlation

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Objectives: To illustrate the imaging features of non-calcified ductal carcinoma in situ (DCIS) on ultrasonography and breast MR imaging and to determine the role the imaging studies in the diagnosis and treatment decision of non-calcified DCIS.
Methods: Radiologic images and clinical histories of 34 patients with histologically verified non calcified ductal carcinoma in situ (DCIS) were retrospectively studied. All patients were female and between the ages of 27 and 73 years (mean age, 47.6 years). Mammography (n=34), Breast US (n=34), and Breast MR imaging (n=29) were performed. The diagnosis of DCIS of the breast was pathologically confirmed by means of examination of the specimens obtained at surgical biopsy. We correlated radiologic findings with pathologic results.
Results: All patients were female and between the ages of 27 and 73 years(-mean age, 47.6 years). The mean size was 1.7cm. DCIS is a heterogeneous disease comprising a spectrum of noninvasive malignant tumors of the breast. In the 34 patients who underwent ultrasound, 32 patients presented with abnormal findings: mass(63%), intraductal echogenic lesion(18%), irregular ductal wall thickening or nodularity(15%) and mixed pattern(4%). In the 29 patients who had received breast MRI, a mass was present in 22 patients and irregular ductal enhancement in 7 patients.
Conclusions: Diagnosis of non-calcified DCIS by mammography is challenging. Thus, high resolution US and breast MRI can be essential to decide accurate diagnosis. Comprehensive knowledge of US and MRI findings of non-calcified DCIS of the breast can help early detection and improve prognosis.

PPT2-004

Diagnostic Pitfalls in the Breast Ultrasound

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Objectives: Breast ultrasonography (US) is currently an easy-approached tool in breast imaging and a first-line examination for both detection and characterization of breast masses. It is a well-established adjunct to mammography and is used to improve the specificity of diagnosis.
Methods: However, some factors may be the diagnostic pitfalls of US, affecting its values. For examples, a smaller lesion which is difficult to differentiate by shape and margin, an isoechoic lesion surrounded by fat, a heterogeneous echoic lesion surrounded by a heterogeneous background, deep lesions in huge breasts, subareolar lesions, misinterpretation by a physician, and lesions caused by poor and underdeveloped operator skills.
Results: Recent studies have emphasized the use of tools complementary to B-mode US, including real-time elastography and Doppler imaging, in the evaluation of breast lesions missed on US. Radiologists can take a number of steps that will enhance the accuracy of US image interpretation and decrease the rate of false-negative findings.
Conclusions: The aim of our presentation is to investigate the factors hindering early breast cancer detection and to show our experiences by case presentation. Based on our cases and experiences, we provide our solutions to overcome these factors aiming to an optimum US examination.

PPT2-005

Inflammatory Myofibroblastic Tumors of the Breast with Multiple Metastases to the Brain, Lung, and Pancreas: Ultrasonographic Findings and a Review of the Literature

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Objectives: We encountered a case of inflammatory myofibroblastic tumor (IMT) of the breast with multiple metastases to the brain, lung, and pancreas. Here, we present clinical imaging results and report the significance of sonographic findings of breast IMT along with a literature review.

Methods: Case report and literature review.

Results: A 16-year-old girl with a history of subarachnoidal hemorrhage was admitted to our hospital due to tonic-clonic seizure. Computed tomography (CT) and magnetic resonance (MR) imaging showed multiple mass lesions in the brain, lung, and pancreas and a solitary mass lesion in the left breast. Breast ultrasonography showed a circumscribed oval-shaped low-echoic mass with a central high-echoic region. Power Doppler sonography revealed an unusual spiral-shaped flow signal. Breast tumorectomy was performed for definitive diagnosis, and pathological analysis indicated IMT.

Conclusions: A literature review indicated that ultrasonographic findings of IMT of the breast are nonspecific, as in other systems or organs. It would be difficult to make a diagnosis of primary IMT of the breast preoperatively due to its rarity and the lack of specificity of clinical imaging findings. In addition, the likelihood of IMT of the breast is unlikely in younger patients without an obvious family history of hereditary breast cancer.

PPT2-006

Interobserver Variability of Breast Ultrasound Categorization Modified by the Abcs-K for the Mammography and Ultrasonography Study for Breast Cancer Screening Effectiveness (Must Be) Trial

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Objectives: To evaluate interobsever variability of breast ultrasound categorization based on the Breast Imaging Reporting and Data system (BI-RADS) and modified by the Alliance for Breast Cancer Screening in Korea (ABCS-K).

Methods: Ten breast radiologists with 3-16 years of experience participated in a quality control workshop in March 2016 for the Mammography and Ultrasonography Study for Breast Cancer Screening Effectiveness (MUST BE) trial. Two investigators selected 125 sets of breast lesions, those were pathologically proven to be malignant or clinically proven to be benign showing stability for at least 2-years, and prepared power point slides showing 2 representative orthogonal images per each lesion. After a brief lecture about the modified categorization, 10 radiologists independently categorized the lesions blinding to mammographic images and pathologic results. The interobserver variability were measured using kappa statistics.

Results: The overall and overall weighted kappa values for the modified categorization (2, 3, 4, and 5) were 0.52 and 0.72, respectively. The overall kappa value was 0.66 when dichotomizing the interpretation into benign (BI-RADS 1, 2, and 3) or suspicious (BI-RADS 4, 5). However, those for the subdividing category 4 (a, b, and c) were 0.37 and 0.56, respectively. The overall kappa value was increased up to 0.48 when dichotomizing the interpretation into low suspicion (BI-RADS 4a) or over moderate suspicion (BI-RADS 4b and 4c).

Conclusions: In the modified categorization, ABCS-K radiologists showed moderate interobserver agreements for the decision of biopsy (category 2, 3 vs. 4, 5) and fair agreements for the subdividing category 4. More clear guidance for the modified categorization and further effort to improve interobserver agreements are needed for successful performance of MUST BE trial.

PPT2-007

Mimic Breast Cancer as the Location of a Penetrating Breast Artery: A Case Series

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Objectives: Irregularly shaped hypoechoic areas accompanied by Doppler flow signal are sometimes encountered during breast ultrasonography. Although these findings are suggestive of invasive cancer in one section view, they may not be reproducible in any other section. This situation is referred to as mimic breast cancer.

Methods: We present five cases of mimic breast cancer on ultrasonography, and discuss the features.

Results: Our experience suggests that these findings may represent areas where a penetrating breast artery emerges through the mammary zone. The cancer-like appearance may be due to a combination of irregular disconnection of the mammary zone by the penetrating artery and perivascular fat tissue and shadowing from the artery close to the anterior mammary fascia. Such mimic lesions would likely be interpreted as breast cancer by less experienced examiners, because they would focus on the abnormal appearance despite the lack of reproducibility on other section views. Interpretation as a breast tumor is associated with a risk of vessel injury by needle biopsy, which would not provide any clinical benefit.

Conclusions: It is important to consider that irregularly shaped hypoechoic regions on breast ultrasonogram accompanied by Doppler flow signal in only a certain section can be caused by the normal structure where a penetrating breast artery emerges through the mammary zone.

PPT2-008

New Scoring System for the Evaluation of Breast Ultrasound Scanning Technique

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Objectives: "Dense Breast Problem in Breast Cancer Screening" is discussing in many countries with matured screening systems. For the Dense Breast Women in mammography, it is important to inform the most recommended screening modality to add to her screening.Now breast ultrasound screening will be expected to the most recommended screening modality for the dense breast women by the report of J-START. But it have some problems intrinsically. The sensitivity, specificity and accuracy will change not only by the equipment but also "Breast Ultrasound Scanning Technique" of the examiners.To perform the good breast ultrasound screening system, we must find out the evaluation method for the ultrasound scanning technique. This time, we made a scoring system and performed a trial using this score with stored images the before and after ultrasound practical training by one-to-one and skilled instructors.

Methods: We had four times practical training in Japan screening society. We stored 210 images the before and after training with agreement by the students, and made scores of each other. In this training, That Nakashima's Breast Ultrasound phantoms modeled for breast ultrasound training, with sophisticated human breast anatomies, softness and some hard targets like breast cancer and benign tumors in it.
Results: 190/210(90.48%) student's images were improved the score. And the score improvements are better for beginners especially.
Conclusions: As the evaluation method for the breast ultrasound screening the new scoring system is useful. Furthermore we consider it is applicable with the evaluation of breast ultrasound scanning technique.

PPT2-009

Pictorial Review–Male Breast Ultrasound

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Objectives: 1) To understand male breast anatomy, physiology and pathology. 2) To become familiar with the ultrasound features of benign and malignant male breast conditions, diagnostic pitfalls and optimizing techniques. 3) To present a spectrum of male breast pathologic cases.
Methods: Male breast ultrasound and bilateral oblique mammographic views are routinely performed for imaging evaluation of the male breast at our institutions. High frequency linear transducers are used to obtain high resolution ultrasonography of the breast.
Results: We review the imaging and pathologic features of a spectrum of benign and malignant processes involving the male breast. The most common clinical scenario is gynaecomastia, which has different ultrasound appearances in its nodular, dendritic or diffuse forms. The rarer benign palpable lumps such as angiolipoma, schwannoma, intraductal papilloma, and lipoma have typically well-defined borders with varying echogenicities. The other non-neoplastic entities such as intramammary lymph node, sebaceous cyst, diabetic mastopathy, hematoma, fat necrosis, subareolar abscess, breast augmentation, venous malformation, secondary syphilis, and nodular fasciitis are not commonly seen in male breast ultrasound.
Conclusions: The majority of male breast conditions are benign. Ultrasound provides useful clinical information in ascertaining the nature of a lesion, its vascular supply and the relationship with the surrounding structures. The knowledge and experience of the operator is crucial in making the accurate diagnosis by overcoming the potential diagnostic pitfalls and optimising techniques. This enables the clinician in planning and optimising the appropriate therapy.

PPT2-010

The Sonogaphy is a Valuable Tool for Diagnosis of Microcalcification in Screening Mammography

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Objectives: The purpose of our study was to investigate whether sonography an adjunctive imaging for determining benign or malignancy lesions in breast microcalcification after screening mammography.
Methods: According to BI-RADS assessment categories systems, category 4 or 5 needed further tissue proof. This retrospective study enrolled patients in St. Paul hospital who underwent tissue proof between May 1, 2011 to March 31, 2017. All patients with microcalcification in screening mammography were divided into two subgroups: the group of BI-RADS 0 initially then turn into BI-RADS 4 or 5 after magnified mammography (group A) and the other group of BI-RADS 4 or 5 (group B). We excluded patients with incomplete data including no tissue proof or no sonography report in our hospital. We evaluate the correlation between the pathologic results and the sonographic findings.
Results: A total of 133 patients were reviewed, 105 (78.9%) patients were group A. Among 105 specimens in the group A, 23 (21.9%) were proved malignancy. The sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of sonography were 52%, 84.1%, 48%, 86.3%, and 77.1%, respectively. Sixteen (57.1%) out of 28 patients in the group B were malignant. The findings of sonogrpahy showed high sensitivity, specificity, PPV, NPV, and accuracy for malignancy (87.5%, 75%, 82.4%, 81.8%, and 82.1%, respectively).
Conclusions: Sonography could provide good specificity in undetermined microcalfication. A biopsy may be avoided if microcalcifications in mammography appear absolutely benign on sonography and those patients can be followed-up with interval serial exam.

PPT2-011

Value of Combination of Shear-Wave Elastography and Color Doppler Us for Preventing Unnecessary Excision of Equivocal Fibroepitheal Lesions Diagnosed by Core Needle Biopsy

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Objectives: To evaluate the diagnostic value of shear-wave elastography (SWE) and color Doppler ultrasound (US) for preventing unnecessary surgical excision of equivocal fibroepithelial lesions (FELs) diagnosed by core needle biopsy (CNB)
Methods: This retrospective study included 89 patients with equivocal FEL [FEL with a possibility of both fiboroadenoma (FA) and phyllodes tumor (PT)] diagnosed by CNB. Of 89 patients, 78 underwent surgical or vacuum-assisted excision and 11 underwent follow-up US without excision. Mean elasticity (Emean), maximum elasticity (Emax), and vascularity were determined by SWE and Doppler US for each lesion. For excised 78 FELs (52 FAs, 26 PTs), diagnostic performances were calculated to differentiate FAs and PTs. For non-excised 11 FELs, follow-up results were assessed.
Results: In excised equivocal FEL, median Emean and Emax were significantly lower for FAs than PTs (Emean, 37.3 vs. 71.4 kPa, $P=0.02$; Emax, 46.8 vs. 78.5 kPa, $P=0.03$). Low vascularity (0-1 vessel flow) on color Doppler US were more frequent in FAs than in PTs ($P< 0.01$). In differentiating between FAs and PTs, the combination of SWE and Doppler US with 'Emean>57.0 kPa or high vascularity (≥2 vessel flows)' showed a higher area under the curve (0.702) than SWE or Doppler US alone (0.648-0.663), and sensitivity and negative predictive value of combined modes were 100%. Of the 11 equivocal FELs without excision, two lesions with 'Emean≤57.0 kPa and low vascularity' showed no change during follow-up. Among other nine non-excised FELs showing 'Emean>57.0 kPa or high vascularity', one (11.1%, 1/9) lesion showed interval increase in size during follow-up.
Conclusions: Equivocal FELs showing both low elasticity value and low vascularity were not upgraded to PTs on further excision. Our result suggests that combination of SWE and color Doppler US may help select patients with equivocal FELs diagnosed by CNB for whom further excision is not needed.

T3. Chest Ultrasound

Symposium

T3-14-IN01

Ultrasound Guided Biopsy of Chest and Lung Lesions

Michael G. Kawooya
Ernest Cook Ultrasound Research and Education Institute (ECUREI), Kampala, Uganda

Approach to biopsy of intrathoracic and mediastinal structures are often performed by CT scan or fluoroscopy. Ultrasound has been rarely used because of overlying aerated lung which obscures sonographic visualization of lung many lung lesions. This is especially so for central lung lesions. For more superficial lesions adjacent to the pleura and for lesions overlaid by pleural effusions, ultrasound is at times used to guide biopsy and aspiration with accuracy approaching 90% and complications of less than 5%.

In developing countries where CT scan is not so widely available, accessible and affordable, ultrasound is often the only method to guide chest and mediastinal biopsies.

We retrospectively reviewed 100 cases of ultrasound –guided chest procedures, the majority of which were lung biopsies, followed by pleural biopsy for complex pleural effusions. Histological analysis revealed adenocarcinoma of the lung as the commonest lesion followed by inflammatory pleural thickening. Lymphoma was the second commonest mediastinal and lung tumor. The accuracy of the procedure was 90%. Unsuccessful procedures were in areas overlaid by the scapula, the thick muscles of the posterior chest wall and proximity to vital mediastinal structures. Complications occurred in less than 2% of patients, and this was occasional hemoptysis and mild chest pain which all did not require admission.

These findings are comparable to several other studies. Ultrasound guidance is advocated for pleural, lung and mediastinal lesions as a flexible, portable, safe, affordable and accurate alternative to other imaging technologies.

T3-14-IN02

The Sound of Lung – Ultrasound of the Lung and Mediastinum

Christoph F. Dietrich
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The analysis of lung artefacts has gained increasing importance as markers of lung pathology. B-line artefact (BLA), caused by a reverberation phenomenon, is the most important lung artefact. In this presentation the current role of BLA in pneumology is discussed. The current literature about BLA is summarized in healthy subjects and patients with interstitial syndrome (pulmonary fibrosis and edema) including technical factors influencing BLA visualization. BLA imaging is influenced by more factors than recently assumed [(1, 2)]. When multiple BLA are visualized in the lung, they represent a sign of increased density due to the loss of aeration in the lung periphery. This condition may indicate different diseases including cardiogenic pulmonary edema, diffuse or focal interstitial lung diseases, infections and acute respiratory distress syndrome (ARDS). Correct interpretation of BLA in lung ultrasound is strongly influenced by associated sonographic signs and careful integration of all relevant clinical information. BLA are useful to monitor clinical response, and may become crucial in directing the diagnostic process [(3)].

T3-14-IN03

Transcutaneous Airway Ultrasonography

Chin-Chung Shu
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Airway plays an important role in respiration and once it becomes dysfunctional, many chest diseases develop. In fact, airway is not easily measured and the NTUH team successfully measured trachea disease and detect the extubation failure by tracheal and laryngeal ultrasound. In addition, obstructive sleep apnea is a frequent disease. MRI and CT have been previously used for measuring the collapse of pharyngeal airway during sleep apnea but the cost and radiation are not good for general application. We aimed to explore the association between obstructive sleep apnea severity and pharyngeal parameters using transcutaneous pharyngeal ultrasound. The diameters of the retro-glossal (RG) and retro-palatal (RP) regions were measured by pharyngeal ultrasound through submental approach. The procedure of Müller maneuver was applied. Using the prediction model constructed with changes of RP diameters at Müller maneuver and neck circumference, the independent predictors of severe OSA had 100% sensitivity and 65% specificity. Currently, further validation and application in different ethnicity are warranted.

T3-14-IN04

Airway Ultrasonography in Critical Care

Wan-Ching Lien
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Airway ultrasound is a valuable, non-invasive, simple, and portable diagnostic tool point. Ultrasound enables us to identify important sonoanatomy of the upper airway such as thyroid cartilage, epiglottis, cricoid cartilage, cricothyroid membrane, tracheal cartilages, and esophagus. Understanding this applied sonoanatomy facilitates clinicians to use ultrasound in assessment of airway anatomy for difficult intubation, ETT and LMA placement and depth, assessment of airway size, ultrasound-guided invasive procedures such as percutaneous needle cricothyroidotomy and tracheostomy, prediction of postextubation stridor and detecting upper airway pathologies. Better technological advancements, portability, and availability of ultrasound in most critical areas facilitate upper airway ultrasound to become the potential first-line non-invasive airway assessment tool in the future.

T3-14-IN05

Lung Ultrasound in the Breathless Patient

Adrian Goudie
Fiona Stanley Hospital & King Edward Hospital for Women

Although it was previously thought that ultrasound had only a limited role in investigating lung disease, it is now recognized that it can provide useful information in a range of diseases, including in the acutely breathless patient. This talk will discuss the different ultrasound findings that can be used to distinguish both pleural and parenchymal lung disease, and discuss some of the mimics and pitfalls.

T3-15-IN01

The Use of Lung Ultrasound in Acute Circulatory Failure: the FALLS-Protocol

Daniel Lichtenstein
Intensive Care Unit, Hospital Ambroise Paré, Paris-West University, Boulogne, France

FALLS-protocol combines simple echocardiography and lung ultrasound, using our universal microconvex probe and simple material for sequentially assessing causes of circulatory failure, following Weil's terminology. The cardiac sonography excludes pericardial tamponade, right heart dilatation of pulmonary embolism, BLUE-protocol excludes a tension pneumothorax (A'-profile): obstructive shock is discounted. Then a negative search of a B-profile (usually pulmonary edema) allows to discount left cardiogenic shocks. The remaining causes are hypovolemic and distributive shocks. These patients (FALLS-responders) have the A-profile, schematically, indicating clearance for fluid therapy. Patient's improvement suggests hypovolemic shock. No improvement under fluid therapy results in a interstitial edema, a direct marker of clinical volemia at an early, infra-cinical stage: a B-profile appears (FALLS-endpoint). Hypovolemic shock is discounted. The only remaining mechanism is distributive shock, mainly septic shock. FALLS-protocol is open to any criticism. Answers to many questions are detailed in our textbook. FALLS-protocol can be associated with any usual tool.

T3-15-IN02

Lung Ultrasound, a Holistic Discipline. The Example of the BLUE-Protocol

Daniel Lichtenstein
Intensive Care Unit, Hospital Ambroise Paré, Paris-West University, Boulogne, France

The BLUE-protocol is a fast protocol allowing the diagnosis of an acute respiratory failure. It considers the main causes seen in 97% of adults admitted to the ICU. It uses the 10 main signs of lung ultrasound in the critically ill and a venous approach. A decision tree considers first anterior lung sliding. Present with multiple B-lines (the B-profile), it suggests hemodynamic pulmonary edema (sensitivity 97%, specificity 95%). Present without B-lines (A-profile), it is associated with pulmonary embolism if venous thrombosis detected (sensitivity 81%, specificity 99%). Absent with exclusive A-lines (A'-profile), it suggests pneumothorax (when lung point associated, sensitivity 88%, specificity 100%). Absent with multiple B-lines (B'-profile), it is linked with pneumonia (specificity 100%). COPD or asthma generate a nude profile. Pneumonia generates 3 other profiles (space constraints prevent their description). A simple unit with a unique microconvex probe is suitable. Answers to many questions are detailed in our textbook.

T3-15-IN03

Transthoracic Ultrasound Elastography in Pulmonary Lesions and Diseases

Chor-Kuan Lim
Far Eastern Memorial Hospital

Ultrasound elastography has shown promising result in the diagnosis of various diseases, however, its application in pulmonary diseases has yet to be elucidated. Our study aimed to assess the application and feasibility of ultrasound elastography in various pulmonary lesions and diseases.

We enrolled forty-five patients with radiographic evidence of pneumonia, tumors or obstructive pneumonitis and 70 ultrasonic lesions were identified (eight necrosis, 17 atelectasis, seven consolidation and 38 tumors). Ultrasound elastography was performed and the strain ratio, which was the ratio of strain of the reference tissue to an equally measuring region of interest of a lesion, was measured. The strain ratio was significantly different between these lesions with different ultrasound morphology (necrosis *vs.* atelectasis *vs.* consolidation *vs.* tumor: 1.03 ± 0.71 *vs.* 2.51 ± 1.14 *vs.* 19.98 ± 15.59 *vs.* 36.19 ± 20.18; $p<0.05$). The strain ratio of primary lung cancer was also significantly different from pneumonia ($p=0.023$) and metastatic lung cancer ($p=0.015$). From the result of our study, we concluded that transthoracic ultrasound elastography can differentiate pulmonary lesions with different ultrasound morphology. In addition to B-mode ultrasound, this newly emerges ultrasound mode can be applied in invasive ultrasound-guided procedures, such as ultrasound-guided aspiration and biopsy.

T3-15-IN04

Endobronchial Ultrasonography for Peripheral Pulmonary Lesions

Noriaki Kurimoto,[1] Takeshi Isobe,[1] Teruomi Miyazawa,[2] Masamichi Mineshita[2]
[1]Division of Medical Oncology and Respiratory Medicine, Shimane University Hospital, Izumo, Japan, [2]Division of Pulmonology, Department of Internal Medicine, St.Marianna University, School of Medicine, Kawasaki, Japan

I. How to identify the route to the peripheral lung lesion: Before bronchoscopy, we should track and draw the bronchial branches leading to the lesion on CT images. For the lesion in the lower, middle lobe, or lingular segment, we reverse CT images right to left or left to right. For the lesion in the right upper lobe, we turn CT images to the left 90 degrees. For the lesion in the left superior segment, we turn CT images to the right 90 degrees.

There are 4 patterns of bronchial branching on CT images. The 1st pattern is Vertical Pattern: main stream of bronchial branching is vertical on the axial CT slices (for example: B1, B2a, B1+2, B3c, B7-B10), the 2nd pattern is Horizontal-horizontal Pattern: from the horizontal branch to horizontal branching, the 3rd pattern is Horizontal-vertical Pattern: from the horizontal branch to vertical branching, and the 4th pattern is Horizontal-oblique Pattern: from the horizontal branch to oblique branching.

On the vertical pattern, we draw the bifurcation similar to the angle of the bifurcation of axial CT images. On the Horizontal-horizontal Pattern, we draw the next generation's bronchus right and left. On the Horizontal-vertical Pattern, we draw the next generation's bronchus up (cranial) and down (caudal).

II. EBUS visualization: The EBUS images that clearly depict internal echo brightness, linear and point-like echoes, and the internal structure of lesions, such as vasculature, can be saved. We have reported that EBUS imaging of PPLs can be used to diagnose and assess the degree of differentiation between benign and malignant lesions. PPLs are classified as type I if the internal echoes are homogeneous, type III if the internal echoes are heterogeneous, and type II if there are mainly hyperechoic lines and dots near the probe. About 92% of type I lesions were benign, whereas 99% of type II and type III lesions were malignant. Type I lesions are subclassified as type Ia, if they have patent vessels (often due to pneumonia) and as type Ib, if there are no vessels (often due to organized pneumonia). Type II lesions are subclassified as type IIa, if there are no vessels (often relatively early well-differentiated adenocarcinoma with much air) and as type IIb, if there are vessels (often advanced well-differentiated adenocarcinoma with little air). Type III lesions are subclassified as type IIIa, if there scattered linear echoes (often lung cancer) and as type IIIb, if there are no linear echoes (often poorly differentiated adenocarcinoma).

III. EBUS using a Guide Sheath: With EBUS using a thin guide sheath (2.0 mm in diameter), the diagnostic rate was 81.7% for 115 malignant lesions in 2009-2011. Histological diagnosis was 62.1%. Cytological diagnosis was 79.1% (brush: 75.9%, lavage: 39.1% wash inside the sheath: 59.2%).

There are several techniques of EBUS-GS. I will show 2 tips for reaching to the peripheral lesions. The first technique for inserting the probe within the lesion is to select the bronchial branch under fluoroscopy. The second technique is to select the bronchial branch using cup & down lever of the bronchoscope under EBUS images.

IV. Ultrathin Bronchoscope: In these years, we use the ultrathin bronchoscope for checking bronchial abnormalities of peripheral pulmonary lesions before performing EBUS-GS. I will show representative cases with the ultrathin bronchoscope.

T3-15-IN05

EBUS Elastography for Thoracic Lesions

Takehiro Izumo
Department of Respiratory Medicine, Japanese Red Cross Medical Center, Tokyo, Japan

Endobronchial ultrasound guided transbronchial needle aspiration (EBUS-TBNA) is a widely used minimally invasive procedure that has been shown to have a high sensitivity and diagnostic yield for detecting metastasis to hilar and mediastinal lymph nodes (LNs). Recently, elastography, a new ultrasonography-associated technology that measures tissue compressibility, was introduced. In principle, pathophysiological processes, such as malignancy, make tissues less deformable or stiff. Elastography, is a new non-invasive EBUS modality that is hypothesized to predict mediastinal and hilar nodal metastasis based on hardness of tissue. Based on our results, we propose a simple EBUS elastography classification that could predict with 96.7% accuracy the presence or absence of mediastinal and hilar nodal metastasis. Type 1 (predominantly non-blue) indicates a benign pathology; Type 2 (part blue, part non-blue) is equivocal; and Type 3 (predominantly blue) indicates malignancy. EBUS elastography is a useful tool with very high sensitivity, specificity and accuracy for differential diagnosis of mediastinal and hilar LNs. Aside from providing complementary information to conventional EBUS imaging, it may potentially increase the diagnostic yield of EBUS-TBNA and reduce the number of unnecessary biopsies.

T3-15-IN06

EBUS for Solid and Ground Glass Opacity Pulmonary Lesions

Takehiro Izumo
Department of Respiratory Medicine, Japanese Red Cross Medical Center, Tokyo, Japan

In the past several years, X-ray fluoroscopy had been commonly employed to determine the lung field during transbronchial biopsy (TBB); however, precise localization of a PPL has not always been possible leading to low diagnostic yield. For ground glass opacities (GGOs), the value of X-ray fluoroscopy even becomes less. We have previously reported the use of tomosynthesis instead for GGOs. The value of virtual X-ray fluoroscopy and CT fluoroscopy has potential but remains to be known. The advent of endobronchial ultrasound (EBUS) has dramatically increased precise bronchoscopic confirmation of the location of a PPL before sampling. In particular, the radial probe EBUS is used to indicate that a lesion has been reached. For solid peripheral pulmonary lesions (PPLs), Kurimoto et al have described three major types of echogenicities that might differentiate between benignity and malignancy. For GGOs, we have observed constant radial-EBUS patterns that we called blizzard and mixed blizzard signs.

Free Paper

OPT3-001

Endobronchial Ultrasound with Transbronchial Needle Aspiration in the Diagnosis of Bilateral Hilar and Mediastinal Lymphadenopathy

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Objectives: Bilateral hilar and/or mediastinal lymphadenopathy (BHL±ML) is an important radiographic finding. The purpose of this study was to reexamine the diagnosis of BHL±ML by Endobronchial Ultrasound-guided Transbronchial Needle Aspiration (EBUS-TBNA).

Methods: We carried out a retrospective analysis of data from 170 consecutive patients with BHL±ML who underwent EBUS-TBNA. Patient's characteristics including age, sex, symptoms, radiographic abnormalities, lymph node size, procedural complications, and the final pathologic diagnosis were recorded.

Results: There were 6 diagnostic categories. Sarcoidosis was the most common diagnosis (66%), followed by lymphoma (13%), and reactive lymphadenopathy (12%). Nonlymphoma malignancy was found in 4 case (2.4%). The diagnosis was made by EBUS-TBNA in 85.9% of the cases. The diagnostic accuracy for EBUS-TBNA was 95%. There were no significant complications from EBUS-TBNA.

Conclusions: EBUS-TBNA is a safe and minimally invasive procedure with a high diagnostic yield for BHL±ML. Sarcoidosis is still the most common diagnosis but the incidence seems to have decreased over the years. The increase in nonsarcoidosis patients

and the evidence that lymphoma does occur in some asymptomatic patients suggests that biopsy confirmation with EBUS-TBNA is warranted.

OPT3-002

Application of Transthoracic Shear-Wave Ultrasound Elastography in the Diagnosis of Pulmonary Lesions

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Objectives: Transthoracic Shear-wave Ultrasound Elastography (SWE) is rarely used in evaluating pulmonary lesions. This study aims to investigate the usefulness of transthoracic SWE in evaluation of the etiology of subpleural pulmonary lesions.
Methods: This retrospective observational study was conducted in a tertiary medical center in Taiwan. Transthoracic SWE was performed via Toshiba Aplio 500 Platinum Ultrasound Machine. The elasticity of subpleural pulmonary lesions with acceptable shear wave propagation were recorded, followed by real-time echo-guided aspiration and/or biopsy. The diagnoses were made by pathology, microbiological studies, or judging by the clinical course for at least 6 months after the transthoracic ultrasound.
Results: From Jan 2016 to Apr 2017, 55 patients received transthoracic SWE followed by transcutaneous needle aspiration and/or biopsy if necessary. Base on the echo pictures, the pulmonary lesions were categorized into air-bronchogram group (n=14) and hypoechoic group (n=40). In air-bronchogram group, the elasticity of pulmonary malignancy was significantly higher than the benign etiologies (88.22 ± 15.37 vs 40.39 ± 34.02, $p < 0.01$). In hypoechoic group, the elasticity of pulmonary malignancy was 72.85 ± 29.05 while benign lesion 67.42 ± 26.31 ($p = 0.72$). Among pulmonary malignancies, the elasticity of pulmonary adenocarcinoma was significantly higher than the non-adenocarcinoma malignancies (87.90 ± 26.35 vs 51.80 ± 17.40, $p < 0.01$).
Conclusions: Transthoracic SWE is very useful in providing the information of tissue elasticity in different pulmonary lesions. Based on the data from transthoracic SWE, Pulmonary adenocarcinoma had the higher elasticity than the non-adenocarcinoma pulmonary malignancy. Air-bronchogram lesions with high elasticity, tissue proof via echo-guided aspiration and/or biopsy should be considered due to the high possibility of malignancy.

OPT3-003

The Role of Transthoracic Ultrasonography in Predicting the Outcome of Community - Acquired Pneumonia in Hospitalized Children

I-Chen Chen, Jiunn-Ren Wu, Jong-Hau Hsu, Zen-Kong Dai
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Objectives: Transthoracic ultrasound (TUS) has recently become a valuable tool in the diagnosis of community-acquired pneumonia (CAP). This study assessed the association between TUS findings and clinical outcome in children with CAP.
Methods: The medical records of pediatric patients hospitalized with CAP who underwent transthoracic ultrasonography within 48 hours of admission were retrospectively reviewed. Associations between the TUS findings and patient outcome were analyzed, including intensive care unit (ICU) admission, length of hospital stay, and tube thoracotomy.
Results: The study enrolled 142 patients (median age, 60 months): 28 (19.7%) required ICU admission, 14 (9.89%) underwent tube thoracotomy, and 26 (18.3%) had a hospital stay > 9 days. Multifocal involvement seen by TUS were independently associated with ICU admission, a prolonged hospital stay, and tube thoracotomy ($p=0.0027$, $p=0.02$, and $p=0.0262$, respectively). A pleural effusion and fluid bronchogram were independent predictors of a longer hospital stay ($p=0.003$ and $p=0.006$, respectively). In addition, a fluid bronchogram was an independent predictor of tube thoracotomy ($p=0.0262$).
Conclusions: TUS findings of fluid bronchogram, multifocal involvement, and pleural effusion were associated with adverse outcomes, including longer hospital stay, ICU admission, and tube thoracotomy in hospitalized CAP children. Therefore, TUS is a novel tool for prognostic stratifications of CAP in hospitalized children.

OPT3-004

Pediatric Lobar Pneumonia with Emphasis on Real Time Dynamic Images

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Objectives: Lobar pneumonia is a serious infectious disease capable of causing severe mortality and morbidity in children. Conventionally, radiological imaging evaluation is the test of choice for diagnosing pneumonia and follow up. Our objective was to determine the accuracy and safety of sonographic signs that indicate lobar pneumonia in pediatric patients with particular emphasis on real time dynamic images to evaluate the pulmonary dynamic changes resulting from lobar pneumonia.
Methods: We conducted an observational study comparing lung ultrasound in 65 children from birth to 18 years of age suspected having pneumonia in a tertially- teaching hospital. All ultrasound examinations were conducted using a 3-8 MHZ curvilinear probe. Chest sonography was performed by 2 of the authors (CWT and KSH). Chest sonography was interpretated independent of the radiographic findings. We included 65 patients who had the final diagnosis of lobar pneumonia All these patients had conventional clinical examination (chest radiography) as indicated by their staffs.
Results: A total of 65 patients were identified with lobar pneumonia. Within a range of 3 months old to 18 year-old and a mean and standard deviation of 6.5 ± 4.1 years old. Respectively; 8 on the right upper, 13 on the right middle, 16 on right lower, 9 on left upper and 19 on left lower lobe. Sonographic signs that indicate lobar pneumonia were limited pleural motion, decrease or absence of inspiratory expansion, and airbronchogram. There were no missed cases with lung ultrasound for diagnosing pneumonia in children.
Conclusions: Chest ultrasonography is a useful, safe and accurate diagnostic tool for evaluate children with lobar pneumonia. Our experience showed no missed cases with combined dynamic and static sonographic images. It opens a new window for diagnosis of lobar pneumonia in children.

T4. ACUCI 2017 TAIPEI

Special Lecture

T4-14-IN01

Where Physics Meets Biology: Quantifying the Biological Effects of Combination Treatments of Focused Ultrasound Mediated Heating and Radiotherapy

Gail ter Haar, Marcia Costa
Therapy Ultrasound, Division of Radiation and Imaging, The Institute of Cancer Research, London, UKT4-14-IN01

Radiotherapy (RT) is widely used for treating many cancers. While it has been shown to be very effective in many cases, and its toxicity to normal tissues has been greatly reduced by the advent of image modulated RT, the hypoxic cells that are often found in central tumour regions remain resistant to killing by ionizing radiation. It is therefore of interest to investigate a combination treatment in which focused ultrasound is used to ablate these hypoxic regions. This strategy has been used in pre-clinical studies using a subcutaneously implanted human head and neck tumour (CAL^{R}) in immunosuppressed mice. Hypoxic regions were identified immediately prior to being targeted by ultrasound using photoacoustic imaging. RT-alone treatments (at 10 Gy) resulted in a 46% treatment response rate (full tumour remission or growth inhibition within a 60 day follow up-period). This increased to 71% for ultrasound ablation of hypoxic regions before RT, and 86% when the ultrasound followed RT. These results will be discussed, as will their implications for future combination therapies.

T4-14-IN02

Focused Ultrasound Therapy Enhanced by Microbubbles

Kullervo Hynynen,[1,2,3] Ryan M. Jones,[1,2]
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Meaghan A. O'Reilly,[1,2] David Goertz[1,2]
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MRI guided focused ultrasound provides a completely noninvasive method for delivering energy deep in the body. This has been successfully exploited for thermal ablation of tissues and for locally enhanced drug delivery. The focal thermal ablation shows great promise in replacing many invasive surgeries with completely noninvasive procedure with much faster recovery time and reduced complications. However, treatments are relatively slow and acceleration would make these treatments clinically more acceptable. Animal research demonstrated that significant enhancement in the ablation efficiency can be achieved using microbubbles. Similarly, microbubbles enhance local drug delivery. However, the use of microbubbles carries a risk for bleeding and therefore exposures need to be controlled. We have used acoustic emissions from the bubble to control these exposures such that safe and reliable enhancement of ablation or drug delivery can be achieved. In this talk we will review our experience with bubble enhanced heating and drug delivery.

T4-14-IN03

Microscale Ultrasonic Bioeffects and Their Biomedical Implications

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The gas-filled microbubbles oscillate and vibrate when a sonic energy field is applied and may reflect ultrasound waves. The intense radial oscillation of microbubbles makes them several thousand times more reflective than normal body tissues and emits significantly stronger acoustic signal. The unique acoustic property of microbubbles can be used as sensitive acoustic probes in molecular imaging when conjugated with certain a ligand or antibody. Moreover, due to the large surface area, microbubbles are wonderful tool as gene and drug carriers. More importantly, the bubbles were easily destroyed by ultrasound exposure, making it possible deliver drugs or genes to specific tissues by ultrasound-targeted microbubble destruction. All of these properties make microbubbles of many powerful emerging applications, such as molecular imaging, drug delivery and therapy. In this talk, we will present the current progresses on ultrasonic microbubbles as an ideal tool for ultrasound molecular imaging and ultrasound-mediated drug delivery. Moreover, precise transportation microbubbles and single cell to any specified location with MEMS technique by acoustic radiation force will also be discussed.

T4-14-IN04

Therapeutic Applications of Microbubbles with Nanoparticle Encapsulation

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New developments in imaging physics have found promising biomedical applications. One example is the combination of ultrasound and photoacoustics that has demonstrated new opportunities in both imaging and therapeutic applications with functionalized microbubbles playing a pivotal role. The microbubbles typically used in ultrasonic imaging as the contrast agent present unique mechanical properties and the associated acoustic cavitation has been exploited for therapeutic purposes. Similarly, gold nanoparticles (AuNPs) are found to be a good contrast agent for photoacoustic imaging for its bioconjugation capabilities. The efficient light absorption of AuNPs and abilities to tune their optical properties have also led to new photothermal therapy methods. New development in combined diagnosis with therapy for both modalities have also been introduced. AuNPs encapsulated with microbubbles (AuMBs) have been introduced as a photoacoustic and ultrasound dual-modality contrast agent. Applications can be extended to theranosis purpose. In a previous study, an enhanced delivery method of AuNPs is proposed by using microbubbles as a targeted carrier and by inducing acoustic cavitation to enhance permeability. At least 10 times improvement in AuNP delivery and twenty degrees of temperature elevation were achieved. An optical microscope which collects the two photon fluorescence emitted by AuNPs further confirms the enhanced delivery. Finally, *in vivo* delivery of AuNPs was demonstrated with laser-induced thermotherapy that showed hyperthermia (>45°C) with sonoporation. Therefore, controlled release of AuNPs is feasible with acoustic cavitation and the procedure can further improve therapeutic effects of the AuNPs. Such functionalized microbubbles can also be used by exploiting the radiosensitization effect of gold nanoparticles (AuNPs) to enhance the cell-killing of ionization on tumor cells. In our research, we utilized AuMBs together with ultrasound as a radiosensitizer. Pre-radiotherapy cavitation carried out by acoustic stimulation increased the permeability of cell membrane and intracellular uptake of AuNPs. Simultaneous measurement of cavitation during ultrasound treatment also confirmed the production of cavitation. After combined treatment of AuMBs and ultrasound, Huh7 cells, a notoriously radioresistant cancer cells, was exposed to various dose of irradiation by a 6-MV linear accelerator. Cologenic

assay showed a significant radiosensitization with AuMB+US, especially with high-dose irradiation (10 Gy). A dose modifying factor at 60% survival fraction (DMF60%) of 0.74 was obtained with AuMB and ultrasound treatment.

T4-14-IN05

Multifunctional Microbubbles in Ultrasound Theranostics

Chih-Kuang Yeh
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The discipline of medical imaging is expanding beyond an assessment of anatomical structure to functional imaging and an assessment of the nature and extent of disease. This advancement is made possible by recent discoveries in molecular science, which provide the opportunity to design targeted contrast agents. Targeted imaging using ultrasound relies on contrast agents to localize a specific molecular signature or physiologic system and combines the efficacy of a contrast agent with an adhesion molecule to target the contrast directly to the desired region. Current ultrasound contrast agents are encapsulated microbubbles and have demonstrated effectiveness in cardiology and radiology. These contrast agents become identifiers of a specific molecular signature either by their preferential uptake by a physiologic system or by specific targeting of the agent through incorporation of adhesion molecules into the microbubble shell. Targeted ultrasound contrast agents provide an opportunity to image physiology or pathology that might be otherwise difficult to distinguish from the surrounding tissue without targeted contrast enhancement. This talk proposes the multi-functional microbubbles employed with ultrasound for drugs delivery/release, mechanical cell destruction, and US/MRI targeted imaging applications, thus presenting a new strategy for ultrasound theranostics.

T4-14-IN11

CEUS Beyond the Liver: Vascular Application. EFSUMB Guidelines and Personal Experience

Vito Cantisani, MD, PhD
EFSUMB, Italy

Recently EFSUMB produced the update of non-liver applications recommendations including stenosis carotid evaluation and abdominal aortic evaluation. The most recommended indication is the identification and classification of endoleak.

Endo vascular aortic repair [EVAR] is performed with low perioperative morbidity and mortality rate and short hospital stay. However, EVAR needs a close and lifelong imagining surveillance for a timely detection of possible complications including endoleaks, graft migration, fractures, and enlargement of aneurysm sac size with eventual rupture. Contrast enhanced computed tomography [CTA] is actually considered the gold-standard in EVAR follow-up, but it is accompanied with radiation burden and renal injury due to the use of contrast media. In the last two decades several studies have shown the role of contrast enhanced ultrasound [CEUS] in post-EVAR surveillance, with very good diagnostic performance, absence of renal impairment, and no radiation, accompanied by low costs, in comparison with CTA. In numerous prospective studies and meta-analyses the detection and characterization of endoleaks with CEUS is comparable to that of CTA imaging. Nowadays, in the EVAR surveillance novel strategies which involve CEUS with a central role, are suggested by several authors and applied in many institutions. I will present a comprehensive overview and analyses of the literature on the CEUS state-of-art imagining of EVAR follow-up, with its technique, findings, diagnostic accuracy, and its role in the follow up program.

T4-14-IN12

EFSUMB Non-Hepatic CEUS Guidelines – an Update

Paul Sidhu
King's College London

The use of contrast enhanced ultrasound is limited by a narrow licensing regulation, where there is restriction to the heart, breast, liver and peripheral vascular. Nevertheless, many practitioners employ CEUS 'off-label' in many areas, notably the kidneys, pancreas, aorta and bowel. All these areas currently are 'off-label' but this does not prevent dedicated practitioners from developing the usefulness of CEUS in clinical diagnostic procedures. The wealth of experience allows the confident use of CEUS in many areas that are currently 'off-label'. The recognition of this development by EFSUMB resulted in the first non-hepatic guidelines published in 2012, which detailed the many areas of CEUS practice outside conventional practice and presented the current evidence for safety and efficacy. There has been further development in the non-hepatic use of CEUS and new guidelines published in 2017. The new guidelines presents consolidation with more evidence in many areas of the usefulness of CEUS, presents the scientific data, and makes recommendations based on this evidence. These EFSUMB guidelines will allow confident evidence based management of the clinical practice of using CEUS 'off-label' to the benefit and safety of patients.

T4-14-IN13

CEUS Guidelines: Evidence Based Medicine or off Label Use?

Christian Pállson Nolsøe, Asc Prof, MD, PhD
WFUMB President Elect, Diagnostic Radiologist, Ultrasound Section, Division of Surgery, Dep of Gastroenterology, Herlev Hospital, Copenhagen Academy for Medical Education and Simulation, University of Copenhagen, Denmark

WFUMB and EFSUMB as a joint venture in 2013 published CEUS guidelines simultaneously in UMB and UiM entitled "Guidelines and Good Clinical Practice Recommendations for Contrast Enhanced Ultrasound (CEUS) in the Liver –Update 2012 A WFUMB-EFSUMB Initiative in Cooperation With Representatives of AFSUMB, AIUM, ASUM, FLAUS and ICUS". These guidelines recommend CEUS as the first method of choice after conventional ultrasound for the diagnostic work-up of focal liver lesions. Recommendations are based on the results of multiple case series most of which are single center studies with few large multicenter design published. Also available are few systematic reviews and meta-analyses. The use of and indications for CEUS has kept growing throughout the last two decades and an increasing number of new indications for CEUS with a range of new applications has been implemented. Most of these are off-label indications. A PubMed search identified studies evaluating CEUS. Most are rather small with only eight published studies evaluating more than 200 focal liver-lesions. Available CEUS Guidelines are based on these results and an evaluation of overall performance and evidence of CEUS with special emphasis on diagnosis of malignant liver lesions will be presented.

T4-14-IN14

A Phase 3 Multicentre, Randomised, Comparative Study of the Efficacy and Safety of Sonazoid and SonoVue in Subjects with Focal Liver Lesions Undergoing Pre- and Post-Contrast Ultrasound Imaging

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Purpose: To compare the efficacy and safety of Sonazoid™ and SonoVue® in subjects with focal liver lesions (FLLs).
Materials and Methods: The study was conducted at 17 centres in China and Korea. A total of 424 subjects were randomised to receivea single injection of either Sonazoid (0.12 μL microbubbles/kg) or SonoVue (2.4 mL) for contrast-enhanced ultrasound (CEUS) assessment scans. Three blinded readers evaluated the pre- and post-contrast images.Contrast-enhanced CT (CE-CT), CE-MRI, or biopsy provided the reference diagnosis. Safety variables were assessed4 hours after injection, with follow-up at 24 and 72 hours.
Results: There was statistically significant improvement in specificity with Sonazoid for all 3 Readers (p=0.0093) and for Reader 1 (p=0.0023) and Reader 2 (p=0.034) with SonoVue in target focal liver lesion diagnosis as benign or malignant. There was a statistically significant improvement in accuracy for Reader 2(p=0.033) with Sonazoid and for Reader 1(p=0.012) with SonoVue. Sensitivity was generally somewhat higher pre-contrast than post contrast for both Sonazoid and SonoVue. Across all 3 readers Sonazoid and SonoVue were similar in diagnosing FLLs as benign or malignant.

Treatment-Emergent AEs (TEAEs) were recorded for 55 (13%) of subjects and the majority were mild in intensity. No serious AEs or deaths occurred in this study.
Conclusion: This study indicated that the efficacy of Sonazoid in diagnosing FLLs as benign or malignant was similar to that of SonoVue. Both contrast agents were well tolerated.
Keywords: Contrast-enhanced ultrasound, focal liver lesions, Sonazoid, SonoVue, efficacy, safety

T4-14-IN15

Current Status and Prospectives of CEUS in Taiwan

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The clinical experiences of Levovist (Schering AG, Germany) in Taiwan (1996) were promising in the characterization of focal liver tumors. Although effective in the application in various organs, Levovist has certain shortcomings, e.g., shorter longevity of the echo-enhancing effect and incapability of being satisfactorily with harmonic imaging techniques with these limitations. Levovist was withdrew from Taiwan market in 2003. Since there was a general consensus that contrast-enhanced US (CEUS) may facilitate an accurate US diagnosis and can overcome the limitation of conventional US imaging, it was believed CEUS should be introduced to Taiwan. SonoVue, Definity, and Sonazoid are three of the more successful contrast agents in the past 10-15 years. SonoVue have been widely used in Europe and parts of Asia and Sonazoid is now in the process to obtain approval to be used in Asian countries out of Japan, Korea, and Taiwan, as well as America. Definity is now in the process to get approval in Taiwan. Other echopharmaceuticals are now designed to change the attenuation or impedance of sound for enhancing the differentiation of signals of a target organ from that of the surrounding tissue.

During the past 9 years, a lot of efforts have been made to introduce USCA into the Taiwan healthcare community. In order to conduct a pilot study to convince Taiwan Food and Drug Administration (TFDA) for the possible approval of USCA to be used in Taiwan, three manufacturers (SonoVue, Sonazoid, and Definity) were invited to survey the Taiwan market. Finally, GE Healthcare got the first chance to convince the subcommittee of USCA (under the umbrella of Commission of Research and Development of Medical Ultrasound, Chinese Taipei Society of Ultrasound in Medicine, CTSUM). And Sonazoid was the priority agent accepted by CTSUM.

We expect with the wide applications of USCA in Taiwan, more experience can be accumulated. The subcommittee of USCA with its 40 committee members subspecialized in different fields (e.g., gastroenterology, gynecology, cardiovascular, small parts, neurology, pediatric, etc.) will conduct more studies to find out other utilities of CEUS to benefit patients.

T4-15-IN08

The Very Early Phase Hemodynamics of Hepatocellular Carcinoma Using Contrast-Enhanced Ultrasonography with Sonazoid

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CT and EOB-MRI are in common use worldwide for diagnosing hepatocellular carcinoma (HCC). However, we initially employ contrast-enhanced ultrasound (CEUS) with Sonazoid, yielding clear enhanced real-time images with minimal contrast agent use with no adverse events. Starting in 2007, approximately 2000 hepatic nodules were examined by CEUS with Sonazoid. Nodule hemodynamics were observed with special attention to the pure arterial and early portal phases up to 1 min after Sonazoid injection (0.01ml/kg) followed by a subsequent phase up to 30 minutes. We analyzed enhancement characteristics using inflow-time mapping, arterial capture or a time-intensity curve and calculated covariance-adjusted sensitivities for 143 pathologically confirmed nodules (118 HCC and 25 benign nodules) in 143 patients. As to the poorly differentiated (PD) HCC, which showed three enhancement patterns, the likelihood of a nodule being PD was 65% with the most frequent pattern, i.e. hypo-hyper-hypo. All moderately differentiated (MD) HCC were hyper in the pure arterial and hypo in the subsequent phase. The differences among the likelihoods of being MD depended on the enhancement seen in the early portal phase. Well-differentiated (WD) HCC showed several complex patterns but 68% were hypo in the arterial phase. If the three phases were all hypo or hypo-iso-iso, nodules were WD. Most benign nodules were hyper in both the pure arterial and the early portal phase. CEUS with Sonazoid revealed remarkable hemodynamic differences among hepatic nodules, possibly reducing the need for tumor biopsy.

T4-15-IN09

CEUS & Fusion & Interventional US: Symbiotic triplets or useless gadgets?

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The use of CEUS in combination with image fusion techniques has expanded the field of interventional ultrasound and established new possibilities in patient management and diagnostic capabilities.

CEUS is a powerful diagnostic tool due to excellent time resolution and the possibility to keep a suspected lesion in the scanning plane throughout the entire contrast study. This feature frequently results in CT negative metastases being diagnosed with CEUS.

Fusion ultrasound is a new medical application of image fusion, whereby US images are presented simultaneously with corresponding, previously acquired images obtained from other imaging modalities such as CT, PET or MRI.

CEUS and fusion, and especially the combination of the two, may become decisive factors in liver imaging with the positive consequence that biopsy may be reserved to a limited number of equivocal cases.

In case of non-operability, however, biopsy of lesions seen at CT, PET or MRI remains mandatory to confirm malignancy before chemotherapy or image-guided ablation with RF, MW, cryo or similar techniques. Here the combined use of CEUS and fusion may enable biopsy of otherwise ultrasound invisible lesions.

CEUS and FUS performed before and after ablation procedures improve the succesrate.

Use of CEUS and fusion may change the classic indications for biopsies and reduce the number of diagnostic biopsies. US-guided biopsies, however, will still be required in case of equivocal findings and likely will continue to serve as Gold-Standard. In addition, CEUS may visualize bleeding related to interventional US thus reducing the risk of severe complication.

Interventional US has countless applications and above recent technological achievements have provided new valuable elements to its use.

T4-15-IN10

US-US Overlay Fusion Imaging in the Evaluation of Treatment Response After RFA

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Recent advancements in technology permit two-dimensional (2D) multiplanar reconstruction images of CT or MRI to display in the same plane as US images in real time. It was reported that fusion imaging–guided RFA was useful in the treatment of hepatic malignancies that were inconspicuous on B-mode US. Moreover, the application of fusion imaging allows display of the tumor before and during/after ablation on the same US images side by side, and the imaging overlays can show the tumor image before ablation within an ablated hyperechoic zone in real time. Therefore, the image overlay of US–US fusion imaging can visualize the ablative margin three dimensionally according to the US probe action.

We have developed US–US overlay fusion imaging in RFA for hepatocellular carcinoma. US–US fusion imaging has 3 clinical applications in RFA therapy. The first is the real-time monitoring of RFA lesion formation. Clinicians can employ B-mode US to observe the bubble-related hyperechoic region and preliminarily evaluate the ablation zones comparing the pre-ablation image of the tumor using US–US fusion imaging.

The second application is related to decision making about additional ablation. We could confirm any lesion with a poor ablative margin during the session, and then extend the necrotic area by additional ablation. The third is visualization of the safety margin on US. Although the endpoint of conventional RFA cannot be based on objective evidence with US, US–US fusion imaging offers an evidence-based quality improvement in RFA therapy. In conclusion, US–US fusion imaging could show tumor images before ablation and the ablative area on US in real time. The image overlay of US–US fusion could visualize the ablative margin of RFA on US. Therefore, US–US fusion imaging can contribute to RFA therapy with a safety margin, that is, the so-called precise RFA.

T4-15-IN11

CEUS for Pancreatobiliary Diseases

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Recent advancements in technology permit two-dimensional (2D) multiplanar reconstruction images of CT or MRI to display in the same plane as US images in real time. It was reported that fusion imaging–guided RFA was useful in the treatment of hepatic malignancies that were inconspicuous on B-mode US. Moreover, the application of fusion imaging allows display of the tumor before and during/after ablation on the same US images side by side, and the imaging overlays can show the tumor image before ablation within an ablated hyperechoic zone in real time. Therefore, the image overlay of US–US fusion imaging can visualize the ablative margin three dimensionally according to the US probe action.

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T4-15-IN12

CEUS of Problematic Renal Masses: Comparison with CECT and CEMRI

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Ultrasound (US) is often the first-line imaging modality in the evaluation of the renal masses. If the findings of a renal mass do not meet all of US criteria of a simple cyst, it should be characterized further. Usually characterization of indeterminate renal masses is well done with CT or MRI, but sometimes it is inconclusive on these imaging techniques. In thoses cases and in patients to whom radiation exposure or use of iodine or gadolinium contrast agents is undesirable, contrast-enhanced US (CEUS) may be a valuable alternative to evaluate those problematic renal masses. CEUS may replace CECT or CEMRI if the patient has marginal or poor renal function, hypersensitivity to iodine contrast agent, or fear of radiation exposure.

CEUS has long history in medical US but drew attention only recently. With the first generation microbubble agents several studies showed added value of CEUS as compared to the conventional Doppler US. We reported that CEUS provided better visualization of tumor vascularity in indeterminate cystic renal lesions than other imaging modalities using a first-generation agtent. The most important limitation of the first generation agent was that it could not provide an enough duration of contrast enhancing effect. With introduction of the second generation microbubble agents with better stability and duration of contrast effect, CEUS examination became a practical alternative of CECT or CEMRI in evaluation of problematic renal masses. We do not think that CEUS will be used routinely in US examination of renal masses like contrast enhancement is routine in CT for renal masses. However, we are sure that CEUS will be a valuable imaging technique if it is used in well selected cases of problematic renal masses. In evaluating problematic renal masses, CEUS may reveal findings that were not seen or confirm findings equivocal at other imaging studies. Results of CEUS can be analyzed qualitatively as to the presence or absence of enhancement, vascular pattern and heterogeneity etc. Quantitative analysis can be done on peak intensity, time to peak, and rate of wash-in and wash-out, etc.

T4-15-IN13

Artificial Intelligence for Liver CEUS: the Initial Experience

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Objective: In this work, we propose to develop a two-stage multi-view learning framework based computer-aided diagnosis (CAD) for liver tumors with only three typical CEUS images selected from three phases.
Materials and Methods: In the first stage, the deep canonical correlation analysis (DCCA) is performed on three image pairs between arterial and portal venous phases, arterial and delayed phases, respectively, which will generate totally six-view features. While in the second stage, these multi-view features are then fed to a multiple kernel learning (MKL) classifier to further promote the predictive diagnosis result. The proposed DCCA-MKL algorithm is then evaluated on 93 patients.
Results: The proposed DCCA-MKL algorithm achieved the mean classification accuracy, sensitivity and specificity of 90.41 ± 5.80%, 93.56 ± 5.90% and 86.89 ± 9.38%, respectively. Moreover, it improved by at least 0.99% and 2.00% using this algorithm compared with all other ones in terms of accuracy and sensitivity, respectively.
Conclusion: The experimental results indicate that DCCA-MKL algorithm achieves best performance for discriminating benign liver tumors from malignant liver cancers.

T4-15-IN14

Contrast-Enhanced Ultrasonography: the Experience of Peking University Cancer Hospital

Keynote Speech

T4-14-IN06

Clinical Usefulness of Contrast-Enhanced Ultrasound and Fusion Imaging in Ablation Treatment of Liver and Pancreatic Cancer

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Ablation therapy for liver and pancreatic cancer is performed under ultrasound imaging guidance. Contrast-enhanced ultrasound (CEUS) is used for tumor delineation and efficacy evaluation in local ablation therapy. Sonazoid gives us long lasting Kupffer phase imaging in which bubble signals are emitted from Kupffer cells after phagocytosis. Vascular phase imaging is used for differential diagnosis of the tumor and Kupffer phase imaging is used for delineation of the tumor and ablation area.

At the same time, ultrasound fusion imaging with CT, MRI and PET has an important role in the safe and effective ablation therapy. Multi planar reconstruction (MPR) imaging of these modalities which is consistent with real time ultrasound imaging can cover weak points of ultrasound imaging.

Needle navigation technology is also indispensable to monitor the needle tip during puncturing and ablation procedures even when the needle tip could not be visualized well on real time ultrasound imaging.

RFA and MWA for liver cancers and IRE (irreversible electroporation, NanoKnife™) for pancreatic cancer can be performed safely and effectively using contrast-enhancedultrasound and fusion imaging technologies.

T4-14-IN07

Hepatic Nodules in Liver Cirrhosis: US and CEUS

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Hepatocellular carcinoma (HCC) is the 6th most common malignancy worldwide, 6% of all cancer. Unfortunately, HCC is a devastating cancer with 5year survival less than 5%. Among risk factors of HCC, liver cirrhosis and hepatitis B, C Virus are most important.

Liver cirrhosis is a diffuse hepatic parenchymal process with extensive fibrosis and regenerative nodule formation and irreversible.

In the management of hepatic nodule in liver cirrhosis, early diagnosis and treatment is necessary. For this purpose, understanding of hepatocarcinogenesis is important. There are two pathways, one is de novo pathway and the other is multistep pathway. De novo pathway is a development of HCC without background of chronic liver disease or liver cirrhosis. Multistep pathway is a development of HCC in the background of liver cirrhosis from regenerative nodule (RN) through dysplastic nodule (DN), eHCC to advanced HCC. Cellular and histopathologic change in hepatocarcinogenesis from RN to HCC include iron, glycogen, copper, and fat, vascularity, bile duct and Kupffer cell change. These cellular and histopatologic change can be visualization on imaging.

For hepatic nodule, US techniques have been continuously evolved during the recent several decades from static B-scan imaging going through real-time imaging, Doppler imaging, elastography volumetric imaging and finally to virtual US and contrast imaging. US role for hepatic nodule in liver cirrhosis includes surveillance of hepatic nodule for early diagnosis of HCC, differential diagnosis hepatic nodule, intrahepatic staging of advanced HCC, evaluation of vascular lesions and portal thrombi, evaluation of liver transplantation, and planning, guidance & monitoring of biopsy and ablation of liver cancer. For detection of hepatic nodules, gray scale US is a screening and surveillance test with acceptable sensitivity and specificity, but, US shows poor performance in advanced contracted liver cirrhosis with poor depiction rate, less than 30 %. Grayscale US is sometimes useful for the Dx of liver nodule, particularly with characteristic findings. If the lesion shows peripheral halo, mosaic pattern and lateral shadowing, these findings are indicative of HCC. But, in many cases, findings of grayscale US are not specific. Doppler US can be used, and sometimes, it is useful, but in many cases of small nodule, Doppler US is not specific. In such a case, US contrast agent is useful to make a correct Dx of hepatic nodule. With an US contrast agent, we are able to make a dx. by demonstrating hemodynamic change of hepatic nodule in multiphasic images.

There are two techniques of contrast-enhanced US. One is high MI and the other is low MI imaging. High MI imaging is no longer used. Low MI imaging using second generation contrast agents such as Sonovue or Definity, is a continuous bubble imaging and is useful in vascularity assessment. Another contrast agent, Sonazoid, is available in Japan, and Korea. This agent is taken up by Kupffer cells. So, we can evaluate hepatic nodule in vascular phase as well as Kupffer (post vascular) phase with this contrast agent. Advantages of CE US over CT/MR are high sensitivity to contrast, real-time imaging, disruption-replenishment sequence, no renal excretion, no ionizing radiation, purely intravascular contrast, as you see in this diagram by Dr Wilson from Canada. Other advantages of CE US are ready availability, low cost, excellent patient's compliance, and possible repeated exams with short intervals.

Recently loco-regional treatment of HCC is rapidly progressing. For local therapy, chemical ablation including ethanol injection is now replaced by thermal ablation such as radiofrequency ablation (RFA), microwave or high intensity focused US (HIFU). For regional (intravascular) therapies, in addition to conventional TACE, TACE with drug eluting beads or radioembolization is now investigated. The role of US for Tx is planning before Tx, targeting, monitoring and controlling during Tx, and assessing response after Tx for early detection of recurrence.

In summary, for focal liver lesion, US improves lesion detection, allows lesion characterization, reduces the need for CT/MR, and US has been introduced into guidelines, and improves patient management. For assessment of treatment response, US allows intra-and post-procedural evaluation, and is useful in patient follow-up after therapy as an alternative to CT/MR evaluation.

T4-14-IN08

Imaging of pathologies of the aorta by contrast-enhanced ultrasound

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Abnormalities of the abdominal aorta may represent a diagnostic challenge in patients both with acute and chronic clinical symptoms. In addition to the examination using color coded duplex ultrasound, contrast enhanced ultrasound (CEUS) with low-mechanical-index (low MI) may contribute in achieving a precise diagnosis. Most of these patients will be treated by endovascular aneurysm repair. Endoleaks following endovascular aneurysm repair (EVAR) are common. Contrast-enhanced ultrasound (CEUS) is a promising new method for the diagnosis and follow-up of endoleaks. CEUS with SonoVue® allows a rapid and noninvasive diagnosis in the follow-up after EVAR. The sensitivity and specificity of conventional ultrasound, compared to the MS-CTA is estimated up to 33-63% and 63-93%. These values can be increased through the use of CEUS in up to 98-100% (sensitivity) and 82-93% (specificity).

This presentation describes the etiology, classification and importance of different abnormalities of the abdominal aorta and the types of endoleaks. The value of CEUS in this clinical scenario will be discussed.

T4-14-IN09

The Difference between Conventional Doppler and New Advanced Doppler (Superb Micro-Vascular Imaging) and Contrast Harmonic Ultrasound and Contrast SMI on Breast Ultrasound

Dr. Kazutaka Nakashima
Kawasaki Medical School

It is very important to know the vascularity in or around tumor for the diagnosis and selection of treatment. But we don't know the tumor vascularity enough, because of poor diagnostic tool for this area. Recently new techniques of vascular evaluation, new advanced Doppler system, such as SMI, Angio+, and contrast ultrasound systems, such as Contrast Harmonic and Contrast SMI. These system have high sensitivities and capabilities to observe the slow or small vascular flow. Now we can research the small vascularity with these equipment. But there are some problems, the capacities of these equipment are same sensitivities and the observable flow is a small vessels or artery or slow vessels or artery. What is the difference of intra-tumoral follow and around tumoral flow?

In this presentation, I will show the image of conventional Doppler and new advanced Doppler (SMI/Angio+) and Contrast Ultrasounds (Contrast Harmonic/Contrast SMI), and some pathological images together, to consider the difference of each tools.

T4-14-IN10

Contrast Enhanced Ultrasound: Liver Imaging Reporting and Data System (CEUS LI-RADS)

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Hepatocellular carcinoma (HCC) is the 5th common cancer and 2nd leading cause of cancer death worldwide. All society guidelines support the use of imaging to establish the noninvasive diagnosis of HCC without confirmatory biopsy if imaging is definitive. Therefore, accurate imaging is vital in HCC patient management. The American College of Radiology (ACR) endorsed the Liver Imaging Reporting and Data System (LI-RADS) for standardized reporting and data collection of computed tomography (CT) and magnetic resonance (MR) imaging for hepatocellular carcinoma (HCC) in high-risk patients in 2011 [http://www.acr.org/quality-safety/resources/LIRADS]. Originally developed for CT and MRI, LI-RADS was expanded in 2016 to include CEUS coincident with the approval in the United States of a microbubble contrast agent for liver imaging (Lumason®, known as SonoVue® in Europe and elsewhere). CEUS LI-RADS currently includes 8 categories to codify the probability of HCC based on imaging. The categories range from definitely benign (LR-1) to definitely HCC (LR-5). Observations categorized as LR-5 can be managed as HCC without histological confirmation. CEUS LI-RADS also includes a separate category (LR-M) for observations that are definitely or probably malignant, but with imaging features not specific for HCC. The differential diagnosis for such lesions includes atypical HCC and intrahepatic cholangiocarcinoma (ICC); biopsy may be needed to distinguish these possibilities. LR-TIV (tumor in vein) is assigned for observations with definite tumor in vein, even if a parenchymal component is not identified at imaging; biopsy is not needed to

confirm the vascular invasion but may be needed to determine the underlying tumor type. LR-NC (not categorizable) is assigned to observations that cannot be categorized due to image degradation or omission. The details of categories, algorithm, major features, and ancillary features can be downloaded from the ACR website (https://www.acr.org/Quality-Safety/Resources/LIRADS). The presentation will summarize the updated version of CEUS-LI-RADS (v2017).

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Refresh Course

T4-15-IN01

Contrast-Enhanced EUS: A Preliminary Report of Definity Experience

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The use of microbubble contrast agents has improved the detection and characterization of the intralesional vascularity. The application of the contrast agents in combination with modern ultrasonographic techniques such as harmonic imagings is widely used and it offers substantial advantages for better differentiation, localization, and post-treatment assessment of the target lesions. Moreover, endoscopic ultrasound (EUS) can assess the intra-abdominal lessons without the interference of abdominal fat or bowel GSD. However, contrast-enhanced EUS cannot completely replace tissue acquisition to ascertain the tumor nature, particularly for the solid pancreatic tumors.

Mastering the technique of EUS and the pathophysiology of the examined target lesion will improve the accuracy of contrast-enhanced EUS. The enhanced phases of liver tumors are cumbersome and include arterial, venous, and parenchymal phases. However, the enhanced phases of the other visceral organs only consist of arterial and venous phases. Moreover, most studies of the other visceral organs focus on the arterial phase. Definity, with durability more than 5 minutes, is a good choice for contrast agent used in contrast-enhanced EUS.

T4-15-IN02

Intradermal Contrast-Enhanced Ultrasound Guided Fine Needle Aspiration Biopsy on Sentinel Lymph Nodes: Preoperative Diagnostic accuracy in Breast Cancers

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Background: To explore the diagnostic value of pre-operative contrast-enhanced ultrasound (CEUS) combined with fine needle biopsy (FNA) of sentinel lymph nodes (SLNs) in breast cancer patients.

Methods: The 63 consecutive patients with biopsy-proved breast cancer were enrolled. Two radiologists performed the procedure of axillary sentinel lymph nodes CEUS with intradermal microbubble injection. After the first enhancing axillary lymph node was localized, US-guided FNA was performed preoperatively. Methylene blue and indocyanine green were injected intradermally peri-areola to identify the SLN(s) during the operation. Enhancing patterns of SLN(s) and FNA results were compared with the final histopathological diagnosis.

Results: In 60 of 63(95.2%) patients, 73 SLNs were successfully identified by CEUS. SLNs CEUS enhancement pattern demonstrated as homogeneous, heterogeneous enhancement and no enhancement. 25 (34.2%) SLNs were enhanced homogeneously, and their FNA showed 23 negative and 2 suspicious, but all of them were negative on the final histopathologic examination. Heterogeneous enhancement was seen in 42(57.5%) SLNs. Among them FNA detected 9 metastatic SLNs, and the following histopathologic examination recognized 6 more of metastasis. All of the 6 unenhanced SLNs were involved both on FNA and histopathologic examination. If we use the heterogeneous enhancement or nonenhancement and FNA positive or suspicious as the diagnostic standard of SLN metastases, the sensitivity, specificity, positive predictive value and negative predictive value and accuracy were 71.4%, 100%, 100%, 89.7% and 91.8%.

Conclusions: CEUS enhancement pattern combined with FNA proved to be a feasible and accurate procedure to recognize the metastatic SLNs of breast cancer patients with clinical negative axilla preoperatively.

Key words: Sentinel lymph node (SLN), Contrast-enhanced ultrasonography (CEUS), Fine needle biopsy (FNA), Breast cancer.

T4-15-IN03

Contrast Imaging Methods by Using Sonazoid for Chronic Liver Disease

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Contrast-enhanced ultrasonography allows real-time assessment of the liver vascularity pattern and improves diagnostic accuracy for the classification of focal liver lesions (FLLs). Since these patterns vary due to the time phase after injection, it has three-dimensional information (2D+time). Parametric Imaging (PI) is a method to compact time information into a still image, i.e., one color-coded still image can contain the same information as a long-time movie clip.

First, PI was investigated to differentiate FLLs such as metastatic tumor [1], hepatocellular carcinoma [2] and hemangioma [3] by using Sonazoid microbubbles. We have found that the "arrival time" was the most efficient parameter for the imaging, while "peak time" was not very clear because of the accumulation of Sonazoid into the liver parenchyma. Second, PI has been investigated to quantify chronic liver disease (CLD), such as fibrosis stage [4], obstructive jaundice [5]. It has a potential of functional imaging rather than morphological imaging, quantifying the balance between the portal vein and the hepatic artery etc.

Another application of the PI is used in the post-vascular phase (Kupffer phase). A high-MI transmission breaks Sonazoid bubbles in the liver parenchyma. The depth of bubble disappearance relates to the concentration of bubbles in the Kupffer cells, which has a potential of the grading of hepatic fibrosis or planning of the output level of the RF-ablation [6].

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T4-15-IN04

A New Diagnosis Standard for Enterovesical Fistula in Crohn's Disease by Intracavitary Contrast-Enhanced Ultrasound

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Enterovesical fistula is a relatively rare condition complicating Crohn's disease (CD), often requiring surgical treatment [1]. Ascertaining the presence of fistula and visualization of its anatomy are important for undertaking a decision for surgery and may impact the operative strategy. However, conventional x-ray studies often fail to demonstrate the fistula tract. Ultrasonography (US), computed tomography (CT) and magnetic resonance (MR) imaging have a high sensitivity and specificity for the diagnosis of intra-abdominal fistulas, with similar diagnostic accuracies [2]. However, these methods may still fall short of detection of occult and complex fistulas and/or delineating their tracts. Intra-cavitary contrast-enhanced ultrasound (IC-CEUS) was recently proved useful for detecting biliary tract and perianal fistula by locally-injected contrast agent [3-4]. Compared with CT and MR, IC-CEUS has the advantages of non-ionizing radiation and cost-efficacy. We describe the feasibility of IC-CEUS for detection of entero-vesical fistula in a patient with CD using surgery as reference standard.

Our center is one of the starting area of the first domestic CD bowel ultrasound unit, has accumulated more than 600 cases, this paper reviews the literature at home and abroad, and combined with the ultrasonic diagnosis and the experience with abdominal abscess on CD interventional therapy – catheter drainage in 30 cases is discussed.

T4-15-IN05

Early Changes in Contrast Enhanced Ultrasound Predict for Pathologic Response to Chemotherapy in an Animal Tumor Model

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Objective: The purpose of this study was to examine CEUS whether could earlier predict pathologic response to chemotherapy than morphologic method in a MCF-7 tumor model.

Methods: Twenty MCF-7 breast cancer bearing nude mice were included in this study. Animals received either adriamycin or a control substance were imaged before and after treatment with an ultrasound scanner after bolus injection of SonoVue. Dynamic contrast enhanced ultrasound was performed at pretherapy, Day 3, Day 5 and Day 7 after adriamycin administration. Regions of interest within the tumor were analyzed off-line to determine perfusion parameters including peak enhancement (PE), area under the curve of wash-in (WIAUC), wash-in rate (WIR), wash-in perfusion index (WIPI) and quality of fit (QOF). The section equivalent to ultrasound imaging plane was stained with Hematoxylin and Eosin to allow for assessment of tumor cell density and Ki67 for situation of tumor proliferation, CD34 for tumor micro-vascular density.

Results: There were no significant differences in tumors perfusion and tumor volumes before treatment. Treatment with adriamycin resulted into a significant decrease in PE, WIAUC, WIR and WIPI in comparison with control group ($P < 0.05$) at Day 3, when there was no significant difference in tumor volume. The volume of treated tumors was significant smaller than that of control tumors ($P < 0.05$) at day 7. The tumor cell density estimated by pathology slice was significantly lower in treated tumors than in control tumors at day 7 ($P < 0.05$). The positive Ki67 cell density and CD34 estimated by pathology slice were also significantly lower in treated tumors than in control tumors at day 7 ($P < 0.05$). The correlation between micro-vascular and perfusion parameters was obvious ($P < 0.05$).

Conclusions: Changes in tumor micro-vessel functionality as depicted by CEUS early on after starting adriamycin -based chemotherapy can predict final pathologic response. Contrast enhanced ultrasound will be a new way for evaluating tumor response to chemoth.

T4-15-IN06

The Role of CEUS in Radiofrequency Ablation of HCC

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Background: The treatment efficiency of local thermal ablation therapy (including through percutaneous, laparoscopic or intraoperative approaches) on hepatic malignant tumors, both HCC and liver metastases, has been emphasized and affirmed. Unenhanced US is commonly used to guide ablation it is easy to use and widely available. However, CEUS can provide more important information and plays a more significant role in ablation therapy.

1. Choose indications according to number and size of lesions: Number and size are of crucial importance to define the eligibility of the patient for treatment. CEUS is sensitive to detect small lesions which are invisible on unenhanced US or CT, even satellite lesions of 3-5mm, providing evidence for choosing indication. Usage of CEUS to choose indications can reduce recurrence rate and prolong survival time [Chen, JUM 2007].

2. Measurement of tumor size: CEUS can accurately show the dimensions of tumors. The assessment of size must include the perilesional hypervascular halo or area which must be included in the treatment volume. unenhanced US cannot detect all the lesions visualized by CECT or CEMRI, real-time CT/MRI–US fusion imaging helps define the location, characteristics, and the size of the sonographically undetectable lesions.

3. Definition of tumor margins: CEUS can depict the infiltrating margin and the invasiveness of tumors better than unenhanced US [Chen, CR 2007]. Precise depiction of the tumor margins by CEUS allows better definition of its relationships with surrounding structures, such as the intestines, diaphragm and gallbladder, thus helping develop appropriate treatment strategies and reducing the risks of complications [Chen, JVIR 2006; Chen, JUM 2007]. This is especially important for subcapsular and exophytic tumors.

4. Assessment of degree of enhancement and homogeneity of vascularity and presence of necrosis to direct ablation therapy: For liver metastases, in substance phase CEUS can be more sensitive to display small washout lesions invisible on CECT or CEMRI, which should be positively treated by ablation. In addition, CEUS can accurately guide electrode placement.

5. Identification of blockage of tumor feeding vessels: when these are detected with CEUS, the region where they enter the tumor should be ablated first because a larger treatment volume can be achieved once the main blood supply has been blocked. Subsequently, a secondary CEUS evaluates the effect of blocking tumor feeding vessels to guide ablation, which can increase the effective inactivation rate [Hou, WJG 2009].

6. Early diagnosis of bleeding: CEUS can precisely show whether there's active bleeding in liver, judge the degree of liver damage and origin of vessel damage, direct clinical therapy or guide puncture ablation coagulation therapy and evaluate hemostatic effect. At the end of ablation, once liquid collection detected in the front of liver, CEUS should be performed to monitor and evaluate bleeding.

7. The location of residual recurrence for ablation therapy: U US can't easily identify recurrent residual area shown on CT/MR. CEUS can sensitively show activity area and guide puncture, which can efficiently improve the second ablation treatment effect of residual recurrent tumors. [Minami Y, AJR 2004]

Conclusion: With the development of ablation technique and improvement of its efficiency, the cases of big hepatocarcinoma, liver metastases and residual recurrent tumors after ablation clinically requiring ablation treatment have increased. In light of local ablation therapy challenges, the application value of CEUS has been increasingly valued clinically. In the course of ablation treatment, each patient needs one contrast agent(such as Sonovue), which can be used several times. The common dosage is 2ml-1ml-1ml-1ml or 2.4ml-1ml-1.5ml. Its effectiveness, practicability and economic efficiency demonstrate that CEUS has played an irreplaceable role in improving the ablation treatment efficiency of liver tumors.

T4-15-IN07

Future Prospects for Contrast Ultrasound

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The Instruments: New technical approaches in ultrasound are already having an impact on contrast imaging; the most striking among these is planewave imaging. By abandoning focused beams in favour of a broad insonation encompassing the field of view, an image is acquired each pulse, increasing the famerate to the PRF (typically around 5,000 per second). Both linear and nonlinear Doppler processing can be performed with coherent ensemble lengths of around 100, producing simultaneous contrast, colour and spectral Doppler imaging at framerates of 50-100Hz. This allows a new imaging mode, showing real-time anatomy, perfusion and velocity resolved spectral and colour Doppler, greatly increasing the versatility of the clinical contrast exam, particularly in fast moving structures. Efforts are already underway to implement such schemes in 3D using matrix a array probes. A consequence of very high speed acquisition is that ensembles of bubbles, or even individual bubbles, can be tracked from frame to frame. For the former case, combining such 'short track MIP' imaging with curvature operators already used in CT and MR angiography produces real time images of vessel morphology of unprecedented quality. In the latter case, if the agent is sufficiently sparse in tissue yet samples all of the microvessels over time, the path of individual bubbles can be tracked to create 'super-resolution' images of the perfusion bed, whose dimensions are below the wavelength of the ultrasound, which for conventional imaging, defines a lower limit of spatial resolution.

The Bubbles: The current generation of microbubbles were developed before the nonlinear imaging methods used to detect them were invented. To a great extent, the resonant properties of these bubbles which are the basis of their use in diagnosis an therapy have come about by serendipity. Slowly, a new generation of agents that are designed for specific applications or functionalised for biological interactions is emerging. Bubbles which are targeted with ligands specific for inflammation, angiogenesis or thrombosis have already been demonstrated. Bubbles can be loaded with drugs or plasmid DNA for theranosis. Yet to date, all of these targets are the endothelial cells that line blood vessels. While microbubbles stay within the vasculature offer a number of advantages to contrast ultrasound imaging, there are situations where the pattern of extravasation of a diffusible tracer has important clinical relevance. Liquid nano-droplets of perfluorocarbon (PFC) of a 200-400nm diameter range can selectively diffusible through angiogenic vascular endothelium and, due to the so-called 'enhanced permeability and retention' (EPR) effect, accumulate in solid tumours. An externally applied ultrasound field then 'activates' the droplets into bubbles while they remain in the interstitium. Such bubbles can not only report on tumours for diagnosis, they can in principle be targeted to extravascular molecules (such as those expressed on malignantly transformed hepatocytes), and may further be capable of degrading the extracellular matrix, so driving drugs into hitherto hard to treat solid tumours.

While the development of instruments results in rapid translation of technological ideas to the clinic, the cycle for new drug development is inevitably slowed by the complexity and cost and of the regulatory process. Nonetheless, developments already apparent in the research field assure a bright and diverse future for ultrasound contrast.

Free Paper

OPT4-001

Contrast Enhanced Ultrasound Liver Imaging Reporting and Data System Version 2016: Application of the Diagnostic Algorithm and Feedback on 1,773 Liver Lesions

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Objectives: To evaluate the diagnosis performance of the American College of Radiology Contrast Enhanced Ultrasound Liver Imaging Reporting and Data System (CEUS LI-RADS) version 2016 (v2016).

Methods: A total of 1610 HBV-positive patients with 1773 untreated CEUS-detected liver nodules were analyzed retrospectively and categorized as CEUS LI-RADS categories 1-5 and M (LR-1-5 and -M) according to CEUS LI-RADS v2016. All lesions were pathologically and/or clinically confirmed with a minimum of 1-year follow-up. The rates of malignancy or HCC were calculated.

Results: Of 1773 lesions, 8.4% had a LR-1 and -2 assessment; 10.2%, a LR-3 assessment; 7.4%, a LR-4 assessment; 56.5%, a LR-5 assessment; and 17.5%, a LR-M assessment based on initial CEUS images. The malignancy rates of LR-3, -4, -5, and -M lesions were 11.0%, 87.0%, 98.9%, and 99.4%, respectively; and the HCC rates were 9.4%, 80.2%, 97.5%, and 71.0%, respectively. Of 310 LR-M lesions, 213 (68.7%, with 192 HCCs (90.1%)) presenting as distinct solid nodules with arterial

phase hyperenhancement (APHE) (in whole or in part, not rim or peripheral discontinuous globular enhancement), only with early (within 60 seconds) or marked washout, were recategorized as LR-5. The HCC rates of LR-5 and -M were adjusted to 96.2% and 28.9%.

Conclusions: As LR-M lesions have a high HCC rate, a recommendation of recategorizing nodules with APHE and early or marked washout as LR-5 may be appropriate.

OPT4-002

Vessel Classification Using Ultrasound Contrast Imaging

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Objectives: Ultrasound contrast imaging could provide a cost effective method of assessing vascular networks in disease progression and treatment monitoring. Previously, it has been shown that large vessels can be distinguished from the microvasculature using ultrasound contrast imaging video data. Our aim was to further this distinction allowing more detailed identification of veins, arteries, arterioles and capillaries.

Methods: The highly vascularised ovine corpus luteum (CL) was used as large veins and arteries can be imaged at the same time as other vessels and smaller capillaries. SonoVue contrast agent was administered in 2.5ml bolus injections. The perfusion of the CL and surrounding area was observed on a Philips iU22 scanner with a L9-3, linear array probe in contrast imaging mode. Data was stored as DICOM and later processed offline. The time intensity curves and the associated flow parameters were extracted for different regions of interest (2x2 pixel), thus enabling the output of maximum projection maps from each parameter. Principal component analysis (PCA) was used to reduce the dimensionality of this multi-dimensional feature space allowing focus on fewer independent parameters with the largest variance (information). A binary mask identifying larger vessels (from microvasculature) was estimated using the first principal component. Colour Doppler imaging, histological evaluation and the video sequences provided ground truth validation of the vessel types.

Results: Time intensity curve characteristics were associated with specific types of vessels with absolute and relative value bounds without the use of set thresholds. For the data presented arbitrary intensity units (AIU) represent pixel intensity. Selection criteria for artery, vein, arterioles and capillary dominated areas were established using PCA along with time intensity curves. Veins present a significant delay in the start of their wash-in phase with the mean normalised time to peak of the intensity curve being 1 ± 0.04s for arteries and 1.23 ± 0.2s for veins and mean normalised wash-in time of 0.9 ± 0.03s for arteries compared to 1.13 ± 0.1s for veins. To identify areas of capillary flow from other vessels the wash-in and wash-out rates were significant indicators with mean normalised wash-in rates for capillaries being 0.3 ± 0.2AIU/s compared to 0.9 ± 0.1AIU/s for arteries and 0.65 ± 0.2AIU/s for veins. For all vessel types the peak intensity and the area under the time intensity curve were significantly different. Domains that present dominant capillary and venule/arteriole flow were possible to identify through the PCA analysis. From 5 individual comparisons, the mean overestimate in Doppler signal compared to the PCA vasculature was $38 \pm 11\%$. Thus estimating a binary mask from the flow parameters extracted from contrast videos can provide information on the micro-vessels as well as more detailed information on the larger veins and arteries compared to current methods. In the regions where smallest identifiable vessels were seen on the maximum projection maps the vessel diameter was calculated to be between 400 – 600μm.

Conclusions: Parametric maps based on the flow of ultrasound contrast agent through vessels can provide information on the nature of the vessels within the resolution limit of ultrasound imaging, which is this case is around 300μm. Vessels such as arterioles that are smaller than 100μm, can be identified due to their strong signal and different flow kinetics compared to larger vessels and capillaries. Domains of capillary flow are also clearly defined. Automation of the technique could provide an efficient way of monitoring micro-vessels in a clinical setting. This is desirable in an effort to improve flow quantification, as the physiological state of disease relates directly to micro-flow area and dynamics.

OPT4-003

Indocyanine Green Loaded Magnetic Plga Nanoparticles Encapsulated with Liquid Perfluorocarbon for Multimodal Imaging - Guided Photothermal Tumor Ablation

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Objectives: Near-infrared (NIR) laser induced photothermal therapy (PTT) has become an appealing strategy as an effective local, minimally invasive treatment modality, which requires photosensitizer to convert optical energy into thermal energy to kill cancer cells. To improve the efficacy of PTT, we developed PLGA nanoparticles encapsulating superparamagnetic iron oxide (Fe3O4), indocyanine green (ICG) and pefluoropentane (PFP) as synergistic agents for NIR laser induced PTT.

Methods: In this study, we fabricated a novel phase-shifted fluorescent magnetic nanoparticles Fe3O4/ICG@PLGA/PFP NPs that effectively produce heat in response to NIR laser irradiation, enhance tumor therapy via the thermal ablation effect and phase-shift thermoelastic expansion effect, and be used as multi-modal contrast agent for magnetic resonance/ultrasound/NIR fluorescence (MR/US/NIRF) imaging-guided therapy.

Results: Histology and electron microscopy confirmed severe damage of cell injuries with the fragmentation of lysed cell membranes and nuclear, leaving remnants of the nucleus shadow, and lots of microbubbles generated with iron particles expelled to the edge or outside of the microbubbles. This study shows that Fe3O4/ICG@PLGA/PFP NPs can be used as effective nanotheranostic agents for treatment of tumor.

Conclusions: The synthesized multifunctional Fe3O4/ICG@PLGA/PFP NPs used in this study showed promising results as a theranostic agent for cancer multimodal imaging and hyperthermia treatment. The photoabsorber of Fe3O4 nanoparticles and ICG were simultaneously embedded in the shell, the microbubbles generated using the liquid-gas phase shift process conferred MR/US/NIRF imaging properties to Fe3O4/ICG@PLGA/PFP NPs, thus enabling imaging-guided tumor therapy. This successful demonstration of use of nanobiotechnology for stimuli-responsive MR/US/NIRF imaging and NIR laser induced PTT therapy provides an alternative modality for strong "nanotheranostics".

OPT4-004

Contrast Enhanced Ultrasound (CEUS) Assessment of Normothermic Ex Situ Perfusion Demonstrates Improved Liver Arterial Resistance

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Objectives: Ex situ liver perfusion offers the potential to "recondition" organs prior to transplantation. Putative benefits of perfusion include delivery of oxygen, as well as wash-out of the microcirculation prior to transplantation. Assessment of "reconditioning" has previously centred around biochemistry, such as lactate clearance. Ex-vivo assessment of liver perfusion by CEUS has not been widely reported in the literature.

Methods: 7 human livers declined for transplantation underwent ex-vivo normothermic perfusion with a red-cell based perfusate at fixed pressures (arterial pressure 75 mmHg, portal pressure 5 mmHg). Contrast enhanced ultrasound (CEUS) was used to assess the livers at zero, two and six hours. 0.7mls Sonovue was injected in the hepatic artery and portal vein separately to identify circulation specific differences in perfusion. Cineloops acquired in the hepatic hilum using low MI technique had regions of interest placed on the main vessel and the parenchyma to generate perfusion curves (Intensity (Db)/ Time (s)). Area Under the Curve (AUC) was analysed (difference between vessel and parenchyma (dAUC) resistance) to quantify changes in tissue perfusion.

Results: During perfusion portal vein vessel flow, as measured by AUC, remained relatively stable across all livers, as did the portal parenchymal AUC (dAUC 471/454/340 at 0/2/6 hours). However, although arterial vessel AUC improved, arterial parenchymal flow improved proportionally more (433/197/39 at 0/2/6 hours).

Conclusions: CEUS assessment of a human liver on ex-situ normothermic perfusion is possible. Normothermic ex situ perfusion improves the hepatic arterial vascular tone, but has an even greater effect on parenchymal arterial microcirculation.

OPT4-005

CEUS Can be Used to Assess Lesions which are of Intermediate Probability or Probable for HCC on Contrast Enhanced CT/MRI

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Objectives: To review the use of LI-RADS (Liver Imaging Reporting and Data System) for diagnosis of HCC with CEUS when compared to corresponding CECT/MRI.

Methods: Retrospective analysis of high risk patients who presented to our centre for contrast enhanced ultrasound (CEUS) evaluation of liver lesions from July 2010 to April 2016 was performed. Patients with eventual diagnosis of hepatocellular carcinoma (HCC) on imaging or histology were identified. Findings of CEUS studies which had a corresponding contrasted enhanced CT or MRI (CECT/MRI) study performed within a period of 4 months were reviewed and assigned the appropriate grading according to latest CEUS LI-RADS and CT/MRI LI-RADS guidelines.

Results: In total, 30 patients were reviewed. On CECT/MRI, 13, 8 and 7 cases were graded as LR-3(intermediate probability), LR-4(probable) and LR-5(definitive) respectively. In 2 cases, the lesion on CEUS could not be visualized on the corresponding CECT/MRI. When compared, all CT/MRI LR-4 and LR-5 lesions were classified as CEUS LR-5. Amongst the CT/MR LR-3 lesions, majority were upgraded on CEUS with 8(62%), 3(23%), 2(15%) classified as CEUS LR-5, LR-4 and LR-3 respectively. None were downgraded. The 2 lesions not seen on CECT/MR but seen on CEUS were classified as CEUS LR-4 and LR- 3. Amongst CT/MR LR-3 cases, 7(31%) showed arterial enhancement and/or washout on CEUS that was not seen on CECT/MRI.

Conclusions: CEUS matches CECT/MRI for diagnosis of definitive HCC. CEUS may upgrade lesions classified as intermediate probability or probable for HCC on CECT/MRI and should be considered as a further assessment tool in such cases.

OPT4-006

A Revised Li-Rads Classifications for Contrast-Enhanced Ultrasound in Assessing Focal Liver Lesions by Comparison with Cect

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Objectives: The aim of our study was to compare the diagnostic efficiency in differentiating benign from malignant focal liver lesions (FLLs) between Liver Imaging Reporting and Data System based upon contrast-enhanced ultrasound (LI-RADS-CEUS) proposed by Fujian Ultrasound Medical Engineering and the current LI-RADS based upon contrast-enhanced computed tomography (LI-RADS-CECT).

Methods: Each lesion was assessed by the LI-RADS-CEUS and LI-RADS-CECT respectively, and all of the identified FLLs were eventually confirmed by the pathologic examinations or imaging follow-up for at least 2 years. Considering LI-RADS 4 and 5 as being malignant, the diagnostic performance was compared in terms of sensitivity, specificity, coincidence rate, positive likelihood ratio (LR+), negative likelihood ratio (LR−), Area Under the Curve (AUC) and Youden-index.

Results: All 95 patients enrolled in this study underwent conventional ultrasound, CEUS and CECT examinations, totally of 126 FLLs were identified. Among the 126 FLLs, 51 were eventually confirmed as malignancies and 75 were benign lesions. There was no significant difference in sensitivity (82.3% vs. 92.2%), specificity (93.3% vs. 89.2%) and coincidence rate (88.9% vs. 90.4%) between LI-RADS-CEUS and LI-RADS-CECT ($p>0.05$). The values of LR+, LR−, AUC and Youden-index for LI-RADS-CEUS were12.28, 0.18, 0.948 and 75.7, whereas those for LI-RADS-CECT were 8.54, 0.09, 0.959 and 81.4, respectively.

Conclusions: LI-RADS-CEUS, which demonstrated comparable performance to LI-RADS-CECT, is a useful imaging tool in differentiating benign or malignant FLLs.

OPT4-007

Early Prediction of Tumor Response to Bevacizumab Treatment in Murine Colon Cancer Models Using Three-Dimensional Dynamic Contrast-Enhanced Ultrasound Imaging

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Objectives: To evaluate whether three-dimensional (3D) dynamic contrast-enhanced ultrasound (DCE-US) imaging allows assessing early changes in tumor perfusion following antiangiogenic treatment, and whether these changes could predict treatment response in two animal models of colon cancer that simulate clinical responders and nonresponders.

Methods: Clinically responding (n=20; LS174T) and nonresponding (n=20; CT26) colon cancer xenografts were established in 40 mice. Ten mice from each group received either antiangiogenic therapy (anti-VEGF blocking with bevacizumab, 10mg/kg) or saline as controls and were imaged longitudinally with 3D DCE-US at baseline (day 0) and days 1, 3, 7, and 10 following treatment. The change in three perfusion parameters (peak enhancement [PE], area under curve [AUC], time to peak [TTP]) relative to baseline was compared to the percentage area of neovasculature on ex vivo quantitative immunofluorescence and with response at day 10 assessed by tumor volume.
Results: PE and AUC significantly decreased in LS174T tumors within 1 day after antiangiogenic treatment (P=0.005), but not in CT26 tumors (P>0.05). Similarly, the percentage area of neovasculature on immunofluorescence significantly decreased in treated vs. control LS174T tumors (P<0.001), but not in treated vs. control CT26 tumors (P=0.796). Early decrease in both PE and AUC by 45-50% were predictive of treatment response in 100% (95% CI, 69.2%, 100%) of responding tumors, and in 100% (95% CI, 88.4%, 100%) and 86.7% (95% CI, 69.3%, 96.2%), respectively, of nonresponding tumors.
Conclusions: 3D DCE-US provides clinically relevant information on the variability of tumor response to antiangiogenic therapy and could eventually serve as a biomarker for predicting treatment outcomes.

OPT4-008

Laser-Activatible Gold Particles for Phase Transformation Imaging and Therapy in Metastatic Lymph Nodes

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Objectives: The gold nanoparticles were incorporated into PLGA/PFH (Au-PLGA/PFH) particles to observe their enhanced ultrasound imaging and treatment effect in rabbit metastatic lymph nodes.
Methods: Double emulsion evaporation method was used to prepare the Au-PLGA/PFH particles. The size distribution, the morphological and structural characterization, the optical obsorbing property were estimated. The rabbit VX2 tumor was inoculated in rabbits subcutaneous thigh muscles to build popliteal lymph node metastasis of tumor models. After the Au-PLGA/PFH particles were introduced into lymph nodes by rabbit footpad, US were used to image the popliteal lymph nodes in real-time, also the Color Doppler Flow Image (CDFI) were acquired. With a wavelength of 532nm laser irradiation in vitro, the image of lymph nodes were observed under 2D and contrast enhance mode. Improving the laser energy, the irradiation was done every 48 h for a total of three times, this process was observed by US and CDFI. 48 h after the last irradiation, the rabbits were sacrificed, and the lymph node tissue were removed to measure the size, also the HE, immunohistochemistry and transmission electron microscopy (TEM) measurement were carried.
Results: The Au-PLGA/PFH particle is about 1 μm in diameter, the gold nanoparticles are located around the shell, these are clearly visible as small black dots in the PLGA shell. A UV-Vis shows there is a strong optical obsorbing peak of the particles in 525nm. Thus, with a 532 nm laser irradiation in vitro, the particles in lymph nodes absorb light energy to enhance the local temperature, when the temperature is over the phase transition threshold of PFH, the particles transfer into bubbles and enhance the US imaging. In addition, as the laser fluence increased, the creating bubble that expanded within the tumor cells, eventually destroyed the cells. Therefore, the lymph nodes enlarge slowly or smaller than before. HE, immunohistochemisty and TEM further conform this effect.
Conclusions: This work demonstrates PLGA/PFH particles containing gold nanoparticles can use as US contrast agents and theragnostic agents.

OPT4-009

CD105-Loaded Docetaxel Lipid Microbubble Combined with Ultrasound - Triggered Microbubble Destruction for Inhibition of Proliferation of HCC in Vitro and in Vivo

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Objectives: To investigate the proliferation inhibition and apoptosis promotion of hepatoma cells MHCC-H and HepG2 induced by ultrasound triggered microbubble destruction (UTMD) with CD105 labeled Docetaxel Loaded Lipid Microbubble (CD105-DLLM).
Methods: 1. CD105-DLLMs were made by mechanical vibration technique and streptavidin. 2. CD105-DLLMs were tested in vitro cell experiment, human hepatoma cells were divided into 4 groups including control group, DOC group (Docetaxel), CD105-DLLM group and UTMD-CD105-DLLM group (Docetaxel Loaded Lipid Microbubble with Ultrasound destruction). Cell proliferation, cell cycle, apoptosis and cytotoxicity were tested by CCK-8 assay. 3. The apoptotic signaling pathway of the cells in each group was tested by western blotting. ①Caspase pathway: the protein expression level of bcl, bax, cyto-c,caspase-3 and P53. ②MAPK pathway : p-ERK1/2, p-p38, ERK1/2 protein. 4. In vivo fluorescence imaging experiment of tumor bearing nude mice: Cy-3 staining was performed on the targeted microbubbles and then injected into tumor bearing nude mice to observe whether the microbubbles were imaged in vivo.
Results: 1. DLLM with suitable particle size and good physical properties was prepared, and it has applied for the national invention patent. 2. The proliferation inhibition effect of DLLM on MHCC-H and HepG2 cells: The proliferation of hepatoma cells was inhibited and the apoptosis rate of hepatoma cells increased. 3. The results of western blotting showed that the protein expression level down in UTMD with CD105-DLLM group. 4. Cy-3 staining and CD105-DLLM can be used for fluorescence imaging in nude mice. Results provide more direct evidence for ultrasound irradiating docetaxel-loaded microbubbles in MHCC-H cells, we have used western-blot to show that CD105-DLLM group down-regulated the expression of proliferating cell nuclear antigen and apoptosis protein as Caspase-3, p-ERK1/2 protein, and meanwhile up-regulated that of p-p38 protein in human liver cancer cells MHCC-H expression changes of ERK1/2 and p38 protein reflected the activation of MAPK signal transduction pathway.
Conclusions: UTMD with CD105-DLLM can inhibition effect on hepatoma cells and in nude mice.

OPT4-010

Contrast-Enhanced Ultrasound (CEUS) Determines Supraspinatus Muscle Atrophy after Cuff Repair

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Objectives: Muscle degeneration following rotator cuff tears is mainly assessed by MRI. Contrast-enhanced ultrasound (CEUS) as functional imaging can assess microvascular perfusion which represents muscle tissue vitality. In this cross-sectional study we evaluated the supraspinatus muscle perfusion after cuff repair and analyzed its association to the grade of echogenicity in B-mode ultrasound indicating fatty infiltration and the functional shoulder outcome.

Methods: Patients that received unilateral refixation of the supraspinatus were invited for a single follow-up, functional scores such as Constant-Score (CS) were assessed. CEUS examination was performed bilaterally in an oblique sagittal plane of the supraspinatus fossa. Perfusion was quantified with parameters like Wash-in-Perfusion-Index (WiPI) and Peak Enhancement (PE) using VueBox quantification software. Function and perfusion were referenced to the contralateral shoulder and correlated. Echogenicity was classified in a three-point scale compared to the trapezius muscle.

Results: 67 patients were available with a mean follow-up of 38.0±18.5 months. The function of the operated shoulder was worse than contralaterally (relative CS: 80±19%). CEUS revealed diminished perfusion on the operated shoulder (WiPI, 55.1±40.2%, $p<.001$). A strong correlation could be demonstrated between the perfusion deficit and the functional impairment (relative WiPI and CS: $rs= .644$, $p< .001$). Higher grade of echogenicity was associated to lower perfusion.

Conclusions: CEUS is able to visualize the impaired supraspinatus muscle perfusion after rotator cuff repair. With its ability to quantify microvascular perfusion as a surrogate parameter for muscle vitality and function, CEUS may serve as an ultrasound-based method to perioperatively evaluate rotator cuff muscles.

OPT4-011

Evaluation of Renal Lesions Using Contrast-Enhanced Ultrasound (CEUS): A 10-Year Retrospective Mono-Center Analysis

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Objectives: To investigate the usefulness of contrast-enhanced ultrasound (CEUS) in the evaluation of renal masses.

Methods: This study included 255 patients with a single renal mass with imaging studies between 2005-2015. Patient ages ranged from 18 to 86 CEUS was used for determining malignancy or benignancy and findings were correlated with histopathology. Out of 255 renal masses 212 lesions were malignant (83,1%) and 43 were benign (16,9%). Diagnostic accuracy was tested by using the histopathological diagnosis as the gold standard.

Results: CEUS showed a sensitivity of 99.1% (95% confidence interval (CI): 96.7%, 99.9%), specificity of 80.5% (95% CI: 65.1%, 91.2%), positive predictive value (PPV) of 96.4% (95% CI: 93.0%, 98.4%) and a negative predictive value (NPV) of 94.3% (95% CI: 80.8%, 99.3%). Kappa for diagnostic accuracy was $\kappa= 0.85$ (95% CI: 0.75, 0.94) Out of 212 malignant lesions 130 clear cell renal carcinomas (RCC), 59 papillary RCC 7 chromophobe RCC, 4 combined clear cell and papillary RCC and 12 other malignant lesions were diagnosed. Out of 43 benign lesions 10 angiomyolipomas, 3 oncocytomas, 8 benign renal cysts and 22 other benign lesion swere diagnosed. 10 lesions were falsely identified as malignant or benign, whereas 8 lesions were false-positive and 2 lesions false negative. The 8 false-positive lesions included 5 oncocytomas or angiomyolipomas and 3 Bosniak category III lesions.

Conclusions: CEUS is an useful method, which can be used to differentiate between malignant and benign renal lesions. In daily clinical routine, patients with contraindications for other imaging methods can particularly benefit using this method.

OPT4-012

The Contrast Enhanced Perfusion Pattern and Pathological Changes of Papillary Thyroid Cancer (PTC) and the Correlation with Pathogesis

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Objectives: To evaluate the contrast enhanced perfusion pattern of PTC micro-vascular imaging (MVI) quantitatively, and investigate the correlation between MVI features, CD34 micro-vascular density (MVD), and whole genoe DNA copy number abrrevation(CNA) of the PTCs.

Methods: Thirty-nine pathological and clinical confirmed sporadic PTCs were evaluated with real-time gray-scale contrast-enhanced micro-vascular imaging under a low mechanical index. The micro-bubble agent was SoneVue. Of the 39 PTCs, 33 were classical PTCs, 6 were PTC with follicular variant (FVPTC). The △ROI ,which is the subtraction of peak echo intensity between the lesion region of interest (ROI) and normal thyroid parenchyma ROI, was used to evaluate the perfusion characteristics of PTC MVI quantitatively. The paraffined specimens were selected for immunohistochemical (IHC) staining for CD34. The correlation between △ROI, CD34 expression level and the whole genome DNA copy number abbrevation(CNA) grouping of the PTCs were evaluated.

Results: △ROI was strongly correlated with the CD34 expression($p=0.000$), significant differences were detected in the distribution pattern of △ROI value among different CD34 expression levels, no overlapping of the mean △ROI values and the 95% confidence intervals was found among the different CD34 expression levels. The PTC MVI perfusion was therefore classified into 3 patterns, low perfusion, focal perfusion and high perfusion, on the basis of combining △ROI values with the peak ehco pattern in time-intensity curve. The high DNA CNA PTCs presented mainly with high and focal perfusion pattern, the low DNA-CNA PTCs showed a combination of focal and low perfusion, the normal DNA-CNA PTCs mostly demonstrated low perfusion patterns. The mean △ROI values rose with the extent of DNA-CNAs accordingly.

Conclusions: Based on the strong correlation of △ROI and CD34 expression, △ROI can be take as an objective indicator for the quantitative evaluation of PTC MVI pattern and intensity. The MVI perfusion intensity of PTC showed a positive correlation with the extent of CNAs, which proves that the PTC angiogenesis is related to the gene level pathogensis.

OPT4-013

Feasibility Study of Sonazoid-Enhanced Ultrasound (SEUS) in Therapeutic Response Evaluation after Targeted Therapy in Rabbit Hepatic Vx2 Carcinoma

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Objectives: This study is to assess feasibility of Sonazoid-enhanced ultrasound (SEUS) in therapeutic response evaluation after targeted therapy in rabbit hepatic VX2 carcinoma.

Methods: This study was approved by our institutional animal care and use committee. SEUS was performed on rabbit hepatic VX2 carcinomas, which are divided into treatment group (n=10,

30mg/kg/day of Sorafenib) and control group (n=8), baseline, one-day, and one-week after first treatment. Sorafenib treated group were given by gavage once a day for 7 days with sorafenib suspension, whereas rabbits in control group were given saline of the same volume. We analyzed the tumor size, US perfusion parameters, and echogenicity of the kupffer phase in both tumor and liver parenchyma in each time period. The time intensity curve (TIC) was used to obtain quantitative parameters of enhancement patterns. Fourteen US perfusion parameters were obtained. Spearman correlation test was used to analyze the correlation between time and perfusion parameter.

Results: In tumor size, treated group did not show significant different between baseline and 1 week follow-up (mean size; 13.30±2.50 and 15.3±4.24, P=.47), however control group showed significantly increased in size (mean size; 11.13±2.29 and 16.63±5.81, P=.019). In sorafenib treated group, peak intensity (PI, 102.92±33.30, 73.10±35.55, 59.43±36.10), area under the curve (AUC, 4345.06±1509.47, 3118.51±1688.58, 1359.26±1596.29), AUC during wash-in (AUC_in, 1516.36±704.63, 1092.66±645.37, 702.62±550.50) showed a tendency to decrease significantly over baseline, one-day, and one-week (P<.05). However, control group showed no significant decrease over time. In the Kupffer phase of liver parenchyma, sorafenib treated group showed a tendency to decrease significantly over baseline, one-day, and one-week (P<.05). However, tumor showed no significant decrease over time.

Conclusions: SEUS is feasible to predict therapeutic response evaluation after targeted therapy because it is useful for not only perfusion evaluation using perfusion parameters, but also liver parenchyma evaluation using Kupffer phase.

OPT4-014

The Application of Contrast Enhanced Ultrasound for the Characterization of Hepatic Tumors: An Assessment Focusing on Hepatocellular Carcinoma

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Objectives: Contrast enhanced ultrasound (CEUS) has been used in clinical practice in the past decade. However, there are only limited experiences for clinical application in Taiwan. Researchers aimed to report our initial experience of CEUS in the diagnosis of hepatic tumors and also tried to identify if some putative factors are associated with the typical findings of hepatocellular carcinoma (HCC) on CEUS.

Methods: From September 2015 to January 2017, 126 patients were recruited for CEUS at Tainan Municipal Hospital for evaluation of unknown focal liver lesions. The enhancement pattern of the nodules was evaluated according to the 2012 WFUMB-EFSUMB guidelines. Chi-square tests, Fisher's test and Mann-Whitney U-tests were utilized to analyze the differences regarding clinical characteristics.

Results: The study population consists of a total of 61 patients with 64 liver nodules. After the pathologic work-up, 53 of 64 nodules (83%) had been diagnosed as HCC. Among those with biopsy proven HCC, 39 of 53 nodules (73.6%) examined by CEUS had a typical enhancement pattern with arterial hyperenhancement and washout in the portal/late phase. Higher BMI (>25.5 kg/m2) showed significantly negative association with the typical HCC enhancement pattern on CEUS (p=0.04).

Conclusions: From researchers' initial experience, CEUS with Definity® contrast agent can be safely and effectively applied in the diagnosis of hepatic tumors. Further investigations based on more cases of liver tumors are still warranted.

OPT4-015

The Feasibility Study of Contrast-Enhanced Us Using a 3D Transducer for Tumor Volume Measurement in Rabbit Hepatic Vx2 Carcinoma Comparison with 2D Us and 3D Us without Contrast: Preliminary Results

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Objectives: To investigate the feasibility of tumor volume measurement using contrast-enhanced US with 3D transducer (3D CEUS) in rabbit hepatic VX2 carcinoma.

Methods: Three different tumor volume measurements, including 2D US using the equation, 4/3(π)(abc), 3D US without contrast, and 3D CEUS were performed in 35 rabbit hepatic VX2 carcinomas. With the tumor volume from CT as a reference standard, we compared difference between CT volume and each different US tumor volume. The mean difference and correlation coefficient between each US volume measurement and CT volume were analyzed.

Results: Tumor volume measurement using 3D CEUS and 2D US using equation showed no statistical difference compared to CT volume (0.276cm3, 0.212 cm3, and 0.263 cm3 vs. 0.306cm3, 0.247 cm3, 0.276 cm3, p>0.05). However, 3D CEUS provided the highest correlation coefficient with CT volume (R = 0.835 and 0.720) and the highest intraclass correlation (0.973 and 0.993). 3D CEUS provided a smaller mean difference with CT volume (0.016 cm3 and 0.033 cm3) than 2D US, showing 3D CEUS's accurate measurement of tumor volume.

Conclusions: Due to its highly accurate, reliable, and reproducible measurements of tumor volume, 3D CEUS may be useful for predicting the therapeutic response evaluation after treatment.

OPT4-016

Clinical Value of Contrast-Enhanced Ultrasound in Differential Diagnosis of Early Hepatocellular Carcinoma and Dysplastic Nodules

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Objectives: To evaluate the clinical significance of contras-enhanced ultrasound (CEUS) in the diagnosis of early hepatocellular carcinoma (eHCC) in patients with liver cirrhosis and analyze enhancement patterns of nodules.

Methods: A total of 2130 patients with liver cirrhosis received CEUS scan. Among them, 176 with a solitary tumor in the size of 1.0 to 3.0cm were included in this study. The final diagnosis was confirmed by the histological results obtained from ultrasound-guided biopsy. According to the size, tumors were classified into 1.0-2.0cm group and 2.0-3.0cm group. The ROC curve was used to evaluate the clinical significance of CEUS in the diagnosis of eHCC with different size.

Results: A total of 176 nodules, including 127 HCC and 49 non-HCC were enrolled in this study. 85.8% (109/127) of HCC were hypervascular during arterial phase of CEUS. The proportions of hypervascular tumors in 1.0-2.0cm group and 2.0-3.0cm group were 81.0% and 90.0%, respectively. 72.4% of HCC in 1.0-2.0cm group showed that the hypervascularity in arterial phase and contrast wash-out in portal of delayed phase, while 88.4% of HCC in 2.0-3.0cm group appeared by above enhancement pattern (p=0.022). 16 of 58 HCC with the size of 1.0-2.0cm did not meet the image diagnosis criteria recommend by guideline.

Conclusions: CEUS are useful for the differential diagnosis of eHCC and dysplastic nodules in liver cirrhosis. Compared with the tumors in

size of 2.0-3.0cm, fewer tumors in size of 1.0-2.0cm show enhancement patterns meeting the image diagnosis criteria. Thus, eHCC may be described by hypervascularity in arterial phase without wash-out in later phase. However, careful differential diagnosis between eHCC and dysplastic nodules should be performed.

OPT4-017

Feasibility of Using 3D Contrast Enhanced Ultrasound Technology to Predict the Treatment Effect of Targeted Drugs-Loaded Thermosensitive Hydrogel Therapy on the Rabbit Vx2 Tumor Model

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Objectives: Minimally-invasive ultrasound (US)-guided tumor microwave ablation (MWA) has been increasing clinical use for treatment of focal liver cancer. However, this technique cannot achieve complete ablation in many cases, especially at margins of tumors > 3 cm in diameter and adjacent to blood vessels is challenging. In the present study, we combined targeted thermosensitive hydrogel with microwave ablation in therapy of rabbit VX2 tumour model. 3D-contrast enhanced ultrasound was used to predict the treatment effect.
Methods: In this animal care and use committee-approved study, study was carried out in accordance with the guidelines issued by the National Institutes of Health for care of laboratory animals. Aplio500 US system (Toshiba, Japan), equipped with a PVT-382 MV high frequency transducer (3.5MHz) was used. 3D-CEUS was performed on the rabbit VX2 hepatic tumor model (600-1000 g, n=40). Combined microwave ablation with targeted drugs-loaded thermosensitive hydrogel was used to enhance therapeutic efficacy. The feasibility and accuracy of 3D-CEUS imaging were verified by immunohistochemistry results and western blot results.
Results: Results demonstrated that intratumoral injection thermosensitive hydrogel to sustained release As2O3 in the cavity after microwave ablation significantly improved the tumor growth inhibition efficiency. During 5 weeks follow-up by 3D-CEUS, increased necrotic areas from 34% to 76% were detected intra-tumor. Furthermore, the anti-angiogenesis effects of Gel-MW was mediated by suppression of CD31, CD34 and VEGF.
Conclusions: Thermosensitive hydrogel in combination with US - guided MWA has potential clinical applicability for treatment of liver tumors. 3D-CEUS played a fundamental role in monitoring the efficacy of treatment.

OPT4-018

Ultrasonographic Differential Diagnosis of Focal Gallbladder Adenomyomatosis and Early Stage Gallbladder Cancer: Value of Conventional Ultrasound Combined with Contrast-Enhanced Ultrasound

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Objectives: To assess conventional ultrasound (CUS) combined with contrast-enhanced ultrasonography (CEUS) for the differential diagnosis of gallbladder adenomyomatosis (ADM) and early stage gallbladder cancer (GBC).
Methods: CUS and CEUS data of 21 histopathologically proven ADMs were analyzed and compared with 34 GBCs (≤T2 stage) retrospectively.
Results: Significant differences were found in lesion location, intramural anechoic space, echogenic foci, intactness of GB wall on CUS, and enhancement pattern, intramural anechoic space, intactness of GB wall on CEUS. The fundal proportion was 57.1% (12/21) in ADMs and 11.8% (4/34) in GBC (p=0.001). Intramural anechoic space, echogenic foci, intactness of GB wall on CUS and linear or branch blood flow were detected in 42.9% (9/21), 52.4% (11/21), 76.2% (16/21) and 28.6% (6/21) of cases in ADM group, compared to 5.9% (2/34), 11.8% (4/34), 26.5% (9/34) and 73.5% (25/34) in GBC group (p=0.001, p=0.002, p=0.001, p=0.001), respectively. Hypo-enhancement, intramural anechoic space and intactness of GB wall on CEUS were detected in 76.2% (16/21), 71.4% (15/21) and 85.7% (18/21) cases of ADMs, whereas 11.8% (4/34), 5.9% (2/34) and 17.6% (6/34) of GBCs (p<0.001, p=0.001, p=0.001). The prior Youden's index were 0.72, 0.66 and 0.65 based on intramural anechoic space on CEUS, hypo-enhancement and intactness of GB wall on CEUS, respectively.
Conclusions: Intramural anechoic space and intactness of GB wall were more detected in ADMs when combined with CEUS which helped to improve the diagnosis of ADMs. Hypo-enhancement, intramural anechoic space on CEUS, intactness of GB wall on CEUS, location in GB fundus, intramural echogenic foci, lack of blood flow on CUS are useful markers for diagnosis of gallbladder ADMs.

OPT4-019

Detectiono of Pancreatic Carcinoma and Liver Metastases with Contrast-Enhanced Ultrasonography: Comparison with Contrast-Enhanced Multi-Detector Row CT

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Objectives: To compare Contrast-enhanced ultrasonography with contrast material-enhanced multi-detector row computed tomography (CT) in detection of pancreatic carcinoma and liver metastases.
Methods: This study included 60 patients (48 men, 12 women; mean age, 63.2 years) consisting of 40 patients with pathologically confirmed pancreatic carcinoma (mean size, 3.6 cm) and 20 without a pancreatic lesion. seventy-six liver metastases (mean size, 1.5 cm) in 20 patients with pancreatic carcinoma were diagnosed at pathologic examination or multimodality assessment. Three readers blinded to the final diagnosis interpreted all contrast-enhanced ultrasonography and contrast-enhanced CT images and graded the presence (or absence) of pancreatic carcinoma and liver metastasis on patient-by-patient and lesion-by-lesion bases. Receiver operating characteristic analysis, to compare the diagnostic performance of contrast-enhanced ultrasonography and CT imaging.
Results: No significant differences were observed between CT and contrast-enhanced ultrasonography in depiction of pancreatic carcinoma. However, contrast-enhanced ultrasonography had greater sensitivity in depicting liver metastasis than did CT (P<0.05) and in the lesion-by-lesion analysis (P<0.05).
Conclusions: Contrast-enhanced ultrasonography was equivalent to dynamic contrast-enhanced CT in depicting pancreatic carcinoma and had better sensitivity for depicting liver metastases, suggesting the usefulness of Contrast-enhanced ultrasonography for evaluation of patients with pancreatic carcinoma.

OPT4-020

Perfusion Patterns and Dynamics in Diabetic Nephropathy (DN) Rhesus Monkeys of Renal Parenchyma by Contrast-Enhanced Ultrasound

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Objectives: To assess perfusion patterns and dynamics in diabetic nephropathy (DN) rhesus monkeys of renal parenchyma by using contrast-enhanced ultrasound (CEUS).
Methods: Ten rhesus monkeys were included in this study. The contrast agent was applied respectively in ten rhesus monkeys by intravenous bolus injection. The time-intensity curve was used to obtain flow-related parameters such as area under curve (AUC), time from peak to one half (HPT), intensity peak (PI), time to peak (TTP) and rise time (RT).
Results: Compared with normal control group, lesion group AUC, HPT and PI decreased significantly, and time to peak (TTP) delayed slightly. Analyzed RT in two groups, there was no significant difference. We found when blood biochemical indicators of renal function were no obvious abnormal findings, the perfusion indexes are more sensitive and dependent in early diagnosis of DN.
Conclusions: AUC, HPT and PI might be useful in diagnostic predicting the hemodynamic changes of renal parenchyma.

OPT4-021

Contrast-Enhanced Ultrasound Evaluation of Chronic Kidney Disease: A Pilot Study

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Objectives: The aim of this study was to investigate the clinical significance of real-time gray-scale contrast-enhanced ultrasound (CEUS) through evaluating renal microvascular perfusion in chronic kidney disease.
Methods: Chronic kidney disease (CKD) patients (n = 26) were stratified according to estimated glomerular filtration rate (eGFR): Group I (CKD stage I and II), eGFR ≥60 ml/min/1.73m2, Group II (CKD stage III), eGFR of 30 ≤ eGFR < 60 ml/min/1.73m2, Group III (CKD stage IV and V), eGFR of eGFR < 30 ml/min/1.73m. The real-time and dynamic imaging from renal cortex was performed using CEUS. The >85% goodness-of-fit (GOF) index were chosen for the analysis. Several bolus model perfusion parameters including peak enhancement (PE), wash-in rate (WiR), wash-out rate (WoR), wash-in and wash-out area under curve (WiWoAUC), and rise time (RT) were calculated and compared among three groups. Several laboratory parameters including blood urea nitrogen (BUN), serum creatinine (SCr), red blood cell (RBC), urine proteinuria (UPr), urine creatinine (UCr) and UPr/UCr were also measured and compared among three groups. Correlation between perfusion or laboratory parameters and eGFR were assessed.
Results: The >85% GOF index were chosen for the analysis in 24 patients (aged: 57.2 ± 19.8). Of 24 patients, 4 patients were classified as group I, 13 patients were classified as group II and 7 patients were classified as group III. In perfusion parameter analysis, there were no significant differences between patients of 3 groups. No parameters significant positively correlated with eGFR. In laboratory parameter analysis, there were significant differences between patients of 3 groups in several parameters (RBC, BUN, SCr, Glucose, Total cholesterol, Phosphorus, Total protein, $p<0.05$). They also were significant correlated with eGFR (correlation coefficient, R= -0.7625 to 0.6026).
Conclusions: CEUS is a safe, noninvasive, simple and feasible technique. CEUS could assess renal microvascular perfusion in a real-time and dynamic manner. Further studies with many participants including healthy control group are needed.

OPT4-022

Introduction of Fusion Imaging and Contrast Enhanced Ultrasound (CEUS): The Impact on a Liver Ablation Service

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Objectives: Percutaneous ablative therapies for primary and secondary focal liver tumours are becoming increasingly utilised as an alternative to surgical treatment or palliative therapies such as trans-arterial chemo-embolisation (TACE) and systemic chemotherapy. This is in part due to improving thermal ablative technologies and novel techniques such as Irreversible Electroporation (IRE). These radiologically guided procedures are only possible with confident and precise on-table imaging during the procedure, often in challenging background livers, such as in macro-nodular cirrhosis. Contrast enhanced ultrasound (CEUS) and fusion ultrasound, often used in combination, allows confident peri-operative visualisation of lesions not previously deemed suitable for percutaneous therapy, and is significantly increasing the numbers of patients receiving potentially curative treatment.
Methods: Every patient referred for radiologically guided ablation of a focal liver lesion within a twelve month period was included in a retrospective analysis, looking at type of ablation and where advanced ultrasound techniques were used and the value they brought to the procedure.
Results: In 2016, 44 patients underwent ultrasound guided percutaneous ablative therapy on focal liver tumours (35 were MW, 9 were IRE). Advanced ultrasound techniques were incorporated into 66% (29/44) of all cases. On 16 occasions the ablations were performed under CEUS guidance either pre- or peri-operatively, a further 13 under CEUS/fusion guidance pre- or peri-operatively and one ablation was only possible using needle tracking and an off-axis approach.
Conclusions: In our centre, CEUS and fusion has become an integral part of liver treatment, broadening the application of ablative therapies in liver cancer.

OPT4-023

Contrast-Enhanced Ultrasound for the Characterization of Malignant Vs. Benign Focal Liver Lesions in a Prospective Multicenter Experience - Srumb Study

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Objectives: To evaluate the utility of contrast-enhanced ultrasound (CEUS) in assessing the diagnosis of benign vs. malignant focal liver lesions (FLL), in a multicenter experience.
Methods: The prospective study including 14 Romanian centers was performed over a period of 6 years (February 2011- April 2017) and included 2062 FLLs assessed by CEUS. The lesions were included in the study if they were newly diagnosed on B-mode, less than 3 lesions/patient, evaluated by CEUS and that had a second imaging technique (CT, MRI) or histology as reference.
Results: Using as "gold standard" contrast enhanced CT, contrast enhanced MRI or liver biopsy CEUS performance for the malignant lesions 1179 (57.1%), was: 91.5% sensitivity, 97.5% specificity, 98.1% positive predictive value (PPV), 89% negative predictive value (NPV) and a diagnostic accuracy of 94.2%. For the benign lesions 883 (33.9%) CEUS had: 88.9% sensitivity, 95.4% specificity, 98.1% positive predictive value (PPV), 91.4% negative predictive value (NPV) and a diagnostic accuracy

of 92.5%. For the most frequent lesions CEUS showed: HCC- 76.6% sensitivity, 98.2% specificity, diagnostic accuracy of 90.2%; Hemangiomas - 90% sensitivity, 98.8% specificity, diagnostic accuracy of 96.5%; Metastasis- 90.9% sensitivity, 98% specificity, diagnostic accuracy of 96.3%

Conclusions: CEUS proves its utility in assessing correctly the malignancy of a focal liver lesion. Due to its very good performance, it can confidently be used in liver imaging.

OPT4-024

Multiparametric Ultrasound Algorithm for the Reevaluation of Inconclusive Focal Liver Lesions Evaluated by Contrast Enhanced Ultrasound

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Objectives: The new features implemented in ultrasonography created the concept of multiparametric ultrasound (MPUS) [1] that can bring valuable information to standard ultrasound evaluation. The aim of this paper was to evaluate the benefit of MPUS to the inconclusive focal liver lesions (FLL's) evaluated by means of contrast-enhance ultrasonography (CEUS).

Methods: A three-step algorithm was designed. In the first step, an elastographic method was used that ruled in or out severe liver fibrosis (fibrosis ≥F3). The second step consisted in quantifying the tissue perfusion of lesions evaluated by CEUS. This feature allows through the time intensity curve the quantitative assessment of the perfusion parameters in the late phase in comparison with the adjacent parenchyma, enabling to highlight the wash-out. In the third step with the help of a color-coded map based on perfusion kinetics (parametric imaging feature from GE-LOGIQ E9), the lesions are evaluated according to a parametric imaging map during the arterial phase, displaying by colors the enhancing pattern and the hyper-and hypo-enhanced areas of a FLL. We reevaluated according to MPUS algorithm 70 inconclusive CEUS video-clips performed in our center, in which the final diagnosis was established by CT, MRI or liver biopsy.

Results: We selected the raw data of 70 randomly, inconclusive CEUS examination of FLL's over a period of two years (January 2015- December 2016) and reevaluated the CEUS video clips applying the MPUS algorithm. From 70 FLLs, 14 were not suitable for the algorithm due to inappropriate examination. From the remaining 56 FLLs, 29 (51.7%) were correctly diagnosed in concordance with the reference method, in 18 (32,1%) lesions a final diagnosis could not be established and in 9 (16%) cases the MPUS algorithm misdiagnosed the lesions. The predominant lesion was hepatocellular carcinoma (HCC) 22/56 (39.2%) cases. With the help of MPUS, we correctly diagnosed 17/22 HCC.

Conclusions: With the help of our MPUS algorithm, we managed to orientate the diagnosis in more than a half of the lesions and established a correct diagnosis in 51.7%. An algorithm approach for the diagnosis of HCC seems to be the proper way.

OPT4-025

Contrast-Enhanced Ultrasound Performance in the Evaluation of Focal Nodular Hyperplasia in a Multicenter Study

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Objectives: Contrast-enhanced ultrasound (CEUS) has become the main player in the evaluation of focal liver lesions. The aim of this study was to evaluate the sensitivity, specificity and accuracy of CEUS for focal nodular hyperplasia from a large study group.

Methods: A multicenter prospective study was performed in fourteen Romanian centers, over a period of 6 years (02.2011-03.2017), that gathered 2062 newly detected focal liver lesions evaluated by CEUS. Each lesion had a contrast CT, MRI or histology as reference method. The lesions have not been previously diagnosed by other imaging technique, and they were considered conclusive if they had an obvious enhancement pattern, as recommended by the guidelines. CEUS performance for the FNH was assessed using OpenEpi software for the statistical analysis.

Results: During the 6 years study, 2062 "de novo" focal liver lesions, have been evaluated by CEUS. From this cohort, 94/2062 (4.5%) had a typical FNH enhancing pattern as described in the EFSUMB guidelines. Contrast CT/MRI and biopsy diagnosed additional 15 FNH. From the 94 cases diagnosed as FNH by CEUS, in 9 the final diagnosis was different (5 of them adenomas). CEUS performance for the FNH was: 84% sensitivity, 99.4% specificity, 89.7% positive predictive value, 99.0% negative predictive value and 98.5% diagnostic accuracy for the diagnosis of focal nodular hyperplasia.

Conclusions: FNH is a benign liver lesion that can accurately be characterized by CEUS as a first-line imaging method.

OPT4-026

Clinical Value of Ceus in the Diagnosis of Prostate Cancer in Elderly Patients

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Objectives: Objective to investigate the role of Qualitative and quantitative analysis of contrast-enhanced ultrasonography (CEUS) in the diagnosis of prostate cancer in different PSA groups.

Methods: After the completion of conventional transrectal ultrasound, CEUS was performed immediately. The end of CEUS, prostate biopsy were performed immediately. The characteristics of CEUS images of each group were compared with the results of puncture pathology.

Results: The diagnostic sensitivity of CEUS in prostate cancer was 95% among groups. For patients with PSA of less than 20ng/ml, the specificity was 90%, which greatly increased the positive rate of prostate cancer. In the PSA 4-10ng/ml and 10-20ng/ml two groups, compared with conventional ultrasound, the detection rate of CEUS in the diagnosis of prostate cancer, there were significant differences ($P<0.01$).

Conclusions: CEUS has a high detection rate and specificity for the elderly patients with prostate cancer and it can be one of the most valuable diagnostic techniques.

OPT4-027

Contrast-Enhanced Ultrasonography of Pancreatic Neuroendocrine Tumor

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Objectives: To analysis the contrast-enhanced ultrasonography(CEUS) manifestations of pancreatic neuroendocrine tumor(PNET) and to explore the clinical value of CEUS in diagnosis of PNET.
Methods: The CEUS of twelve pathologically diagnosed PNET from June, 2009 to December, 2016 were retrospectively observed. The enhancement extent and enhancement patterns of CEUS in pancreatic tumors were analyzed.
Results: Pancreatic neuroendocrine tumor was found in 9 cases, while pancreatic neuroendocrine carcinoma was found in 3 cases. The tumors located in pancreatic head (n=5), pancreatic tail (n=5), pancreatic body (n=1), pancreatic body and tail (n=1) respectively, with diameters ranged from 2.2 cm to 8.2 cm,11 were solid and 1 were solid-cystic lesions.10 cases present as well-defined hypoechoic lesions, while 2 cases present as inhomogeneousen hyperechoic lesions. Among the 12 cases of PNET,9 cases (75.0%) demonstrated hyper- or iso-enhancement, which included 5 cases (41.7%) showing homogeneous enhancement and 4 cases (33.3%) showing inhomogeneousen hancement, and the other 3 cases (25.0%) demonstrated hypo-enhancement.
Conclusions: CEUS is an effective and non-invasive diagnostic approach for PNET. Hyper- or iso-enhancement of CEUS is typical appearance of PNET.

OPT4-028

Usefulness of Contrast-Enhanced Ultrasonography (CEUS) in Differential Diagnosis of Solid or Cystic Renal Masses

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Objectives: To determine whether contrast-enhanced ultrasound can be used to differentiate benign renal masses such as angiomyolipoma (AML) with minimal fat or complicated cysts from renal cell carcinomas (RCC).
Methods: We retrospectively collected patientswith histolopathologically confirmed solid renal masses such as angiomyolipoma, clear cell carcinoma and papillary renal cell carcinoma and complicated cysts who underwent CEUS with SonoVue during May 2012 to March 2017. Two abdominal radiologists reviewed CEUS and were blinded to the final diagnoses. We analysed rates, grades, patterns of contrast enhancement on arterial phase, heterogeneity of contrast enhancement at nephrographic phase and wash-out patternon delayed phase compared with adjacent renal cortex of these tumors. The Mann-Whitney test was used to statistical analysis for these parameters.
Results: The study population consisted of 33 patients (13 women and 20 men) with 33 lesions. There were 4 AML, 22 clear cell carcinoma, 5 papillary renal cell carcinoma and 2 complicated renal cysts. Lesion heterogeneity on nephrographic phase was much more seen in RCC than AML .(sensitivity=76%, specificity=100%, p=0.002). And wash-out pattern on delayed phase was more seen in RCC than AML (sensitivity=84%, specificity=100%, p=0.001). Lesion hypovascularity on arterial phase was more seen in papillary renal cell carcinoma than clear cell carcinoma (sensitivity=66%, specificity=90%, p=0.05).
Conclusions: Lesion heterogeneity on nephrographic phase and washout pattern on delayed phase were useful findings for differentiating small RCC from AML. Hypovascularity on arterial phase was useful for differentiating papillary renal cell carcinoma from other solid renal tumors.

OPT4-029

The Diagnostic Value of Contrast Enhanced Ultrasound in Acute Aortic Dissection

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Objectives: Acute aortic dissection is an life-threatening disease that symptoms come on abruptly and progress quickly. patients without treatment have a mortality approaching 1%-2% in the acute stage. Prompt and accurate diagnosis and timely treatment are profoundly important. CTA is first examination method selected to patents who are suspected for AD, but it has some limitations such as contrast agent allergy and radiation exposure. contrast enhanced ultrasound is convenient and safe, however the research on the AD is rare.
Methods: From November 2015 to Jaunary 2017, We enrolled 41 patients (28 males and 13 females, mean age 57.8±11.1 years) with clinical suspicion of AD in Wuhan Union hospital. Conventional transthoracic echocardiography (TTE)、contrast transthoracic echocardiography (c-TEE) and multislice computed tomography angiography (MS-CTA) were performed to scan the whole aorta in sequence. Serving CTA as the reference standard, We compared conventional ultrasound with CEUS in diagnosing the characterization of AD.
Results: Of the 41 patients, 22 patients were diagnosed for AD and 20 underwent surgical repair. Using Stanford classification system, type A were detected in 40.9% (9/22) of patients, type B were seen in 59.1% (13/22). C-TEE correctly diagnosed all the patients, however Conventional TEE had 5 false-positive results because of artifacts (4 in ascending aorta and 1 in the arch). C-TEE distinguished a flap from an artifact in 5 cases, identifed the false lumen slow blood flow in 1 and defined the border of false lumen thrombosis clearly in 8. Conventional TEE visualized intmal flaps in 20 of 22 cases, with the use of contrast enhancement increased to 22 (p=0.49). Conventional TEE correctly identified the true lumen from false lumen in 19/22 (86.4%) cases, and c-TEE in 22/22 (100%) (P = 0.23) cases. Specificity of conventional TEE increased after contrast enhancement from 73.68 to 100% (P =0.046) for the diagnosis of AD, and both two methods' sensitivity are 100% (P=1.0).
Conclusions: CEUS can accurately diagnose and analysis the characteristics of AD, it is superior than conventional ultrasound in discovering the details lesions of AD, and will provide important information for the diagnosis of AD.

OPT4-030

Ultrasonographic Features of Hepatic Epithelioid Hemangioendothelioma

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Objectives: To investigate the of hepatic epithelioid hemangioendothelioma (HEHE) on B-mode and contrast-enhanced ultrasound (CEUS).
Methods: From January 2012 to September 2016, 17 patients with surgery orbiopsy confirmed HEHE were retrospectively analyzed for their clinical history, B-mode ultrasound and CEUS characteristics.
Results: The mean age of the 17 patients was (42.88±13.95) y (range 23-69 y). 10 out of 17 were female. On B-mode ultrasound, 11 (11/17 , 64.7%) were multiple lesions, of which 10 cases involved the whole liver. 6 (6/17 , 35.3%) cases were single lesion. 88.2% of lesions (15/17) located underneath the capsule. The mean size of these lesions were (3.93±2.23)cm. They appeared as hypoechoic (13/17, 76.5%), hyperechoic (1/17, 5.9%) and mixed-echoic (3/17, 17.6%). Lesions in 10 (10/17, 58.8%) cases were well-circumscribed while the rest (7/17, 41.2%) were not. 94.1% of lesions (16/17) were regular shaped. 7 patients underwent CEUS, 5 of them (5/7, 71.4%) showed a rim-like hyperenhancement in arterial phase while the other 2 presented overall hyperenhancement of the lesions with uneven perfusion inside during arterial phases. All cases(7/7, 100%) who underwent CEUS demonstrated hypoenhancement in portal and delay phases.

Conclusions: Multiple subcapsular hypoechoic focal liver lesions with regular shape remind of the possibility of HEHE. CEUS provided considerable value in diagnosis.

OPT4-031

Liver Focal Fatty Change Evaluated by Contrast-Enhanced Ultrasound: A Retrospective Study in an Ultrasound Expert Center

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Objectives: The goal of this paper was to evaluate the liver focal fatty change (either fat infiltration or fatty sparing) assessed by contrast-enhanced ultrasound (CEUS), in a tertiary center.

Methods: A retrospective study was performed that evaluated a cohort of 2904 de novo focal liver lesions (FLLs) assessed by CEUS (according to EFSUMB guidelines) over a period of seven years (2010-2016). Focal fatty change (FFC) lesions that were referred for contrast assessment were 319/2904 (11%). From 2904 FLLs, 979 (33.7%) were also evaluated by a second line imaging technique or histology (due to the incomplete EFSUMB diagnostic pattern criteria). We evaluated the sensitivity, specificity and accuracy of CEUS for the FFC that were confirmed by a second line imaging technique (CT, MRI) or histology. For the statistical analysis we used OpenEpi software.

Results: From 2904 de novo FLLs, 319 (11%) were FFC, in female 46.4%, in male 53,6%; mean age 54.3+/- 11.9 years, mean lesion size: 3.37±2.13 cm. 233/319 (73%)- were fatty sparing and 86/319 (27%)-fat infiltration. FFC represented by focal infiltration were diagnosed on liver with chronic hepathopaty: 25/319 (7.8%) and 61/319 (92.8%) on liver without fibrosis. CEUS was conclusive (lesions with typical enhancement pattern as presented in EFSUMB guidelines) for the diagnosis of FFC in 97.2% of cases. From 979 FLLs group (CT, MRI or histology for the final diagnosis), 31/979 (3.2%) were FFC. 22/31 (71%) were fatty sparing and 9/31 (29%) were fat infiltration. CEUS performance in the diagnosis of FFC was: 72.73% Sensitivity; 99.67% Specificity; 98.28% Accuracy. The performance of CEUS was influenced by the diameter of the lesion (>5cm) and the presence of sever fibrosis ≥F3.

Conclusions: CEUS is an accurate and specific method for the diagnosis of focal fatty changes; still the results can be influenced by the size of the lesion and the presence of liver cirrhosis.

OPT4-032

Contrast Enhanced Ultrasound, The First Step in the Evaluation of Focal Liver Lesions

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Objectives: The aim of this paper is to evaluate the performance of CEUS as a first step in the evaluation of focal liver lesions (FLLs) in cirrhotic and non-cirrhotic patients.

Methods: A retrospective study was performed on a cohort of 2904 FLLs evaluated by CEUS between September 2009-December 2016, according to EFSUMB guide lines (2) in a tertiary center. 979 (33.7%) FLLs did not completely fulfill the EFSUMB-CEUS criteria thus needing to be confirmed by other imaging technique (contrast-enhanced CT, contrast-enhanced MRI) or histology. Lesions that were previously diagnosed have been excluded. Using CT, MRI and histology for the final diagnosis we calculated the specificity, sensibility and accuracy of CEUS for the difficult FLLs that challenged the examiner, in cirrhotic and non-cirrhotic patients.

Results: CEUS managed an overall correct diagnosis in 76.8 % (752/979) of the lesions. From the 979 FLLs, 335 (34.3%), (67.7% HCC, 4.7% Hemangioma, 3.8% Metastasis, 18.2% Other benign lesions and 5.3 % Other malignant lesions), were detected in liver cirrhosis (LC) and 644 (65.7%), (36.1% Metastasis, 19.5% Hemangioma, 6.8% HCC, 31.3% Other bening lesions and 6% Other malignant lesions) were in non-cirrhotic liver (NC). In LC CEUS performance for benign lesions was: 87.7% Se, 93.6% Sp and 90.4% Ac. For malignant lesions in LC, CEUS performed: 76.1% Se, 92.4% Sp and 83,8% Ac. In the NC group, CEUS performance for benign lesions was: 82%Se, 95.8% Sp and 88.4% Ac. and for malignant lesions was: 90.16% Se, 90.13% Sp and 89.4% Ac. CEUS performance on the most frequent lesions: Hepatocellular carcinoma (HCC) in LC: 65.2% Se, 86% Sp, 68.5% Ac. HCC in NC: 65.9% Se, 94.7Sp, 92.1 Ac. Metastasis in LC: 30.7 Se, 97.3Sp, 92.9% Ac. Metastasis in NC: 78.5% Se, 91.2% Sp, 85.5% Ac. Hemangioma in LC: 68.7% Se, 95.6 Sp, 93.4% Ac. Hemangioma in NC: 77.2% Se, 96.1% Sp and 91.3 Ac.

Conclusions: CEUS is an accurate and reliable method as a first step in the evaluation of FLLs. Liver cirrhosis does not influence significantly CEUS performance.

OPT4-033

Contrast-Enhanced Ultrasound in the Diagnostic of Liver Abscesses. A Prospective Multicenter Experience

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Objectives: Liver abscess is a rare medical condition in which therapeutic success depends on a correct and rapid diagnosis. Contrast-enhanced ultrasonography (CEUS) in the evaluation of liver abscesses (LA) might be the solution. The goal of the study was to evaluate the performance of CEUS for the diagnosis of LA in a prospective multicenter study.

Methods: A prospective multicentre SRUMB study was performed, which included 2062 CEUS examinations from 14 centers in Romania, over a six years period (02.2011-03.2017). All lesions were "de novo" focal liver lesions (FLLs), maximum three/patient, inconclusive at standard ultrasound evaluation and with a reference method (contrast CT or MRI or biopsy) as gold standard. We evaluated the sensitivity (Se), Specificity (Sp), and accuracy (Ac) of CEUS for liver abscesses from this cohort. CEUS was considered to be conclusive if the enhancement pattern was typical for an LA according to the EFSUMB guidelines (1).

Results: From the 2062 FLLs, 43.5% were discovered in women and 56.5% in men, with the mean age of 52.4 years. From all FLL, 45/2062 (2.2%) were diagnosed by the gold standard as LA. CEUS achieved: 86.6% sensitivity, 99.8% specificity, 95.1% positive predictive value, 99.6% negative predictive value and 99.5 % diagnostic accuracy for the diagnosis of liver abscesses.

Conclusions: CEUS is a confident diagnostic technique, with very good performance for the diagnosis of liver abscesses.

OPT4-034

Enhancement Pattern of Liver Metastasis on Contrast Enhanced Ultrasound Examination - Monocentric Experience

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Objectives: To evaluate the enhancement pattern of liver metastasis on contrast enhanced ultrasound (CEUS) examination.
Methods: We performed a retrospective study, which included 496 patients with liver metastasis admitted in the Department of Gastroenterology and Hepatology of Emergency County Hospital of Timisoara between January 2010-December 2016, respectively 496 patients [303 men (61.1%) and 193 women (38.9%)], mean age 64.1 ± 10.7years. CEUS evaluation started from the suspicion of liver metastasis in the context of a neoplasia with single or multiple liver lesions or from the suspicion in standard ultrasound of liver metastasis. We analyzed the cause of liver metastasis, the enhancement pattern on CEUS (hypo- or hypervascular metastasis) and the relationship between primary tumor / behavior in CEUS.
Results: The most common cause of liver metastasis was colon cancer (in 28% of cases - 139), followed by pancreatic cancer (62 cases – 12.6%) and gastric cancer (50 cases - 10%). Other causes were: breast cancer (6.4% - 32 cases), oesophageal cancer (3% - 15 cases), ovary, uterus, pharynx, small intestine, kidney, prostate, melanoma, etc (22.6%). In 17.4% cases the primary tumor was not identified. After CEUS examination in 258/496 (52.1%) cases the metastasis were hypervascular and in 238/496 (47.9%) cases were hypovascular. All liver metastates showed washout in the portal and late phase. A correlation was found only between gastric cancer and hypervascular appearance - 30/50 hypervascular metastasis vs. 20/50 hypovascular metastasis ($p = 0.042$). The vascularity of liver metastasis on CEUS was not correlated with the primary tumor.
Conclusions: CEUS is a good imaging method for the detection and characterization for liver metastasis. In the arterial phase in 258/496 (52.1%) cases hyperenhancing pattern was observed (hypervascular metastasis) and hypoenhancing pattern (hypovascular metastasis) in 238/496 (47.9%) cases. In our study, we found no significant correlation between the primary tumor and The vascularity of liver metastasis, excepting gastric cancer which seemed to correlate with hypervascular metastasis.

OPT4-035

Potential Pitfalls of Contrast Enhanced Ultrasound (CEUS) in Characterization of Liver Tumours: Case Series

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Objectives: Contrast enhanced ultrasound (CEUS) is an emerging diagnostic tool used for evaluation of liver lesions, particularly in patients who are unsuitable for contrast enhanced computed tomography or magnetic resonance imaging. This ultrasound technique has enable real-time evaluation of intra-lesional vascularity in all phases, conferring CEUS a temporal resolution superior to other imaging methods. However, given CEUS relative recent entry into clinical usage; the pitfalls encountered in imaging of liver lesions have not yet been well discussed.
Methods: Case series review.
Results: We will review a case series of 5 patients who underwent CEUS for characterization of liver tumours in our department. False diagnoses were initially made and they were later disproved on histopathology correlation or follow up imaging. The false positive diagnosis of hepatocellular carcinoma was made in 3 cases which demonstrated arterial enhancement followed by porto-venous washout. These lesions were subsequent proven to be hepatic haemangioma, focal nodular hyperplasia and abscess/ inflammatory pseudo-tumours. A false positive diagnosis of a dysplastic nodule was made in one case due to its initial hypoenhancement and this was later found to be focal pancreatic heteropia. The final case was a false negative diagnosis of a hemangioma which demonstrated arterial enhancement and no washout but was actually a small well-differentiated hepatocellular carcinoma. We will discuss how these false diagnoses could have been avoided.
Conclusions: CEUS can be a useful diagnostic modality for characterization of liver lesions. However, operators must correlate with patient's underlying risk factors and should be aware of imaging pitfalls when performing CEUS.

OPT4-036

Colorized Fusion Using Ceus for RFA

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Objectives: Evaluated of usefulness of new technology using colorized fusion with CEUS for RFA.
Methods: Before RFA, we extracted DICOM data using the 3D volume analyzer system SYNAPSE VINCENT called Synapse 3D internationally and integrated these DICOM data onto US platform. Using this method, we can make colorized fusion images and this new technology can also use contrast enhanced US mode.
Results: 13 patients with eleven HCC and four liver metastasis nodules were enrolled in this study. All cases were able to get the complete response using colorized fusion technology after RFA. This new technology is very useful to understand the segmentation in the liver more easily and visually than usual gray scale US, especially for beginner operators.
Conclusions: This new technology is useful for education and support of CEUS and RFA.

OPT4-038

The Application of Image Fusion-Guided Contrast-Enhanced Ultrasonography in Detecting Small Liver Nodules

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Objectives: At present, the commonly used medical imaging methods for early HCC include CECT / CEMRI and CEUS. Compared with other imaging scan, ultrasound is a convenient, flexible, real-time method and the common routine for the examination of liver lesions. However, the low spatial resolution of ultrasound many cause small lesions invisible on the screen. An imaging model with both the advantages of ultrasound, namely high sensitivity in the diagnosis of the characteristics of the lesion, and the ability of CT / MRI, i.e. high spatial resolution to achieve sufficient accuracy is needed. Magnetic navigation image fusion imaging is such method.Therefore, our aim is to explore the value

of image fusion-guided CEUS in detecting liver nodules with abnormal blood supply missed by conventional ultrasonography and CEUS.

Methods: 35 patients with forty-two liver nodules and HBV cirrhosis missed by US and CEUS, detected by contrast-enhanced CT/MRI, were analyzed retrospectively. Image fusion-guided CEUS was performed after the fusion of ultrasound and contrast enhanced CT/MRI images.

Results: Our results show that image fusion were performed successfully in all 35 patients. The technical success rate was 100%. Average fusion time was 4.1±1.8 min. Forty liver nodules with abnormal blood supply were detected by image fusion guided CEUS, and the detection rate was 95.2%. The diagnosis accuracy rate of image fusion guided CEUS was 97.5%. Two nodules misdiagnosed by contrast-enhanced CT were achieved by image fusion guided CEUS.

Conclusions: Our results indicate that Image fusion guided CEUS has a high detection rate and diagnosis accuracy for liver nodules with abnormal blood supply missed by US and CEUS. This method can improve the clinical diagnosis and guide interventional procedures.

Poster Session

PPT4-001

A Case of Hepatic Inflammatory Pseudotumor with Time-Dependent Contrast-Enhanced Ultrasonography Findings

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Objectives: Hepatic inflammatory pseudotumor (IPT) is a rare benign disorder with non-specified image findings that depend on the inflammatory stage. Here, we report a case of hepatic IPT with contrast-enhanced ultrasonography (CEUS) findings that changed over time.

Methods: Case report and literature review.

Results: The female patient in her 40s referred for close examinations of a new lesion appearance in hepatic segment 5 on contrast-enhanced computed tomography (CT) during follow-up for a solitary necrotic nodule in hepatic segment 6. Ultrasonography revealed a 13-mm hypoechoic solid lesion with an ill-defined border in her liver. At the first visit, the new hepatic nodule showed a strong homogeneous enhancement pattern in the arterial phase of the CEUS, while it showed a prolonged enhancement pattern in the portal phase of CEUS. In the post-vascular phase, the nodule showed an enhancement defect. Six months after these initial findings, the contrast enhancement pattern of the portal phase has changed into a wash-out pattern. The nodule showed a wash-out pattern in both the portal and equilibrium phases of contrast enhanced CT. Dedifferentiation of hepatocellular carcinoma was not denied and laparoscopic partial hepatectomy was performed. The resected specimen clearly showed a distinct tumor without a capsule. Pathological finding showed increased number of spindle cells and small blood vessels with infiltration of inflammatory cells including plasma cells in the tumor. The nodule was diagnosed IPT.

Conclusions: This case suggested that follow-up with CEUS might be useful to diagnose IPTs for hypoechoic solid lesions with ill-defined borders.

PPT4-002

Sonazoid-Enhanced Ultrasonography Guidance Improves the Quality of Pathological Diagnosis in the Biopsy of Focal Hepatic Lesions

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Objectives: Contrast-enhanced ultrasonography (US) using second-generation contrast agent Sonazoid has improved the detection and characterization of focal hepatic lesions. We evaluated the utility of Sonazoid-enhanced ultrasonography (SEUS) in guiding percutaneous biopsy of focal hepatic lesions by comparing accuracy of histopathological diagnosis between B-mode US and SEUS guidance.

Methods: This retrospective study included 140 focal hepatic lesions in 127 patients (mean age; 63.6 years) referred for US-guided percutaneous biopsy between April 2012 and September 2016. The diagnostic accuracy of the biopsy was defined as the percentage of the total number of lesions clearly diagnosed at the initial biopsy. A case was considered a technical failure when pathological results failed to specifically indicate final diagnosis owing to insufficient material or when pathological results changed from benign to malignant by re-biopsy.

Results: Among 140 focal hepatic lesions, 57 lesions underwent biopsy with B-mode US guidance while 83 received SEUS guidance. Patient characteristics (sex, age, lesion location and diameter, and reasons for biopsy) did not differ significantly between groups. Diagnostic accuracy was significantly higher under SEUS guidance than B-mode US guidance (91.6% vs. 75.4%, respectively; $p < 0.05$). When biopsies were performed to diagnose or rule out malignancy in indeterminate focal hepatic lesions, diagnostic accuracy was also significantly higher under SEUS guidance than B-mode US guidance (100% vs. 70.8%, respectively; $p < 0.05$). SEUS guidance resulted in a significantly higher rate of successful single-puncture attempts during biopsy procedures than B-mode US guidance (53.0% vs. 35.1%, respectively; $p < 0.05$).

Conclusions: SEUS guidance improves the accuracy of hepatic tumor biopsy pathological diagnosis compared to B-mode US guidance. SEUS guidance is recommended for more accurate localization of suitable hepatic lesion biopsy areas since it increases conspicuity and differentiates viable area from denaturalization or necrosis.

T5. Echocardiography

Pre-Congress Workshop/Symposium

T5-13-IN01

TEE: Simulator-Based TEE Training

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Perioperative transesophageal echocardiography monitoring (TEE) can evaluate the morphology and the function of circulatory system. The basic idea of perioperative TEE is to find the characteristics of TEE images, establish the individual pathophysiological model, improve decision-making ability, control and manage the risk during the perioperative period, and combine it with relevant experience and evidence-based medicine. Therefore, perioperative TEE should be normalized and standardized in the clinical practice. How to collect and use TEE images to solve problems in the clinical practice by focusing on the methods of Focus-TEE monitoring is very important. This study has been performed to illustrate the value of standardized echocardiography training on the guidance of TEE which includes the following three parts:

Part 1 Standardized procedure of work shifts.

Cardiac surgeries are discussed in advance and the standardized teaching method on the procedure of selecting standard TEE views are used in the meaningful cases.

Part 2 Standardized four basic cardiac ultrasound views.

The four chamber views, left atrium long axis, aortic valve short axis, right atrium inflow, and the right atrium outflow tracts are selected first, then target views are selected.

Part 3 Problem-based procedure of selecting views.

Different diseases are matched with different TEE views, depending on the kind of disease. For example, standardized view-selected procedures of ASD (artium septum defect). Four basic views are selected for the ASD preliminary assessment, then four methods of ASD surgeries are recommended according to the assessment. After the surgery, operation related complications prediction: occlude fall off, etc. are also evaluated.

The standardized procedure for selecting TEE views will be beneficial for choosing the best way of ASD operations and reduce the complications.

T5-13-IN02

Transesophageal Echocardiographic Guidance for Septal Puncture and Balloon Mitral Commissurotomy

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Interatrial septal puncture has become more and more important in the era of percutaneous intervention for structural heart diseases. Some arrhythmia ablation procedures may also require septal puncture.

However, septal puncture is probably one of the most risky percutaneous intervention techniques. It may inadvertently perforate the atrial wall or the ascending aorta, leading to cardiac tamponade or even death. Online guidance with TEE can dramatically reduce the risk. Selection of optimal bicaval plane is of paramount importance. The Brockenbrough puncture needle within the Mullin sheath should be managed so that the typical tenting sign can appear on this plane before protruding the puncture needle.

Online TEE is also very convenient for guiding balloon commissurotomy in patients with mitral stenosis. It can provide immediate post-dilatation hemodynamic information through Doppler measurements, and reveal flail mitral valve if the chordae have ruptured. It can reduce the risk of cerebral embolism in patients with isolated immobile appendageal thrombus, if they decide to undergo balloon commissurotomy after anticoagulation for more than three months. Importantly it can detect life-threatening complications such as pericardial tamponade promptly and reliably. Indeed, mastering the technique of online TEE guidance is truly rewarding for balloon mitral commissurotomy.

T5-13-IN03

TEE in TAVI

Toshinari Onishi
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Aortic stenosis (AS) has been the most common valvular heart disease in the past decades. Although surgical aortic valve replacement (SAVR) is a well-established therapy, transcatheter aortic valve implantation (TAVI) provides an alternative treatment option for inoperable and high surgical risk patients with symptomatic AS. Echocardiography plays an important role in procedural planning, device placement or deployment, and post-procedure follow up. Intra-procedural transesophageal echocardiography is recommended by the American Society of Echocardiography because of its incomparable ability to provide rapid and accurate information, to evaluate the early function of the bioprosthesis, to define the severity and location of paravalvular leakage, and to detect complications such as sudden worsening of MR, new left ventricular wall motion abnormalities, cardiac tamponade, and dissection or rupture of the aortic root.

T5-13-IN04

Technique of TEE Guidance in MitraClipping

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The 5 year results of the EVEREST II Trial as well as the results of the TVT Registry confirm excellent results of the MitraClip procedure in properly selected patients. Transesophageal echocardiography (TEE) plays a pivotal role in procedural guidance. Accurate guidance to cross the interatrial septum at a specific location is particularly important in percutaneous treatment of mitral regurgitation with the MitraClip system. Specific parameters which predict procedural success are also best assessed with 2D and 3D TEE. MitraClip orientation with respect to the mitral valve leaflets is best assessed with 3D TEE. Assurance of leaflet grasping, stability, improvement in mitral regurgitation, size of the residual atrial septal defect, and confirmation of no development of mitral stenosis are all assessed with TEE during the procedure.

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T5-13-IN05

Current Applications of Intracardiac Echocardiography in The Catheterization Laboratory

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Intracardiac echocardiography (ICE) is slowly replacing transesophageal echocardiography as the preferred imaging tool to guide device closure of atrial septal defects and patent foramen ovale. Further, with the emergent new technology of percutaneous valve repair/replacement, ICE is being used more frequently to monitor various procedural steps.

Standard views obtained by ICE include home view "neutral view" that delineates the tricuspid valve and right ventricle inflow and outflow; the septal view that delineates the septum and the defect; the long axis view that delineates the superior vena cava, the defect and the left atrium and the short axis view that delineates the aortic root, the septum and the left atrium.

The use of ICE in small children with atrial communications who undergo device closure of their defects provide better images of the atrial septum and the various stages of device closure. Specifically, the left atrium is better visualized using ICE.

Cost effectiveness and comparison with TEE is also discussed.

Symposium

T5-14-IN01

Current Advancement of Transthoracic 3D Echocardiography for the Quantification of Left Chamber Parameters

Masaaki Takeuchi
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It has passed more than 20 years, since the first-generation transthoracic real-time 3D echocardiography came appeared in the clinical arena in 1998. Although the earlier day's transthoracic 3D echocardiography (3DTTE) had limitations mainly due to large footprint of 3D transducer, lower temporal and spatial resolution, making its routine clinical use quite difficult, several studies have reported its accuracy for the quantification of left chamber parameters over 2D echocardiography against cardiac magnetic resonance imaging as a reference. With continuous advancement of ultrasound technology, quality of 3DTTE image has been much improved, and now, one-beat acquisition of the whole heart with high volume rate is possible in many ultrasound manufactures. 3DTTE expands its acquisition in not only patients with sinus beat but also those with irregular heart beat and those who cannot stop breath adequately. Although each ultrasound company has their own quantification software for the analysis of left ventricular (LV) volumes, ejection fraction and mass, manual tracing on the endocardial border causes measurement variabilities in different examiners and different institutions. The adoption of recently developed fully automated LV and left atrial (LA) quantification software with 3DTTE might be one potential solution to eliminate this problem. I will present the current status of fully automated software with 3DTTE for the assessment of LV and LA volumes.

T5-14-IN02

The Added Value of 3D Echo to Assess RV Geometry and Function

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Quantitative assessment of the right ventricle (RV) by conventional echocardiography is a challenging task due to its complex asymmetric geometry (limiting the ability to adequately visualize both inflow and outflow tracts in the same view), highly trabeculated endocardial borders, lack of precise anatomic landmarks, and unfavourable position of the RV in the chest. Furthermore, two-dimensional echocardiography (2DE) diameters of the RV vary significantly with minor rotation or tilting the transducer and may be inaccurate, leading to an under- or overestimation of RV size.

Three-dimensional echocardiography (3DE) opened a new era in echocardiographic evaluation of the RV. 3DE allows to include all three parts of the RV (i.e. inflow, outflow and apical trabecular part) in the same dataset. RV acquisitions derived from stitching together consecutive multibeat volumes offer high temporal and spatial resolution. These data sets can be further analysed using dedicated software packages to obtain the mapping of the RV endocardial surface and to measure the RV volumes and function without using geometrical assumptions or approximations.

Despite a slight underestimation, RV 3DE measurements closely correlate with RV volumes measured by cardiac magnetic resonance (CMR) and by volumetric thermodilution during cardiac catheterization both in children and adults. It's worth stressing out that 3DE remains the only echocardiographic technique capable of a reliable calculation of RV EF from end-diastolic and end-systolic volume measurements. In the most recent meta-analysis aimed to explore the accuracy of different imaging modalities (2DE, 3DE, radionuclide ventriculography, computerized tomography- CT, gated single-photon emission CT, and invasive cardiac cineventriculography) for RV EF using CMR as reference method, 3DE has proven to be the most reliable technique, overestimating the RV EF only by 1.16% (range -0.59 to 2.92%). Normative data for 3DE RV volumes and EF including age-, body size-, and sex-specific reference values based on large cohort studies of healthy volunteers is also available. Inclusion of the recommendations for 3D RV volumetric analysis in laboratories with appropriate 3D platforms and experience in the most recent edition of chamber quantification guidelines highlights the importance of 3DE in the assessment of RV.

T5-14-IN03

Application of 3D Echo in the Diagnosis of Complex CHD

Pang kunjing
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Objective: to analyze the clinical value of three-dimensional echocardiography in the diagnosis of congenital heart disease by transthoracic three-dimensional echocardiography.

Methods: Prospective using three-dimensional echocardiography in the diagnosis of 210 pre-operational cases of complex congenital heart disease, compared with the traditional two-dimensional ultrasound diagnosis results with surgical findings as the gold standard, the accuracy of the analysis of the characteristics and the diagnostic results of the three-dimensional ultrasound diagnosis method. Results:The diagnostic thinking of 3D echocardiography is different from that of two-dimensional echocardiography. Three dimensional thinking is more conducive to the three-dimensional understanding of the structure of the heart.

For the cases of complex congenital heart disease with excellent two-dimensional image, the results of three-dimensional ultrasound diagnosis were more accurate than two-dimensional ultrasound. Including the measurement of atrial and ventricular septal defect diameter, accurate assessment of cone structure of tetralogy of Fallot patients, judge the position relationship of ventricular septal defect and large arteries of double outlet right ventricle cases. For two dimensional images with poor quality, the quality of 3D images is worse and the diagnostic results have no advantage. For congenital valvular diseases, three-dimensional ultrasound has no advantage over 2D in the diagnosis of valvular structures because of the delicate structure of valves and the resolution limits of three-dimensional images.

Conclusion: The establishment of diagnostic thinking of three-dimensional echocardiography is beneficial to the understanding of the spatial structure of congenital heart disease and to improve the accuracy of diagnosis. The resolution of the current three-dimensional echocardiographic diagnostic instrument is still limited by the acoustic window condition, and it is still difficult to achieve satisfactory imaging for the delicate structure of the heart valve.

T5-14-IN04

Tips and Tricks of Transesophageal Echocardiographic Guidance During Cardiac Interventions

Cheng-Wen Chiang
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Online transesophageal echocardiographic (TEE) guidance has become a useful and convenient technique for various structural heart disease interventions, e.g., interatrial septal puncture, balloon mitral

commissurotomy, mitraClipping, atrial septal defect (ASD) device closure etc. There are some important tips and tricks.

(1). For septal puncture, 2D echo may be better than 3-D echo. The optimal tenting sign should be managed to appear on the bicaval plane before protruding the puncture needle. If the tenting sign appears on a plane showing the right upper pulmonary vein, it indicates that the needle is pointing too posteriorly, increasing the risk of atrial wall perforation. Conversely, if the tenting sign appears on a plane showing the ascending aorta, it indicates that the needle is pointing too anteriorly, increasing the risk of aortic perforation.

(2). Live 3D zoom mode is very convenient and better than 2D for monitoring ASD device deployment.

(3). Fluoroscopy is still useful for monitoring some parts of the intervention procedures. If available, fusion imaging would be very convenient.

(4). The duration of using color Doppler and 3-D echo should be kept short. Long duration tends to elevate the temperature of the TEE probe.

(5). When using loop function, the time mode may be more desirable than the beat mode to prevent interruption of an important recording.

T5-14-IN05

Intracardiac Echo Guidance for Interventions of Structural Heart Diseases

Qi-Ling Cao

T5-14-IN06

Intracardiac Echo Guidance of Intervention

Yun-Ching Fu
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Interventional therapy for congenital and structural heart diseases has become more and more popular nowadays. Transesophageal echocardiography (TEE) has been successfully used for guiding the procedure but requires general anesthesia. Intracardiac echocardiography (ICE) uses a miniaturized ultrasound tipped catheter which is placed in the heart to obtain the image. Imaging with ICE has evolved from cross-sectional imaging using a rotating transducer (similar to intravascular ultrasound) to sector-based imaging using a phased-array transducer. Phased-array ICE has many advantages over rotational ICE including a greater frequency range, greater depth of field, steerability, and the possibility of acquiring Doppler and color flow imaging. With their steerability, phased-array catheters can be easily advanced and positioned through short sheaths rather than through long guide sheaths. The AcuNav (Siemens Medical) phased-array ICE was first introduced in Taiwan in December 2004. In our experience, ICE can provide excellent images for device closure of ASD, VSD, ruptured sinus Valsalva aneurysm and transseptal puncture eliminating the need of general anesthesia.

T5-14-IN07

Echocardiographic Risk Stratification in Asymptomatic Patients with Paradoxical Low Flow Low Pressure Gradient Severe Aortic Stenosis

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After the introduction of paradoxical low flow low pressure gradient severe aortic stenosis (PLFLG-SAS) in 2007, there are still ongoing debates regarding pathophysiology, therapy and prognosis in PLFLG-SAS. Symptomatic patients with PLFLG-SAS are usually associated with worse outcome, even though the symptom is related to either AS itself or coexistent comorbidities, such as heart failure with preserve left ventricular ejection fraction (HFpEF). PLFLG-SAS has two phenotypes, including true SAS and pseudo-SAS. Surgical aortic valve replacement or transcatheter aortic valve replacement (TAVR) could be useful in the former, but not useful or even harmful in the latter patients. Recent studies have demonstrated some echocardiography parameters such as projected aortic valve area during dobutamine stress echocardiography, global longitudinal strain (GLS) and calcium score of the aortic valve on multidetector computed tomography can be discriminate from true SAS to pseudo-SAS.

However, there is a subset of patients with PLFLG-SAS, who deny any AS related symptom in the outpatient clinic. Many patients are older with limited physical activity. Thus, subjective symptomatic assessment is not accurate to determine whether the patient is truly asymptomatic. Following echocardiography parameters might be useful to select high-risk group of patients for future adverse outcome among patients with asymptomatic PLFLG-SAS.

1): LV mass index
2): GLS
3): left atrial volume index
4): Diastolic dysfunction grade
5): right ventricular function

I will discuss the usefulness of these parameters for the risk stratification in asymptomatic patients with PLFLG-SAS.

T5-14-IN08

Transesophageal Echo in Transcatheter Aortic Valve Implantation

Toshinari Onishi
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Aortic stenosis (AS) has been the most common valvular heart disease in the past decades. Although surgical aortic valve replacement (SAVR) is a well-established therapy, transcatheter aortic valve implantation (TAVI) provides an alternative treatment option for inoperable and high surgical risk patients with symptomatic AS. Echocardiography plays an important role in procedural planning, device placement or deployment, and post-procedure follow up. Intra-procedural transesophageal echocardiography is recommended by the American Society of Echocardiography because of its incomparable ability to provide rapid and accurate information, to evaluate the early function of the bioprosthesis, to define the severity and location of paravalvular leakage, and to detect complications such as sudden worsening of MR, new left ventricular wall motion abnormalities, cardiac tamponade, and dissection or rupture of the aortic root.

T5-14-IN09

Making TAVR Simple: TTE or TEE Guidance

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In 2012, ACC recommended the TEE as a mandatory tool in TAVR procedure. However, in 2017, ACC changed their statement as the TEE was an alternative tool. Alain Cribier performed first in man TAVR in 2002 with general anesthesia and TEE. Thereafter, they stated the procedures were done by local anesthesia without TEE in most of their cases. Minimalized TAVR seems attractive method. There are some problems of TAVR remained to solve, such as paravalvular leakage and residual pressure gradient. But the TEE has complications, such as esophageal injuries or tracheal intubation. Newer generation of devices might decrease the complications and paravalvular leakage. Without TEE, TAVR could be done safely, but we might loss some details.

T5-14-IN10

Transesophageal Echo in Mitral Valve Interventions

Sunil Mankad
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2D and 3D transesophageal echocardiography (TEE) has emerged as the gold standard in guiding a variety of mitral interventions in the

catheterization lab. These procedures include mitral paravalvular leak closure, the MitraClip procedure for mitral regurgitation, and mitral valve-in-valve therapy. For mitral paravalvular leak closure 3D TEE and color Doppler imaging is of paramount importance to determine the shape and size of the defect and gauge its suitability for percutaneous closure. During paravalvular leak closure 2D and 3D TEE also is important to make sure that no leaflet impingement has occurred, which is the most common reason for failure of the procedure. Accurate guidance to cross the interatrial septum at a specific location is particularly important in percutaneous treatment of mitral regurgitation with the MitraClip system. Specific parameters which predict procedural success are also best assessed with 2D and 3D TEE. MitraClip orientation with respect to the mitral valve leaflets is best assessed with 3D TEE. Assurance of leaflet grasping, stability, improvement in mitral regurgitation, size of the residual atrial septal defect, and confirmation of no development of mitral stenosis are all assessed with TEE during the procedure. Finally, mitral valve-in-valve therapy is now an option in both prosthetic as well as native mitral valve stenosis and regurgitation.

T5-14-IN11

Tips and Tricks for MitraClip Procedure

Shih-Hsien Sung
Taipei Veterans General Hospital

There have been more than 10,000 MitraClip procedures performed to treat either functional or degenerative mitral regurgitation (MR). Echocardiography is the essential imaging modality for MitraClip treatment. Echocardiography in peri-interventional assessment is used for: (i) patient selection, (ii) guidance of the procedure, (iii) the identification as well as the assessment of the severity of any complications during the procedure, (iv) the evaluation of the final result after clip implantation, and (v) the assessment at follow-up.

Patient selection: In order to select a patient for the MitraClip procedure, the first step is to assess the severity of MR. In addition to grading MR severity; the MV morphology and the cause of MR should be assessed in detail by transoesophageal echocardiography.

Guidance of the procedure: Two-dimensional TEE can be used as the sole method for guidance during the MitraClip. However, 3D TEE provides valuable additional information and is therefore recommended for the guidance of MitraClip procedures.

Assessment of complications: It has been demonstrated that MitraClip implantation is a remarkably safe procedure; however, complications may occur at any time of the intervention and the team performing the procedure must be aware of them and should be prepared for adequate detection and treatment.

Post-procedural follow-up: For post-procedural follow-up, TTE is usually sufficient. It has been suggested several parameters for quantitative MV assessment adapted from current guidelines, including color flow Doppler of the MR, MV inflow gradient, assessment of pulmonary vein flow, residual ASD evaluation, systolic pulmonary artery pressure, LV size and volume measurements in systole and diastole, and LVEF. In case there is an abnormality that needs clarification, an additional TEE should be performed.

T5-14-IN12

The Diagnosis and Differential Diagnosis of Acute Coronary Syndrome

Jing Ping Sun, MD, FACC, FAHA

Acute coronary syndrome (ACS): is a serious condition, without proper management, the outcome will be poor. Early detection and accurate diagnostic is important to improve the outcome. ACS could presents with atypical symptom, lack of specific ECG changes, and negative cardiac biomarkers. Accurate assessment of chest pain in the emergency department requires a though knowledge of the differential diagnosis and appropriate use of diagnostic tools.

I will discuss the diagnosis and differential diagnosis case by case.

T5-14-IN13

Stress Echo in HFPEF

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Exercise echocardiography is usually performed to detect reduced LV systolic and/or diastolic reserve capacity in the setting of coronary disease or diastolic dysfunction, as patients with diastolic dysfunction may have a similar hemodynamic profile (in terms of cardiac output and filling pressure) at rest as healthy individuals who have normal diastolic function.

Diastolic stress testing is indicated when resting echocardiography does not explain the symptoms of heart failure or dyspnea, especially with exertion. Patients with heart failure with preserved ejection fraction (HFPEF) account for nearly 50% of heart failure population. The most appropriate patient population for diastolic exercise testing is the group of patients with grade 1 diastolic dysfunction, which indicates delayed myocardial relaxation and normal LA mean pressure at rest.

Diastolic stress testing is best performed with exercise and not using dobutamine as the administration of the drug does not simulate the day-to-day physiologic stress.

T5-14-IN14

Ultrasound-Mediated Drug Delivery for Cardiovascular Disease

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Cardiovascular disease is the number one cause of death worldwide and thrombo-occlusive disease is a leading cause of morbidity and mortality. Ultrasound has been developed as both a diagnostic tool and a potent promoter of beneficial bioeffects for the treatment of cardiovascular disease. Ultrasound exposure can induce the release, delivery and enhanced efficacy of a thrombolytic drug (rt-PA), or bioactive gases from echogenic liposomes. By encapsulating drugs into micron-sized and nano-sized liposomes, the therapeutic can be shielded from degradation within the vasculature until delivery is triggered by ultrasound exposure. Microbubbles oscillate when exposed to ultrasound and create stresses directly on nearby tissue or induce fluid effects that effect drug penetration into vascular tissue, lyse thrombi or direct drugs to optimal locations for delivery. Insonification accelerates clot breakdown in combination with rt-PA and ultrasound contrast agents, which nucleate sustained bubble activity, or stable cavitation. Mechanisms for ultrasound enhancement of thrombolysis and drug delivery, with a special emphasis on acoustic cavitation and radiation force, will be reviewed.

T5-14-IN15

Intravascular Ultrasound Guided Percutaneous Coronary Intervention

Kenichi Fujii
Higashi Takarazuka Satoh Hospital, Japan

Intravascular ultrasound (IVUS) is a promising imaging modality to guide percutaneous coronary intervention (PCI). Recently, there

has been increasing evidence supporting the clinical utility of IVUS-guided PCI with drug-eluting stent (DES) implantation, including observational studies and randomized trials. IVUS provides cross-sectional image of the whole coronary artery wall, and allows us to evaluate the severity of stenosis, assess plaque morphology, and optimize DES implantation. IVUS guidance can increase the efficacy of DES and decrease adverse clinical events. In the session, I will show my clinical experience and available evidence on IVUS-guided PCI with DES implantation.

T5-14-IN16

Comparison Among US, OCT and MRI

Hung Chung-Lieh, MD, MSc
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Multiple non-invasive modalities can be used for early recognization of diseased myocardium, either ischemic or non-ischemic origin. Radiological approach by using computed tomography (CT) may allow dedicated morphological/anatomic approach while magnetic resonance imaging (MRI) provided further functional assessment, as well as viability test. Other emerging imaging techniques may include positron emission tomography (PET), which further provides information regarding status of metabolism at the tissue/cellular level. A variety form of multimodality imaging have recently been developed to overcome the limitation of single imaging modality in clinical labs and thus rendered additional assessment and clinical interpretations possible. More recently, the development of optical coherence tomography has also allowed more detailed vascular morphology feasible and visible in a 3D re-constructional manner.

In this lecture, we will review the clinical application and comparisons of Cardiac MRI, OCT and Echo for the assessment and characterization of the cardiovascular structures and morphological assessments. In particular, we will focus on ischemic heart diseases, it remained crucial to accurately characterize myocardial function (both quantitatively and in quality) and further help discriminate viability, extent of lesion involvement (transmural or non-transmural old myocardial infarction - subendocardial or transmural), peri-infarcted ischemia and advanced vascular imaging, which can provide invaluable information for guiding further therapeutic strategy and improving patients' prognosis. In non-ischemic cardiomyopathy, cardiac MRI may also act as a robust imaging modality with high spatial resolution to provide the excellent tissue characterization regarding the exact size, locations, patterns of lesions involvement, as well as global systolic function evaluation.

T5-15-IN01

The Role of 3D Echocardiography in Congenital Heart Disease

Satoshi Yasukochi
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The understanding of the three dimensional morphological assessment of cardiac structure together with hemodynamics is essential in cases with congenital heart disease, when one plan a surgical correction and evaluate the post-surgical status. Among many imaging modalities, the 3D echocardiography (3DE) could provide a real time 3D morphology in motion and 3D flow configuration.

The 3DE imaging are obtained ether by transthoracic, by trans-esophageal or by trans-pericardial approach. The 3DE images depends on the fundamental 2D images with echo-window and frame rate. In this regard, trans-esophageal 3DE has better special resolution than those by transthoracic one, but has also limitation of applicability of probe insertion and of the necessity of general anesthesia in small children. To acquire the most fine 3Dimages for surgical planning and assessment before and after the cardiac surgery, the trans-pericardial 3DE gains more clinical significance especially in complex congenital heart disease. We present our experience using trans-pericardial 3DE in this presentation.

T5-15-IN02

Tips and Tricks of TEE in CHD Intervention

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Transesophageal echocardiography (TEE) now is considered an essential part of diagnostic and monitoring during modern cardiac and thoracic aortic surgery. Perioperative TEE is a major component of patient management, and important for surgical and anesthetic decision making. Frazin first introduced the clinical use of transesophageal echocardiography (TEE) in 1976. However, the pediatric TEE probe was established and use clinically in 1990. In 2009, the new microTEE probe (s8-3t Philip) was developed and brings benefits of the TEE to use in patients under 3Kg.

Clinical management of congenital heart lesions by using the TEE can be achieved by surgical repair, via catheter-based device closure and during hybrid surgery. Therefore, in this presentation we review our experiences of using intraoperative TEE in pediatric patients who underwent different types of congenital heart surgery, interventional therapy and hybrid surgery.

We reported that intraoperative TEE for 256 consecutive neonates and infants undergoing complex congenital heart surgery. TEE was successful performed in 97% of infants with CHD during surgery and only 3% failed due to systemic arterial hypotension and saturation in 7 infants (4 in TAPVC and 3 in CoA) only 5.6 % patients with inadequate surgical repair and need immediate revised.

Interventional techniques for treatment of congenital heart disease are evolving rapidly and have become established routine in a large number of centers worldwide. TEE image was used to evaluate the size, number and location of the defects, selection of appropriate device, guiding the procedures and confirmed the results.

Hybrid surgery for CHD, a new medical trend. It combined minimally-invasive method with traditional surgical techniques and catheter based procedure. Hybrid for HLHS (single ventricle palliation combing surgical PAB with catheter ductal stenting), periventricular closure of VSD, periventricular pulmonary stenosis, periventricular aortic valve replacement.

In conclusion, TEE is routinely and successfully used during pediatric CHD surgery repair, intervention procedures and hybrid surgery to improve the quality of surgical repair and to potentially reduce the morbidity and mortality.

T5-15-IN03

Coronary Imaging Evaluation in Acute Kawasaki Disease

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Acute Kawasaki disease (KD) is a systemic vasculitis in infants or children that develops predominantly in the coronary arteries. Evolution of criteria for determination of coronary artery lesion (CAL) in acute KD started from 1984, when the Japanese Ministry of Health (JMH) published criteria only in case of luminal diameters changes (diameter is greater than 3.0mm in children $<$ 5-year-old or greater than 4.0mm in children at least 5-year-old). Later In 1998, Jane W. Newburger, et al suggested that BSA-specific criteria should be used since CAL contribute to the long-term outcome and therapeutic strategy. The

JMH-defined criteria underestimated the real incidence of CAL in acute KD. In 2004, American Heart Association (AHA) scientific statement suggested using BSA-adjusted Z score >2.5 as supplementary echocardiographic criteria.

For the past decade, we use these criteria as **solely** parameter in diagnosis of whether acute complete or incomplete KD with CAL. Recently, new studies (from national wide survey of Japan, Korea and Taiwan) reveal increasing trend in KD over the past 6 years, as well as the incidence of incomplete KD, which was determining by coronary artery segment Z score>2.5. Meanwhile, experts have reported the **increasing incidence of CAL**. Sudo et al. from Japan suggest that the higher incidence of coronary artery lesions in patients with incomplete presentation was firstly due to **diagnostic bias** because of the use of echocardiography in the diagnostic process, and secondly due to delays in the treatment because of difficulties in making the diagnosis. Also, experts from South Korea suggest that the validity of the diagnostic criteria of incomplete presentation by the American Heart Association should be thoroughly tested in the immediate future based on the same reason.

We have evaluated serial echocardiographic data of our acute KD patients in Taiwan. Our data showed that various coronary arteritis lesions presented in acute KD, include various degree of luminal prominence, aneurysm formation, lack of tapering, irregularity and intimal thickening brightness. The result confirms a truth that the nature of KD is medium-sized arteritis involved coronary artery the most. In conclusion, the CAL should be defined by detailed coronary arteries morphology instead of single dimensional change, whether is absolute diameter or Z score.

T5-15-IN04

Echocardiography in the Diagnosis of Neonatal Critical Heart Disease

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Congenital cardiovascular disease, refers to in the development of embryo in the womb, due to various reasons lead to abnormal development of the cardiovascular system, namely when the baby is born cardiovascular system structure of the deformities and (or) function abnormal lesions.

Fetal circulation is mainly based on systemic circulation, and there is no effective pulmonary circulation，arterial catheters, venous catheters and ovaries are special channels for fetal blood circulation most of the blood in the fetus is mixed blood. The fetus gets nutrition through the placenta. After birth, the lungs have a ventilatory function, forming a real pulmonary circulation and circulatory system. Arterial catheters, venous catheters, and umbilical vessels are disused，a series of changes in the blood circulation becomes extinct.

This time, we are talking about epidemiology, pathological anatomy, clinical manifestations and echocardiography characteristics of PDA dependent congenital heart disease, atrial septum limited type of congenital heart disease, left to right diverge congenital heart disease, total anomalous pulmonary venous drainage and obstruction, congenital vascular ring.

T5-15-IN05

Echocardiography in Emergency and Critical Care in Children

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Echocardiography is a useful tool in the management of critical care unit in children. Before the era of the easy accessibility of the ultrasound machine and the skill of echocardiography, fluid management is an art. Nowadays, with the help of echocardiography, we have numbers that give us information concerning preload, contractility and afterload. We can measure the fractional shortening which reflects the contractility; the size of left atrium and the collapsibility of inferior vena cava which give us information of preload. In fact, we can calculate stroke volume and cardiac output with the use of the echocardiography. With the input of blood pressure, we can calculate the systemic vascular resistance. This is extremely useful in cases with sepsis because very often, this may be the very first clue that the patient is going into sepsis and early intervention helps to stop the cascade of deterioration. In addition to these commonly seen scenarios in PICU, we need echocardiography to rule out congenital heart diseases including total anomalous pulmonary venous drainage and coartation of aorta and to measure the severity of the pulmonary hypertension for our patients in neonatal intensive care.

T5-15-IN06

Pre-EVT Evaluation, Intra-EVT Guidance, Post-EVT Follow-Up of Duplex Ultrasound for Low Extremity Arterial Disease (LEAD)

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Duplex Doppler imaging of the lower limb arteries is a very effective tool, and it is cheaper and more widely available than CT and MRI. Besides, duplex ultrasound can provide clinicians with detailed information on location, extent, and severity of disease from the visceral aorta to the tibial arteries. Duplex scanning is interpreted in conjunction with limb-pressure measurements to categorize arterial hemodynamics and functional impairment accurately. Understanding the features of duplex-acquired velocity spectra recordings is fundamental to accurate diagnostic testing, including the characteristic spectral features of "normal" versus "abnormal" lower-limb arterial flow, hemodynamic changes associated with stenosis or occlusion, and the status of distal limb or foot perfusion. The Recent advance of techniques and devices enable endovascular therapy (EVT) as the first-line treatment in patients with LEAD.

Duplex scanning can provide an arterial map of occlusive or aneurysm lesions analogous to an angiogram. Testing is accurate before and after intervention for the detection of stenosis. The detection of high-grade stenosis in an arterial repair allows for pre-emptive treatment before thrombosis occurs and improves long-term patency. In this talk, we will give a brief review of the role of a duplex in the era of EVT for LEAD.

T5-15-IN07

Role of Intravascular Ultrasound in Percutaneous Vascular Intervention

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For many years, coronary angiography has been considered as the "gold standard method" to evaluate patients with coronary artery disease. However, angiography only provides two-dimensional silhouette of the lumen and is unsuitable for the precise assessment of atherosclerotic plaque. Intravascular ultrasound (IVUS) has provided valuable information on cross-sectional vascular structure and has been used to guide percutaneous vascular intervention in different subsets of vascular lesions. IVUS is also a useful tool for planning interventional strategies and optimizing stent deployment, particularly when stenting complex lesions such as left main disease and chronic total occlusion disease. In addition, it can be used to evaluate vascular responses, including neointimal growth and strut apposition, during follow-up. The current perception and adoption of innovative interventional devices, such as bioabsorbable scaffolds, will increase the need for IVUS. IVUS-guided percutaneous vascular intervention seems to be associated with a significantly reduced risk of death, myocardial infarction, target lesion revascularization, and stent thrombosis.

T5-15-IN08

Echo Doppler in Carotid Artery Disease

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Carotid Intima Media thickness is an early non-invasive marker of presence of atherosclerosis and its thickness correlates with progression or regression of atherosclerosis in vascular system. Evaluation of carotid plaques gives information about soft, lipid rich unstable plaques prone to rupture versus hard, fibrous and calcific stable plaques. Significant coronary artery disease is co-associated with obstructive carotid disease in 26% of patients, especially with triple and left main disease and may require simultaneous tackling. Degree of stenosis of carotid arteries as determined by peak systolic and end diastolic velocities helps in selecting cases for surgical endarterectomy or stenting. Cases of carotid dissection and aorto-arteritis can be evaluated by carotid ultrasound and followed up.

T5-15-IN09

Color Doppler Assessment of Upper Limb Arteries

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Arterial disease is uncommon in the upper extremity than in the legs. The conditions that result in compromise of arterial flow in upper limb are also a little different from those affecting the lower limbs. Mechanical compression occurring in the thoracic outlet, Vasospasm in the digital arteries, Trauma-related thrombi in the hand and wrist and embolic thrombi from the heart or proximal arm aneurysm or plaques are more common in upper limb.

The flow in the larger arteries of upper extremities is pulsatile. Normally the Doppler waveforms are triphasic but are variable and may dramatically change depending on room temperature and fidgeting patients performing clenching and unclenching of fists.

Atherosclerosis: Origin of subclavian arteries is a common site for Atherosclerotic plaque formation and stenosis.

The stenosis that reduce the lumen diameters by 50% or greater can be identified by increased velocity of flow through them, post-stenotic turbulence and dampening of the distal waveforms.

Significant stenosis at the origin of subclavian artery may cause vertebral steal.

Thoracic-outlet Syndrome: Compression of the subclavian artery as it emerges from the thoracic outlet can cause flow disturbances and ischemia in the upper extremity. The reduction of flow due to impingement of the artery can be demonstrated by dampening or cessation of flow on Doppler while putting the arm in abduction and external rotation. Repeated trauma in long standing cases can cause permanent changes and may result in thrombus formation or occlusion.

Raynaud's disease & Raynaud's phenomenon: Raynaud's disease is a vasospasm of digital arteries resulting in attacks of intermittent pallor, cyanosis and pain in the fingers.

Digital waveforms may be normal at rest but flow may totally cease in response to cold stimuli. The proximal arteries reveal a stunted spiky systolic flow with absent diastolic flow.

Raynaud's phenomenon is referred to a condition where presence of cold sensitivity is complicated by a fixed arterial obstruction, and which is a much more serious condition.

Embolic occlusion: Embolus can arise in the heart or from atherosclerotic plaques at the origin of the subclavian artery. The caliber of the vessel is typically normal or may be slightly larger in acute phase and no flow is visible on the Doppler.

T5-15-IN10

Peripheral Venous Color Doppler and Laser Treatment of Varicose Veins

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Color doppler ultrasonography (CDUS)Duplex ultrasonography (CDUS has become an essential part of the evaluation of patients with superficial venous insufficiency. CDUS has also become an important tool in directing and assessing the results of a variety of minimally invasive treatments of this disease. In this article, we review the salient aspects of performing an adequate DUS evaluation and the utility of this technique in guiding treatment.

Doppler Ultrasonography(CDUS)do is an inexpensive, portable, and reproducible means of simultaneously assessing both the venous anatomy and physiology.

CDUS is also important tool for image-guided endovenous methods used to ablate incompetent veins.

CDUS is used to evaluate the GSV and the small saphenous veins (SSV) and their primary tributaries.

These veins are found outside the superficial fascia, in the subcutaneous tissue, on imaging.

Goals of the CDUS examination are: to identify all incompetent truncal veins and to determine whether they are responsible for the patient's clinical problem.

CDUS ULTRASOUND IN GUIDING SCLEROTHERAOY: Sclerotherapy is performed of deeper superficial veins and incompetent perforating veins.

After injection, successfully treated veins frequently go into spasm.

Follow-up US several weeks after injection usually demonstrates noncompressible veins filled with trapped blood. The trapped blood usually resorbs and the successfully treated vein becomes a cord that may be difficult to find with US.

CDUS ULTRASOUND IN GUIDING ENDOVENOUS THERMAL ABLATION: Laser and radiofrequency (RF) EVTA of the saphenous veins and their primary tributaries utilizes laser or RF fibres. The goal of these therapies is to occlude the incompetent vein segments permanently.

CDUS should always be done to evaluate the treated vein segments periodically after EVTA. This is generally done in the first few weeks after therapy, a few months later, and at yearly intervals.

CDUS should also be performed to evaluate for the cause of any recurrent varicose veins. In the first several weeks after therapy, the treated veins are either smaller or the same size as before treatment, with a thick wall and nearly obliterated lumen.

There should be no flow in the entire treated vein segment.

Most treatment failures are evident in the first few weeks as either thrombosed vein segments that subsequently recanalize or veins that are unchanged compared with the preliminary examination.

Conclusions: CDUS is an integral part of the modern evaluation and management of patients with Varicose veins.

Precise anatomic flow mapping is required prior to planning treatment.

Treatment with EVTA and occasionally sclerotherapy requires precise monitoring with CDUS

All patients treated with ETVA should be observed with CDUS for several months after the procedure to confirm its success.

A combination of EVTA and sclerotherapy is an effective modern management for varicose veins

T5-15-IN11

Automated Adaptive Analysis Algorithm for Left Heart

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Accurate assessment of left heart volumes and function is essential in every echocardiographic examination. 3D echocardiography has been shown by multiple studies to be superior in accuracy and reproducibility to 2D echocardiography, because of avoidance of geometric assumption and foreshortened views. However, widespread adoption of 3D echocardiography for left heart assessment has not become the clinical reality, probably due to the time and training required for obtaining reproducible 3D volumetric measurements. Adaptive analysis of 3D echocardiographic dataset uses machine learning algorithm to automate the volumetric measurement of the left heart volumes. Improved reproducibility and workflow efficiency of adaptive automated analysis of left heart chambers has been recently demonstrated by studies. This promising software has the potential to enable the integration of 3D echo volumetric left ventricular and atrail measurements into routine clinical workflows globally.

T5-15-IN12

Volumetric Analysis Versus Deformation Imaging in Assessing Left Ventricular Function

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Left ventricular ejection fraction (LVEF) has been the essential parameter used for diagnosis and management in patients with heart failure. However, LVEF is less useful as a marker of risk as it approaches normal. Recent echocardiographic advancements significantly improves our perception of heart failure and extents our diagnostic horizon. The acquisition of real-time three-dimensional volumetric data avoids the reliance on geometrical assumptions and provides a more integrative view of regional myocardial mechanics, although with reduced image quality and lower frame rate than two-dimensional echocardiography. Deformation imaging has shown good correlation with sonomicrometry data, is somewhat less load dependent than LVEF and may provide better insight into myocardial dysfunction in patients with HFpEF. LV strain represents a better predictor of outcome than traditional LVEF; it is associated with functional capacity and provides more accurate, reproducible, and detailed information regarding LV function and mechanics. A more complete evaluation and understanding of left ventricular function in patients with heart failure requires a more comprehensive assessment.

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T5-15-IN13

Extracorporeal Cardiac Shock Wave Therapy(CSWT) in Patients with Severe Coronary Artery Disease(CAD) Unsuitable for Percutaneous Coronary Intervention (PCI) and Coronary Artery Bypass Graft Surgery (CABG) Guided by Echocardiography

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Objective: To test the effectiveness and feasibility of extracorporeal CSWT in patients (pts) with severe CAD unsuitable for PCI and CABG.

Patients and methods: 51 pts were enrolled. They were 35 men and 16 women aged from 41 to 89 years old (67.5 $\pm$10.9). Extracorporeal CSWT was performed with the application of 100 shocks/spot at 0.09 millijoules/mm^2 (mJ/mm^2) energy flux density for 3-9 spots each time with three times per week at each series for three series at 1, 5, 9 weeks. The location and depth of CSWT application were based on thallium 201 myocardial perfusion scan findings guided by echocardiography. The exercise tolerance, thallium 201 myocardial perfusion scan and echocardiography were followed up 6 months later.

Results: These 51 patients received 1500 to 7500 low intensity shock waves during entire treatment course with an average of 4682 $\pm$ 1293 shock waves. Exercise duration with Bruce protocol increased from 304 $\pm$ 148 seconds before CSWT to 350 $\pm$ 115 seconds after 6 months ($p < 0.0174$). The CCS angina score was decreased from 2.9 before CSWT to 2.0 after 6 months ($P < 0.001$). 39(76%) pts had perfusion improvement by thallium 201 myocardial perfusion scan. Echocardiographic study showed left ventricular (LV) end-diastolic dimension and volume were decreased significantly from 55.0 $\pm$ 8.5 mm and 152.2 $\pm$ 57.2 mm^3 to 53.1 + 8.1 mm and 140.5 +52.8 mm^3 after 6 months ($P=0.0185$, $P= 0.0232$). LV systolic dimension decreased from 36.8 $\pm$ 8.8 mm before CSWT to 34.6 $\pm$ 9.2 mm after 6 months ($P =0.006$). LV systolic volume changed from 62.5 $\pm$ 37.8 mm^3 to 55.0 $\pm$ 38.5 mm^3 ($P= 0.0282$). LV ejection fraction increased from 60.0 $\pm$ 12.6% before CSWT to 63.5 $\pm$ 12.7% after 6 months. ($P =0.032$). Regional wall motion score index was decreased from 1.30 $\pm$ 0.36 before CSWT to 1.21 $\pm$ 0.30 after 6 months ($P= 0.0024$). No side effects related to CSWT were found.

Conclusions: Our study demonstrated that echocardiography can be used as a guide for performing extracorporeal CSW. And CSWT can improve angina symptoms, increase exercise duration and improve myocardial perfusion, left ventricular remodeling, myocardial wall motion and finally improve left ventricular ejection fraction. Our study also demonstrated that CWST is safe and effective. This kind of therapy can be applied to the pts of severe CAD with refractory angina unsuitable for PCI or CABG.

T5-15-IN14

The Clinical and Research Applications of Speckle Tracking Echocardiography

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The left ventricle (LV) performs longitudinal shortening-lengthening movements around the long axis as well as thickening and thinning movements around transverse axis, whereas both thickening-thinning (in the radial axis) and lengthening-shortening (in the circumferential axis) movements occur in the short axis throughout the cardiac cycle. Speckle tracking echocardiography overcomes the angle-dependence limitation of TDI-derived strain. These techniques provide more unique information about myocardial fiber orientation. In the assessment of cardiac function and loss of function, it is essential to understand the helical architecture of myocardial fibers and concordantly examine the fibers in terms of shortening, thickening and torsion movements around heart own axis during systole and diastole. According the clinical research reports recent decade, speckle tracking echocardiography is an easy-to-use method that provides more objective data on myocardial mechanics and reflects the regional and global ventricular functions in a superior way in terms of diagnosis and prognosis; and a good tool for clinical research.

T5-15-IN15

The Role of Left Atrium

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Left atrium (LA) contributes 20-30% of cardiac output. LA volume and function measured by 2D biplane area length and real-time 3D echocardiography have been well-validated and widely used. LA function consists of 3 components, including reservoir, conduit, and active contractile phases. The most frequently used echocardiographic method for evaluation of phasic function of LA is volumetric method. LA volume measured by biplane area-length method and corrected by body surface area is a useful index for studying LA remodeling, and early LA remodeling has been proven to have prognostic significance in heart failure after myocardial infarction. Phasic changes of LA volume can be measured in different phases of cardiac cycle. Volumetric measurements are useful in evaluation of LA, however, volumetric changes can not reflect changes of the LA wall itself.

Tissue Doppler imaging has been applied for the assessment of cardiac function, including atrial function. Atrial deformation evaluated by tissue Doppler derived strain or strain rate imaging can be used for assessment of LA wall directly. Newly developed speckle tracking echocardiography is useful in assessment of left ventricular strain and strain rate. This non-Doppler two-dimensional strain imaging avoids effects of Doppler angle and ventricular tethering. Speckle tracking echocardiography was recently used for assessment of LA function after resynchronization therapy. The feasibility of LA longitudinal strain and strain rate measured by speckle tracking echocardiography has been verified in healthy subjects, and adequate tracking can be performed in 94% of subjects or in 97% of segments.

Early changes of LA function can be documented by speckle tracking echocardiography. We have found the phasic LA function changed in untreated hypertension subjects and correlated with left ventricular diastolic function. LA strain also has prognostic implications such in primary mitral regurgitation or in atrial fibrillation.

T5-15-IN16

Three-Dimensional Speckle Tracking Echocardiography for Assessment of Right Ventricular Morphological Changes and Dysfunction on Long-term Lymphoma Survivors Received Anthracycline Therapy

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Background: Left ventricular dysfunction is clinically used for cancer patients receiving anthracycline-based therapy to identify its cardiotoxicity. However, the long-term effect on right ventricular (RV) performance are still unknown to a great extent. The purpose of this study was to investigate the long-term impact of anthracycline treatment on RV function and structure on lymphoma survivors using three-dimensional speckle tracking echocardiography (3D-STE).

Methods: Two- (2D) and three-dimensional (3D) echocardiography were performed on 18 long-term survivors (follow-up periods: 4.89±1.02 years) with diffuse large B cell lymphoma (cumulative dose of anthracycline: 491.44±80.9mg) as well as 26 age- and gender-matched healthy controls. 2D RV parameters included tricuspid annulus plane systolic excursion (TAPSE) derived by M-mode echocardiography, Tei-index (myocardial performance index) derived by Pulsed Wave Doppler (PW-Tei) as well as Tissue Doppler imaging (TDI-Tei). 3D-STE parameters contained RV dimensions including basal-cavity, mid-cavity and longitudinal diameter (RVD1, RVD2 and RVD3 respectively), RV fractional area change (FAC), end-diastolic volume (3D-EDV), end-systolic volume (3D-ESV), RV ejection fraction (RVEF) as well as RV longitudinal strain of the septum (RVLS-sept.) as well as the free wall (RVLS-FW).

Results: Compared with healthy controls, the mean 3D-EDV decreased significantly (58.44±14.88ml vs. 80.52±26.47ml, p=0.01), as well as RVD3 (49.46±6.79mm vs. 58.17±8.31mm, p<0.001). The 3D-EDV correlated positively with RVD3 (r=0.70, p=0.001). The average RVEF and FAC worsened obviously (RVEF: 46.01±9.40% vs. 58.22±5.96%, $p < 0.01$; FAC: 38.87±13.84% vs. 51.64±54.86%, $p < 0.01$). Furthermoare, these two indexes showed markedly correlation (r=0.50, p=0.036). The mean RVLS-sept. reduced (-15.16±4.44% vs. -24.87±5.11%, $p < 0.01$) with the TDI Tei-index deteriorated dramatically (0.55±0.07 vs. 0.38±0.04, $p < 0.01$). Other parameters manifested no comparable differences between the two groups.

Conclusion: Remarkable changed RV chamber size and damaged systolic function can be identified by 3D-STE on long-term lymphoma survivors compared with the general population.

T5-15-IN17

Three-Dimensional Echocardiography-Derived Non-Invasive Right Ventricular Pressure-Volume Analysis

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In patients with pulmonary hypertension, repeated evaluations of right ventricular (RV) function are still required for clinical decision making, but the invasive nature of current pressure-volume analysis makes conducting regular follow-ups in a clinical setting infeasible. We enrolled 12 patients with pulmonary arterial hypertension (PAH) and 10 with pulmonary venous hypertension (PVH) May 2016–October 2016. All patients underwent a clinically indicated right heart catheterization (RHC), from which the yielded right ventricular pressure recordings were conjugated with RV volume by 3-D echocardiography to generate a pressure-volume loop. A continuous-wave Doppler envelope of tricuspid regurgitation was transformed into a pressure gradient recording by the simplified Bernoulli equation, and then a systolic pressure gradient-volume (PG-V) diagram was generated from similar methods. The area enclosed by the pressure-volume loop was calculated to represent semi-invasive right ventricular stroke work ($RVSW_{RHC}$). The area between the PG-V diagram and x-axis was calculated to estimate non-invasive RVSW ($RVSW_{echo}$). Patients with PAH have higher RV pressure, lower pulmonary arterial wedge pressure and larger RV volume that was contributed by the dilation of RV mid-cavity minor dimension. We found no significant difference of traditional parameters between these two groups, but RVSW values were significantly higher in PAH patients. The RVSW values of these two methods were

significantly correlated by the equation $RVSW_{echo} = 0.8447\ RVSW_{RHC} + 129.38$ ($R^2 = 0.9151$, $p < 0.001$). The linearity remained satisfactory in both groups. We conclude that a PG-V diagram is a reliable method to estimate RVSW and to depict pathophysiological status.

T5-15-IN18

Is Echocardiographic Assessment Right Ventricular Function Routinely Performed?

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Assessment of right chamber function has become increasingly popular and important in recent decades, complementing the evaluation of left chamber functional parameters. The late adoption and integration of right ventricular (RV) function into a complete evaluation of cardiac function could be due in part to the difficulty in visualization of the whole right ventricle, inconsistency in the analysis of RV parameters, and poor understanding of the impact of RV function to prognosis. From M-mode to 2-dimensional (2D) measurements of RV size and function, several parameters, such as fractional area change (FAC), tricuspid annular plane systolic excursion (TAPSE) and RV free wall strain assessed by 2D speckle tracking echocardiography provide important information of the right ventricle. However, there are limitations of using 2D echocardiography to quantify RV volume and ejection fraction (EF), and currently accurate measurements of RV volumes and EF can be relied on cardiac magnetic resonance (CMR) imaging. CMR derived RVEF has been reported to provide incremental prognostic value over left ventricular ejection fraction in patients with idiopathic and ischemic dilated cardiomyopathy. With use of 3-dimensional (3D) echocardiography in conjunction with updated version of RV quantification software, the measurements of RV volumes and EF have become feasible and reproducible. It accuracy has been validated against CMR. With the establishment of reference values in the recent publications, 3D echocardiography determined RV volumes and EF have the potential for our better understanding of RV function and exploration of its significance for outcome research in various clinical scenarios. Thus, it is a prime time to assess RV function with 2D and preferentially 3D echocardiography in routine echocardiography examinations.

T5-15-IN19

New Insights About the Pathophysiology of Functional Tricuspid Regurgitation by 3D Echocardiography

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The pathophysiology of functional tricuspid regurgitation (FTR) involves several mechanisms that may contribute at different extent in different cardiac conditions: i. dilation of the tricuspid annulus (TA) secondary to RV and/or right atrial dilation; ii. changes of the geometry (the TA becomes larger, more circular and flatter) and dynamics (reduced area shortening and excursion) of the TA; iii. Distortion of the spatial relationships among leaflets, chordae and papillary muscles leading to leaftlet tethering and malcoaptation.

Spinner et al.* demonstrated that both annular dilation and papillary muscle displacement contribute to FTR. Significant FTR occurs with only 40% dilation of TA area (conversely, a 75% mitral valve area dilation was needed to create functional mitral regurgitation). TA dilation caused the displacement of the anterior and posterior leaflets from the central coaptation line with a progressive reduction of the leaflet coaptation surface until a gap occurred. In this experimental study, the minimum coaptation length to prevent regurgitation was 5 mm. They found that the anterior leaflet is the one which is the most affected by TA dilation. The investigators demonstrated also that isolated papillary muscle displacement (i.e. without TA dilation) can cause FTR and identified the septal as the most affected leaflet by papillary displacement. Of course, the concomitant presence of TA dilation and papillary muscle displacement produced the largest FTR.

On the other end, it is also a common observation that not all patients with TA dilation have FTR and with the same extent of TA dilation different degrees of FTR may be observed. Afilalo et al.** demonstrated that in patients with pulmonary hypertension TV leaflets remodel by increasing their area and both the occurrence and severity of FTR are related to the extent of leaflet adaptation to increased TA area expressed as the ratio between TV leaflet area/closure area.

Accordingly, we can hypothesize different pathophysiological models of FTR development in different cardiac conditions. A first model where the starting mechanism is TA dilation, typical of patients with dilated right atrium and normal RV (e.g. chronic atrial fibrillation). A second model where the starting mechanism is the remodeling of the RV with the displacement of the papillary muscles and the tenting of TV leaflet typical of patients with pulmonary hypertension, dilated RV and nearly normal right atrium. Once initiated, the RV remodeling secondary to the volume overload may easily produce a further dilation of the TA which aggravates the FTR starting a vicious circle in which FTR begets more FTR and both TA dilation and leaflet tethering coexist in the same patient.

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T5-15-IN20

Assessment of Functional Tricuspid Regurgitation

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Because of the complexity for tricuspid regurgitation (TR) evaluation with invasive methods, echocardiography has always played a central role for TR assessment. The parameters used for this purpose range from qualitative to quantitative, the latter being recommended by current American and European guidelines. Among them, the vena contracta (VC), and the effective regurgitation orifice (ERO), are the most widely used, and should be further supported by other parameters. However the use of traditional parameters for severity assessment of TR is based on extrapolation of the concepts learned from studying the mitral valve. As the tricuspid valve has unique features, being highly dynamic, with a complex coaptation among its three leaflets and regurgitant orifices with complex geometric configurations, there is an urgent need for these parameters to be questioned.

Among the issues to remember when assessing TR, is that its regurgitant orifice is not static. TR regurgitant has been shown to change throughout systole using 3D echocardiography, therefore a single measure is not the ideal parameter to assess TR Consider a patient in which by selecting a midsystolic frame TR is graded as moderate, while selecting another reveals severe TR. Does this patient really has moderate TR?

The respiratory cycle can also influence the TRO patients with TR present a decrease in driving forces during inspiration, while TRO diameter increases importantly (around + 69%). During inspiration, as venous return to the right side of the heart increases, the right ventricle expands its width to accommodate a higher volume, without significantly changing its longitudinal dimension. The increase in width of the RV, apical

displacement of the papillary muscles and the anatomical particularities of the tricuspid valve and the insertion of chordae tendinae to multiple papillary muscles and the RV free wall, result in an increase of tricuspid annular dimension, tenting height and tenting area. Consequently ERO increases, ultimately resulting in a notable increase in regurgitant volume during inspiration with a mean of 20%. Calculating average inspiratory and expiratory parameters such as PISA, TR maximum jet velocity, and TVI might better reflect severity in physiological conditions.

The right heart is also influenced by both preload and afterload a fact that must not be ignored when assessing TR. Within physiological limits, right ventricular contractily can increase with increasing end diastolic volume, using the Frank Starling mechanism. The role of RV afterload effects on TR should also be considered.

VC measurement using 2D echo faces important limitations because TR orifice is not circular and complex geometrical orifices are very common. Because of the complex coaptation between the three leaflets, multiple jets are commonly found, which may lead to underestimating severity if this issue is not appreciated by the echocardiographer. These geometric limitations also limit the follow-up of patients with TR as variations can be observed just by changing the acquisition plane.

PISA radius measured with 2D echo method faces the same geometric limitation as VC as calculations are based on the assumption that PISA is an hemisphere. 3D echocardiography may be useful to overcome this limitation by directly measuring VC even in complex geometric orifices, this measurement can be performed in more than 90% of patients if rhythm is regular and respiration is controlled.

T5-15-IN21

Ultrasound Assessment of Right Ventricular Function in Pediatric Heart Disease

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While the right ventricle has been regarded in the past as a passive conduit for delivery of systemic venous blood to the lungs, the pathophysiologic significance of right ventricular (RV) dysfunction is increasingly recognized. The right ventricle functions either as a pulmonary or systemic ventricle in children, depending on the underlying congenital or acquired heart condition. Children with repaired tetralogy of Fallot and concomitant pulmonary regurgitation represent an important cohort in whom the significant problem is chronic RV volume overload. On the other hand, paediatric patients with chronic RV pressure overload include those with a systemic right ventricle in the setting of congenitally corrected transposition of the great arteries or after atrial switch operation, and those with systemic pulmonary hypertension. The importance of serial monitoring of RV function in these at-risk patients cannot be overemphasized. Notwithstanding the increasing role of cardiac magnetic resonance in the assessment of RV function, echocardiography remains to the most commonly used modality in daily clinical practice. The complex geometry of the right ventricle precludes, however, the use of geometric assumptions in functional assessment. M-mode assessment of tricuspid annular plane systolic excursion and tissue Doppler interrogation of systolic and diastolic regional myocardial velocities can be easily performed and applied by the bedside in the routine assessment of RV function. Additionally, the Doppler-derived myocardial performance index, which is independent of ventricular geometry and takes into account of systolic and diastolic function, has also increasing been used to assess global RV performance. Real-time three dimensional echocardiography and myocardial deformation imaging have shown great promise in the assessment of subpulmonary and systemic RV function, and efforts have been made to facilitate their translation into clinical practice. In conclusion, advances in echocardiographic imaging have revolutionized the evaluation of RV performance and shed light on the pathophysiology of RV dysfunction in paediatric congenital and acquired heart disease.

Free Paper

OPT5-001

Value of Layer-Specific Strains in Hypertrophied Myocardium of Aortic Stenosis from Comparison with Hypertrophy Cardiomyopathy

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Objectives: Intrinsic myocardial mechanics may have different patterns due to different etiologies of myocardial hypertrophy. We used layer-specific strain to compare the hypertrophied myocardium between hypertrophic cardiomyopathy (HCM) and aortic stenosis (AS) individuals. We searched for the differences in strain distribution and clinical implications for these patients.

Methods: Comprehensive echocardiography were performed in 3 groups of 172 consecutive patients with HCM, 129 participants with moderate to severe AS and 79 healthy controls. Left ventricular (LV) layer-specific deformation parameters were obtained by two-dimensional speckle tracking echocardiography, including longitudinal strain of both sub-endocardial and sub-epicardial myocardium. The transmural strain gradient was defined as the strain difference between sub-endocardial and sub-epicardial myocardium. We further divided AS patients into two subgroups according to the median level of transmural longitudinal strain gradient.

Results: In comparison of the layer-specific myocardial deformation parameters between the HCM and AS groups, hypertrophied myocardium from the AS group had better sub-epicardial myocaridial (¬¬-13.5±3.5% vs -11.6±3.5%, $p<0.001$) and sub-endocardial myocardial longitudinal strain (-18.0±4.4% vs -15.3±4.3%, $p<0.001$), and higher transmural longitudinal strain gradient (4.5±1.3% vs 3.6±1.2%, $p<0.001$). Both diseased groups had significantly reduced layer-specific longitudinal strains than the healthy controls (sub-endocardial: -21.20±3.7%, sub-epicardial: -16.7±3.0%, both $p<0.001$). The transmural longitudinal strain gradient of the AS group revealed no significant difference from the healthy controls (4.49±1.3 % vs 4.51±1.0 %, $p = 0.996$), whereas there was significant reduction from the HCM group (3.61±1.2 % vs 4.51±1.0%, $p < 0.001$). This transmural gradient difference still remained significant after being adjusted for global longitudinal strain, age, gender, LV mass index, and average early mitral filling velocity to early annular velocity ratio (E/E') ($p<0.001$) in multivariate analysis. There were no valvular severity differences in the two AS subgroups, but the subgroup with lower transmural longitudinal gradient had significant lower LV ejection fraction (62.8 ± 12.2% vs. 70.4 ± 7.5%, $p < 0.001$) and higher average E/E' (20.6 ± 10.7 vs. 15.9 ± 7, $p = 0.004$).

Conclusions: Hypertrophied myocardium in AS patients not only had better longitudinal strain at sub-epicardial and sub-endocardial myocardium, but also presented with more preserved transmural longitudinal strain gradient when compared to those of the HCM group. The loss of preserving adequate transmural longitudinal strain gradient might reflect intrinsic myocardial dysfunction in AS.

OPT5-002

U-Shaped Activation Propagation Patterns Identified from 2-Dimensional Longitudinal Strain Rate Imaging Predict Outcomes Following Cardiac Resynchronization Therapy

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Objectives: A U-shaped activation propagation pattern was mainly found in patients with left bundle-branch block. We investigated the use of a U-shaped activation propagation pattern identified from color M-mode longitudinal strain-rate imaging in the prediction of cardiac resynchronization therapy (CRT) outcomes.
Methods: Ninety-six CRT candidates were prospectively enrolled. Before CRT implantation, 2-dimensional speckle-tracking strain analyses were performed to determine whether a U-shaped activation propagation pattern was present. The U-shaped propagation pattern was characterized as activation propagation from the midseptum to the lateral or posterior wall through the apex identified from the color M-mode longitudinal strain rate imaging. The study endpoints were: reverse remodeling (>15% reduction of LV end-systolic volume) at 6 months, and adverse outcomes including death or heart failure hospitalization.
Results: At 6 months, 59 (61%) patients had reverse remodeling. A U-shaped propagation pattern identified from the longitudinal strain rate in the apical 4-chamber or long-axis view provided excellent true-positive (89%) and false-negative (9%) rates for predicting reverse remodeling. During a median follow-up of 36 months, 33 patients (34%) had adverse outcomes. Absence of a U-shaped propagation pattern was significantly associated with an increased risk of adverse outcomes (hazard ratio, 5.72; 95% confidence interval 1.75–18.68). Adding the U-shaped propagation pattern to a risk model significantly improved the model (model $\chi 2$ from 9.7 to 15.1, $p = 0.024$), including QRS duration and ischemic etiology.
Conclusions: The U-shaped propagation pattern identified from color M-mode longitudinal strain rate imaging was significantly associated with a favorable CRT response.

OPT5-003

Preliminary Analysis of Normal Reference Values for Left Ventricular Peak Systolic Longitudinal Strain and Strain Rate in Healthy Children at Different Ages

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Objectives: To analyze normal reference values of left ventricular peak systolic longitudinal strain(SL) and strain rate(SrL) analyzed by two-dimensional speckle tracking imaging(2D-STI) in healthy children at different ages.
Methods: We retrospectively analyzed 330 cases of healthy children, which were divided into seven groups according to their ages: classing 0 to 28 days children together as group 1, 28 days to 1 year old as group 2, 1 to 3 years old as group 3, 3 to 6 years old as group 4, 6 to 9 years old as group 5, 9 to 13 years old as group 6, and 13 to 18 years old as group 7. 2D-STI was performed in the 3 apical projections of left ventricle(LV). The regional longitudinal peak systolic strain and strain rate of LV was measured in 18 segments and averaged to provide global longitudinal peak systolic strain(GLPS-avg).
Results: ①Significant differences were found in 3 segments of the same wall($P<0.05$), furthermore, SL and SrL gradually increased from basal segment to apical segment. ②There were no significant difference in SL and SrL of segments between sexes($P>0.05$).③Except basal segment of posterior, inferior wall and posterior septum, SL gradually increased with the raising of age(SL1<SL2<SL3、4、5<SL6、7),as well as GLPS-Avg. ④Regional SL had a positive correlation with age, among apical segment of lateral wall was the most remarkable ($r=0.551$, $P<0.01$); Regional SL had a negative correlation with heart rate, in which middle segment of lateral wall was the most apparent($r=-0.625$, $P<0.01$); GLPS-avg was positive influenced by age($r=0.665$, $P<0.01$) and negative influenced by heart rate($r=-0.625$, $P <0.01$).⑤The heterogeneity was found in regional SrL correlated with age and heart rate in segments.
Conclusions: Normal reference values were preliminarily analyzed on LV peak systolic longitudinal strain and strain rate in healthy children at different ages, and it laid a foundation for early clinical evaluation of LV regional myocardial systolic dysfunction.

OPT5-004

Diabetes Mellitus is the Major Independent Limitation for Assessment of Ischemic Cardiomyopathy by Ergometer Stress Echocardiography

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Objectives: Stress echocardiography(SE) has developed to be one of the leading diagnostic modalities for evaluation of coronary artery disease(-CAD). Exercise or pharmacological SE was applied according to patient characteristics and feasibilities among institutions.We used semisupine bicycle ergometer SE in stable symptomatic patients who had non-diagnostic treadmill exercise electrocardiography. The purpose of this study was to identify the independent clinical factors of indeterminate ergometer SE.
Methods: We conducted a retrospective chart review of semisupine ergometer SE studies for evaluation of de novo CAD.
Results: A total of 257 ergometer SE studies for de novo CAD were included from 400 consecutive SE performed between May 2013 and September 2015. Indeterminate SE was defined by no inducible wall motion abnormality at peak stress imaging with a peak heart rate(HR) below 85% of the maximal predicted HR for age. There were 21 positive, 161 negative, and 75 indeterminate studies. A total of 14 patients were later documented CAD by coronary angiography from 8 positive ergometer SE and 6 indeterminate ones. The sensitivity and specificity of ergometer SE was 100% and 92.5%, respectively. The significant independent factors for indeterminate ergometer SE included diabetes mellitus(DM) (OR 3.133; 95% CI 1.501-6.538; $P= 0.002$), beta-blocker regimen (OR 2.324; 95% CI 1.225-4.411; $P= 0.010$), and baseline HR (OR 0.956; 95% CI 0.929-0.983; $P=0.002$). Preexisting chronic lung disease and joint disease of lower extremities were the major negative findings which do not contribute to indeterminate ergometer SE.
Conclusions: In conclusion, DM is the most important factor of indeterminate ergometer SE for evaluation of de novo CAD. We recommend stressor modalities other than bicycle ergometer for better informative CAD diagnostic value in diabetic patients.

OPT5-005

Using of Two Dimensional Speckle Tracking Echocardiography to Predict Major Adverse Events and Segmental Function Recovery in Patients with Acute Myocardial Infarction and Preserved Ejection Fraction

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Objectives: The aim is to investigate whether strain by 2D speckle tracking echocardiography in patients with acute myocardial infarction (AMI) and preserved ejection fraction (EF≧40%) would predict prognosis and segmental function recovery or not.
Methods: Ninety patients (average age 60.7±12.3 y/o) with new-onset AMI and EF≧40% were enrolled. Echocardiographies were performed after admission (average 3.3 days) and 12 months after percutaneous

coronary intervention. Segmental function recovery was defined as a decrease of ≧1 grade in segmental wall motion score. The global peak longitudinal strain (GLS), circumferential strain (CS), and radial strain (RS) were calculated via EchoPAC, version 11.0 (GE Vingmed).

Results: During follow-up (mean 23.4±12.1months), 20 patients had adverse events including 6 deaths, 3 strokes, 15 revascularizations for culprit vessels. In the multivariate Cox proportional hazard regression model for adverse events, using the forward stepwise method, only female (hazard ratio 4.65 [95% CI =1.49-14.52]) and GLS (hazard ratio 1.16 [95% CI =1.03-1.3]) were independent predictors ($p < 0.05$). Receiver operating characteristic curve analyses for segmental function recovery showed the area under the curves was 0.75 and optimal cut-off value of –12.5% had 67% sensitivity and 76% specificity.

Conclusions: Global longitudinal strain by 2D speckle tracking echocardiography provided important prognostic information and could predict segmental function recovery in patients with AMI and preserved EF.

OPT5-006

The Role of Carotid Intima-Media Thickness Ultrasound Testing and Risk Prediction for the Development of Atherosclerosis in the Young Population Exposed to Bisphenol A

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Objectives: Exposure to Bisphenol A (BPA) is frequently seen in obesity, diabetes, metabolic syndrome, and atherosclerotic cardiovascular diseases. The relationship between BPA, microparticles, and oxidative stress contributing to effect atherosclerosis remains unknown. Objective: We investigate BPA independently correlated with vascular endothelial dysfunction including biomarkers of microparticles, oxidative stress, and carotid intima-media thickness (CIMT).

Methods: A total of 130,756 students who participated mass urine-screening program were recorded in Taiwan between 1992 and 2000. After selection, an observational study involving 886 patients with BPA concentrations. CIMT was defined as the distance from the front edge of the first echogenic line to the front edge of the second echogenic line in the far wall of the vessel. Biomarkers of EMPs and PMPs and oxidative stress were also applied in the study.

Results: Data provided for thicker CIMT of total participants were assessed by different serum markers concentrations (OR 1.73 [95% CI 1.28–2.36], P<0.001). Compared with CD31 in combination with CD42a, CD31 alone was valuably more than 50% of thicker CIMT (OR 1.78 [95% CI 1.19–2.67], P=0.005). CD31 associated with CD42a was documented significantly either more than (OR 1.56 [95% CI 1.04–2.34], P=0.034) or less than (OR 2.02 [95% CI 1.23–3.32], P=0.005).

Conclusions: Our findings support that BPA exposure may foster atherosclerosis via inducing different levels of EMPs and PMPs markers.

OPT5-007

Four-Tiered Echocardiographic Analysis Approach for Congenital Mitral Valve Malformations

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Objectives: Traditional methods of describing and classifying congenital mitral valve malformations (CMVMs) often lack specificity and scientificity. Thus, documentation is incomplete, especially in terms of ultrasound findings. This study is to investigate and systematically analyze ultrasound characteristics of CMVMs via four-tiered echocardiographic analysis (FTEA) method.

Methods: (1) Between January, 2012 and February, 2016, a total of 436 patients diagnosed with CMVMs underwent echocardiographic evaluation at the affiliated hospitals of China Medical University. All defects in this study were evaluated and analyzed via FTEA, using a four-tiered approach: 1. supravalvular region and annulus, 2. valvar leaflets and commissures, 3. chordae tendineae, and 4. papillary muscles. Both anatomic and functional abnormalities of the MV apparatus were investigated at each level of involvement. Written informed consent was obtained from all patients. (2) In a 4-year period, each study subject underwent transthoracic (TTE) and/or transesophageal echocardiography (TEE), including 2D and RT3D, M-mode, or Doppler studies.

Results: From a total of 246,507 echocardiograms, CMVMs were methodically investigated in 436 (0.18%) patients. Using a FTEA approach, involvement was distributed as follows: (1) supravalvular region and annulus (n = 7 [1.6%]; excessive supravalvular tissue, 3; abnormal annulus, 4 [overriding, 1; shifted, 2; bridging/cord-like accessory tissue, 1]); (2) valvar leaflets and commissures (n = 421 [96.3%]; lengthy or excessive, 210; underdeveloped, 35; contracture,12; atretic, 3; anomalously connected, 1; loose or billowy, 63; clefts, 57; dual orifice, 5; localized bulging, 6; accessory tissue element, 4; fibrotic, 18; fused leaflet cusps, 3; abnormal commissures, 4 [fused, 1; clefts, 3]); (3) chordae tendineae (n = 14 [3.2%]; confined to single papillary muscle, 4; excessive, 2; thickened and fused, 2; shortened, 2; fibrotic, 2; accessory tissue element, 1; straddling, 1); and (4) papillary muscles (n = 13 [3.0%]; absent, 2; single, 5; asymmetric, 2; abnormally located, 3; fibrotic, 1).

Conclusions: Detailed incremental FTEA method in a systematic manner clearly defines malformations of the MV apparatus, ensuring more accurate diagnostic imaging. The results of clinical randomized controlled trials confirm that FTEA diagnostic accuracy was higher than conventional methods in CMVMs.

OPT5-008

Comparison of Aortic Annulus Dimensions by Multimodal Measurement before Transcatheter Aortic Valve Replacement

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Objectives: To compare aortic annular diameter measured by transthoracic echocardiography (TTE), transesophageal echocardiography (TEE), and multi-slice spiral computed tomography (MSCT) in patients with severe aortic stenosis, and to evaluate the impact on selection of prosthetic valve size in transcatheter aortic valve replacement (TAVR).

Methods: Clinical data of 138 patients with severe aortic stenosis referred for TAVR between January 2014 and June 2016 in our hospital were retrospectively analyzed. The difference of aortic annular diameter measured by TTE, TEE, and MSCT were compared. TTE was performed after TAVI to evaluate the accuracy of measurement before TAVI.

Results: (1) Mean aortic annulus diameter was 23.37±2.22 mm using TTE and 23.52±1.70 mm using TEE ($p = 0.12$) and correlation between TTE and TEE was excellent ($r = 0.87$, $p < 0.05$). (2) The long-axis diameter (27.86±2.87 mm) and the short diameter (21.91±2.53 mm) measured according to MSCT multiplanar reconstruction were significantly different ($p < 0.05$). There was no significant difference between the mean of the long- and short-axis diameters (24.92±2.38 mm) and the diameter derived from

cross-sectional area (24.84±2.25 mm) by MSCT ($p = 0.08$). However, the diameter derived from the circumference (25.35±2.34 mm) was significantly larger than the mean of the long- and short-axis diameters and the diameter derived from cross-sectional area by MSCT, and the difference were 0.43±0.62 mm and 0.51±0.62 mm respectively (both $p < 0.05$) .(3) Measurements of the aortic annulus diameter by MSCT including the mean of the long- and short-axis diameters, diameter derived from cross-sectional area, and diameter derived from the circumference were larger than the measurement by TTE and TTE significantly (all $p < 0.05$).(4) TAVR postoperative follow-up: Implantation was successful in all patients. Moderate to severe paravalvular leakage was detected in 3 patients at 7 days post TAVR, and 1 patient developed severe prosthetic valve restenosis at 6 months post TAVR and received valve-in-valve implantation.

Conclusions: In severe aortic patients referred for TAVR, measurements of the aortic annulus diameter using TTE and TEE are smaller than the measurements by MSCT. In the absence of a gold standard, selection of prosthetic valve type in TAVI procedure should rely on comprehensive considerations, which is of importance to get good clinical results for severe aortic stenosis patients underwent TAVI.

OPT5-009

A Novel Methodology for Coronary Arteritis Evaluation in Acute Kawasaki Disease

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Objectives: Acute Kawasaki disease (KD) is a systemic vasculitis in infants or children that develops predominantly in the coronary arteries. Current diagnostic criteria of acute KD with coronary artery abnormalities (CAA) only requires diameter Z score>2.5. Plenty of document has revealed that coronary artery diameter alone could be misclassified as normal in acute KD. Instead, we hypothesis that using group of index to establish the diagnosis of KD coronary arteritis. We aim to develop a thorough scoring system useful in systematic evaluation of coronary arteritis lesion.

Methods: 32 children with acute KD plus 100 age-match normal children were assigned to 2 experienced cardiologists who wasn't informed the diagnosis for echocardiography (echo) performed by obtaining dynamic cine-loop recording for frame-by-frame analysis and using quality-optimal highest transducer frequency. CAA are scored as following: 1) Prominence 2) Brightness of arterial wall 3) Irregularity arterial lumen or Lack of tapering 4) Thickness of the arterial wall. Weighted kappa statistics were used to analyze inter-observer and intra-observer agreement, and the agreement percentages were calculated.

Results: Various CAA were present in acute KD, include various degree of luminal prominence in 24 (75%) patients, aneurysm formation in 3(0.9%) patients, lack of tapering in 22(68%) patients, irregularity in 11(34%), and intimal thickening brightness in 24 (75%) patients. Overall, coronary artery anomalies were present in 30 (93%) of our patients in acute phase of KD. FOCUS score >10 in 90.6% (29/32) of patients while only 0.6% (2/32) FOCUS score<5 and 0.3% (1/32) between 5 and 10. The average score is 42.5 ± 17.8. All normal-control patients had FOCUS score < 10.

Conclusions: The incidence of coronary artery abnormalities in acute KD is higher than previously reported. With our novel FOCUS scoring method, more detailed, comprehensive and multi-faced features of CAA other than conventional Z score can be provided. We thus propose a FOCUS score >10 is indicative for acute KD,<5 is indicative for normal coronary, 5∼10 deserves further check-up.

OPT5-010

Echocardiographic Evaluation of Patients with Anomalous Origin of the Left Coronary Artery from the Pulmonary Artery (ALCAPA): A Single Medical Center Experience

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Objectives: Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a very rare congenital cardiovascular anomaly, which may induce a higher mortality rate of infants whom did not receive an early surgical correction. The clinical presentations of ALCAPA are different between pediatric and adult patients. Echocardiography is a useful and non-invasive tool for diagnosis and long-term follow-up study of congenital cardiovascular anomalies even in a small infant. Echocardiographic studies on 6 patients with ALCAPA were reported.

Methods: The medical records of 6 patients with ALCAPA during the last 16 years in our hospital were reviewed retrospectively. The age, sex, clinical presentations, findings of non-invasive and invasive studies, methods of surgical correction, post-operative outcomes and results of follow-up were evaluated.

Results: The age of 6 patients (M/F=2/4) with age ranged from 3 months to 34.7 years. There was 1 patient who were correctly diagnosed after 18 years old. The commonest presentation of pediatric patients was congestive heart failure and the initial presentations of adult patients were non-specific. The echocardiographic findings were absence of orifice of left coronary artery from the ascending aorta (Figure 1), impairment of the left ventricular function with dilatation of the left ventricle (Figure 2), significant mitral regurgitation (100%), dilatation of right coronary artery (Figure 1) (80%), and presence of hyper-echogenic endomyocardium of the left ventricle (Figure 2) (60%). All the 6 patients survived after the surgical confirmation & treatment. Accurate diagnosis was made only by echocardiography on 2 cases and associated with diagnostic catheterization & coronary angiography on the other 4 cases. Post-operative follow-up with echocardiographic studies showed improvement in the severity of mitral regurgitation and left ventricular function in most pediatric patients.

Conclusions: Although the ALCAPA is a very rare congenital cardiovascular anomaly, early and accurate diagnosis and surgical correction is needed. With or without the aid of chest CT imaging study, the ALCAPA can be definitively diagnosis by the careful & advancing echocardiographic studies to avoid the risks of conventional cardiac catheterization and angiography. The post-operative outcomes and long-term follow up of cardiac function can also be easily identified by echocardiography.

OPT5-011

Value of Three-Dimensional Transthoracic Echocardiography in Differentiating between Subpulmonary Ventricular Septal Defect and Rupture of Sinus of Valsalva for a Patient with Infective Endocarditis

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Objectives: Patients with grown-up congenital heart disease are susceptible to infective endocarditis. Their clinical presentation is highly variable. We present a patient with infected subpulmonary ventricular septal defect, complicated with rupture of sinus of Valsalva and multi-organ failure. Three-dimensional echocardiography has an essential role in establishing the diagnosis.
Methods: Case report and literature review.
Results: A 23-year-old man was admitted to our ordinary cardiovascular ward because of prolonged fever and heart murmur. Infected subpulmonary ventricular defect was diagnosed initially by conventional echocardiography, and surgery was scheduled to be performed several weeks later. However, Jaundice and anuric renal failure developed soon. Three-dimensional echocardiography revealed a large defect on right coronary cuspid, with both systolic and diastolic shunting from the aortic root to the right ventricular outflow tract. There were multiple oscillating vegetations on the right side of the ventricular septum and pulmonary cuspids. We performed urgent surgery. The defects of Valsalva and ventricular septum were repaired. After this operation, his vital signs, renal, and hepatic function recovered soon.
Conclusions: Three-dimensional echocardiography helps us to make effective and accurate diagnosis for complex structure heart disease. It has great value in directing therapeutic assessment, and may improve outcomes.

Poster Session

PPT5-001

A Comparison of Different Time Windows Using Contrast-Enhanced Transcranial Doppler Ultrasonography for Detecting Cardiac Right-to-Left Shunt

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Objectives: Contrast-enhanced transcranial Doppler ultrasonography (c-TCD) is highly sensitive for detecting cardiac right-to-left shunt (RLS). The aim of the present study was to determine an optimal time window for cardiac shunt detection.
Methods: We evaluate its optimal time window in 239 consecutive patients with suspected cardiac RLS who underwent simultaneous c-TCD and contrast-enhanced transthoracic echocardiography (c-TTE). Cardiac RLS was considered when at least three MBs appeared in the left atrium, within three cardiac cycles after complete opacification of the right atrium in c-TTE.We evaluated 15-, 20-, 25-, 30-, 35-, and 40-s windows for c-TCD. Receiver operating characteristic (ROC) curve analyses and Spearman's rho rank correlations were conducted for different time windows, with areas under the curve (AUCs) and 95% confidence intervals (95% CIs).
Results: The AUC and thus diagnostic accuracy was highest for the 25-s window (AUC, 0.746; 95%CI, 0.684–0.809).The AUC for the 15-s window (0.667; 95% CI, 0.598–0.737; $p<0.05$) was smallest Spearman's rho rank correlation showed the strongest correlation between c-TCD and c-TTE for the 25-s window (rho, 0.627; 95%CI, 0.534–0.708).
Conclusions: Thus, the 25-s window is recommended for cardiac RLS detection.

PPT5-002

A Pulmonary Artery Aneurysm with Patent Arterial Duct and Secondary to Infection

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Objectives: A twenty-year-old woman was admitted for patent arterial duct (PDA) ligation surgery in Oct 2014. She was hospitalized 8 months earlier due to high fever, cough, exertional dyspnea, staphylococcal aureus endocarditis, and received antibiotic treatment. In the recent admission, a grade 3/6 continuous murmur was heard at the left sternal border, and the other physical examination was normal.
Methods: An echocardiography showed a PDA in Feb 2014 (Fig.1). In Oct 2014, an echo showed a 0.44cm width left-to-right PDA shunt, with peak velocity of 5.6m/s. A saccular main pulmonary artery aneurysm (PAA) was detected, with 3.8cm in width and 2.6cm in depth. It originated from the left side of the pulmonary trunk and 1.5cm above the pulmonary valve annulus. We identified the PDA jet flow unrestrictedly flowing into the aneurysm and swirling within it (Fig.2). The pulmonary artery computed tomographic angiography also revealed the aneurysm and drawn a similar conclusion as echo did.
Results: The echocardiography played a vital role in evaluating the underlying pathology of PDA, invasive follow up, and making the diagnosis of PAA. The patient received a ligation of PDA, aneurysmectomy and the pulmonary artery wall repair surgery to avoid fatal rupture and hemorrhage.
Conclusions: Pulmonary artery aneurysm (PAA) is a rare lesion, which might be idiopathic or has several underlying pathologies. Our case was an extremely rare PAA with PDA and secondary to infection. The high speed PDA shunt flow brought about weakness and injury of the arterial wall. The staphylococcal aureus infective process involving the arterial wall triggered ultimate formation of an aneurysm in the pulmonary artery trunk. Echocardiography accurately determined the morphology, location of the proximal saccular PAA, and revealed the underlying pathology. It provided important information for a well-played surgical intervention to avoid fatal complications of PAA.

PPT5-003

Anomalous Left Coronary Artery from the Pulmonary Artery: Images Studies of Echocardiographic, Heart CT and Angiography

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Objectives: Anomalous origin of the left coronary artery from the pulmonary artery (ALCAPA) is a very rare but serious congenital coronary arterial anomaly. Congestive heart failure, myocardial ischemia &even sudden cardiac death may occur in early infancy. Early diagnosis is usually difficulty before the occurrence of clinical symptoms. Surgical correction is usually necessary as soon as possible to avoid the long-term sequel of myocardial ischemia & significant mitral regurgitation.
Methods: A 3 months old female infant was sent to pediatric clinic due to shortness of breath for two days . Physical examination revealed mild subcostal retraction, a grade II/VI systolic murmur over left lower sternal boarder, hepatomegaly with 3 cm below right costal margin. The peripheral arterial pulsations were normal and without no cyanosis, Chest X-ray film showed moderate cardiomegaly (Figure 1) with normal pulmonary vascularity. She was referred to pediatric cardiologic clinic and echocardiography revealed a single right main coronary artery with diameter of 2.2mm (Figure 2) and moderate to severe mitral valve regurgitation (Figure 3) . The ejection fraction of left ventricle was 12.5%. Emergency heart CT showed only the single right coronary artery (Figure 4). Cardiac catheterization and angiography (Figure 5) confirmed the diagnosis of anomalous origin of left coronary artery from the main pulmonary artery (ALCAPA).
Results: Then she received the surgical total correction with re-implantation of the left coronary artery from main pulmonary artery to ascending aorta. Post-operative recovery was not unevenly. She was under anti-congestive therapy and follow up at pediatric cardiologic clinic regularly. The follow-up echocardiography revealed good anastomosis of left coronary artery with aorta, moderate mitral regurgitation and nearly normal left ventricular function with ejection fraction of 58.97 %.

Conclusions: Although ALCAPA is a very rare congenital coronary artery anomaly, but it is usually presented with sudden onset of congestive heart failure, myocardial ischemia, even cardiac death in infancy when the high pulmonary arterial pressure dropped down as normal sequence. Echocardiography can usually identify only the right coronary artery from aorta, mitral regurgitation and dilatation of left ventricle and atrium. Other images studies such as heart CT and angiography are the accurate diagnostic tool. Post-operative follow up with echocardiography is necessary to assess the anastomosis of re-implanted left coronary artery, the severity of mitral regurgitation and ventricular function.

PPT5-004

Aorto-Atrial Fistula: An Echocardiographic Report

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Objectives: The aorta to atria maybe communicated via a ruptured sinus of valsava aneurysm (RSVA) or an aortic-atria fistula(AAF). In RSVA the echocardiographic findings are diagnostic. In AAF with variable etiology the echocardiographic findings of AAF depend on the nature of the associated disease. We present a case of isolated AAF. The echocardiographic manifestations are described.
Methods: Case report and literature review.
Results: The 75 y/o male p't has had long History of bronchial asthma, chronic lung disease, diabetes and hypertension. He presented with aggravated dyspnea and leg edema. There was no history of trauma or prolonged fever. A grade 3/6 systolic murmur was noted over apex, aortic area radiated to left axilla and back. The CXR showed marked cardiomegaly. EKG showed multiple atrial tachycardia and CRBBB. Echocardiography showed dilated RV,RA, moderate MR, severe TR, and a fistula like tract arising from right coronary sinus draining into RA with a inner diameter 2.2 mm. The color Doppler showed a communication between aorta and RA with color shunting from AO to RA in systole and diastole.
Conclusions: Aorta to atrium fistula may occur in pts without obvious etiology. Congenital anomaly may be a cause of AAF but is rare. Echocardiography is helpful for the diagnosis of AAF. TTE can detect AAF fistula in half of cases. The Doppler flow in AAF shunting was systolic only or with less obvious diastolic flow.The absence of obvious diastolic murmur in AAF may be the result of low diastolic shunting flow.

PPT5-005

Application of Echocardiographic Three-Dimensional Printed Left Atrial Appendage Model to Guide Transcatheter Left Atrial Appendage Occlusion

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Objectives: This study aimed to determine the feasibility of three dimensional (3D) printed left atrial appendage (LAA) models based on 3D transesophageal echocardiography (3D TEE) data and its application value in the interventional LAA closure.
Methods: Eighteen patients who had interventional LAA occlusion underwent pre-procedure TEE and cardiac CT. TEE 3D full volume raw data of the LAA were acquired and post-processed to create a 3D model file. Two modes of the LAA model (cardiac chamber model, cardiac wall model) were printed out by 3D printer. The LAA morphologic classification was assessed by 3D printed chamber model and the LAA dimension measurement was performed on 3D printed wall model. Additionally, preoperative rehearsal was performed on the 3D printed cardiac wall models in the cases with complex LAA structure.
Results: In all the patients, 3D TEE full volume data of the LAA were successfully reprocessed and printed out as 3D LAA chamber models and 3D LAA wall models. The consistency of LAA morphologic classification judgment based on 3D printed models and cardiac CT was 0.918 ($P<0.01$).The LAA ostium dimension measured on 3D printed model was greater than 2D TEE ($P<0.01$) and smaller than X-ray ($P=0.02$), and the LAA depth was greater than 2D TEE ($P<0.01$) whereas was not significantly different with X-ray ($P=0.54$).Based on 3D model morphology, there were 3 complex LAA which were recommended a particular occlusion plan after pre-procedure rehearsal on 3D model. The occlusion success rate was 100%.
Conclusions: Echocardiographic 3D printing technique is feasible and have promising value in supporting planning the transcatheter LAA occlusion.

PPT5-006

Assessment 2D and 3D Global Longitudinal Strain of Abnormal LV Myocardial Deformation Properties Using 3D Speckle-Tracking Echocardiography in Young HCM

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Objectives: Hypertrophic cardiomyopathy (HCM) is a disease predisposes to unexplained left ventricular (LV) hypertrophy and dysfunction and non-dilated ventricular chambers associated unusual myocardial mechanics. The most serious complications of HCM is sudden death for young subclinical patients, thus, observing and analyzing LV strain has particular values of diagnostic and prognostic for young HCM patients.The objective of this study was to determine which strain component assessed by 2-dimensional speckle-tracking echocardiography (2DSTE) and 3-dimensional speckle-tracking echocardiography (3DSTE) was the most powerful predictor for young HCM.
Methods: We enrolled 96 young subjects (45 HCM (32 males; 25 ± 6 yrs) and 41 controls (27 males; 26 ± 4 yrs)) underwent TTE performed strain analysis using both 2DSTE and 3DSTE. Two-dimensional and 3-dimensional global longitudinal, circumferential, and radial strain and global 3-dimensional strain of the LV were measured in each patient using QLab and TOMTEC software by two-independent-specialists.
Results: Data analysis for the new 3D-STE methodology: (-21.94 ± 3.4% vs 27.8 ± 5.1%, $P > 0.001$ (2D GLS), -19.3 ± 3.4% vs 26.3 ± 4.2%, $P < 0.001$ (3D GLS), -85.2±43.7% vs 106.3 ± 26.82%, $P < 0.001$ (3D GRS), -30.7 ±5.7% vs 34.3 ± 6.4%, $P > 0.001$, (3D GCS), respectively. 3D GLS but not GRS, GCS significantly correlated with LVMI, E/Ea and LVOT-PG ($P<0.05$) in young HCM subjects.
Conclusions: LV global 3D systolic strain analysis using the new 3D-STE methodology is feasible and reproducible. 3D GLS is more sensitive index than 2DGLS for young HCM.

PPT5-007

Clinical Study of Left Ventricle Energy Loss in Patients with Heart Failure with Mid-Range Ejection Fraction by Vector Flow Mapping Technique

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Objectives: 1.To evaluate the characteristics of energy loss(EL) in left ventricule by VFM in patients with HFmrEF. 2.Explore the

relationship between EL and cardiac structure and function in patients with HFmrEF.

Methods: The study includes 28 patients with HFmrEF, compared with 23 normals. HFmrEF patients are divided into 2 groups:group I with diastolic dysfunction, group II without diastolic dysfunction. VFM is used to calculate EL in left ventricle in IVR, RFP, ACP, IVC, REP.

Results: The EL at RFP, IVC, REP in left ventricle at every phase decrease in the HFmrEF group. Compared with group II,the EL of group I at IVR and RFP increase ($P<0.05$).The EL at RFP, IVC, REP in left ventricle decrease in the HFmrEF group ($P<0.05$). Compared with group II,the EL of group I at IVR and RFP increase ($P<0.05$). Total EL in LV during RFP is independently associated with E/e' ($\beta= 0.423$, $P= 0.019$).Total EL in LV during ACP is associated with GLS($\beta= 0.392$, $P= 0.039$).Total EL in LV during IVC is independently associated with GLS ($\beta= 0.546$, $P= 0.001$).

Conclusions: In HEmrEF, EL in the left ventricle decreases in RFP, IVC, REP. However, the EL in RFP will increase if accompanied with diastolic dysfunction. The EL in the left ventricle in RFP is related to the diastolic function of the heart, and the EL in ACP and IVC is related to the systolic function of the heart.

PPT5-008

Clinical Value of 5 Necessary Echocardiographic Views in the Screening of Critical Congenital Heart Disease

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Objectives: Analyze the necessary echocardiographic views in the screening of critical congenital heart disease(CCHD) and its value of application.

Methods: We had transcutaneous oxygen saturation screening for 4444 cases among a total of 4510 cases of newborn and had echocardiographic screening for 11 cases who were failed in the transcutaneous oxygen saturation screening. Analyze the different echocardiographic views, especially for the 5 echocardiographic views on parasternal long axis view of left ventricle, parasternal short axis view of aorta, apical four chamber view, apical five chamber view and suprasternal long axis of aortic arch.

Results: According to application of echocardiographic screening for 11 cases, there were 6 cases of CCHD and 5 cases of Non-CCHD. The follow-up result shows that the 11 cases were all with correct diagnosis. So we think that the necessary 5 echocardiographic views could be as basis of CCHD diagnosis.

Conclusions: The application and use of the 5 necessary echocardiographic views could streamline the process of screening CCHD and make it more efficient. In view of its easy to learn and master, it can be recommended as a method for screening CCHD in primary hospitals in china.

PPT5-009

Congenital Left Atrial Appendage Aneurysm: Diagnosis and Management

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Objectives: Aneurysm of the left atrial appendage is rare. We sought to review the published literature on left atrial appendage aneurysm (LAAA) to address its epidemiology, pathology, clinical symptoms, diagnosis and management.

Methods: We reviewed PubMed from 1962 to 2016 to find relevant LAAA cases using medical subject heading (MESH) terms "atrial appendage" and "aneurysm" as search terms. Statistical analysis was done using Minitab 17.0.

Results: One hundred and one cases of LAAA were identified. The symptoms do not arise until the second to the fourth decades of life. Palpitation, dyspnea and chest pain were common clinical symptoms. Echocardiography is considered to be the primary method of diagnosis. Other imaging modalities such as cardiac computed tomography (CT) and magnetic resonance imaging (MRI) are useful for ruling out the differential diagnoses. Surgical treatment is often recommended even in asymptomatic patients for prevention the thromboembolic complications. Seventy-four patients (73.2%) reported in the literatures were treated by surgical treatment. The prognosis is favorable, for freedom from recurrent symptoms and arrhythmia has been reported from 10 days to 8 years follow-up.

Conclusions: Echocardiography is considered the initial diagnostic tool for LAAA. The associated high risk of life-threatening complications and the relative ease of surgical removal suggest that prompt evaluation should be considered in patients with lesions adjacent to the left heart border.

PPT5-010

Coronary Fistulas and Shunts in Terms of Local Hemodynamics and Anatomical Organization

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Objectives: Data on coronary fistulas (CF) available in the literature is non-systemic. No article is specified to explain an abnormal variance of speed (Vmax) and pressure gradient (Gmax) registerable in case of such pathology.

Methods: Transthoracic and transesophageal echocardiography, coronary catheterization.

Results: As follows from the analysis of literature and native data we made a conclusion that the imbalance between the registered Vmax and Gmax in the CF projection with the estimates expected taking into account the cardiac chambers and coronary arteries (CA) pressure indicators most commonly must be caused by embryogenesis disturbance. Against this background of abnormalities "sinusoids" are formed by CA extended terminals type proceeding to cardiac chambers, often in the midst of remaining myocardium cancellation due to dividing of CA to segments of 1-2-3 order, pressure in distal segments of coronary flow from 60-90 mm Hg to 18-28 mm Hg. Maximum reduction of speed and pressure in «sinusoids» leads to even higher pressure differential between CA and cardiac chamber, up to 4-6 mm Hg. Such CF, in terms of mechanism of its development and local hemodynamic characteristics of flows, is better to describe genuine CF.

Conclusions: Higher Vmax and Gmax (up to 44-51 mm Hg) more often may be classified as CF/shunts or to CF in proximal compartment of the coronary stream. Unlike genuine CF, the first ones should be classified as proximal/postsurgical CF/shunts. Reasonability of such division on «genuine» and «proximal/postsurgical» CF is determines by complication probability as well as patient surveillance, physical activity level prescriptions.

PPT5-011

Detection of Left Ventricular Diastolic Dysfunction Grade Ii-Iii by New Dopplerographic Ratio E/El

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Objectives: ASE/EACVI Guidelines (2016) recommend to use Tissue Doppler (TD) ratio E/e' for identifying diastolic dysfunction (DD) grade II-III. Earlier we have demonstrated that diastolic component el of Reflected High Intensity Motion Signals (RIMS) can be used for detection of DD when TD is not available. In this study we aimed to analyze if E/el ratio can be utilized for detection of DD II-III grade.
Methods: We analyzed Dopplerechocardiographic data of 49 subjects. According to ASE/ESCVI Guidelines in 27 subjects (1-st group, healthy persons, mean age 58.6 years) normal left ventricular filling was found; in 22 patients with coronary artery disease (2-d group, mean age 48.6 years) DD grade II-III (pseudonormal and restrictive filling) was detected. RIMS were registered by conventional pulsed wave Doppler from apical 4-chamber view when the sample volume was positioned 2 cm outward from the lateral border of mitral valve. Sensitivity and specificity of E/el ratio in detection of DD grade II-III was determined.
Results: In subjects of 1-st group mean value of E/el was 2.93 ± 0.57 and in 2-d group 4.90 ± 1.79 ($p = 0.000002$). The cutoff value of E/el > 3.5 can detect DD grade II-III with sensitivity 86.4% and specificity 92.6%.
Conclusions: New E/el ratio gives opportunity to discriminate normal left ventricular filling from pseudonormal and restrictive and to detect effectively patients with DD grade II-III in cases when TD is unavailable.

PPT5-012

Echocardiograms Estimated the Severity of Aorticstenosis (AS) Accompanied with Tachycardiac Arrhythmia (AATA)

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Objectives: patients accompanied with tachycardiac arrhythmia (Frequent premature ventricular arrhythmia, supraventricular tachycardia,atrial fibrillation, etc), estimated the severity of aorticstenosis under transthoracic echocardiography (TTE), using the methods as below: continuous-wave (CW) Doppler echocardiography estimated aortic jet speed (VAV) and across valve mean pressure difference ($\triangle P_{mean}$), Doppler echocardiography estimated the effective aortic valve area (AVAeffective) and velocity ratio (VR=VLVOT/VAV) by using the continuity equation, 2D echocardiography estimated aortic valve geometric area in anatomy (AVAanatomy). And compared the stability, accuracy and clinical value of these methods.
Methods: This was a review of 11 AATA cases that were diagnosed in our institution between November 2016 and January 2017. At the condition of tachycardiac arrhythmia, estimating VAV, $\triangle P_{mean}$, AVAeffective, VR and AVAanatomy under TTE. At the condition of normal arrhythmia under cardiopulmonary bypass during the surgery, estimating VAV, $\triangle P_{mean}$, AVAeffective, VR and AVAanatomy once more under transesophageal echocardiography (TEE). And also, estimating AVAanatomy intraoperative exploration. In order to decrease the measurement error, we measured every values at lest three times and choose the mean value.
Results: Compared with the values estimated under normal arrhythmia, at the condition of AATA (with the severity of AS at moderately to severely), the value of VAV and $\triangle P_{mean}$ have differences ($P < 0.05$), easy to underestimate the severity of AS; the value of AVAeffective and VR have differences ($P < 0.05$), easy to overestimate the severity of AS; the value of AVAanatomy, which often greater than the value of AVAeffective, has no obvious difference and has good consistency with the geometric area of aortic measured intraoperative exploration.
Conclusions: When estimating the severity of AS at the condition of AATA under TTE, the methods of assessment by Doppler echocardiography often instability, easy to underestimate or overestimate because of the affection of the ventricular rate. While the method of assessment by 2D echocardiography seemed to be less sensitive to the ventricular rate, so that could be a more reliable method in estimating the severity of AS at AATA and have clinical significance, although it has some differences with the value of AVAeffective.

PPT5-013

Echocardiographic Diagnosis of Pulmonary Artery Sling

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Objectives: The objective of this study was to analyze echocardiographic characteristics of Pulmonary Artery Sling (LPAS) and to explore the diagnostic value of transthoracic echocardiography.
Methods: The echocardiagraphic characteristics of 7 patients with LPAS from 2012 to 2016 were analyzed retrospectively, and compared with computed tomography angiography (CTA) and angiographic reconstructions.
Results: Seven cases included 2 fetuses and 5 children (aged 6 months to 13 months). The 5 children with LPAS were all associated with different types of congenital cardiac defects, such as atrial septal defect, ventricular septal defects, left superior vena cava, patent ductus arteriosus, and so on. And the two fetuses with LPAS didn't find any congenital cardiac defects temporarily. Seven cases included 1 partial left pulmonary artery sling and 6 whole left pulmonary artery sling. Echocardiography showed an anomalous origin of the whole left pulmonary artery from the right pulmonary artery in 6 cases, and an anomalous origin of the lower left pulmonary artery from the right pulmonary artery in 1 case. The morphological and hemodynamic changes were also evaluated. In the 7 patients, 1 case was misdiagnosed, and the others were correctly diagnosed. The diagnosis of LPAS was confirmed by CTA and intraoperative findings in the 5 children.
Conclusions: Echocardiography is effective in diagnosing LPAS, when the main pulmonary artery extends to the right pulmonary artery directly with the main pulmonary artery bifurcation disappeared and left pulmonary artery aroused from the right pulmonary artery.

PPT5-014

Echocardiographic Evaluation of Association Between Pulmonary Hypertension and Right Ventricle Dysfunction in Patients with Severe Rheumatic Mitral Stenosis

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Objectives: Mitral stenosis (MS) is the predominant form of valve involvement in rheumatic disease and still very commonin China. Severe MS often causes pulmonary hypertension (PAH) and consequently leads to right ventricle (RV) dysfunction. RV dysfunction significantly affects clinic outcome but less is known about the relation between pulmonary hypertension and RV dysfunction in case with rheumatic etiology.This study aims to assess RV function in patients with pure severe rheumatic MS stenosis with/without PAH using conventional and3D strain echocardiography to determine if RV strain as parameter of RV function is correlated with PAH.
Methods: Forty patients between 2014-2016 referred for management of pure severe rheumatic mitral valve stenosis (mitral valve area≤1.5 cm2,stage D) were included in the study. Two groups were formed based on pulmonary vascular resistance ,1.6W<PVR≤2.5W, (group II, n=18)and >2.5W(group III, n=21). Age-matched healthy subjects with normal standard

echocardiograms and good quality images were selectedas controls (group I, n=20). RV function were made according to the recommendations of the American Society of Echocardiography using commercially available hardware and software (Philip EPIQ 7). RV function indices include RV ejection fraction (EF), fractional area change(FAC),Tricuspid annular plane systolic excursion (TAPSE) and myocardial performance index (Tei index). 3D global longitudinal strain (GLS) of the RV free wall and interventricular septum were measured using 3D speckle-tracking echocardiography.

Results: Compared to healthy controls, RV EF were decreased in both group II and III, but failed to achieve statistic significant. Compared to group I and group II, RVFAC (43.18±3.10 vs 32.34±5.0, p=0.000) and TAPSE (41.35±4.60 vs 32.34±5.0, p=0.000)was significantly decreased in group III. No significant difference in TAPSE was found between group I and II(21.64±1.98 vs 20.39±2.66, p=0.068). However, Tei index were significantly higher in among three groups. GLS (freewall) and GLS(septum) were significant decreased in group II as compared to controls (p1<0.01, p2<0.01). Further comparision with both group I and II, group III patients had significant lower GLS (freewall) (-26.50±2.02 vs -14.18±2.64, p1=0.000, -22.86±2.50 vs-14.18±2.64, p2=0.000, respectively) and GLS (septum) (-15.43±2.92 vs -8.58±2.63, p1=0.000, -13.54±2.18 vs -8.58±2.63, p2=0.000, respectively). Regression analysis revealed a significantly correlation between GLS(freewall) systolic strain and PVR (r=0.825, p=0.000), as well as GLS(septum) systolic strain and PVR (r=0.804, p=0.000)

Conclusions: RV dysfunction by conventional RV function indices (FAC, Tei index, TAPSE) were observed in all severe rheumatic MS patients and irrespective of pulmonary hypertension. However, Decrease in global RV longitudinal systolic strain may serve as good index for pulmonary artery hypertension in patients with severe rheumatic mitral stenosis.

PPT5-015

Echocardiography in the Diagnosis of Direct Type Lv-Ra Shunt after Trauma: A Rare Case

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Objectives: Congenital LV-RA shunt (Gerbode defect) is a rare intracardiac shunt that accounts for less than 1% of all congenital cardiac defects. Other than congenital malformation, acquired Gerbode defect could be emerged with the etiology including iatrogenic, infective, traumatic, or ischemic event. Transthoracic echocardiography is widely applied in the diagnosis of this defect but with limited diagnostic accuracy. We reported a case in whom a LV-RA shunt was noted by echocardiography after multiple trauma concomitant with complete AV block, with dilated right heart and significant tricuspid insufficiency. The defect was closed by transcatheter intervention eventually.

Methods: Case report and literature review.

Results: A 14-year-old male with multiple trauma after falling from five floors. Chest auscultation revealed a grade II/VI systolic murmur, and ECG showed complete AV block. A LV-RA shunt was noted by echocardiography with dilated right heart. Transcatheter closure of the defect with 10/8 mm Amplatzer Duct Occluder was completed with good result. Permanent pacemaker (DDDR) was implanted for unimproved complete AV block after then.

Conclusions: Any factors leading to ischemia, necrosis, weakening or injury of the septum may predispose to the formation of an acquired LV-RA shunt. This defect could be diagnosed by transthoracic echocardiography, but should be validated by other technique if the quality of defect is uncertain. Surgical closure of LV-RA shunt is feasible, and transcatheter closure is valid in selective patients.

PPT5-016

Evaluation of Energy Loss in Left Ventricle Obtained by Vector Flow Mapping in Patients with Different Degrees of Heart Failure

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Objectives: This study was to quantitatively analyze the energy loss(EL) in left ventricle with vector flow mapping(VFM) in patients with different degrees of heart failure.

Methods: This was a study including 20 healthy volunteers and 56 patients with heart failure which were divided into three groups according to EF: 17 patients in A group(EF<0.30), 22 patients in B group (0.30≤EF<0.40), 17 patients in C group(0.40≤EF<0.5). We calculated global longitudinal strain(GLS) with 2DTT and the average EL in left ventricle in isovolumetric diastole phase(P1), rapid filling phase (P2), slow filling phase (P3), atrial systole phase (P4), isovolumetric contraction phase (P5), rapid ejection phase (P6), and slow ejection phase (P7).

Results: EL in P1, P2, P4 and P6 decreased in heart failure group compared with control group. EL in P4 and P6 decreased in A and B compared with control group; EL in P4 decreased in A compared with C group. EL in P5 increased in C and D compared with A group. GLS in the heart failure group decreased compared with control group with statistical significance (P<0.05).

Conclusions: EL in P1, P2, P4 and P6 decreases in heart failure group compared with control group. There is a tendency that EL in P4, P5 and P6 decreases with the LVEF decreases. Combination of 2DTT and VFM can comprehensive assess the cardiac changes in patients with heart failure.

PPT5-017

Evaluation of The Short Time Prognosis of the Right Ventricular Systolic Function after Percutaneous Coronary Intervention in Patients with Inferior Wall Myocardial Infarction

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Objectives: The aim of the study is to assess the short time recovery of the right ventricular systolic function in inferior wall infarction patients with or without right ventricular (RV) myocardial infarction after percutaneous coronary intervention (PCI) by using 2-dimensional (2D) speckle tracking imaging (STI) longitudinal strain (LS) parameters.

Methods: 38 consecutive patients diagnosed with inferior wall myocardial infarction (IWMI) and treated with percutaneous coronary intervention were included in our study. 17 of them were combined with right ventricular myocardial infarction (RVMI). 24 chest pain patients admitted at the same time but with negative results in the selective coronary angiography were served as blank control. Echocardiography were performed at baseline and for 15 patients before discharged from the hospital (5.2± 2.3 days). Right ventricular 2D strain parameters were then analyzed off line.

Results: The RV global LS (RVGLS), the LS of the basal and mid segments of the free wall and septum were lower than control group in the patient group (P<0.05). Compared with INFMI group, the RVGLS, the LS of the mid and apical segments of the free wall were lower in the RVMI group (P<0.05). Few days after PCI,

basement and middle segments of the free wall (P<0.01) were higher with smaller right ventricular end diastolic (P<0.01) and systolic (P<0.05) area. Tricuspid annular plane systolic excursion were also higher than before (P<0.05).

Conclusions: The 2D-STI RVLS parameters precisely reflected the impaired RV systolic function in the INFMI and RVMI patients, the RV global systolic function were even worse when RVMI involved , mainly for the RV free wall. However, few days after PCI, the RVLS parameters improved quickly and remarkably in both of the INFMI and RVMI patients. The study demonstrates that RVLS parameters could provide more early diagnostic and prognostic information of RV dysfunction in acute INFMI patients with and without RVMI and after successful PCI, right ventricular systolic function could recover rapidly in only few days.

PPT5-018

Histological and Hemodynamic Correlates of Right Ventricular Function in A Pressure Overload Model: A Study Using Three-Dimensional Speckle Tracking Echocardiography

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Objectives: The aims of our study were to assess the characterization of right ventricular (RV) deformation using three-dimensional speckle tracking echocardiography (3D-STE) and association of 3D-STE indices with hemodynamic and histologic parameters in a chronic RV pressure overload animal model.

Methods: Pulmonary artery banding (PAB) was used to induce RV pressure overload in 7 beagles. 3D-STE and hemodynamic measurements were performed in PAB and sham-operated beagles three months after PAB. RV longitudinal, radial and circumferential strain was measured from 3D-STE. RV dp/dtmax was determined from right heart catheterization. Right ventricle was investigated by histology.

Results: Three months after PAB, RV longitudinal strain was decreased, whereas radial and circumferential strain remained unchanged in PAB group when compared with sham-operated group. PAB-induced pressure overload resulted in RV hypertrophy, increased interstitial fibrosis and reduced capillary density. RV circumferential strain was significantly related to dp/dtmax (r=0.718, P=0.013). RV longitudinal strain was significantly associated with interstitial fibrosis(r=—0.733, P=0.010).

Conclusions: Our study reveals the different responses to chronic pressure overload among longitudinal, circumferential and radial strain using 3D-STE. The significant correlations of RV 3D-STE indices with hemodynamic and histologic parameters indicate that 3D-STE may be a valuable tool for assessment of ventricular function in RV pressure overload.

PPT5-019

Impaired Right Ventricular Systolic Deformation in Pulmonary Hypertension Associated with Outcomes: A Three-Dimensional Speckle Tracking Imaging Study

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Objectives: The purpose of our study was to comprehensively assess right ventricular (RV) function in patients with pulmonary hypertension (PH) using three-dimensional speckle tracking echocardiography (3D-STE) and investigate whether 3D-STE parameters was associated with clinical outcomes.

Methods: 60 patients with PH and 25 normal controls were studied by both two-dimensional echo and 3D-STE. RV regional and global longitudinal strain (LS), circumferential strain (CS), radial strain (RS) were calculated by 3D-STE. RV volume and ejection fraction were obtained from cardiac magnetic resonance imaging.

Results: Patients with PH showed increased RV end-diastolic volume and end-systolic volume, and decreased ejection fraction compared with controls; RV global and regional LS, RS and CS were decreased in patients compared with controls. Patients with severe PH exhibited reduced RV global LS, RS and CS compared with patients with mild PH. RV global LS, RS and CS had superior correlations with cardiac magnetic resonance -derived RV ejection fraction, hemodynamic parameters (pulmonary artery systolic pressure and pulmonary vascular resistance) and exercise capacity compared with conventional echo indices. RV GLS was an independent predictor of unfavorable clinical outcomes (Hazard ration: 0.849; 95% CI: 0.748 to 0.964; p=0.011).

Conclusions: Patients with PH show decreased 3D-STE parameters that have better correlations with RV ejection fraction, hemodynamic parameters and exercise capacity than conventional echo indices, and provides prognostic information.

PPT5-020

Infiltrating Lipoma of the Right Ventricle Involving the Interventricular Septum and Tricuspid Valve: Report of a Rare Case and Literature Review

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Objectives: Cardiac lipoma is a rare primary cardiac tumor that is often asymptomatic and diagnosed incidentally. It can be found throughout the heart. Rarely, they arise within the myocardium or from the valve leaflets. Here, we present a case of right ventricular (RV) infiltrating lipoma involving the interventricular septum (IVS) and the tricuspid valve. Although cardiac lipoma is uncommon, they are easily diagnosed by imaging examination and should be confirmed by pathological examination.

Methods: A rare case and literature review.

Results: A 48-year-old woman who suffered from occasional palpitation after exertion for 10 years, and only isolated premature ventricular beats were recorded. Imaging examinations, including two-dimensional echocardiography, three-dimensional echocardiography, contrast-enhanced ultrasound and magnetic resonance imaging, revealed a large mass adherent to the IVS and the RV wall that was consistent with lipoma. The patient underwent surgical repair of the tricuspid valve and excision of the partial mass. The gross specimen revealed piles of 5×4×3cm fragments with yellowish appearance and pathological results showed infiltrating lipoma.

Conclusions: Lipoma is often asymptomatic and diagnosed incidentally. Tumors infiltrating the ventricular wall might damage the myocardium or conduction system and result in ventricular arrhythmias. Surgical excision is the main therapeutic intervention. Multimodality imaging would be great helpful in the diagnosis of cardiac lipoma. Echocardiography is a convenient method for follow-up.

PPT5-021

Is It Possible to Evaluate Regional Left Ventricular Myocardial Contractility with the Help of Reflected Intensive Motion Signals?

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Objectives: Analysis of spectral Tissue Doppler (TD) systolic peak (s') enables accurate assessment of regional myocardial contractility. Unfortunately, not all ultrasound scanners are equipped with TD software. Previously, we have demonstrated that systolic peak (s) of reflected intensive motion signals (RIMS) is useful in the evaluation of global systolic function of left ventricle (LV). In this study we decided to evaluate if peak s of RIMS can be used for analysis of LV regional myocardial contractility.
Methods: 20 patients with coronary artery disease underwent Dopplerechocardiography with registration of TD and RIMS. Apical 4-chamber view was used. s' and s peaks were recorded from apical lateral segment (TD s'a and RIMS sa) and basal lateral segment (TD s'b and RIMS sb) of LV. Correlations (r) between peak velocities of s' and s were determined.
Results: Mean values of TD s'a and RIMS sa were 6.8 ± 1.6 cm/s and 11.0 ± 2.4 cm/s, respectively; correlation coefficient r appeared to be 0.86 ($p < 0.05$; RIMS sa = 2.5 + 1.2 * TD sa). Mean value of TD s'b was 10.1 ± 2.5 cm/s and of RIMS sb 16.8 ± 3.6 cm/s ($r = 0.91$; $p < 0.05$; RIMS sb = 3.2 + 1.3 * TD sb).
Conclusions: Strong direct correlations between homological systolic peaks of TD and RIMS were found in our study. It means that peak s of RIMS can be used for evaluation of regional left ventricular myocardial contractility.

PPT5-022

Positive and Negative Prediction of Heart Failure and Left Ventricular Remodeling by Speckle Tracking Imaging: A Clinical Follow-Up Study of Acute Myocardial Infarction

Hu Bo, Zhou Qing
Department of Ultrasound Imaging, Renmin Hospital of Wuhan University, China

Objectives: We sought to study the progress of heart failure (HF) and left ventricular remodeling (LVR) of the first onset myocardial infarction. Positive and negative values of prediction were analyzed for the patients as well as the change of myocardial systolic function after the infarction.
Methods: 78 patients with first onset ST segment elevated acute myocardial infarction were enrolled. Echocardiography were performed within 24 hours of the onset, 3-month and 6-month after the infarction. At the points of follow-ups, HF was defined as LVEF failed to increase more than 5% and was lower than 35% and LVR was defined as left ventricular end-diastolic volume increased more than 20%. We compared the changes of two-dimensional and speckle tracking metrics and their relations at different time points for the predictive values of HF and LVR.
Results: Both two-dimensional and speckle tracking metrics at 6-month follow-up were better than the baseline ($P < 0.05$, all). Minimal data point of longitudinal strain was the most powerful predicted factor for HF (AUC: 0.792 with sensitivity of 82% and specificity of 86%) while minimal circumferential strain was the best for the prediction of LVR (AUC: 0.821 with sensitivity of 85% and specificity of 83%). As the negative values, we found that changes of longitudinal strain from baseline to 3-month (AUC: 0.754 with sensitivity of 78% and specificity of 75%) best predicted not to be HF as the change of circumferential strain (AUC: 0.776 with sensitivity of 84% and specificity of 81%) for LVR.
Conclusions: Speckle tracking echocardiography has the strong power for positive and negative prediction of HF and LVR after myocardial infarction. Metrics of longitudinal strain as minimum segmental strain and change rate of strain were optimal for the prediction of HF as well as the corresponding metrics of circumferential strain for the prediction of LVR.

PPT5-023

Prediction for Improvement and Remodeling in First-Onset Myocardial Infarction by Speckle Tracking Echocardiography: Is Global or Regional Selection Better?

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Objectives: We sought to investigate the predictive value of left ventricular (LV) global and region of interest (ROI) assessment for the prognosis of AMI patients by speckle tracking echocardiography (STE).

Methods: 81 first-onset AMI patients were enrolled prospectively for baseline and 6-month follow-up analysis. Cardiac function improvement was defined as 5% increase of LV ejection fraction (LVEF) from baseline to follow-up and LV remodeling (LVR) was 20% increase of LV end-diastolic volume (LVEDV). STE longitudinal, radial and circumferential strain (LS, RS and CS) were analyzed for global and segmental LV motion. The ROI strain was selected by wall motion score index (WMSI) scored ≥2 and presented as LS_WMSI, RS_WMSI and CS_WMSI. The echocardiography-derived parameters were compared in receiver operator characteristics (ROC) analysis for predictive values. The time of the whole analysis process was recorded for every patient.

Results: There were statistically significant differences for the comparisons of STE parameters between remodeling and non-remodeling groups as well as improved and non-improved groups ($P < 0.05$, all), while comparisons of 2D and WMSI assessments were not significantly different at baseline. To predict LVR, cut-off value of -5.53% for CS_WMSI has yielded sensitivity of 92.3% and specificity of 89.1% and cut-off value of -9.92% for global CS has yielded sensitivity of 76.9% and specificity of 92.7%; To predict cardiac function improvement, LS_WMSI has given cut-off value of -5.33% with sensitivity of 88.0% and specificity of 85.7% and global LS has given cut-off value of -10.40% with sensitivity of 88.0% and specificity of 69.6%. There were no significant differences of the areas under ROC curves between CS_WMSI and CS to predict LVR and between LS_WMSI and global LS to predict cardiac function improvement ($P > 0.05$, all). The analysis time of global parameters was less than the time of ROI parameters ($P < 0.05$) and the reproducibility of global analysis was slightly better than the ROI analysis.
Conclusions: STE was valuable for the prediction of LVR and cardiac function improvement after AMI. Compared to ROI parameters, global STE parameters were more integral and efficient as predictive factors with high predictive power, less analysis time and better reproducibility.

PPT5-024

Preliminary Study on the Relationship Between Intracardiac Blood Flow and Diastolic Function of Left Ventricle in Patients with Essential Hypertension

Xiaoyi Li

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Objectives: Left ventricular diastolic dysfunction can be detected in the early stage of essential hypertension. Previous studies have used Ganau configuration classification with the European population criterion rather than Chinese population. In this study, we evaluate the energy loss and vortex circulation in diastolic left ventricle in patients with essential hypertension under the criterion of Chinese population and explore the relationship between intracardiac blood flow change and diastolic function.

Methods: Collect the structural and hemodynamic information in left ventricular diastolic period by echocardiography. Measure the energy loss and vortex circulation in left ventricle at different phases by VFM on the offline station.

Results: 63 patients with essential hypertension and 23 volunteers as controls are included. Compared to the controls, the energy loss and vortex circulation is significantly increased in hypertension which has a correlation with the diastolic function. The subgroups under the European criterion which find no significant difference in energy loss, have significant difference in ratio from that of Chinese criterion.

Conclusions: The study shows the different results under two criterions and indicates the Chinese criterion can acquire a better reflection of the left ventricular energy loss in hypertension patients. VFM technology can be used to analyze the left ventricular flow in patients with hypertension, providing a new method to evaluate diastolic function.

PPT5-025

Quantitive Evaluation of the Effects of Successful Percutaneous Coronary Intervention on Left Ventricular Diastolic Function in Coronary Artery Disease Patients

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Objectives: To explore the effect of selective PCI on left ventricular diastolic function with the utilization of echocardiography CAD patients , which has not been investigated in more details.

Methods: Sixty CAD patients refered to Shandong University Qilu hospital for selective PCI were included. Echocardiography was performed 24hrs before,24hrs after and 1 month after stenting for every one. Another 30 healthy individuals were examined as control. The patients were then divided into two groups according to the settings of revascularization during the procedure of selective PCI and the Gensini score. This paper compares the echocardiographic parameters between groups of different culprit vessel and between groups of different severity due to Gensini score ranges.

Results: There were significant differences in E、A、E/A、EDT、Adur、IVRT、E/Ea and Tei-index between 1 month after and 24hrs before PCI(all $p < 0.05$). The similar results were shown in complete revascularization group and patients with Gensini score≤25.

Conclusions: PCI could improve LV diastolic function significantly1 month after stenting, and the effect was much more predominant in patients with low Gensini score.

PPT5-026

Rolling Thrombosis in Right Atrium Leading to CPCR

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Objectives: Pulmonary embolism (PE) is one of the three leading causes of mortality in patients with cardiovascular disease. PE is a global health problem that impairs quality of life and causes economic loss for those who have it. Its risk factors are increasing age, being female, diabetes mellitus, and cancer. Using data from the Taiwan National Health Insurance Research Database (NHIRD), we found that the incidence rate of PE was 19/100,000 person-years.

Methods: A 62-year-old man was diagnosed of lung squamous cell carcinoma in May 2013, and then Port-A catheter was implanted in left subclavian vein. He had left arm swelling and sonography showed thrombus in left subclavian vein, internal jugular vein & left external jugular vein in June 2013. Anticoagulant therapy was administrated. He presented with dyspnea to the out-patient clinic and was admitted to our oncology ward in Janunary 2016. He suffered from desaturation after urinating in the third night of admission. He was endotracheal intubated. A thrombus was rolling from right atrium into right ventricle at the diastolic phase in the echocardiography. Then, the thrombus disappeared in front of the cardiologist, followed with pulseless electrical activity. Cardiopulmonary-cerebral resuscitation (CPCR) was conducted but the patient still passed away.

Results: A 2.0x2.1cm thrombus in the right atrium was found in the echocardiography. We explained the therapy of tissue plasminogen activator to family, and immediately the rolling thrombus flow to the pulmonary artery, causing pulseless electrical activity and then asystole. The patient expired although Cardiopulmonary-cerebral resuscitation (CPCR) was conducted as soon as possible.

Conclusions: We should pay attention to venous thromboembolism in low or upper extremity, or both. Thrombolysis therapy might be the treatment of obstructive shock due to pulmonary embolism.

PPT5-027

Value of Three Dimensional Strain Imaging on Assessing Left Ventricular Systolic Function and Predicting Short-Term Outcome in Chronic Aortic Regurgitation Undergoing Valve Replacement Surgery

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Objectives: This study aimed to evaluate the subtle left ventricular function change in chronic aortic regurgitation (AR) patients using three dimensional strain imaging (3D STI) and to investigate its perioperative prognostic value.

Methods: 3D STI were analyzed in 30 controls, 31 chronic AR patients with preserved LV function (AR+PEF group, LVEF≥55%), and 36 patients with LV dysfunction (AR+REF group, LVEF<55%). Among them, 32 patients underwent aortic valve replacement surgery (AVR).

Results: (1) Comparing controls, global longitudinal strain (GLS, -19.93±1.82% vs. -17.87±2.43%), global radial strain (GRS, 43.63±3.28% vs. 39.80±4.51%), and torsion (2.31±0.60°/cm vs. 1.65±0.41°/cm) were reduced in AR+PEF, with global circumferential strain (GCS, -32.47±3.53%vs. -20.74±4.82%), GLS (-19.93±1.82% vs. -12.56±2.62 %), GRS (43.63±3.28% vs. 27.13±5.90 %), and torsion (2.31±0.60 °/cm vs. 1.17±0.46°/cm) reduced in AR+REF. (2) Strains in middle segments (LS -18.44±3.34%vs. -15.21±3.50%, CS -37.03±5.51%vs-33.67±4.09%, RS 46.02±5.82%

vs. 40.22±4.34%, respectively), in apical segments (LS -21.73±5.27 % vs. -19.18±7.85%, CS -39.07±5.32 %vs. -35.08±4.64 %, RS 50.73±6.74 % vs. 45.20±9.24 %, respectively), and apical rotation (10.42±2.92°vs. 8.47±3.07°) were all reduced in AR+PEF, with basal segmental strains and rotation preserved. (3) Preoperative GLS was the unique independent predictor of perioperative cardiac adverse events. The receiver operating characteristic curves showed that optimal cut-off point was -15.65% with the area under the curve 0.765.

Conclusions: 3D STI can detect subclinical left ventricular dysfunction in AR patients. For patients with preserved LVEF, GCS, basal strains and rotation were important in maintaining normal LEVF. GLS can predict perioperative cardiac adverse events in AVR.

PPT5-028

Chelation Therapy Has a Beneficial Effect in Ultrasonic Endothelial Function in Patients with Elevated Serum Lead or Cadmium Levels

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Objectives: Chelation therapy may decrease the amount of heavy metals in the body, thus decrease the side effects of these toxic materials in affecting our health. However, the reports of the impacts of chelation therapy to the ultrasonic endothelial function in patients with elevated heavy metal levels were limited.

Methods: Thirty coronary artery disease (CAD) patients with elevated lead or cadmium level underwent antioxidant and ethylenediamine tetra-acetic acid chelation therapy for more than 6 months were studied. The blood and urine lead and cadmium levels and ultrasonic endothelial function were evaluated.

Results: Lead and cadmium levels in blood and urine were reduced significantly after 3- and 6-month of chelation therapy ($p<0.001$). Ultrasonic endothelial function analysis over the brachial artery also showed a progressive increase in the flow increase during reactive hyperemia (FIRH) and flow mediated dilation (FMD) after 3- and 6-month of treatments ($p<0.05$ compared with baseline data).

Conclusions: This study revealed that chelation therapy had a significant increase in the ultrasonic parameters of FIRH and FMD, which suggest that this therapy may have favorable impacts in the ultrasound endothelial function in patients with elevated heavy metals.

PPT5-029

Evaluation Of The Effect Of Hemodialysis On Left Ventricular Longitudinal Strain Function Of Myocardium In Patients With Uremia By Velocity Vector Imaging

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Objectives: With the continuous improvement of dialysis technology, the survival rate of uremic patients was significantly increased. But so far, there are few studies about the effects of single dialysis on the left ventricular function in patients with uremia maintenance hemodialysis, and there are still controversial.

Methods: Echocardiography was performed with 35 cases of uremia patients respectively 2H before and after high flux hemodialysis. VVI software was used to analyze the two-dimensional images after conventional measurement and image acquisition,and17 segments of left ventricular peak systolic longitudinal strain (LPS) and layered whole layer strain waa obtained.

Results: Comparing with results before hemodialysis,the values including left atrial diameter (LAD), left ventricular end diastolic and end systolic diameter (LVIDd, LVIDs), and left ventricular diastolic end and end systolic volume (EDV, ESV), stroke volume (SV)were reduced after dialysis($P<0.05$).There was no significant difference about left ventricular ejection fraction(LVEF) ($P>0.05$).Layered strain parameters show that the peak systolic longitudinal strain (LPS) of left ventricular global layer and inner layer,the global layer, subendocardial layer, middle layer and epicardial layer of the basal segment ,the global layer and subendocardial layer of middle segment become lower than the values before dialysis and the difference was statistically significant ($P < 0.05$).However,there was no significant among global epicardial, middle and epicardial of middle segment, global and three layers of apical segments between before and after dialysis in LPS ($P > 0.05$).Single hemodialysis presents a negative effect on left ventricular function.Therefore, it is necessary to monitor the heart function for hemodialysis patients to avoid the occurrence of cardiovascular events during and after dialysis.

Conclusions: VVI technique can be more accurate and effective to evaluate the effect of blood dialysis in uremic patients with left ventricular myocardial regional and global function, and exhibit potential applications in clinical practice.

PPT5-030

Left Ventricular Circumferential Strain In Bama Mini Pig With Coronary Vein Ligation Using Layer-specific Strain

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Objectives: When the coronary blood supply is reduced, it can lead to angina, myocardial infarction, sudden death, ischemic cardiomyopathy, etc.What is the effect of coronary vein occlusion on cardiac function? At present, there are few relevant reports at home and abroad, which needs further research.

Methods: The great cardiac vein of 12 healthy Bama mini pigs were ligated. Left ventricular circumferential strain of three layers myocardium at basal,middle and apical muscle level were compared before ligation, and 30, 60, 90, 120, 150, 180 min after ligation, respectively.

Results: Compared with the basic state, there were no significant difference in the left ventricular ejection fraction(LVEF), left ventricular end diastolic and end systolic diameter (LVIDd, LVIDs), left ventricular diastolic end and end systolic volume (EDV, ESV) and stroke volume (SV). Three levels of circumferential strain decreased significantly after great cardiac vein ligation:apical level >basal level> middle level; three myocardial layers circumferential strain decreased significantly: inner layer >middle layer> outer layer.

Conclusions: Layer-specific strain is a promising approach to evaluate left ventricular global and regional myocardial function in Bama mini pig, and has a value of potential applications in the influence of cardiac vein ligation to left ventricular myocardial function.

T6. Education in Medical Ultrasound

Symposium

T6-14-IN01

WFUMB COE: Current Status and Future Perspectives

Byung Ihn Choi, MD
Department of Radiology, Chung-Ang University Hospital, Seoul, Korea

In this session, characteristics of WFUMB COE, current activity of each COE, and future plans will be discussed.

The aim of WFUMC COE is to conduct education in medical US in developing countries, to confer accreditation after necessary examination and to accumulate current technical information on US. Establishment of WFUMB COE is done by the agreement between WFUMB and society affiliated to WFUMB. Initial term for COE candidate is two years, and term for new COE is three years. COE becomes independent after five years. Renewal is done for every two years, and is approved by WFUMB education committee and WFUMB Administrative Council. WFUMB COE is located in Asia, Africa, Latin America, and Eastern Europe. Secretariat of COE is WFUMB appointed affiliated society, and secretary is appointed by local society. The responsibility of COE is developing training programs, financial administration, and reporting activity every year to WFUMB. The responsibility of WFUMB is approval of the name, recommendation of curriculum, recognition of budget, recommendation of teachers, and advice for management of COE.

Currently, WFUMB has 12 COEs, and one COE, Addis Ababa in Ethiopia, which is still pending. Twelve COEs are Kampala in Uganda, Lome in Togo, Lagos in Nigeria, and Nairobi in Kenya, Khartoum in Sudan, Dhaka in Bangladesh, Jakarta in Indonesia, Ulaanbaatar in Mongolia, Caracas in Venezuela, Caaguazu in Paraguay, Timisoara in Romania, and Chisinau in Moldavia.

COE meeting is an education meeting for director of each COE with chairs of education committee in three regions including Latin America, Africa & Eastern Europe and Asia, because WFUMB can save expenses for the meeting, and can discuss COE activities in depth and detail. This meeting is held once in every two years and held in Africa, Asia and Latin American region.

Future plan of WFSUMB COE is as follows: Name is changing from Excellence to Education. Old COEs will be classified into type 1(Basic), 2(Intermediate), 3(Advanced) by new rules. WFUMB plans to increase the number of new COEs. E-learning will be continuously discussed and applied to education activity of each COE.

T6-14-IN02

Why We Need Infection Prevention and Control Protocols for Ultrasound Practitioners?

Susan Campbell Westerway, PhD, Jocelyne Basseal, PhD
Australasian Society for Ultrasound in Medicine

Although the routine medical ultrasound scan is considered a safe, non-invasive examination, the lack of effective infection prevention and control guidelines can place both the patient and operator at risk of bacterial or viral cross contamination. There are numerous publications on transducer contamination along with the promotion of a number of surveys on infection control, including the survey from the World Federation of Ultrasound in Medicine and Biology. Ultrasound practitioners maybe unsure as to how to best protect themselves and their patients from the risk of infection transmission and this can be of particularly concern when there are no concise guidelines available.

A search of current ultrasound literature revealed very few ultrasound specific guidelines for the reprocessing of transducers post use. The search also exposed the types of bacterial and viral contaminants that have been found on ultrasound transducers following routine ultrasound examinations. This study assessed some of those contaminants for potential ease of spread during an ultrasound scan and whether low or high level disinfectant cleaning regimes was necessary.

Recognition of the potential risk of spread of infection begins with the patients clinical history and visual inspection of the area to be scanned. Inadequate transducer covering and post scan cleaning may be responsible for an increased risk factor for contamination.

This work should make ultrasound practitioners aware of the potential risk of cross transmission of infection as a result of performing an ultrasound examination. It has highlighted the need for the implementation of guidelines for infection prevention and control within the ultrasound practice.

T6-14-IN03

Best Practices for Publishing in Scientific Journals

Christy K. Holland
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A string of impressive publications can be the lifeline for promotion and success for an academic. Once excellent data is produced from your innovative research program, how do you communicate the results as clearly as possible? As the editor in chief of Ultrasound in Medicine and Biology, I have witnessed first hand a range of successful strategies to get papers published. Making sure that your manuscript is aimed at the appropriate journal at the outset can save a great deal of effort and can get your work into print faster. Editors and Associate Editors seek advice from reviewers who are knowledgeable in the general subject of the paper, and the reviewers give opinions on various aspects of the work, including whether the work is original and correct. The editor and reviewers who examine each manuscript are the authors' peers: persons with comparable standing in the same research field as the authors themselves. The composition of a concise cover letter, the creation of an effective response to the reviewers' critiques, and strategies for polite communication will be outlined and discussed. The good news is that editors want to publish your paper and appreciate individuals who create the scientific content that makes a journal thrive.

T6-14-IN04

Ultrasound Qualifications and Credentialing - the ASUM Experience

Lyndal Macpherson
ASUM

The Australasian Society for Ultrasound in Medicine (ASUM) is a multidisciplinary society whose mission is to advance the clinical practice of diagnostic medical ultrasound for the highest standards of patient care. Education is a key role in achieving these high standards. Ultrasound is a complex, highly operator-dependent skill to learn, both in image acquisition and interpretation requiring appropriate training to achieve this.

ASUM has offered training and qualifications in ultrasound for both doctors and sonographers in the specialties of radiology, cardiology, vascular, obstetrics and gynaecology for approximately 40 years. More recently we have added ultrasound training opportunities to physicians in emerging markets as ultrasound is used routinely in such specialties as rheumatology and emergency medicine. Training for examiners and supervisors further supports the professional standards expected to gain qualifications within ultrasound.

Training and education is key to ensuring patient care and safety and does not stop once a qualification is achieved. To support this, ASUM offers continued professional development workshops, webinars and

events to further enhance learning while ensuring recertification of qualifications in line with scope of practice.

T6-14-IN05

Medical Education of Ultrasound in Taiwan

Ming-Ren Chen
President of Chinese Taipei Society of Ultrasound in Medicine

Ultrasonography was first introduced into Taiwan in the late 1960's. The rapid development of ultrasonography urged the necessity of education and the foundation of the Society of Ultrasound in Medicine, ROC in 1984. At present, there are 13 standing committees, including education and training committee in the society. The committee provided regular educational programs in 15 tracts of medical fields every year and enrolled members. The number of founding members was 467, now increased to 5585, with the most members in the tracts of gastroenterology, miscellaneous, and obstetrics/gynecology. The society also regularly train technicians, and have 767 sonographic technician members in the society, with the majority in the tracts of obstetrics/gynecology, neurology, miscellaneous, and gastroenterology. The training of physician members/technicians contains lectures and practice.

Regarding the undergraduate students, ultrasound education varies in colleges and universities at different levels. For example, some start the course in grade 3 and included in clinical physiology, around 10 hours; and the hospital practice in grade 4 for 12-16 hours. However, only introduction of simple principle is taught in the class and less chance of practice because of busy business of hospital. The medical school student could only contact the technique closely in their postgraduate career, depends on which subspecial field they have encountered and the field and enthusiasm of their teacher physician.

Today, ultrasound has become a very prominent subspecialty of medicine in Taiwan. Many societies in medical subspecialty are springing up in this decade, each society almost always include ultrasound training and education. The license of certain subspecialty even becomes the must for cover by insurance of National Health Administration. In addition to the progress of clinical ultrasound in every medical subspecialty, we need to make more effort in education for undergraduates and developing ultrasound science and engineering.

T6-15-IN01

Introduction of WFUMB COE

Byung Ihn Choi, MD
Department of Radiology, Chung-Ang University Hospital, Seoul, Korea

Currently, WFUMB has 12 COEs, and one COE, Addis Ababa in Ethiopia, which is still pending. Five COEs in Africa are located in Kampala in Uganda, Lome in Togo, Lagos in Nigeria, and Nairobi in Kenya, and Khartoum in Sudan. Three COEs in Asia are located in Dhaka in Bangladesh, Jakarta in Indonesia, and Ulaanbaatar in Mongolia. Two COEs in Latin America is located in Caracas in Venezuela, and Caaguazu in Paraguay. Two COEs in Eastern Europe are located in Timisoara in Romania, and Chisinau in Moldavia.

In this session, Directors of each WFUMB COE will present current status of their COEs, and discuss current activity and problems of each COE. And future plans of WFUMB COE will be presented and discussed by three members of education committee of WFUMB.

T6-15-IN02

Current Status of WFUMB COE in Bangladesh

Kanu Bala, MBBS, PhD, FRCP
Director, World Federation for Ultrasound in Medicine and Biology (WFUMB) COE Bangladesh

Due to increasing demands for education and training in ultrasonography, World Federation for Ultrasound in Medicine and Biology [WFUMB] has decided to establish 'WFUMB Center of Excellence' at different continents. Accordingly First "WFUMB Center of Excellence" was established in Dhaka in 2004. On 24 February 2004 an agreement was signed between the Bangladesh Society of Ultrasonography [BSU] and the WFUMB for this purpose. Prof. Hiroki Watanabe-WFUMB President and Prof. Kanu Bala-BSU President signed the agreement on behalf of WFUMB and BSU.

The 19th WFUMB COE Workshop was held on 3 March 2017, Friday at the Auditorium of the National Institute of Nuclear Medicine and Allied Science, Bangabandhu Sheikh Mujib Medical University Campus, Dhaka, Bangladesh. The topic of the workshop was "Controversies in Pregnancy Ultrasound". 152 participants attended the workshop. Prof. Byung Ihn Choi-Korea is the Chairperson of the Advisory Board of the WFUMB COEs and Prof. Kanu Bala-Bangladesh is the Director of the WFUMB Center of Education Bangladesh. Bangladesh Society of Ultrasonography is the host organization.

T6-15-IN03

Kampala WFUMB COE Status 2017

Michael Kawooya
Ernest Cook Ultrasound Research and Education Institute (ECUREI)

Kampala WFUMB COE was launched in October 2004 with subsequent regular renewals. The aim of the WFUMB COE is to offer formal and continuing medical education (CME) courses in ultrasound.

Formal courses are offered at certificate, diploma and Bachelors and Master's degree levels. Continuing medical education courses are offered twice a year aimed at refreshing participants' ultrasound knowledge and skills and at training the trainers. The COE regularly sends reports of its activities to the WFUMB and communicates with other WFUMB COEs.

The COE is under UGASON (Uganda Society for Sonography). ECUREI is the training centre for the COE. ECUREI stands for "Ernest Cook Ultrasound Research and Education Institute". Ernest Cook was British missionary brought first X-ray machine to Uganda, in year 1910.

To date the COE has trained a total of 1,040 ultrasound users since its inception in 2004. This year, the COE held its first refresher course on with the theme "Vascular Ultrasound". The second refresher course will run on 02/09/2017 with the theme "Chest Ultrasound".

Last year in October, ECUREI graduated its first Bachelor's of ultrasound degree students. This year in October, ECUREI will graduate its first Masters of Diagnostic Ultrasound students.

The main challenge facing the COE is the low ratio of ultrasound machines to numbers of students. ECUREI acquired 3 ultrasound machines this year one through a donation and two purchased by ECUREI.

T6-15-IN04

Current Status of WFUMB COE in Venezuela

Center of Education Venezuela, Current Status,
Leandro Fernandez, MD

The COE WFUMB-Venezuela initiated its activities in 2005 and since this year until 2017, we have had a number of attendees of 3,838 with a mean of 306 – 550 persons in each event. The lectures level have been basic, intermediate and advanced ultrasound with Workshops and Hands-on sessions.

In all meetings, we had renowned National and International speakers, including many FLAUS and WFUMB Officers.

In 2016, we decided to change the format of just an annual meeting with a high number of participants. We started to offer courses with longer hands-on session for smaller groups of physicians. The mean number of trainees is 20 per course.

The areas covered are Musculoskeletal, Neurovascular, Nephro-Urology, Abdomen and Vascular.

The COE WFUMB-Venezuela is financially independent of WFUMB but maintain the initiative and commitment for education and promotion for the good practice of ultrasound.

T6-15-IN05

WFUMB COE Timişoara, Romania 10 Years of Experience like a WFUMB COE

Ioan Sporea
Department of Gastroenterology and Hepatology, "Victor Babeş" University of Medicine and Pharmacy Timişoara

The WFUMB Center of Excellence Romania was established in 2007 and it is located in Timişoara. It is also an EFSUMB Ultrasound Learning Centre since 2014.

The ultrasound learning activities in Timisoara have a long tradition, since 1995, and until now more than 1500 physicians started their ultrasound experience in our center under the supervision of the center's members.

Every year the center organize 2 courses of general ultrasound, 3 months each, several courses for students.

Since 2007 we had organized also eleven annual workshops with different topics: Interventional ultrasound, Contrast enhanced ultrasound, Ultrasound in Gastroenterology and Hepatology, Elastography, Ultrasound in Emergencies, Clinical Abdominal Ultrasound, etc.

In 2008 our center was the organizer of EUROSON 2008, an event that brought together over 1,000 participants interested in ultrasonography, from 43 countries.

In 2013 we have organized the first EFSUMB Endorsed Course via telemedicine, involving 2 centers: Timişoara, Romania and Szeged, Hungary.

In 2016 we organized together with Chişinău Ultrasound Learning Center from Moldova the first workshop in cooperation with WFUMB.

We shall continue our educational activities in ultrasonography and our center is open for everybody that wants to learn ultrasound or looks to improve their experience – www.ulctimisoara.ro.

T6-15-IN06

Current Status of WFUMB COE in Indonesia

T6-15-IN07

Basic US Training for Primary Health Care Practitioners in Mongolia

Sonin Sodov, MSDU
WFUMB COE Mongolia

Introduction: Mongolia is a landlocked country bordered by Russia to the north and China to the south, east and west. By the end of 2016, Mongolia has a population of 3,119,900 spread over an area of 1,566 460 sq/km giving a population density of 1.99 per sq/km. 68.9% of the total population live in cities and the remaining 31.1% reside in the rural areas.

The main aims of health services in Mongolia are the provision of accessible, equitable and quality services to everyone.

The priority of Mongolian health sector is to provide primary health care services to citizens.

The health system of Mongolia is based on a two-tier model that provides health services at primary and secondary/tertiary levels:

- Primary health care is delivered by family health centres, soum/rural health centers and intersoum hospitals.
- Secondary health care is provided by district and aimag/provincial general hospitals, rural general hospitals.
- Tertiary health care is delivered by multispecialty central hospitals and specialized centers in capital city of Ulaanbaatar.

Patient pathways: Official patient pathway in Mongolia is based on three layer system in order to improve the system efficiency and encourage public health priority.

There are some differences between the patient pathways in rural and urban areas due to the structural differences in primary health care provision, which reflects geographical circumstances.

Family health centers (FHCs), provide primary care services for the people who live in the capital city and the aimag/provincial centres, while soum/rural health centers provide a wider range of primary care services to the rural population.

The primary care services include outpatient exams, primary diagnostic services, antenatal care, family planning, the prescription of essential drugs, counselling, reassessment check-ups, home visits, palliative care, referrals to district hospitals, and health education and promotion.

A peculiarity of rural PHC in Mongolia is that the soum health centers provide not only outpatient services but also inpatient services for the rural population.

This is mostly because of the geographic and demographic features of Mongolia where the rural population is sparsely distributed over a huge area and they need some inpatient services before travelling long distances to get secondary inpatient care in aimag/provincial hospitals.

The specific challenge of rural primary care is to meet the various health needs of the scattered and distant nomads.

Basic US training for primary health care practitioners: With use of portable ultrasonography machines at the primary health care settings, the need for education and training for primary health care practitioners became important.

During the Congress of WFUMB held in San Paolo in May 2013, Mongolian Society of Diagnostic Ultrasound (MSDU) put in for establishing Center of Education (COE) in Mongolia. WFUMB COE Mongolia established on 25 August 2013 at the Urguu Maternity Hospital No1 in Ulaanbaatar, Mongolia. Since that WFUMB COE Mongolia has conducted a training for primary health care practitioners three times a year for 3 months. 320 doctors were trained. Out of them 80 were rural doctors and 240 family doctors.

T6-15-IN08

Current Status of WFUMB COE in Nigeria

Kofo Soyebi
University of Lagos

Goal of WFUMB is to "help bring sustainable ultrasound programmes to the underserved areas of the world to improve healthcare through collaboration, communication and education." WFUMB achieves these Goals through its COEs in the countries the COEs are located in.

Currently in Nigeria, Centre for Ultrasound Research and Education, WFUMB COE in Nigeria, in recognition of its capacity building activities since 2012, has been given the task of building capacity in rural setting midwives to enable them carry out limited obstetric ultrasonography in pregnant women for purposes of determining the status of their pregnancy for purposes of either managing them locally of referring them to secondary or tertiary Centres, if any abnormality is detected, for further management. Thus, the education mandate of WFUMB is fulfilled. The details of the Project are described in this Presentation.

T6-15-IN09

Current Status of WFUMB COE in Kenya

Prof Sudhir Vinayak
Director, COE Chair, Radiology Department, Aga Khan University Hospital, Nairobi, Kenya

The COE is based in the Radiology department of the Aga Khan University hospital in Nairobi Kenya.

Regular educational programs are organized by the COE on a monthly basis. The topics are current and span the entire field of ultrasound examinations. Attendance is good and numbers are increasing.

We hold an annual conference and the last conference was attended by 110 participants; this was full capacity! Attendees came from Kenya, Uganda and Tanzania. Prof Odd Helge (President, EFSUMB) from Norway was our guest speaker.

Other educational programs include the recently concluded Visiq project. Phillips Medical Systems chose our COE to carry out the

research project. Midwives with no previous experience in performing ultrasound were trained for 4 weeks at the COE using a well-structured curriculum that included both classroom teaching and hands on experience. Upon passing an exit examination, they were certified to perform basic obstetric ultrasounds with a view to identify high risk pregnancies. All scans were performed on portable Visiq ultrasound machines in three remote centers. Images and provisional reports were sent to the COE using mobile phone internet technology and validated by Radiologists. The accuracy of performing and reporting scans by midwives, as well as assessing this type of teleradiology was analyzed and the study was completed in 2016; it was recently published in UMB.

In our region, the COE has had a positive impact; here are some reasons:

a) We have improved skills for Sonographers who are practicing but require hands-on experience to perform difficult/challenging ultrasound procedures.

b) The CME lectures are popular and feedback from Sonographers is very positive. However, initially, it was only amenable to those that live in Nairobi. Sonographers from other cities find it difficult to attend. We are distributing the lectures to members of KESUMB.

c) By creating an interest in ultrasound among Radiographers, many are choosing this as their profession. There are now two training centers in Nairobi and large numbers are enrolling for the diploma courses.

Going forward, we are working on an accreditation process because we realized that there are some poorly trained Sonographers in Kenya who have been certified and are licensed to work. This poses serious challenges about patient safety. As a COE, we submitted a proposal to provide accreditation for qualified Sonographers. This will take the form of a test; those that pass will receive accreditation. Those that fail will be offered help (mainly 'hands on') to achieve accreditation. This idea has been floated amongst the Sonographer community and the response has been very positive. We are awaiting approval from authorities to start the accreditation process and hope to get this early next year.

T6-15-IN10 (1)

Future Plans of WFUMB COE

Christian Pállson Nolsøe, Asc Prof, WFUMB President Elect, Diagnostic Radiologist, MD, PhD
Ultrasound Section, Division of Surgery, Dep of Gastroenterology, Herlev Hospital, Copenhagen Academy for Medical Education and Simulation, University of Copenhagen, Denmark

WFUMB has it as its main purpose to bring sustainable ultra sound to all regions of our world.

According to WHO approximately 2/3 of the worlds population has no access to medical imaging of any kind.

Through our Centers of Education WFUMB supports ultrasound education in low resource areas at 13 locations around the globe.

The intention with our COE Session at WFUMB 2017 in Taipei is to bring together decision-makers and COE leaders from all regions for the benefit of learning from each other and thereby hopefully bring about improvement for both existing COEs and WFUMB COE program in general.

We hope to create new ideas on how to teach ultrasound, new ways to bring out ultrasound to the farthest areas and new COEs to make this come true.

T6-15-IN10 (2)

WFUMB COE – A Good Way to Promote Ultrasound Training World-Wide

Odd Helge Gilja, Prof., MD, PhD
National Centre for Ultrasound in Gastroenterology, Haukeland University Hospital, Bergen, Department of Clinical Medicine, University of Bergen, Norway

The WFUMB CoE's has become an important arena for spreading information and skills on ultrasound to promote competence building world-wide.

In this short lecture I will give some WFUMB perspectives on education in ultrasound.

Hand-held ultrasound scanners are now spreading throughout the world as a very potent tool not only for clinical use, but also for use in educational programs in remote corners of the world. Technological advancement has opened new perspectives to ultrasound in various clinical applications and paves the way for more widespread educational applications.

In EFSUMB, we have developed an array of teaching material including Course Book and an EFSUMB Course Books and multimedia material, also available on the web (www.efsumb.org). WFUMB should also engage in production of educational material for the CoEs to benefit from.

Another goal for the Education Committee of WFUMB would be to establish during the next term one new WFUMB COE in each of the 6 Federations. One idea could be to establish a Task Force Group on course planning that could work to plan and arrange post-graduate courses around the world according the local/national needs. This can be particularly relevant for CEUS and elastography where new research is rapidly expanding.

T6-15-IN10 (3)

Future Plans of WFUMB COE

Dieter Nuernberg
Professor for Gastroenterology, Medical School Brandenburg Theodor Fontane, Neuruppin, Germany

The education program is a very important part of the WFUMB work. The WFUMB Centers of Education (COE's) shall provide qualification in medical ultrasound in developing (underserved) countries. They should grant recognition for to participants after completion of courses, accumulate ultrasound related reference materials and serve as reference centers for the region, they are situated (www.wfumb.org).

Today 13 COE all over the world are accredited. There are 3 types of COEs; Type 1 with basic education in one speciality; Type 2 provides basic and advanced education in one specialty and Type 3 is a multidisciplinary centre with advanced education in two or more specialities.

The future upcoming program should

1. **Increase the number of COEs** in all regions and with the help of all affiliate members (continental federations). The number of COE should double in within the next 5 years and
2. **Establish a fourth type, the Centre of excellence.** Type 4 is a COE with a long experience (more than 10 y), it's financially independent from WFUMB and it supports Type 1 to 3 COE's in the educational work.
3. The COE work and the work of the COE Advisory Board should be structured by a **system of Regional COE Directors** (e.g. East, West, America, EU), they observe closely and support the work of the COEs.
4. The **evaluation program** must be improved by a structured report system and an extended WFUMB visiting program to guaranty the standards.
5. **Students education** must be integrated in the COE work and
6. **POCUS** must be an important part of COE educational program.
7. **Educational material (e-Material)** supported by WFUMB has to be improved for use it in all COEs.

The COEs have to work with a snow ball effect to improve the US knowledge in the rural areas.

T6-16-IN01

Necessary Elements in a Successful Program

Harvey L. Nisenbaum
Department of Medical Imaging, Penn Presbyterian Medical Center, Philadelphia, Pennsylvania

Appropriate use of US has become a core skill that all future physicians will need to learn.

Number of specialties require US training in their Residencies like Radiology, Emergency Medicine, and Obstetrics & Gynecology. All Residencies will require US once mandated by the individual Residency Review Committees. Residencies would be able to concentrate more on patient care if the medical student entering their Residency was already proficient in the use of US.

Medical school mission is to educate and train their students to be the best prepared physicians to provide the best care for their patients. The use of US is a core skill they should be taught. This core skill also enhances their educational experience in medical school.

How does one introduce a new skill into a medical school curriculum that is already jam-packed? The US Integration into medical school curriculum has many requirements which will be briefly discussed in the presentation- "champion"; support of deans; support of module leaders; hands-on teachers; space; budget (US equipment, server to save images for each student, simulation); funding; feedback.

Final thoughts- each medical school is unique; support of the leaders is mandatory; collaboration is essential; resources (space, equipment, time) need to be available; and how rapid and successful the integration of US into the curriculum depends on many factors which are unique to each institution.

T6-16-IN02

Ultrasound in Undergraduate Medical Education in Asia: An Emergency Tool

K. Y. Leung
Chairman, Education Committee, AFSUMB

With the development of ultrasound technology, the availability of small and non-expensive ultrasound machine offering non-invasive, quick and real-time imaging, and the use of ultrasound in all clinical specialties, there is an increasing trend of providing ultrasound training in undergraduate medical education (UME). In Asia, this type of training is currently little for UME compared to the undergraduate training for radiographers or radiology technologists, or postgraduate training. Besides, there are few studies in this region. In one study, learning ultrasound knowledge can be enhanced by andragogy and mnemonics. In another pilot program, a short ultrasound training course was successfully introduced during the final-year medical degree anesthesia rotation. Hands on ultrasound experience can improve ultrasound knowledge of medical students. To overcome the limitations of curriculum time, ultrasound machines and experienced teaching staff, ultrasound training can be provided through e-learning.

T6-16-IN03

American Institute of Ultrasound in Medicine Will Describe Status in North America

Michael Blaivas, MD, MBA
Professor of Medicine, University of South Carolina School of Medicine, Department of Emergency Medicine, Piedmont Hospital Newnan, Atlanta, Georgia, USA

Ultrasound is spreading rapidly throughout medical education in the United States. In cooperation with the Society for Ultrasound in Medical Education (SUSME) the AIUM has worked hard to spread ultrasound education to more medical schools. In 2017, it is estimated that approximately 25% of medical schools in the United States have adopted 4 year (entire medical school length) integrated curricula. The strength of integrated curricula rests in the use of ultrasound from basic science foundational years all the way through clinical years including specialty clinical rotations. This approach allows for full ultrasound integration and optimal learning by medical students. Challenges include a lack of appropriately trained ultrasound basic science and clinical faculty. However, the stigma of leading the educational cutting edge by implementing an integrated ultrasound programs has changed and now medical schools without such programs are seen as failing to keeping pace with educational advances. Yet the massive challenge of educating large numbers of students effectively and efficiently will likely continue for years and require increased reliance of innovate methods such as use of simulation.

T6-16-IN04

Australasian Society for Ultrasound in Medicine Will Describe Status in Australasia

George Condous

T6-16-IN05

Teaching the Ultrasound Student–Planning for Success

Susan Campbell Westerway
ASUM, WFUMB Council

Teaching medical ultrasound can be a demanding task for the tutor / supervisor with many factors to be considered if there is to be a successful outcome for the student. This presentation will look at concepts that may assist both the tutor and student. Two of the key resources implemented by ASUM to assist ultrasound students include learning and skill acquisition plans. A learning plan aims to assist the student in achieving focused learning goals and is written in collaboration with the tutor, thereby encouraging students to take more responsibility for their learning outcomes.

A skill acquisition plan identifies a skill goal so that skill practice strategies can be implemented to assist in achieving that goal.

For further reading please see link below.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5024935/

From Aust Govt Dept Health: In order to develop a learning plan with a learner you will first need to identify their learning needs. From these needs you will be able to formulate learning goals and develop a plan to meet these goals. The learning plan should contain details on what will be learned, how it will be learned, by when, what criteria will be used to evaluate the learning and how the learning will be validated. A learning plan is best prepared by the learner with the guidance and support of a mentor or facilitator. Topic 4 in the module **Planning for Learning at Work** contains detailed information on preparing a learning plan.

Once learner needs have been identified they can be matched up with the units of competence and the resources available.

Steps to develop a learning plan: The following steps will assist you to develop a learning plan with a learner:

1. Assessment of learning needs

This may include analysis of:

- learner's values
- skills
- strengths and weaknesses
- preferred learning style
- suitability of learner's work situation as a work-based learning environment (Is there a quiet place to read/write/ consider? Are study leave provisions available? Is management supportive of work-based learning?).

Identification of learning goals

It is important to identify learning objectives both from a learner's perspective and from an organisational perspective. Those learners

who are undertaking learning as part of a process initiated by their organisation may well have different needs and motivations to those learners who have elected or volunteered to undertake further learning. Once established, learning goals can be reviewed against the learning outcomes of the module/s in this resource. This will assist the selection of appropriate modules.

Identify learning resources, supports and strategies. Evaluate the availability of the following resources and the learner's confidence in accessing them.

- people (facilitator, other learners, mentors, supervisors etc)
- resources (e.g. texts/libraries)
- technology (e.g. phones, Internet/e-mail, video-conferencing)

Specify what constitutes evidence of learning

How will you and the learner know that learning has occurred? Assessment of learning could include a portfolio, case notes, role plays and/or case studies.Top of page

Specify target dates

Specify dates for progress reviews and for module/task completion. Agree on how this will occur.

Target dates for contact with facilitators should specify:

- Informal query or concerns (How can a learner access you if they have a query or concern? For example, e-mail, telephone etc)
- Progress review dates (When will formal contact be initiated to check on progress and how will this be done? For example, by telephone, face-to-face meeting etc.)
- Assessment event due dates (When are assessment events due and how will they be submitted? (For example, by post, e-mail etc)
- Feedback. When will feedback be available on assessment performance and how will that be delivered?

Many learners will want to develop knowledge and skills in a number of areas. Overlapping content across the units has been identified in the individual modules.

Text version of Diagram

Developing a learning plan consists of a cyclical process as outlined in the steps below:

1. Assessment of learning needs - learners should be assisted to assess their:

- Values
- Skills
- Strengths and weaknesses
- Learning style
- Learning environment
- Reason for attending
- (e.g. compulsory - organisation initiated or voluntary – individually initiated)

Identification of learning goals

- Learners goals (SMART)
- Organisational goals (if applicable)
- Module learning outcomes

Identification of learning resources, supports and strategies - includes availability and confidence to access:

- People (facilitator, other learners, mentors, supervisors, colleagues, other professional and services etc)
- Resources (texts/references, libraries etc)
- Technology (Internet/websites, e-mail, videoconferencing etc)

Identification of forms of evidence of learning

Specify timeframes and mode of contact

- Includes time frames for:
- Informal contact (e.g. if the learner has a query)
- Review of progress
- Assessment events
- Finalising module requirements
- Mode of contact could include:
- Telephone call
- E-mail
- Group teleconference (e.g. with other learners)
- Face-to-face meetings

Note: Remember that learning is part of a cyclical process and the development and implementation of the learning plan will form the basis of analysis, reflection and further planning

Motivating learning and assessing outcomes in continuing medical education using a personal learning plan[†]

Virginia Reed

Reed, V. A., Schifferdecker, K. E. and Turco, M. G. (2012), Motivating learning and assessing outcomes in continuing medical education using a personal learning plan http://onlinelibrary.wiley.com/doi/10.1002/chp.21158/full- fn1. J. Contin. Educ. Health Prof., 32: 287–294. http://dx.doi.org/10.1002/chp.21158

Although there is increasing focus on provider behavior change as an outcome of continuing medical education (CME), it has long been known that an increase in knowledge alone is rarely sufficient to induce such change. The Personal Learning Plan (PLP), designed to motivate and assess CME learning, was partly derived from SMART goals (specific, measurable, attainable, realistic, and timely), a concept well supported as a strategy to promote behavior change. The goal of this study was to explore the relationship between SMART goals developed after attending a CME conference and subsequent provider behavior change, using the PLP as a tool.

Skill Acquisition: There are three stages of skill acquisition that sit along a continuum of skill learning. The cognitive stage is characterised by frequent errors and is the stage when the learner has to think a lot about the skill and how to execute it. They also require lots of frequent feedback.

The associative stage is the largest and longest stage. It is characterised by lots of practice. As the athlete progresses towards the next stage errors become less frequent and smaller.

The final stage is the autonomous stage. This stage is characterised by few if any errors that are minor. An athlete at this stage of skill acquisition can think about other aspects of competition and not think at all about the skill itself.

T6-16-IN06

European Federation of Societies for Ultrasound in Medicine and Biology: Status on Student Education in Europe

Odd Helge Gilja, Prof., MD, PhD

National Centre for Ultrasound in Gastroenterology Haukeland University Hospital, Bergen, and Department of Clinical Medicine, University of Bergen, Norway

The European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) recommends that ultrasound should be used systematically as an easy accessible and instructive educational tool in the curriculum of modern medical schools. Medical students should acquire theoretical knowledge of the modality and hands-on training should be implemented and adhere to evidence-based principles. In this lecture I will report EFSUMB status and policy on medical student education in ultrasound.

"Education is the most powerful weapon which you can use to change the world"

(Nelson Mandela)

Technological refinements have made the scanners accessible and affordable up to hand-held devices. Furthermore, hand-held ultrasound has the potential to extend the physical examination, thus confirming the doctor's clinical findings. Technological progress has opened new perspectives to ultrasound in various clinical applications. However, its place in the curriculum of medical schools is currently very variable around Europe and has not been universally defined yet.

EFSUMB has released teaching material for students and as a guide for teachers: The EFSUMB Course Book and an EFSUMB Course Book Student Edition is work-in-progress, Furthermore, atlas on echoscopy and teaching videos (anatomy, examination technique) are freely downloaded from the EFSUMB website (www.efsumb.org).

EFSUMB has decided to establish a separate Student Committee in the federation that will promote student education and relevant activities in Europe. EFSUMB has made new bylaws and are recruiting students from different European countries for the board.

References: Cantisani V, Dietrich CF, Badea R, Dudea S, Prosch H, Cerezo E, Nuernberg D, Serra AL, Sidhu PS, Radzina M, Piscaglia F, Bachmann Nielsen M, Ewertsen C, Săftoiu A, Calliada F, Gilja OH. EFSUMB Statement on Medical Student Education in Ultrasound [long version]. Ultrasound Int Open. 2016 Mar;2(1):E2-7. http://dx.doi.org/10.1055/s-0035-1569413. PubMed PMID: 27689163; PubMed Central PMCID: PMC5023223

T6-16-IN07

Role of FLAUS, Federation of Latin American Ultrasound Societies

Leandro Fernandez, MD

The Federation of Latin American Ultrasound Societies, FLAUS, is committed to the Continuing Medical Education of the sonographist, since its foundation in 1983. In addition to national congresses and educational events, we have standardized itinerant courses that are taught by FLAUS teachers, in Countries with the greatest need for education.

FLAUS maintains two Education Centers -COE, sponsored and academically related to WFUMB, in Paraguay and Venezuela. In these centers, courses and ultrasound training are conducted continuously, aimed at physicians with basic, intermediate and advanced knowledge. The COE - Venezuela works with doctors from the countries of its area of influence as Colombia, Peru and Ecuador. Coming soon, Dominican Republic.

With the development of compact ultrasound equipment and the improvement of Information Technology, ultrasonography has begun to be used as a teaching tool in Medical Schools. There is program at the Federal University of Juiz de Fora, in the state of Minas Gerais, Brazil. Seniors students use portable ultrasound scanners for emergency diagnosis and in remote rural areas. They return the images to a reference nodal center to confirm their diagnostic. The University of Rio de Janeiro, Brazil, has also a program for medical students. At the UNICEN University in Buenos Aires State, students are using ultrasound in the class of anatomy and Emergency Room. The University of Rosario is teaching diagnostic ultrasound, both in Argentina.

FLAUS will motivate the Affiliated Societies and Universities, to implement similar projects.

T6-16-IN08

Mediterranean and African Society of Ultrasound-Status in Their Region

Sudhir Vinayak, Prof
President, MASU, Chair, Radiology Department, Aga Khan University Hospital, Nairobi, Kenya

MASU is a Society, which has been formed to promote the development of US in Africa. It organizes international congresses and courses and has setup a fellowship program in diagnostic and interventional US. The challenges in Africa are immense; both in terms of diversity and extent. Other than a handful of relatively developed radiology services, most are struggling with the ability to train Radiologists and Physicians. Introduction of simple ultrasound skills would go a long way in ensuring that doctors can perform easy ultrasound examinations learnt during their undergraduate years and reduce the burden on Radiologists and Physicians. Introducing ultrasound at an undergraduate level will have multiple advantages ranging from a practical teaching tool, especially for anatomy, to attaining skills to perform ultrasound independently after graduation. At present, there are only a handful of universities that have adopted or intend to adopt this training skill; however, others will follow, albeit at a slow pace. Most universities in Africa offer a 5 year course in medicine. During the first two years, ultrasound can be used as an adjunct to learning anatomy in a 'real-time' environment. This can be followed up in the clinical years with point of care ultrasound examinations (POCUS). Summative assessments during clinical years must test the skills attained and this is best done by DOPS (Direct Observation of Procedural Skills). This will ensure that recently qualified doctors can practice their basic skills accurately and independently.

This also creates an interest in learning ultrasonography at a post graduate level. In many African countries, ultrasound is firmly within the domain of Radiology, however, an early exposure to this modality will create an interest in all clinical areas, thereby opening the use of ultrasound to all specialties.

The introduction of ultrasound in Africa at a medical undergraduate level is still in its infancy and there is no data available regarding its impact. Anecdotal evidence is positive and this is backed by publications from developed countries.

T6-16-IN09

Ultrasound Simulation Training in Pre- and Postgraduate Education

Michael Bachmann Nielsen
Department of Radiology, Rigshospitalet, University of Copenhagen, Denmark

The value of an ultrasound examination depends on the skill of the examiner. Mastery learning ensures that trainees all achieve the same competence level but not necessarily at the same pace. Some have seen ultrasound simulation training as a solution but a review of the literature showed the previous studies were heterogeneous in the choice of simulator, study design, participants, and outcome measures, and the level of evidence for effect was inadequate. Only recently have a standardized test of competency in abdominal ultrasound with solid validity evidence been suggested. The presentation will look at this test which is based on the EFSUMB recommendations for abdominal US and offers a pass/fail standard to facilitate mastery learning. Simulation training could be used at different levels in the specialist training, most likely the greatest benefit would be training to pass the test even before the first patient is examined. Simulation training could be used at basic levels in medical students including hand eye coordination if included in the medical curriculum.

T6-16-IN10

Learning & Teaching with Ultrasound in Germany–the MHB-US-Curriculum

Dieter Nuernberg
Professor for Gastroenterology, Medical School Brandenburg Theodor Fontane, Neuruppin, Germany

Nearly all 36 faculties of medicine in Germany offer medical students during their study ultrasound education in the form of lectures, seminars, exercises, courses, simulator training or e-learning. Only one third of the faculties offer a special US curriculum. Often ultrasound lectures are integrated in the clinical subjects. Usually they add up to 20 to maximal 50 hours. In 2016 sonography was included in the German National Students

Education Program, but only for advanced semesters. In the meantime10 universities have integrated sonography into their skills labs. Here the training is done by lecturers, but also by student tutors (peer teaching). – During the past years the DEGUM (German US Society) has pushed for a stronger impact of sonography on the study curriculum. For that purpose the working group Students US Education presented and published an own curriculum proposal.

The Medical School Brandenburg (MHB) is the youngest faculty of medicine in Germany (founded in 2014). Basis of teaching is a praxis oriented and module referring curriculum. A special MHB-US-Curriculum includes the US as teaching method already during the 1st academic year (anatomy, physiology). During all phases of the study sono-exercises are offered. A 2-stage course systems of several days duration, during the 2nd and 7th semester, is setting the frame. An US-Skills-Lap, equipped with several hands on places, provide the facility for supervised hands on training and self-study. A 2 week training periods in the 6th academic year completes the US education, comprising 260 to 280 hours. Examinations (OSCE test) accompany the stages of the US training. – The MHB-US-Curriculum should enable http://de.pons.com/%C3%BCbersetzung/englisch-deutsch/to young doctors to use sonography immediately at the beginning of their professional activity as clinical examination method in emergency medicine and also during the following specialisation.

T6-16-IN11

Training Midwives to Perform Basic Obstetric PoCUS in Rural Areas Using a Tablet Platform and Mobile Phone Transmission Technology

Sudhir Vinayak, Prof
Chair, Radiology Department, Aga Khan University Hospital, Nairobi, Kenya

Point of care ultrasound (POCUS) has become a very topical subject and can be applied in a variety of ways with differing outcomes. Cost of all diagnostic procedures including obstetric ultrasound exams is a major factor in the developing world and POCUS is only useful if it can be equated to good outcomes and at a lower cost than a routine obstetric exam.

The aim of this study was to train midwives to perform scans in a rural setting and identify high risk pregnancies who were then referred to specialist centers in established institutions for further management. We produced a curriculum for midwives who had no previous experience in ultrasound; they were given didactic lectures as well as hands on training in obstetric ultrasound. A comprehensive exit examination ensured that they were well trained to independently perform scans on their own.

The midwives were stationed in rural locations where POCUS was available for the first time. After scanning the patients, an interim report was generated by them and sent with all images to the main hospital for validation. Unique software was used to send lossless images by mobile phone using a modem. Transmission times were short and image quality transmission was excellent.

All reports were validated by two experienced Radiologists in our department and returned back to the centers. Transmission times, quality of scans, quality of reports and other parameters were recorded and monitored. Analysis showed excellent correlation between provisional and validated reports. Reporting accuracy of scans performed by the midwives was 99.63%. Overall flow turnaround time (from patient presentation to validated report) was initially 35 minutes but reduced to 25 minutes.

The unique mobile phone transmission was faultless and there was no degradation of image quality. There was also excellent correlation between final outcomes of the pregnancies and diagnosis based on reports generated by the midwives. Only one discrepancy was found in the midwives reports. Scan results versus actual outcomes revealed 2 discrepancies in the 20 patients labeled as high risk.

In conclusion, training midwives in POCUS to use an ultrasound tablet device and transmit their images and reports via internet for review of accuracy by a radiologist; focusing identification of high risk patients can be valuable in a remote health facility.

T6-16-IN12

Ultrasound training in Developing Countries, Needs, What is Done? What We Have to Do? The Past, the Present, the Future

Wiem Douira Khomsi, Giovanna Ferraioli, Franca Melloni, Azza Hammou, Ibtissem Bellagha, Sudhir Vinayak, Kofo Soyebi
Presented by Hassen A Gharbi World Health Organization

The past and the needs: The 2/3 of the world population didn't have any access to any medical imaging modality. Training in US is very variable around the world developed and under developed areas. No specific training is available every where

The developing countries definition includes also a great mosaic of countries.

US is a medical imaging modality that needs theoretical education, clinical and practical programs and facilities. Diplomas must be delivered by local National Institutions.

The dreams: Our main objective is to train people to be able to guarantee appropriate use of US and to avoid miss use.

We must adapt and utilize the fantastic treasure represented by the available programs already available on the web, very often free of charge. Solutions are not so easy: National authorities have to play an important role.

Future: Help people to have access 24 hours a day and 7 days by week to the US facilities.

We need for that a deep and continue collaboration between all the NGO's, WHO… working in the field. WFUMB, is playing a fantastic effort since more than 25 years, may play the pilot role in this field.

Free Paper

OPT6-001

The Application of Objective Structured Clinical Examination (OSCE) in Radiological Technology - Assessment of the Performance in Abdominal Ultrasonography

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Objectives: Objective structured clinical examination (OSCE) teaching curriculum is the mainstream method for evaluating medical practice objectively in medical schools and teaching hospitals. The goals of this study were to assess the feasibility of OSCE in diagnostic ultrasonography (US).

Methods: From July 2008 to June 2010, 64 radiological technology students assigned to the department of radiology of Taichung Veterans General Hospital, Taiwan, for internship were enrolled. The diagnostic US teaching curriculum for all students was totally 3 weeks. In 14 students (group A), only summative OSCE were performed. Formative and summative OSCE for 50 students (group B) were carried out in the first and last week of the courses respectively. Wilcoxon signed-rank test was used to assess the difference between formative and summative OSCE in group B students, and the difference of summative OSCE between group A and group B.

Results: In group B students, the summative OSCE scores were upgrading in most students, 84.8%, 87.4%, 89.8%, and 94.7% were in part I, part II, part III, and part IV, respectively. The difference of mean scores between formative and summative OSCE for four examination parts were statistically significant ($p < 0.0001$). The

mean summative OSCE scores of group A versus group B were 3.01 vs. 3.61 (part I), 3.10 vs. 3.88 (part II), 2.77 vs. 3.57 (part III), and 2.88 vs. 4.07 (part IV.). Significant differences were found at p value less than 0.005.

Conclusions: The OSCE is applicable in diagnostic US. The formative OSCE not only shows to students what to learn but also provides information for tutors how to teach.

OPT6-002

Increasing Medical Student's Skills by Liver Ultrasound Simulation

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Objectives: Due to increased number of medical students and limited hours of practical preparation in internal medicine we designed a teaching model using the ultrasound simulator. The Tirgu Mures University of Medicine and Pharmacy Simulation Center offers the perfect conditions for theoretical and practical lessons in the fifth grade students.

Methods: We used a CAE Vimedix Ultrasound simulator designed to make learning more engaging and intuitive. A number of 56 medical students were trained by 6 hours of theoretical lectures and 6 hours of practical skills on simulator, in a period of one semester. They have been taught to obtain standard US images on the liver by transverse section in epigastrium and longitudinal section in the right hypochondrium on the mid-clavicular line. All participants answered a MCT at the beginning and end of the preparation period.

Results: At the beginning of the learning period, from the total of 56 students, 33 (58.9%) were able to recognize liver lobes, 28.8% responded correctly at MCT. After the learning period, practical skills and theoretical knowledges improved: 51 (91%) could recognize and measure the liver lobes and 89% had correct responses at MCT.

Conclusions: Ultrasound simulator is a very useful tool in improving basic ultrasound skills and theoretical knowledge in liver examination. As a general opinion, students were very enthusiastic in learning more about ultrasound examination. A more comprehensive training programme is needed.

OPT6-003

Improvement of Primary Healthcare System Using Wireless Mobile Ultrasound Device: Example of Koica-Cts Program in Vietnam

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Objectives: Resource-limited countries shows low health-care index such as maternal mortility ratio, infant or neonatal death rate. One of KOICA-CTS program, is focusing to improvement of primary health outcomes using wireless mobile ultrasound device in Vietnam. It is necessary to understand basic concept and physics of wireless mobile ultrasound system and importance of PoC sonographic examination in acute care medicine.

Methods: This was review of an example of KOICA-CTS(Korea International Cooperation Agency - Creative Technology Solution) program - a kind of korean official development assistance in Vietnam. This project was practiced for 12 months at middle province of Vietnam, Huang Hoa district, Quang Tri province from February 2016 to January 2017.10 local health centers and more than 500 public health officers(obstetrician, sonographer or volunteer health worker) were participated in the education program of wireless mobile US system. The education program includes difference of previous portable ultrasound system and wireless mobile US system, importance of PoC(Point-of-Care) sonographic examination and detailed instructions of mobile US device. 2 weeks intensive obstetric US training programs provided to users for usage and diagnosis. That program gave them an understanding for automated setting ultrasonography and measurement with reference image guidance. It was a case-control study. The efficiency and effectiveness of ANC(ante natal care) were compared between districts with mobile ultrasonography and those without it.

Results: Education programs(4 times) without strong motivation was not so efficient. The number of cases has begun to increase when we decided to pay for the each US images. Large number of cases were collected and it was useful to improve primary healthcare outcomes. Especially the result was clear in the field of prenatal care.

Conclusions: In this program, we have demonstrated usefulness of wireless mobile US device as a strong tool of PoC US and it is also useful to improve primary health outcomes. We found good example of KOICA CTS program related with improvement of primary health care for resource-limited countries.

OPT6-004

Work-Related Repetitive Use Injuries in Ultrasound Fellows

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Objectives: Extensive studies have reviewed work-related musculoskeletal (MSK) disorders among diagnostic medical sonographers due to repetitive transducer manipulations, prolonged scanning time, and awkward positioning. To date, no study has investigated the prevalence of work-related MSK complaints among EMUS Fellows.

Methods: We conducted a survey study. All fellows enrolled in a United States EMUS Fellowship program who are $>$ 18 years old were included. Fellows with pre-existing MSK complaints were excluded. A list of EMUS Fellowship programs was obtained from eusfellowships.com. An anonymous survey was created, pilot tested, and sent to the fellows of 97 programs.

Results: Sixty-seven out of 130 fellows responded, achieving a 51% response rate. Forty-five (67%) experienced one of more MSK complaints. The most common complaint was low back pain. Fifty fellows (75%) completed $<$6 scanning shifts a month; 65 (97%) reported their shifts lasted $<$ 8 hours. Fellows with $>$ 6 scanning shifts per month were significantly more likely to report a work-related MSK complaint (83% versus 42%; $p=0.0024$, Fisher's exact test). The same was true with fellows performing $>$ 20 studies per scanning shift (90% versus 53%, $p=0.0385$).

Conclusions: EMUS fellows who perform more studies per shift or more scanning shifts per month are at a significantly higher risk for work-related MSK problems. EMUS Fellowship programs need to better educate their fellows on Ultrasound ergonomics. Future studies should focus on how to best reduce these injuries during fellowship training and for later clinical practice. Possible limitations include recall bias, selection bias, and non-response bias.

OPT6-005

Can a Sonographer Successfully Teach in Outreach Program?

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Objectives: Outreach programs are a fundamental tool in providing ultrasound education to low resources environments. Yet these are typically organized and executed by physicians. This study assessed whether a sonographer can successfully teach scanning skills.

Methods: We used a week-long course in Yangon, Myanmar, co-organized by TheFetus.net and ISUOG to test whether a non-USA sonographer could give lectures and teach scanning skills to 45 Ob-Gyn (this represented 7% of the Ob-Gyn in Myanmar). The sonographer came from Taiwan and has 6 years of scanning experience. She had no previous teaching experience to physicians. The same set of instructions were given to the entire faculty team (4 physicians and 1 sonographer). All 5 faculties scanned in a large room partitioned in 5 areas, with each faculty overseeing an even number of students. Student satisfaction was measured by questionnaires and by monitoring by the hosting faculty from the institution. The course director could monitor all 5 rooms easily, and faculties could ask assistance to every other faculties thanks to the physical organization.

Results: There was no difference in satisfaction from the various faculty: the mix of personal skills was complementary. The sonographer initial shyness was rapidly compensated and her technical skills and equipment knowledge appreciated. The students unanimously requested her presence for follow-up courses.

Conclusions: Outreach courses can not only be taught by physicians, enthusiastic sonographers can also contribute effectively.

Poster Session

PPT6-001

Implementing Methodology for Teaching Initial Radiology for First Year Radiology Residents in on Obstetrical Ultrasound

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Objectives: Introduction of a new teaching methodology in obstetrical ultrasound especially aimed at beginners, to enable initial radiology residents toperform a complete Doppler Ultrasound after one month of internship.

Methods: Obstetrical ultrasound learning occurs in the first and second years of residence in Radiology. First year residents usually have little or no experience in ultrasound before their obstetrical stage. During the first year, the purpose of internship is to perform a complete obstetrical ultrasound exam with dopplerfluxometry. In view of the inexperience of these residents, we created a teaching methodology in 2014; therefore, three full years of use have been completes. The teaching sequence was: Step 1: Only biometry was introduced, following recommended international guidelines: head circumference, bi parietal diameter, occipital frontal diameter; abdominal circumference, femur length, humerus length. Step 2: After a satisfactory performance in biometry resident are introduced to the techniques of checking the spine, diaphragm, four heart chambers and placenta, both for measurement and grading. Step3: After residents perform adequately for steps one and two, the move to step three, which consists in the performance of dopplerfluxometry for determination of heart beating, umbilical artery, median cerebral artery and uterine artery. Step 4: After a satisfactory step three, residents move to estimation of amniotic fluid index, cervix length, nuchal fold, lateral atrium cerebral, pelvis renal diameter and details of fetal face. Percentile 10 : no capacity to perform complete steps one and two Percentile 25: capacity to perform steps one and two but incomplete step three. Percentile 50: Capacity to perform steps one, two and three and part of step four. Percentile 75: Capacity to perform all steps.

Results: In 2014, 19 first year residents were subjected to the method, in 2015 26 first year residents, in 2016 28 residents, with percentile distribution as shown in table 1.Table 1: Relationship between number of students by year correlated with percentiles PercentilesYears 10255075201412 13320153 41722016 2619 2”

Conclusions: The new method proved to be effective as a first approach for teaching initiating residents. As a result, about 80% of new residents could perform a complete obstetrical dopplerfluxometry ultrasound test. After a complete year of residence, we checked the opinion of the students and found that 80% of them declared themselves capable of realizing an obstetrical examination with dopplerfluxometry ultrasound examination. This agreed with our evaluation about their performance.

PPT6-002

Limited Education of Lung Ultrasound Conducted to Medical Students: A Pilot Study

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Objectives: Lung ultrasound (LUS) is a useful tool to identify lung problems. Unfortunately, there are no LUS educational programs for medical students so far. We designed a simple LUS training course for medical students during the ED rotation. The purpose of the study was improving cognitive and psychomotor learning domains, knowledge of ultrasound, knowledge of LUS, image acquisition, and image interpretation after the training.

Methods: Forty medical students in the fourth grade were enrolled in the study. Student achievement was evaluated through examinations of cognitive and psychomotor skills. A survey was conducted following the training.

Results: The average test result before and after the training was 42.1 ± 13.7 and 82.6 ± 10.7, respectively. With respect to the assessment of LUS performance, the acceptable rates for right and left anterior chest wall scanning and right and left posterolateral scanning were 95%, 97.5%, 92.5%, and 100%, respectively. The students felt a highly confident about the ability to administer LUS to patients after training and they agreed that it was necessary to include LUS education in the medical school curriculum.

Conclusions: This study showed that limited LUS education to improve their knowledge, image acquisition and interpretation ability among the medical students without ultrasound experience was successful.

PPT6-003

The 100 Most-Cited Articles Focused on Ultrasound Imaging: A Bibliometric Analysis

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Objectives: The number of citations that an article has received reflects its impact on a particular research area. The aim of this study was to identify the 100 most-cited articles focused on ultrasound (US) imaging and to analyze the characteristics of these articles.

Methods: We determined the 100 most-cited articles on US imaging via the Web of Science database, using the search term. The following parameters were used to analyze the characteristics of the 100 most-cited articles: publication year, journal, journal impact factor, number of citations and annual citations, authors, department, institution, country, type of article, and topic.

Results: The number of citations for the 100 most-cited articles ranged from 1,849 to 341 (median, 442.0) and the number of annual citations ranged from 108.0 to 8.1 (median, 22.1). The majority of articles were published in 1990–1999 (39%), published in radiology journals (20%), originated in the United States (45%), were clinical observation study (67%), and dealt with vascular (35%). Department of Internal Medicine at University of California and Research Institute of Public Health at University of Kuopio (n = 4 each) were the leading institutions and Salonen JT and Salonen R (n = 4 each) were the most prolific author.

Conclusions: Our study presents a detailed list and analysis of the 100 most-cited US articles, which provides a unique insight into the historical development in this field.

T7. Elastography

Symposium

T7-16-IN01

Elastography Basic Principles

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Elastography displays the biomechanical properties of the tissue whereas B-mode ultrasound displays the acoustic properties. These properties are not related to each other. Elastography can be considered a virtual palpation: under a stress, stiffer tissues show less longitudinal displacement and higher speed of transverse displacement. Elastography techniques are based or on the assessment of the longitudinal displacement of the tissue induced by a stress, as in strain elastography and acoustic radiation force impulse (ARFI) imaging, or on the assessment of the speed of the transverse displacement of the tissue as in shear wave elastography. In strain elastography a part of the body is compressed axially by pressing across its surface and the internal tissue displacement is converted to a strain image (percentage of deformation), because the percentage of deformation will be constant whereas displacement decays with depth. In the ARFI imaging, the acoustic radiation force generates a localized displacement of a few microns in the ultrasound axial direction. ARFI generates also shear wave displacement at one point (point shear wave elastography) or along several lines (2D-shear wave elastography). Shear waves can be generated by an external mechanical push as well, as in vibration controlled transient elastography (VCTE), magnetic resonance elastography (MRE) or vibro-elastography.

T7-16-IN02

High Resolution Elastography for Eye

Chih-Chung Huang
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Estimating the corneal elasticity can provide valuable information for corneal pathologies and treatments. Ophthalmologic pathologies such as keratoconus and the phototoxic effects of ultraviolet radiation on the cornea caused the corneal elasticity change. Not only the corneal pathologies but also the efficacy evaluation of corneal treatment, such as evaluating the recovery of corneal refractive surgery and the efficacy of corneal collagen crosslinking treatment are related to corneal elasticity. This makes quantitative estimation of the elasticity of the human cornea important for ophthalmic diagnoses. The present study investigated the use of a proposed high-resolution shear-wave imaging (HR-SWI) method based on a dual-element transducer (comprising an 8-MHz element for pushing and a 32-MHz element for imaging) for measuring the elasticity of the human cornea. The distance between these elements was 1.5 mm. Due to the image lateral resolution being limited by the distance between the pushing and imaging beams, a spatial algorithm named the Pseudo-Sudoku Algorithm (PSA) was used to improve the lateral resolution. The gelatin-phantom results showed the ability of the PSA to distinguish the elasticity distribution of a small two-side phantom (2.2 mm $\times$ 3.5 mm). The image resolutions of HR-SWI in the axial and lateral directions were 301 and 129 μm, respectively. The elasticity values of corneas from six human donors were also measured by HR-SWI, with all of the *ex vivo* results demonstrating the potential of HR-SWI in clinically measuring the elasticity of the human cornea.

T7-16-IN03

Ultrasound Shear Wave Elastography: Principles and New Technologies

Shigao Chen
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Tissue stiffness measured by ultrasound shear wave elastography is useful for many clinical applications such as liver fibrosis staging and cancer imaging. This presentation gives an overview of various technical components of shear wave elastography, including the relationship between shear wave speed and tissue mechanical properties, generation of shear wave by ultrasound radiation force and mechanical vibration, detection of shear wave by ultrasound scanner, and methods for calculation of shear wave speed. Commercial shear wave technologies covered in this talk include SuperSonic Imagine, Fibroscan, and Comb-push Shearwave Ultrasound Elastography (CUSE). Examples of new technologies under development will also be given. Confounding factors for shear wave elastography will be discussed.

T7-16-IN04

Evaluation of Shear Wave Dispersion Caused by Liver Fibrous Structure Using Hepatic Fibrosis Progression Model

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In chronic hepatitis diagnosis, shear wave elastography is utilized for evaluating fibrosis progression. Not only the elasticity but also the viscosity of liver tissue is considered to be useful information for its diagnosis. Therefore, in recent years, a method of evaluating tissue viscosity using shear wave dispersion has been used clinically. However, the shear wave dispersion also occurs due to tissue viscosity, but also due to the microstructure of tissue. Therefore, we quantitatively evaluated the shear wave dispersion caused by the liver fibrous structure using a hepatic fibrosis progress model. At that time, in order to evaluate only the shear wave dispersion caused by the liver fibrous structure, the viscosity in the model was set to zero. As a results, the shear wave dispersion (shear wave dispersion slope) were 0.02 ± 0.003, 0.32 ± 0.20, 0.62 ± 0.25, 1.25 ± 0.89, and 0.73 ± 1.53 m/s/kHz for stage F0, F1, F2, F3, and F4. The dispersion slope tended to increase with progress of the hepatic fibrosis stage. However, in stage F4, the result was greatly affected by the location of the ROI, so the variance increased. The shear wave dispersion caused by the liver fibrous structure was about 10-20 % of that in in vivo measurement. Therefore, we confirmed that the shear wave dispersion is influenced by the liver fibrous structure together with the liver viscosity.

T7-16-IN05

Analysis of Acoustic Properties of Liver Organelles Including NASH

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Accurate diagnosis of non-alcoholic steatohepatitis (NASH) is a critical issue in current clinical practice. Non-invasive diagnosis of NASH can be achieved by quantitative ultrasound (QUS), which requires a detailed understanding tissue-specific acoustic microstructure at cellular scale (i,e., 10 μm). Therefore, QUS methods would benefit from the knowledge of the acoustic properties of organelles in NASH livers because they may represent the dominant scattering source at conventional frequencies used for in vivo assessments (i.e., $<$ 15 MHz). This study focuses on obtaining speed of sound (c) of organelles (i.e., nucleus, cytoplasm, and fibers) using above-mentioned 250-MHz

ultrasound in normal, steatosis, fibrosis, and NASH rat livers. In addition, regarding the same liver, the relationship between the sound wave velocity measured by the ARFI method and the viscoelasticity of the liver measured by the rheometer was compared with inflammation of the liver, fat deposition and fibrosis by using the Zener model.

T7-16-IN06

Three Dimensional Elastography of Breast Tumors

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Elastography is widely used for evaluating breast or liver elasticity. It is useful for diagnosing benign or malignant. Two dimentional strain elastography is popular as it is easily adopt routine breast US examinations. Authors evaluated the usefulness of three dimentional real-time tissue elastography (3D-RTE) for diagnosing breast tumors.

The equipment used was Ascendus with EUP-LV74 probe (Hitachi Healthcare). The 3D-RTE images were divided into three types according to the occupancy of blue contrast images. Elastic scores (ES) were obtained by two dimentional real-time tissue elastography (2D-RTE) examination. The diagnostic accuracy of 3D and 2D-RTE images in differentiating malignant from benign breast tumors was evaluated.

The utility of 3D-RTE images was comparable to that of ES on 2D-RTE examination in differentiating malignant from benign breast tumors. In addition, utilizing 3D-RTE images in cases with an ES of 3 on 2D-RTE may increase the diagnostic accuracy of breast tumors.

T7-16-IN07

Computer-Aided Diagnosis for Breast Elastography

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Ultrasound elastography is a newly developed technique of imaging the tissue elasticity and it has been used clinically to examine a variety of breast lesions in patients. In general, the breast cancer tissue is harder than the adjacent normal breast tissue. Recently, we have developed a computer-aided diagnosis (CADx) system for 2D/3D stain and shearwave elastography. Several elastographic features and B-mode features are used in the proposed elastography CADx system. Several companies such as Aloka, U-systems, and Siemens have developed the new automated whole breast ultrasound (ABUS) machines to automatically scan the whole breast and save the US images into an image file. There are several hundreds or even thousands of image slices in an ABUS case. Hence, a computer-aided detection (CADe) system is proposed for the ABUS systems to find suspicious frames and locate the approximate positions of tumors in the ABUS images. An ABUS Viewer system developed in our MOEA Technology Development Program for Academia project has been transferred to TaiHao Medical Inc., Taiwan (http://taihaomed.com/) and the TaiHao's BR-ABVS Viewer has obtained the FDA clearance in 2016.

T7-16-IN08(1)

Comprehensive Ultrasound Diagnosis for Breast Lesions – with High Resolution B Mode/Strain Elastography/ High Sensitive Vascular Evaluation

Dr. Kazutaka Nakashima
Kawasaki Medical School

We have reported and presented the utilities of the comprehensive ultrasound, for the diagnosis and decision to treatment of breast lesions. The basic theory of the comprehensive ultrasound is the way to pull out the highest performance of high resolution B mode and strain elastography and Doppler vascular evaluation to estimate breast lesions and its pathological features. In the ultrasound scanning, one of most important problem of ultrasound examination is that ultrasound performance changes by the examiners skill simply. In breast area, the degree of the performance changing is wider, because of its high frequency bands. We found the scanning techniques to get highest performance is almost same skill.

To use these techniques, we get good information not only from the morphology but also the rigidity and the vascularity together. Then we can estimate the pathological diagnosis with high specificity.

In this presentation, we will show the some lesions with comprehensive ultrasound images. Those are difficult to diagnose with only B mode images, but the comprehensive ultrasound makes its diagnosis more confirmable.

T7-16-IN08(2)

Elasticity Imaging of the Breast: Techniques and Pitfalls

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Assessment of tissue elasticity using medical ultrasound (US) is one of the most recent development of US technologies. There are various methods to obtain elastography of the breast. Several interpretation methods and their relationships based on a BI-RADS classification system have been proposed. The most commonly used interpretation methods include EI/ B (Ratio of the lesion size on elastography to the B-mode size), width ratio, strain ratio, lesion fat ratio (LFR, ratio of target mass stiffness to that of subcutaneous fat). These are semi-quantitative value derived from strain elastography (SE). The Tsukuba score, a kind of strain pattern, using a fine-point scale has been used for differentiating between benign and malignant masses with satisfactory accuracy. Shear wave velocity or shear wave speed (SWS) in units of m/s and stiffness or elasticity in units of kPa are quantitative values in shear wave elastography (SWE) systems. Procedures during elastography should be carefully done to avoid some pitfalls in image producing and interpretation. First of all, obtaining an optimal B-mode image and a good elastography image (EI) is essential. A nonperpendicular angle of the probe to the chest wall/ skin, unstable vibration, improper or uneven compression, and motion of patient will cause suboptimal EI. A proper interpretation is based on a good EI, and multiple interpretation methods can be applied to a lesion to obtain a proper diagnosis. Difficulty may be encountered when measuring a fibrous tumor arising in dense breast tissue on the elastogram, and false positive result may be created. Some of the problems can be avoided by comparing the stiffness of the lesion to the surrounding tissue and LFR may help eliminate this problem. A cystic lesion may show tri-laminar appearance (blue, green, and red), but if not all three colors are present, comparison with B-mode image is helpful. Elastography systems and the applications themselves continue to evolve; new tools and new evidence will likely emerge. We anticipate that the direction of development, imaging methods, and diagnostic approaches will change in the future.

T7-16-IN09

Elastography for Intravascular Ultrasound

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The ability to measure the elastic properties of plaques and vessels would be useful in clinical diagnoses, particularly for detecting a vulnerable plaque. This study demonstrates the feasibility of intravascular

ultrasound (IVUS) elasticity imaging—combining acoustic radiation force impulse (ARFI) imaging and shear-wave elasticity imaging (SWEI)—for detecting the distribution of stiffness within atherosclerotic arteries in vitro. A dual-frequency IVUS transducer with two elements was used to induce the propagation of a shear wave (by the 8.5-MHz pushing element), which could be simultaneously monitored by the 31-MHz imaging element. The ARFI and SWEI images were reconstructed by measuring the quantified values of peak displacements and the wave velocity of shear wave propagation, respectively. System performance was verified using gelatin phantoms. The phantom results demonstrate that the small stiffness changes with difference of shear modulus of 1.6 kPa can be detected in both ARFI and SWEI images. Moreover, stiffness distributions of atherosclerotic aortas from rabbits were obtained, for which the peak displacement and the shear-wave velocity were 2.6∼4.3 μm and 0.26∼0.32 m/s, respectively, in lipid-rich plaques, and 0.8∼1.2 μm and 3.28∼3.45 m/s in the arterial walls. These results indicate that IVUS elasticity imaging can be used to distinguish the elastic properties of plaques and vessels.

T7-16-IN10

Elastography of the GI Tract

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Elastography is a relative new technique that depicts the stiffness of tissue and is already used in clinical practice for several indications. Guidelines and recommendations of the different techniques and clinical applications was published by EFSUMB. Elastography and strain imaging has also been suggested as a tool for assessing diseases of the gastrointestinal tract.

The bowel wall is a thin structure, which does not make it the ideal organ to be studied with elastography. However, pathology of the GI tract such as inflammation or tumour causes bowel wall thickening and often reduces motility and luminal contents in the affected area which may facilitate strain imaging. There is evidence for the use of elastography in endorectal ultrasonography, but the evidence for transabdominal elastography of the bowel is sparse. However, some recent studies suggest that it can be used to differentiate between fibrotic and inflammatory stenosis in Crohn's disease. In patients with a stricture of the bowel and resultant bowel obstruction, it is important to determine if there is active inflammation at the site of stricture or if the obstructed segment is fibrotic. Using elastography, the active inflammatory components will be softer whereas the fibrotic stricture will appear stiffer. Accordingly, one may apply elastography to evaluate stiffness of the stenotic area, thus providing more clues to the fibrous content of the stricture.

In conclusion, elastography may become a relevant clinical tool, but we need more studies to determine its usefulness in the management of patients with GI diseases.

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T7-16-IN11

US-Elastography in Breast and Thyroid: How, When, Why?

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By assessing hardness as indicator of malignancy, elastography has recently become an additional tool for thyroid and breast nodules differentiation and nowadays also in evaluation of diffuse thyroid diseases, in combination with baseline ultrasound and FNAC. The different techniques of elastography applied to the thyroid and breast based their analysis on two different types of compression force. Free hand compression force includes the strain elastography (SE), with its qualitative and semi quantitative variants and the q-static analysis that uses the pulsation of the carotid artery (ECI index). The quantitative approach with compression induced by an acoustic pulse of the probe includes shear wave elastography (SWE) and Acoustic Radiation Force Impulse. Main features, diagnostic accuracy and main recognized limitations of different elastographic techniques, suggesting how we can improve their diagnostic performance according the most updated Guidelines will be presented.

T7-16-IN12

Testicular Elastography

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Palpation to estimate the consistency or hardness of a lesion is a diagnostic method practiced in Egypt in 2600 BC and Elastography offers a "Virtual Palpation". This technique provides a visual representation of the tactile information conventionally obtained by physical palpation of the tissue. aFor the better understanding Is necessary to define some terms; Elasticity: ability of an object to deform or bend under pressure. Stiffness: rigidity, inability to deform under pressure. Strain: amount of deformation of the tissue and It is calculated as the change in distance between two points divided by the initial distance. Compression Source: is the way that the tissue is compressed.

We know that malignant tumors are hard and by the depiction of this characteristic with the use of Elastography, the clinician can be alert about the high probability of carcinoma of testis, the patient could have. Goddi published a Sensitivity 87.5%, Specificity 98.2%, Predictive + 93.3%, Predictive - 96.4%, Accuracy 95.8% for differentiating benign from malignant lesions. The testis can be evaluated by using qualitative and quantitative elastography, which will depend on the type of technique available at the ultrasound department. Elastography is a promising method for the evaluation of testicular masses and in a short time, it will be used routinely on clinical practice.

T7-16-IN13

Spatial-Dependent Mechanical Properties of the Heel Pad by Shear Wave Elastography

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The heel pad plays an importante role in gait, and its biomechanical behavior and functionality are determined by its specialized architecture and mechanical properties. The purpose of this study was to apply supersonic shear wave elastography, an ultrasound-based noninvasive modality that can quantitatively estimate the shear stiffness of the tissue, to investigate the spatial-dependent mechanical properties of the heel pad. Measurements were conducted in 40 heel pads of 20 normal

participants aged between 20 and 30 years by shear wave elastography. The continuous change in local shear stiffness of the heel pad along the depth direction of the heel pad was measured. The result showed that the mechanical properties of heel pad were highly heterogeneous but followed a simple and specific pattern that local heel pad shear stiffness was highest beneath the plantar skin and decreased continuously with increasing depth. This finding provides a better understanding of the heel pad biomechanics and basis for further investigation of the heterogeneous properties of the heel pad.

Free Paper

OPT7-001

Us Elastography Using Carotid Artery Pulsation May Increase the Diagnostic Accuracy for Thyroid Nodules with Us - Pathology Discordance

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Objectives: To prospectively evaluate the diagnostic performance of ultrasound elastography (USE) using carotid arterial pulsation and to determine interobserver and intraobserver agreements of USE for thyroid nodules.
Methods: US examination and USE using carotid artery pulsation were performed in 148 patients with 173 nodules in a prospective design. The US features and elasticity contrast index (ECI) were assessed by observer 1 and the ECI was reassessed by observer 2. ROC curve analysis was performed to evaluate the diagnostic performance and to compare the AUC (Az) values of gray-scale US, ECI, and a combined assessment. Intraclass correlation coefficient (ICC) value was used to evaluate the interobserver and intraobserver agreements in the measured ECI values.
Results: Among a total of 173 nodules, 95 nodules were malignant and 78 nodules were benign. The mean ECI was significantly higher in malignant nodules (3.1 $\pm$ 1.5) than in benign nodules (1.7 $\pm$ 0.8) ($p < 0.001$). The Az values of each dataset were 0.768 (95% CI, 0.698–0.828) for gray-scale US, 0.695 (0.621–0.763) for ECI, and 0.782 (0.713–0.841) for a combined assessment. ICC for interobserver agreement was 0.96 ($p < 0.001$), and for intraobserver agreement were 0.97 ($p < 0.001$) and 0.98 ($p < 0.001$) for observer 1 and 2, respectively. Excellent interobserver and intraobserver agreement was found in thyroid USE.
Conclusions: USE using carotid artery pulsation may have a potential role to increase the diagnostic accuracy for nodules with US-pathology discordance with reproducible results.

OPT7-002

Breast Cancer Imaging by Color Doppler Shear Wave Elastography

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Objectives: In shear wave elastography, complicated shear wave wave-front caused by the reflection, refraction, and diffraction at the tissue boundary degrades the accuracy of velocity measurement. If the shear wave wave-front is visualized in real-time, the accuracy increases because the velocity is estimated along the shear wave propagation direction. Moreover, observed wave-front pattern provides valuable information about tissue structure, which makes the detection of the stiff part easier.
Methods: We have proposed a novel shear wave elastography (Color Doppler Shear Wave Imaging: CD SWI) [Y.Yamakoshi, et al. IEEE tans on UFFC. 64, 340 (2017)]. Continuous shear wave of a frequency that is n/4 (n being an odd number) times the PRF is introduced from the tissue surface. Then, the shear wave wave-front appears simultaneously as a stripe pattern on conventional ultrasound color Doppler image. This cost-effective shear wave elastography is implemented on ACUSON S3000 (Siemens). The shear wave frequency is 235.3Hz.
Results: Shear wave velocity measured by CD SWI was compared with that by ARFI for breast phantom. Shear wave velocities by two methods showed good correlation, but the standard deviation of CD SWI was 42% of that of ARFI. Malignant lesions were imaged by CD SWI as an area with high shear wave velocity. Inherent shear wave propagation around a malignant lesion was also observed.
Conclusions: It is suggested that a combination of shear wave image of CD SWI and B-mode image improves the sensitivity in detection of malignant lesions in breast tissue.

OPT7-003

A Large Scale Validation of Two-Dimensional Shear Wave Elastography in the Diagnosis of Liver Fibrosis Progression in Patients with Chronic Hepatitis B

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Objectives: Two-dimensional shear wave elastography (2D-SWE) is a noninvasive approach for staging chronic liver diseases. Our previous published study had established the cut-off value of 2D-SWE in the diagnosis of significant fibrosis (7.2 kPa), severe fibrosis (9.2 kPa), and cirrhosis (10.4 kPa) based on 304 patients with chronic hepatitis B (CHB). The aim of this study is to validate the value of 2D-SWE in assessing liver fibrosis progression and to compare its diagnostic accuracy with serological fibrosis indices involving aminotransferase/platelet ratio index (APRI), fibrosis index based on the 4 factors (FIB-4), King's score and Forns index.
Methods: From July 2015 to January 2017, 639 subjects who underwent partial hepatectomy were enrolled in the study and they were divided into S0–S4 groups by using resected liver specimen. There were 535 males and 104 females with an average age 54.1$\pm$10.7 yrs (19-82 yrs). All patients were examined with 2D-SWE (Aixplorer ultrasound system) and serological testing preoperatively to obtain liver stiffness measurements (LSMs) and values of serum fibrosis models. Performance of noninvasive methods was analyzed for validation with areas under the receiver operating characteristic curve (AUCs).
Results: Intraobserver agreement of intraclass correlation coefficient was 0.943 for the five measurements of liver stiffness. Mean values of LSMs were 5.52$\pm$1.15 kPa (n=33), 6.51$\pm$1.09 kPa (n=74), 7.95$\pm$0.81 kPa (n=107), 9.41$\pm$1.32 kPa (n=135), and 14.55$\pm$3.50 kPa (n=290) for the fibrosis S0, S1, S2, S3, and S4 groups, respectively. When the optimal cutoff values of 2D-SWE were applied for S2-4 fibrosis stages, AUCs in predicting significant fibrosis, severe fibrosis and cirrhosis were 0.970, 0.971 and 0.979, respectively. All noninvasive approaches were statistically significantly related to hepatic fibrosis stage ($P<0.05$). When compared with four serological fibrosis indices, 2D-SWE showed significantly higher AUCs than four serum fibrosis indices in predicting significant fibrosis, severe fibrosis and cirrhosis ($P < 0.05$ for all).
Conclusions: The large scale validation shows that 2D-SWE is an effective approach in predicting significant fibrosis, severe fibrosis, and cirrhosis in CHB patients with notably higher diagnostic accuracy than serum fibrosis models.

OPT7-004

Liver Stiffness Measurements with Supersonic Shearwave Elastography in the Preoperative Evaluation of the Liver Fibrosis for Infants with Biliary Atresia

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Objectives: To investigate the value of Supersonic shear-wave elastography (SSWE) in the assessment of hepatic fibrosis in patients with biliary atresia (BA) and to analyze factors that might influence the SSWE value.

Methods: The ethics committee approved this study, and informed parental consent was obtained. From January 2012 to January 2016, sixty-seven infants with BA who preoperatively had SSWE measurements and consequently underwent Kasai portoenterostomy were ruled in. All patients were also underwent preoperative serologic testing. Interoperative liver specimens were reviewed in a blinded manner by two pathologists using METAVIR criteria. SSWE measurements were correlated with pathological results, age and serologic testing results.Performance of SSWE in differentiating liver fibrosis was determined by using areas under the receiver operating characteristic curve (AUCs).

Results: The SSWE value of F0 (n=1), F1 (n=16), F2 (n=28), F3 (n=18), F4 (n=4) was 8.2Kpa , 11.0 (8.4-12.2) Kpa , 12.6 (10.1-13.9) Kpa , 16.6 (14.7-24.0) Kpa, 20.3 (13.4-37.2) Kpa, respectively. SSWE value were significantly correlated with γ-glutamyltranspeptidase ($P=0.010$), age($P<0.001$) and liver fibrosis $P<0.001$). Logistic regression analysis demonstrated that liver fibrosis($P<0.001$) and age ($P=0.033$) were significantly associated with SSWE. The AUC for differentiating severe fibrosis or greater (≥F3) was 0.896, with an optimal cutoff value of 13.2 Kpa.

Conclusions: Preoperative SSWE measurements for infants with BA could be used as a noninvasive tool for prodicting severe fibrosis or geater (≥F3). However, SSWE value might be influenced by infant's age.

OPT7-005

The Effects of Normothermic Ex-Situ Perfusion on Liver Elasticity Measurements Using Shearwave Elastography

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Objectives: Ex situ liver perfusion offers the potential to "recondition" organs prior to transplantation. Vasoconstriction during cold storage may be reduced by perfusion, which in turn, should result in a "relaxation" of the liver and decreased stiffness. To our knowledge this is the first report of direct shearwave elastography measurements in human ex-vivo livers on machine perfusion.

Methods: 9 human livers declined for transplantation underwent ex-vivo normothermic perfusion with a red-cell based perfusate at fixed pressures (arterial pressure 75 mmHg, portal pressure 5 mmHg). Shearwave elastography (ElastPQ, Philips healthcare) was performed at zero, two and six hours in the centre of the right lobe. Six measurements were made at each time interval and the velocities averaged. Other factors were measured such as warm ischaemic time, lactate, bile production and biopsies were taken at regular intervals.

Results: Shearwave elasticity measurements were achievable in all livers. Elasticity mean at baseline was 1.932 m/s (SD 0.154 m/s), at two hours 1.652 m/s (0.164 m/s) and at six hours 1.806 m/s (SD 0.137 m/s). Liver elasticity reduced between zero and two hours in almost all livers (8 of 9 livers) and then rose again between two and six hours (6 of 9 livers). This suggests that normothermic perfusion is reducing vasoconstriction and washing out the microcirculation making the liver more compliant in the early phase, however, these effects are diminished in long term perfusion.

Conclusions: Shearwave elastography of ex-vivo liver transplants is possible and demonstrates a reduction of liver elasticity in the first two hours of normothermic perfusion.

OPT7-006

Association of Lower Hardness Sonoelastography of Quadriceps Muscle with Sarcopenia

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Objectives: Reduced muscle mass had associated with high mortality. So it is urgent for simple techniques to early detection sarcopenia. Our objective was to examine the validity of sonoelastography to predict sarcopenia in osteoporotic patients. This study aimed to evaluate the association of sonoelastography and dual-energy X-ray absorptiometry in patients with sarcopenia and osteoporosis.

Methods: We conducted an observational study in Kaohsiung Chang Gang Memorial Hospital. Sarcopenia was determined using a dual-energy X-ray absorptiometry. Sonoelastography was performed over mid thigh over quadriceps muscle. We measure hardness and elastography ratio of quadriceps over subcutaneous fat tissue. ROC analysis was used to find best cut-off point.

Results: A total 78 (33 sarcopenia, 45 non-sarcopenia) patients were enrolled. The mean age was 79.61 ± 6.54 years in sarcopenia group and 76.51±6.58 in non-sarcopenia group($p=0.05$). Most patients (91%) were women. Sonoelastography showed sarcopenia patients had more soft than non-sarcopenia patients, furthermore the elastography ratio of quadriceps over subcutaneous tissue was lower than non-sarcopenia patients. When the cut points determined by receiver operating characteristic (ROC) curve analysis were applied, The best cut-point of hardness was 75.28%(sensitivity, 0.511; 1-specificity, 0.091), while the best cut-point of quadriceps over subcutaneous tissue was 1.07 (sensitivity, 0.556; 1-specificity, 0.121).

Conclusions: Sonoelastography was easily applicable in patients with sarcopenia and osteoporosis. Using hardness content and elastography ratio of quadriceps over subcutaneous ratio render more information of muscle character. Early detection of sarcopenia with sonoelastography in patients with osteoporosis afford future trend of preventive medicine in geriatric patients.

OPT7-007

Real-Time Elastography for the Diagnosis of Liver Fibrosis in Chronic Hepatitis B

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Objectives: Liver fibrosis is the pathological basis of many chronic liver diseases. Therefore, it is very important to provide an accurate assessment of the degree of liver fibrosis for diagnosis of the disease, and in patients with chronic viral hepatitis, select appropriate antiviral therapy and predict prognosis. Real-time elastography (RTE) is a novel noninvasive ultrasonography modality for measuring liver elasticity that has been recently applied to the quantitiative assessment of liver fibrosis. The ratio of the elastic strain of liver to the elastic strain of intercostal muscle has been determined using RTE. The aims of this study were, first, to evaluate the accuracy of the quantitative assessment of liver fibrosis in patients with chronic viral hepatitis B by calculating the elastic strain ratios determined for different stages of liver fibrosis;

second, to compare the accuracy among elastic strain ratios, laboratory parameters aspartate transaminase platelet ratio index (APRI) and Forns index for classifying stages of liver fibrosis in patients using liver biopsy the gold standard.

Methods: Liver biopsies, blood testing, and RTE was performed in 71 patients with chronic viral hepatitis B and liver cirrhosis. The ratio of the elastic strain of liver tissue to that of muscle tissue was determined and correlated with the stages of histological fibrosis and results of laboratory examinations.

Results: There was a highly negative correlation between the elastic strain ratio and stages of histological fibrosis (Spearman's correlation coefficient $r = -0.702$, $p < 0.001$). There was a high correlation observed between decreasing elastic strain ratio and increasing stage of fibrosis. With significant liver fibrosis (Scheuer score [S] $\geq$ S2) and cirrhosis (S = S4) as diagnostic criteria, the areas under the receiver operating characteristics curve (AUC) of elastic strain ratios were 0.863 and 0.797 respectively. The AUC for significant fibrosis was higher than the AUC for blood parameters used to diagnose significant liver fibrosis. The elastic strain ratio cutoff values of 1.10 and 0.60 were identified as diagnostic of significant fibrosis and cirrhosis, respectively, with sensitivities of 77.8% and 50.0%, respectively, and specificities of 80.0% and 96.7%, respectively.

Conclusions: In summary, our results demonstrate that RTE can provide improved diagnostic discrimination of significant liver fibrosis in chronic viral hepatitis B patients, which is important for the management of these patients. Blood parameters also proved to be have good diagnostic value for differentiating severe liver fibrosis from cirrhosis; therefore, the combination of RTE and laboratory tests may further improve the sensitivity and specificity of the noninvasive assessment of liver fibrosis. Further advances in elastography technology, as well as large prospective studies that provide adequate statistical power will better delineate the usefulness of elastography in the field of liver disease.

OPT7-008

How Shear Wave is Generated by Acoustic Radiation Force and Propagates in Kidney

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Objectives: We have experienced frequent failure of shear wave elastography (SWE) on kidney. In our past investigation, the shear wave (SW) arrival was unclear, or could not be distinguished from the background fluctuation in the displacement profile. In this study, we investigated the physical mechanism of this phenomenon in detail. Here we made three hypotheses: (1) Generated SW is obscured because of blood flow, (2) Push-pulse cannot generate SW in kidney, (3) Complicated structure with dense and fine renal vessels interferes with the propagation of SW.

Methods: We analyzed received IQ data of SWE for three excised swine kidneys, a natural sponge (to mimic porous structure of the kidney), and two healthy volunteers (liver and kidney). The swine kidneys and the sponge were scanned in water. The ultrasound scanner used was LOGIQ E9 (GE Healthcare) with a 3.5 MHz convex probe (C1-6-D). For the volunteer scan, acoustic intensity of the push-pulse was varied between three levels: same level as clinical recommendation, a half of it, and zero (no push). When scanning livers, we included a large portal vein intentionally for comparison. Acquired IQ data (echo signals of a series of tracking pulses) were transferred into a PC and analyzed into the velocity distribution and its change over time after push-pulse insonification. Those changes of velocity distribution were visually inspected, while average velocity and standard deviation were calculated over time inside the area of push-pulse insonification.

Results: For the swine kidney, SWE images were sufficiently homogeneous. IQ data analysis revealed an evident propagation of SW. For the volunteer, typical velocity peak was observed in liver and kidney. Amplitudes of SW were sufficient compared to the background fluctuation by blood flow, and this fluctuation was larger in kidney than in liver. At the same time, however, kidney contained many pixels which indicate irregular velocity profiles. In those pixels, background velocity fluctuation was large, and therefore a typical pattern of shear wave arrival was not recognized. Such signals were also observed in a large portal vein. In addition, the shape of generated SW was different between the two organs, especially in one of the two volunteers. The region of excitation (area of deformation induced by push-pulse) was wide and not smooth in kidney. The sponge also presented such a rough velocity distribution, while the average velocity induced by the push-pulse was comparable with that for livers and kidneys. The background fluctuation in velocity profile decreased with higher push-pulse intensity level in both liver and kidney. This implies that the shear wave has an effect of pushing blood flow out from its traveling area.

Conclusions: From all the above results, we concluded that all the three hypotheses were reasonable. As for the second hypothesis, based on the sponge experiment results, it is suggested that it is rather inhomogeneous and porous structure than vascularity that affects the appearance of generated shear wave. Considering the result of swine kidney, however, the vascularity is thought to contribute to the characteristic structure of kidney. The question remains why the clear SW generation was observed in one volunteer's kidney (and why not in the other's). The difference in speed and pressure of the blood flow might be one of the possible factors.

OPT7-009

Combination of Strain and Shear - Wave Elastography Can Reduce the Unnecessary Biopsy of Breast Lesions

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Objectives: To compare strain elastography (SE), acoustic radiation force impulse (ARFI)-inducing Virtual Touch Imaging (VTI) and Virtual Touch Imaging Quantification (VTIQ) in the evaluation of ultrasound (US) Breast Imaging-Reporting and Data System(BI-RADS) category 4 lesions.

Methods: A total of 267 patients with 278 BI-RADS category 4 lesions (151 benign and 127 malignant) were evaluated with conventional B-mode US, SE, VTI and VTIQ, implemented on a Siemens Acuson S2000 ultrasound machine. The diagnostic performances including area under the receiver operating characteristic curve (AUC), sensitivity, specificity were evaluated.

Results: Overall, VTIQ alone showed the highest AUC (0.904), which was significantly higher than EI (0.824) ($p=0.0108$), VTI (0.843) ($p=0.0442$), VTIQ plus VTI (0.822) ($p=0.0099$), VTIQ plus EI (0.79) ($p=0.0006$) and VTI plus EI (0.761) ($p=0.0001$). In lesions < 1 cm, the AUC for VTIQ, VTI and EI were similar (0.913, 0.881 and 0.802, $p>0.05$) , while VTI showed higher sensitivity than VTIQ (100% vs 92%) and VTIQ showed higher specificity than VTI (85% vs 68.3%). With the combination of VTI and VTIQ, 68.3% BI-RADS 4A lesions were downgraded with only one carcinoma in situ, while 86.7% were downgraded with 6 malignancies when using VTIQ alone.

Conclusions: VTIQ had the highest diagnostic performance in evaluating BI-RADS 4 lesions. In small lesions(< 1 cm), VTI achieved higher sensitivity than VTIQ and EI. The combination of VTIQ and VTI has the potential to reduce unnecessary biopsies for BI-RADS 4A lesions.

OPT7-010

Evaluation of Liver Ablation Using Two-Dimensional Shear-Wave Elastography in the Rabbit Liver Model

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Objectives: To explore the Shear Wave Elastography (SWE) cut-off value of the radiofrequency (RF) ablations and the optimal scale of SWE to delineate the ablation zone.
Methods: The Institutional Animal Care and Use Committee approved this study. The livers of 30 healthy rabbits were radio-frequency ablated. Conventional ultrasound, contrast enhanced ultrasound (CEUS) and two-dimensional SWE were performed to depict the ablation zone 1h, 2h, 3h, 1d, 7d and 28d after ablation (six groups, five rabbits for each group). Then the livers were harvested for NADH staining. SWE parameters, elasticity distribution, SWE min of the ablation zone and SWE max of the liver tissue beside the ablation boundary were measured. The Receiver Operating Characteristic Curve was obtained to calculate the SWE cut-off value of the ablation zone. Reset the scale of SWE image according to the cut-off value. The overlap percent between elasticity maturation region of SWE image and non-enhanced region of CEUS image was assessed.
Results: Highest SWE value was found in the center and that decreased gradually to the peripheral. Non-enhanced regions in CEUS images overlapped well with the ablative tissue in NADH images in 96% specimens. The SWE cut-off value of ablative tissue was 49 kPa – 50 kPa. The elasticity maturation region in SWE image with scale of 50 kPa well delineated the non-enhanced region of the CEUS image in 88% specimens.
Conclusions: There was regular elasticity distribution in the ablation area. The SWE cut-off value of ablative tissue is 49 kPa – 50 kPa. The optimal scale for SWE to delineate the ablation zone is 50 kPa.

OPT7-011

Association between Preoperative Us, Elastography Features and Prognostic Factors of Papillary Thyroid Cancer with Brafv600E Mutation

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Objectives: To investigate the value of US and elastography to predict prognostic factors of papillary thyroid cancer (PTC) in positive BRAFV600E Mutation group.
Methods: This prospective study was institutional review board approved; informed consent was obtained. This study included 116 patients (mean age, 50 years; range, 23–77 years) with 116 pathologically proven PTCs. Conventional US, US elasticity imaging (EI), and Virtual Touch tissue imaging (VTI) and Virtual Touch tissue quantification (VTQ) of acoustic radiation force impulse (ARFI) imaging were performed for each nodule before surgery. Multivariate logistic regression analysis was performed to assess 23 independent variables for prognostic factors prediction. Diagnostic performance was evaluated with receiver operating characteristic (ROC) curve analysis.
Results: Forty-two (36.2%) of 116 PTC patients with BRAFV600E Mutation had central lymph node metastasis (LNM). Nine (7.8%) and fifty-six (48.3%) had lateral lymph node metastasis (LNM) and extrathyoidal extension (EE), respectively. In multivariate logistic regression analyses, rich internal flow (odds ratio [OR]: 6.66; 95% confidence interval [CI]: 1.97, 22.53) was the best predictor for central LNM, followed by male sex (OR: 4.22; 95% CI: 1.65, 10.74), halo sign absence (OR: 2.78; 95% CI: 1.09, 7.08) (all $P< 0.05$). VTQ ratio (OR: 1.57; 95% CI: 1.08, 2.29) was the only predictor for LLNM ($P= 0.02$). Rich internal flow (OR: 6.33; 95% CI: 2.00, 20.03) was the strongest predictor for EE, followed by male sex (OR: 3.29; 95% CI: 1.27, 8.50), halo sign absence (OR: 2.90; 95% CI: 1.16, 7.27), and VTQ ratio (OR: 1.63; 95% CI: 1.11, 2.39) (all $P< 0.05$). EI were not significantly associated with prognostic factors in positive BRAFV600E Mutation group ($P> 0.05$).
Conclusions: ARFI imaging and conventional US are both promising techniques in predicting prognostic factors in PTC patients with BRAFV600E Mutation, which has a potential to avoid unnecessary therapeutic neck dissection in high-risk PTC patients.

OPT7-012

Use of Acoustic Radiation Force Impulse Elastography to Predict Acute Pancreatitis: A Case-Control Study

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Objectives: Diagnosis of uncomplicated acute pancreatitis (AP) by trans-abdominal ultrasonography is not sensitive. We try to demonstrate the potential value of acoustic radiation force impulse (ARFI) elastography on prediction of AP.
Methods: We performed ARFI elastography (Siemens Acuson S2000™ ultrasound system: median value of 3 valid measurements and median value, meters/second (m/s)) on 20 AP patients and 43 control patients who received ultrasonography for indications other than AP (non-AP group) between March 2016 and March 2017. Measurement of ARFI at pancreatic body was carried out via transhepatic route. The ARFI mean values, clinical and laboratory data of two groups were analyzed.
Results: More male patients was noted in AP group (male 80.0% vs. 37.2%, $p=0.002$).The mean age of AP and non-AP groups were 42.80 ± 10.67 years and 49.70 ± 15.79 years ($p=0.08$), respectively. Etiologies for AP were alcohol (13/20, 65%), followed by biliary tract stones (3/20, 15%), hypertriglyceridemia (2/20, 10%), and unknown cause (2/20, 10%). Most (18/20, 90%) of ARFI elastography in AP group were performed within 24 hours after the hospitalization. The mean values of ARFI in AP and non-AP groups were 1.88 ± 0.72 m/s and 1.13 ± 0.29 m/s ($p<0.001$), respectively. Higher ARFI values were found in alcohol (2.08 ± 0.80, $p<0.001$) and hypertriglyceridemia (1.66 ± 0.10, $p=0.003$) related AP than controls. Using cut-off value of ARFI 1.32 m/s for diagnosis of AP had sensitivity and specificity of 85.0% and 79.1%, respectively (AUC ROC 0.86). ARFI elastography had no value in prediction of serum lipase level ($P=0.412$), BISAP score ($P=0.936$) and the length of hospitalization days ($P=0.831$).
Conclusions: Higher ARFI was found in AP patients, especially for alcohol and hypertriglyceridemia related causes. However, the value of ARFI was not associated with clinical severity. Further study with larger number of study subjects is warranted to demonstrate the diagnostic and prognostic role of ARFI elastography in AP patients.

OPT7-013

What Happened with Liver Stiffness Values Assessed by Means of Transient Elastography in Patients with HCV Liver Cirrhosis after DAA Treatment

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Objectives: Liver stiffness (LS) measurements by Transient Elastography (TE) has been widely accepted as a tool for fibrosis assessment. The aim of this study was to assess LS dynamics in a group of patients with HCV liver cirrhosis after DAA treatment.

Methods: This bicentric clinical trial included 276 patients with compensated HCV cirrhosis (all genotype 1b), who received DAA for 12 weeks. All patients were evaluated by means of TE at the beginning and at the end of treatment (EOT), and one subgroup (180 patients) also 12 weeks after EOT, all of them with sustained viral response (SVR 12), and another subgroup (55 patients) also at 24 weeks after EOT (SVR 24). Reliable LS measurements (LSM) were defined as median value of 10 valid LSM, with IQR<30% and SR≥60%. Both M and XL probes were used. For diagnosing cirrhosis we used a cut-off value of 12 kPa as proposed by the Tsochatzis meta-analysis. We considered a decrease or increase of more than 10% in LSM as being significant.

Results: Out of 276 subjects, reliable measurements were obtained in 92.7%, so that the final analysis included 256 patients. The mean LS values decreased significantly after DAA: 25 ±11.7 kPa vs. 22.5±12. kPa (p=0.009). Most patients, (59.7% - 152/256) presented more than 10% decrease in LS values, 23% (59/256) had stable LS values, while in 17.3% (45/256) cases, the LS values increased.In the subgroup of 180 patients where LSM were also performed 12 weeks after EOT (SVR 12), the mean LS values were significantly lower 12 weeks after EOT as compared to baseline: 20.3±10.8 kPa vs. 25.5±11.4 kPa (p<0.0001) and also as compared to EOT: 20.3±10.8 kPa vs. 22.8±12.2 kPa, (p=0.04). In the subgroup of 55 patients wher LSM were also performed 24 weeks after EOT (SVR 24), the mean LS values were significantly lower at SVR 12 and SVR 24 as compared to EOT (18.7 ± 8.2 kPa vs. 21.6 ± 7.7 kPa, p=0.05 and 18.3 ± 6.6 kPa vs. 21.6 ± 7.7 kPa, p=0.01).

Conclusions: In our group mean liver stiffness values evaluated by TE significantly decreased after antiviral treatment at SVR 12 and SVR 24, as compared to EOT. Overall, in our study almost 60% of patients had EOT liver stiffness values lower than at baseline, at SVR 12 almost 75% of patients had liver stiffness values lower than at baseline and at SVR 24 almost 77% of patients had liver stiffness values lower than at baseline.

OPT7-014

The Efficiency of Shear Wave Elastography Evaluation in Determining the Malignity Potential of Solid Thyroid Nodules

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Objectives: To evaluate the efficiency of quantitative shear-wave elastographic ultrasound evaluation in determining the malignity potential of solid thyroid nodules.

Methods: In period between September 2014 and January 2016, 191 solid thyroid nodules of 189 patients who had referred from endocrinology clinic of our institution were enrolled in this study. The volumes, gray-scale ultrasound features and mean quantitative shear-wave-elastographic data of the nodules were recorded. Acoustic-radiation-force-impulse (ARFI) method was used for shear-wave evaluation. The fine-needle-aspiration (FNA) and the pathologic results of the operated patients were statistically analyzed with the shear-wave-elastography findings.

Results: In 189 patients, 159 were female and 30 were male. The cytopathologic results were with benign in-nature, with athypic-cytology and with malign or suspiciously malign in-nature or suspicion of malignity in 117, 28 and 21 nodules, respectively. The specimen from FNA was insufficient in 25 nodules. 34 nodules of 33 enrolled patients were operated. The cut-off-values in terms of mean-shear-wave-velocity value of nodules for differentiating the benign nodules from malign lesions were 2,735 m/s and 2,740 m/s in terms of FNA cytopathology and post-operative histopathology results, respectively (with 81.0 % sensitivity, 82.6% specificity; and 83.3% sensitivity, 93.7% specificity).

Conclusions: Quantitative shear-wave-elastography evaluation is concluded to be an effective, non-invasive and practical imaging modality in considering the malignity potential of solid thyroid nodules.

OPT7-015

Elastoscan to Differentiate Benign from Malignant Thyroid Lesions and Correlation with Cold Nodule in Thyroid Scan and Histopathology

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Objectives: The aim of this study to assess the efficacy of Elastoscan in differentiating thyroid nodules and accuracy to detect thyroid cancer in comparison to cold nodule in radio-isotop thyroid scan and Histopathology.

Methods: All 43 patients were evaluated first by ultrasound, Elastoscan, radio-isotop thyroid scan and histopathology. Strain Elastoscan done to assesses the elastic properties of tissues by analyzing tissue strain that used here. Strain ratio less than 5 considered as benign and higher than 5 considered as malignant. Radioisotope thyroid scan done to detect cold nodule. Thyroidectomy done and histology was used as gold standard.

Results: Elastography shows malignancy in 9(21%), intermediate in 11(26%), benign in 23(53%) patients. Cold nodule in 32(74%), hot nodule in 5(11%) ,warm nodule in 6(14%) patients in Radio-isotop scan. Out of these 32 patients 28 benign and 4 patients malignancy in Elastography and 3 patients in Biopsy. Out of 9 patients 7 patients show malignancy in Biopsy. Out of 11 patients 9 show malignancy in Biopsy. Histopathology shows among this 43 patients 13 papillary cancer, 2 follicular cancer, 1 medullary cancer, 20 hyperplasia and 7 adenomas.

Conclusions: In this study 12% cold nodule malignant in Elastoscan and 9% cold nodule malignant in histopathology. This study shows specificity of Elastoscan is 85.2, sensitivity 100, accuracy 90.7, Positive predictive value 80 and negative predictive value100 but specificity of biopsy is 100.

OPT7-016

Shear Wave Elastography of the Breast Lesions: Quantitative Analysis of the Heterogeneous Elasticity Improves the Diagnosis Performance

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Objectives: To evaluate whether addition of quantitative analysis of the heterogeneous elasticity (Ehetero) could improve the diagnosis performance of shear wave (SW) elastography in breast cancers.

Methods: From October 2015 to February 2017, 239 patients with 255 breast lesions (126 benign, 129 malignant) were enrolled in this study. All lesions were evaluated with ultrasound Breast Imaging Reporting and Data System (BI-RADS) and VirtualTouch IQ shear wave elastography. Three region of interests were placed over the highest stiffness or lowest stiffness area of the lesions to measure the SW velocity (SWV), respectively. Ehetero was determined as the difference between the averaged highest SWV and lowest SWV. The diagnosis performances

including area under the receiver operating characteristic curve (AUC), sensitivity, specificity, positive and negative likelihood ratio were determined for BI-RADS, SWVmax and Ehetero.

Results: Ehetero showed the highest AUC (0.953; 95% confidence interval [CI]: 0.924 - 0.983), which was higher than SWVmax (0.938; 95% CI: 0.908 - 0.968) (P<0.001) and BI-RADS (0.705; 95% CI: 0.662 - 0.748) (P<0.001), with a positive likelihood ratio of 19.53 (95% CI: 8.9 - 42.7) and a negative likelihood ratio of 0.07 (95% CI: 0.04 - 0.10). The sensitivity of Ehetero was 93.02% (95% CI: 87.2% - 96.8%), which was significant higher than SWVmax (83.72%, 95% CI: 76.2% - 89.6%) (P<0.001), while there was no significant difference for the specificity between Ehetero (95.24%, 95% CI: 89.9 - 98.2) and SWVmax (92.86%, 95% CI: 86.9 - 96.7) (P=0.375).

Conclusions: Quantitative analysis of the heterogeneous elasticity can improve SW elastography sensitivity in breast cancer detection, without losing of specificity.

OPT7-017

Qualitative Analysis with Virtual Touch Tissue Imaging & Quantification for Differential Diagnosis of Breast Lesions Compared with Quantitative Analysis

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Objectives: To evaluate the diagnostic performance of Virtual Touch Tissue Imaging & Quantification (VTIQ) for differential diagnosis of breast lesions, using a new qualitative analysis (i.e. the elasticity score in the travel time map) compared with quantitative analysis.

Methods: From June 2014 to July 2015, 266 pathologically proven breast lesions were enrolled in this study. The maximum, mean, median, minimum, and standard deviation of shear wave speed (SWS) values (m/s) were assessed. The elasticity score, a new qualitative feature, was evaluated in the travel time map. The area under the receiver operating characteristic (AUROC) curves were plotted to evaluate the diagnostic performance of both qualitative and quantitative analyses for differentiation of breast lesions.

Results: Among all quantitative parameters, SWS-max showed the highest AUROC (0.805; 95% CI: 0.752, 0.851) compared with SWS-mean (0.786; 95% CI:0.732, 0.834; P=0.094), SWS-median (0.775; 95% CI:0.720, 0.824; P=0.046), SWS-min (0.675; 95% CI:0.615, 0.731; P=0.000), SWS-SD (0.0738; 95% CI:0.712, 0.817; P=0.074). The AUROC of qualitative analysis in this study obtained the best diagnostic performance (0.871; 95% CI: 0.825, 0.909; P=0.011), compared with the best parameter of SWS-max in quantitative analysis.

Conclusions: The new qualitative analysis showed the superior diagnostic performance in the differentiation of breast lesions in comparison with quantitative analysis.

OPT7-018

Shear Wave Based Ultrasound Elastographies (SWE) Detection in HCC Patients with Liver Stiffness and Main Related Factors

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Objectives: Use Shear wave based ultrasound elastographies (SWE) detection of Hepatocellular Carcinoma (HCC) in patients with liver stiffiness, and find a effective, noninvasive way to assess of HCC patient' liver condition dignoses, explore the most related factors among age, sex, Body Mass Index (BMI), patient's living habit like alcohol, smoke, and laboratory index as alanine aminotransferase (ALT), glutamic oxalacetic transaminase (AST).

Methods: We applied shear wave based elastography point quantification (ElastPQ) in 71 HCC patients individuals to determine the impact of liver location (segments I–VIII). The SWE was use for asses the liver stiffness for abdomen examine in Xijing Hospital, Ultrasound Department. Then we use χ^2-distribution, single factor regression analysis and multi-factor regression analysis.

Results: Patients were dig noses as HCC (69 patients with HBV virus) decided into different liver tissue fibrosis stage S0(8.70%), S1(7.25%), S2(7.25%), S3(17.39%), S4(21.7%), respectively. The liver stiffness mean value was significantly high (P=0.026), Odds ratio(OR)=4.490. This SWE mean value (Mean) was the independent factor which may cause HCC. Single factor regression analysis shows the most related factor in HCC patient's liver SWE value were age(P<0.001), ALT(P<0.001), AST(P<0.001). Multi-factor regression analysis pointed that age and mean of SWE value are the key factor in HCC patients.

Conclusions: This research examined the major risk factors associated with patients with HCC. The results showed that sex, age, ALT and AST as well as the Mean, Max, Min and SD of elastography were associated with the development of HCC.

OPT7-019

In How Many Patients We Will Misdiagnose Esofageal Varices by Using the Baveno Vi Criteria?

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Objectives: The place of noninvasive techniques for the prediction of presence of portal hypertension in patients with liver cirrhosis is one of the current research topics.The aim of this study was to evaluate the applicability of the Baveno VI criteria in a cohort of known compensated HCV liver cirrhosis patients, to see how often we misclassify the presence of esophageal varices (EV).

Methods: We did a prospective multicentre study, from September 2015 to December 2016, which included all patients with perfectly compensated HCV liver cirrhosis, diagnosed by means of elastography, ultrasound, endoscopic and biological criteria prior to interferon free treatment. All patients were evaluated by upper gastrointestinal endoscopy, transient elastography (TE) and biological tests. By using Baveno VI criteria we classified the patients in: probably without EV (liver stiffness - LS<20 kPa and thrombocites>150,000/mm3), probably with EV (LS±25 kPa) and the "gray zone" in between these criteria.

Results: Out of 403 patients, 127 (30.7%) had LS<20 kPa, 89 (22%) had LS between 20-25 kPa, 190 (47.3%) had LS>25 kPa, 120 (29.7%) had thrombocytes >150,000/mm3, while 283 (70.3 %) had thrombocytes <150.000/mm3. For the subgroup probably with EV, the Baveno VI criteria had PPV=84.6% (Se=40.7 %, Sp=74.6%, NPV=26.8%) for predicting the presence of esophageal varices, while for the subgroup probably without EV had NPV=80.3% (Se=50.2%, Sp=58.6%, PPV=75.6). The subgroup that had LS <20 kPa and thrombocytes >150,000/mm3, was compound of 60 patients. Using these criteria we correctly classified 80% patients, with a Se=80 %, Sp=28.3 %, PPV=50 %, NPV=61.2%, AUROC=0.70, CI=(68.2-71.3). The best cut-off value for TE for predicting the presence of EV of any grade in our

group was >23 kPa, AUROC 0.79 (Se=68.8%, Sp=56.9%, PPV=44.7%, NPV=78.4%).

Conclusions: By using the Baveno VI criteria in patients with liver cirrhosis for the prediction of presence of esophageal varices, we can misclassify only 20 % of patients.

OPT7-020

Elastpq in Differentiating Benign and Malignant Focal Liver Lesions

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Objectives: To investigate the value of ElastPQ measurement for differential diagnosis of benign and malignant focal liver lesions (FLLs) by using histologic results as reference standard.

Methods: A total of 155 FLLs in 155 patients were included. ElastPQ measurement was performed for each lesion in which the shear wave velocity (SWV) was measured. The difference in SWV and SWV ratio of FLL to surrounding liver were evaluated, and the cut off value was investigated. Receiver operating characteristic (ROC) curve was plotted to evaluate the diagnostic performance. Histology as gold standard was obtained by surgery in all patients.

Results: A total of 155 lesions including 130 (83.8 %) malignant FLLs and 25 (16.2 %) benign ones were analysed. The SWV of malignant and benign FLLs was significantly different, 2.77 ± 0.68 m/s and 1.57 ± 0.55 m/s, respectively ($P < 0.05$). The SWV ratio of each FLL to the surrounding liver parenchyma was 2.23 ± 0.49 for malignant and 1.14 ± 0.36 for benign FLLs ($P < 0.05$). The area under the ROC curve in distinguishing malignant from benign lesions was 0.704 for SWV and 0.755 for SWV ratio. The cut off value for differential diagnosis was 2.06 m/s for SWV and 1.67 for SWV ratio. The associated sensitivity and specificity were 80.6 % and 75.4 % for SWV and 67.3 % and 71.2 % for SWV ratio, respectively.

Conclusions: ElastPQ measurement provides reliable quantitative stiffness information of FLLs and is helpful in the differential diagnosis between malignant and benign FLLs.

OPT7-021

How Often Do We Find Steatosis and Significant Fibrosis in Type 2 Diabetes Mellitius Patients

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Objectives: The aim of the present study was to assess the severity of liver fibrosis and steatosis in a cohort of type II diabetic patients, using non-invasive methods:Transient Elastography (TE) and Controlled Attenuation Parameter (CAP).

Methods: The study included 354 type II diabetic patients,who were prospectively randomized (every first 6 patients who were referred to the Metabolic Disease Outpatient Clinic on a consultation day), evaluated in the same session by means of TE and CAP(FibroScan EchoSens) to assess both liver fibrosis and steatosis. Each patient was evaluated for the presence of viral hepatitis (B, C) and an AUDIT-C score was performed to exclude alcohol abuse. Reliable liver stiffness measurements (LSM) were defined as the median value of 10 LSM with an IQR/median <30%. For TE and CAP, M and XL probes were used. A cut-off value of 8.2 kPa [1] was used to define severe fibrosis (F≥3). For differentiation between stages of steatosis we used the following cut-off values [2]: S2 (moderate) - 255 db/m, S3 (severe) - 290 db/m.

Results: Out of 354 diabetic screened we excluded those with associated viral hepatitis, those with an AUDIT-C score ≥8 and those with unreliable LSM. The final analysis included 239 subjects (59.4% women,40.6% men, mean age 60.4±9.3; BMI=31.8± 6.1 kg/m2) with reliable LSM. Accordingly to BMI 10.8 % had normal weight, 26.4% were overweight and 62.8% were obese. Moderate and severe steatosis by means of CAP was found in 18.4% and 69.5 % cases respectively. Severe fibrosis was detected by means of TE (LSM≥8.2 kPa) in 29.3% (70/239) of subjects.

Conclusions: In our group, 87.9 % of diabetic patients had moderate and severe steatosis by CAP and 29.3 % of them had severe fibrosis (TE ≥ 8.2 kPa), suggesting the need for their systematical assessment.

OPT7-022

The Role of Different Noninvasive Fibrosis Assessment Scores in the Evaluation of Liver Fibrosis in Nafld Patients

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Objectives: Several noninvasive fibrosis assessment tests were developed in order to replace invasive procedures as liver biopsy. Our goal was to assess the correlation between APRI, FIB 4 Index and BARD score with transient elastography (TE) in patients with fatty liver disease. We also observed the relation between hepatic steatosis index (HSI) and steatosis quantified by CAP.

Methods: We conducted a prospective study from October 2016-March 2017 which included 156 diabetic patients (average age 60.8 years, 37.8% males, 62.2% females) evaluated both by serum markers (TGO, TGP, platelets) as well as by TE (Fibroscan, Echosense,Paris, France, with incorporated CAP function). Based on specific formulas we calculated APRI, FIB 4 index, BARD score and HSI. We excluded the patients without liver steatosis at ultrasound. Liver stiffness (LS) measurement was considered reliable only if 10 valid values were obtained, with an IQR<30% and a success rate>60%. For differentiation between stages of liver fibrosis, the following cut-off values were used (1): F2-F3: 7-10.2kPa, F4≥10.3 kPa. We considered mild steatosis if CAP=230-275dB/m, moderate steatosis-CAP=275-300 dB/m and severe steatosis-CAP>300 dB/m (recommended by the manufacturer).

Results: Severe steatosis according to CAP measurements prevailed: 67.3% of patients (105/156), whereas the distribution between mild and moderate steatosis was similar 16% vs. 16.7%. 76.2% of the patients were overweight BMI >28 kg/m2.We found a small, but significant correlation between liver stiffness assessed by TE and liver stiffness predicted by APRI (Spearman's rho=0.26, p<0.001) and BARD scores (Spearman's rho=0.183, p= 0.02). We found a small, but significant correlation between liver fibrosis measured by TE in patients with at least significant fibrosis (F2, LS≥7 kPa) and APRI (Spearman rho=0.2, p=0.01).We did not find a correlation between TE values and FIB 4 (Spearman's rho=-0.11, p= 0.17). We found no correlation between CAP values and HSI (Spearman's rho=0.14, p= 0.08).

Conclusions: An APRI score >1 correlates with significant fibrosis quantified by TE. BARD score ≥2 can predict advanced fibrosis. These two simple scores could be used as first line test to rule out patients without advanced fibrosis.

OPT7-023

Intraobserver Reproducibility of Two- Dimensional Shear Wave Elastography in Children

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Objectives: Assessment of liver fibrosis is vital in establishing the diagnosis, therapeutic options and prognosis of liver diseases. There are a limited number of studies evaluating 2D SWE techniques in children, all focusing on providing cut-offs for fibrosis staging. We aimed to evaluate a 2D SWE technique in children, by investigating intraobserver reproducibility of the method.
Methods: We conducted a prospective study from November 2015- July 2016, recruiting 73 consecutive children (age range: 3-17 years, mean age 11.7±3.5 years) evaluated in the 2nd Pediatrics Clinic.We used the 2D-SWE.GE (Logiq E9, GE Healthcare, Chalfont St Giles- UK), with a C1-6-D probe. The trapezoid sample box was placed 1-2 cm under the liver capsule, in full liver parenchymal area, avoiding large tubular structures. We placed the ROI in the most homogenous area of the sample box. One examiner (with an experience of more than 50 examinations using this technique in adults) performed 10 liver stiffness measurements (LSM) for each child. For the intraobserver reproducibility analysis we calculated the medians of the first five and last five LSM.
Results: LSM were similar across age categories- children older than 10 years vs younger children: 4.21 ± 1 kPa vs 4.14 ± 1 kPa, p= 0.78. We found higher LSM in obese children: 4.4 ± 0.9 kPa vs 3.9 ± 1.0 kPa, p= 0.06 and in boys: 4.3 ± 1.0 kPa vs girls: 3.8 ± 0.9 kPa, p= 0.05. In 4 children the measurement was unquantifiable due to the heterogeneous elastographic image. The intraobserver reproducibility showed that there were similar results for the first 5 LSM compared to the last five LSM (4.2±0.9 vs 4.3±0.9, p=ns), for the entire group, as well as for normal weight children (4.0±0.9 vs 4.1±1.0, p=ns) and obese children (4.4±0.9 vs 4.4±0.7, p=ns).
Conclusions: Our study revealed that the use of 2D SWE.GE in children is reliable and highly reproducible. Moreover, we showed that a limited number of LSM is necessary to obtain such good results.

OPT7-024

How to Improve the Reliability of Liver Fibrosis Evaluation Using 2D-Swe.Ge

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Objectives: To assess the impact of using quality criteria for liver stiffness (LS) evaluation by means of 2D Shear Wave Elastography from General Electrics (2D-SWE.GE), while using Transient Elastography (TE) as reference.
Methods: We included 226 subjects in our study, with or without chronic liver disease, in whom LS was assessed using 2D-SWE.GE (LOGIQ E9, GE Healthcare) and TE (FibroScan, EchoSens). Reliable LS measurements were defined for TE as the median value of 10 measurements with a success rate of ≥60% and an interquartile range (IQR)<30% of the median LS values. For 2D-SWE.GE 10 LS measurements were acquired in a homogenous area and the IQR and the IQR/M were calculated in each case. We divided our subjects into 3 groups according to the 2D-SWE.GE IQR/M: IQR/M<0.10: 41 (18.1%) cases; 0.10<IQR/M≤0.30: 155 (68.6%) cases; IQR/M>0.30: 30 (13.3%) cases. We calculated the correlation coefficient between TE and 2D-SWE.GE in each group.
Results: All 226 (100%) subjects included had 10 valid measurements by means of 2D-SWE.GE and reliable results by TE. A strong positive correlation was found between LS values obtained by means of 2D-SWE.GE and TE in the IQR/M<0.10 group (r=0.84, p<0.0001). A strong positive correlation was found between LS values obtained by means of 2D-SWE.GE and TE in the 0.10<IQR/M≤0.30 group (r=0.80, p<0.0001). A weak positive correlation was found between LS values obtained by means of 2D-SWE.GE and TE in the IQR/M>0.30 group (r=0.41, p=0.02). The correlations were significantly stronger in the IQR/M<0.10 and 0.10<IQR/M≤0.30 groups as compared to the IQR/M>0.30 group (both p=0.0013). No statistical differences were found between the correlations in the IQR/M<0.10 and 0.10< IQR/M≤0.30 groups (p=0.43).
Conclusions: Using the IQR/M<0.30 as quality criteria significantly increase the reliability of LS measurements by means of 2D-SWE.GE. Using IQR/M<0.10 criteria does not significantly improve the reliability of 2D-SWE.GE LS measurements as compared to 0.10< IQR/M≤0.30 criteria.

OPT7-025

Shear Wave Liver Elastography with a Propagation Map: Diagnostic Performance and Inter-Observer Correlation for Hepatic Fibrosis in Chronic Hepatitis

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Objectives: This study aimed to determine the diagnostic performance of hepatic fibrosis by shear wave elastography (SWE) with a propagation map for liver fibrosis, and to assess its reliability considering transient elastography (TE) as the reference standard.
Methods: Our prospective study included 115 consecutive patients with suspected or alleged chronic hepatitis. Patients underwent SWE by two different operators and TE by sonographers on the same day.
Results: The correlation coefficient of the intraclass correlation test between an experienced radiologist and a third year radiology resident was 0.878. There was a moderate correlation between the SWE and TE (r = 0.511) for hepatic fibrosis. The best cut-off values predicting significant hepatic fibrosis and liver cirrhosis by SWE were >1.78 m/s (area under the receiver operating characteristic curve [AUROC] = 0.777) and >2.24 m/s (AUROC = 0.935), respectively.

Conclusions: SWE with a propagation map is a reliable method for predicting hepatic fibrosis regardless of operator experience.

Poster Session

PPT7-001

Assessing Liver Stiffness by 2D-Shear Wave Elastography in a Healthy Cohort

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Objectives: To assess the normal range and agreement of liver stiffness measurements in healthy subjects, using 2D-Shear Wave Elastography from General Electric (2D-SWE-GE) compared with Transient Elastography (TE).
Methods: We included 80 healthy subjects without known liver disease, in whom liver stiffness (LS) was evaluated in the same session using two elastographic methods, TE and 2D-SWE-GE. Reliable liver stiffness measurements (LSM) were defined for TE as the median value of ten measurements with a success rate (SR) of ≥60% and an interquartile range (IQR) <30%, and for 2D-SWE-GE as the median value of 10 measurements acquired in a homogenous area and IQR <30%.
Results: Reliable LSM were obtained in 79 subjects (98.7%) by means of 2D-SWE-GE and in 80 subjects (100%) by means of TE (p=0.9). The mean LSM value in our cohort of healthy subjects obtained by means of 2D-SWE-GE was 5.1±1.3 kPa, which was significantly higher than the LSM values assessed by TE (4.3±0.9 kPa, p< 0.0001). In 2D-SWE-GE mean LSM values were significantly higher for men than for women, 5.9±1.2 kPa vs. 4.7±1.2 kPa (p=0.0005).
Conclusions: 2D-SWE has a very good feasibility (98.7%) in healthy subjects. The mean LSM value determined by 2D-SWE-GEin healthy subjects is 5.1±1.3 kPa. LSM values obtained by means of 2D-SWE-GE are higher than those obtained by TE in healthy subjects.

PPT7-002

Controlled Attenuation Parameter for Prediction of Hepatic Steatosis in a Taiwanese Cohort with Chronic Hepatitis

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Objectives: The object of this study is to evaluate the performance of controlled attenuation parameters (CAP) for the prediction of liver steatosis in Taiwanese patients with chronic hepatitis.
Methods: Chronic hepatitis patients with liver biopsy performed within recent 2 years were enrolled. CAP was acquired using a FibroScan ® M probe. CAP values were compared across histologic steatosis grades.
Results: Ninety-three patients (mean age 67.2 years; 58% male) were enrolled. The etiologies of chronic hepatitis were hepatitis C 58%, hepatitis B 31%, and others 11%. The case numbers of respective steatosis grades were: S0, 56; S1, 31; S2-3, 6. The mean ± SD of CAP for each steatosis grade was 202 ± 31 (S0), 230 ± 37 (S1), and 289 ± 47 (S2-3) (P< 0.001 by Kruskal-Wallis test). The area under the receiver operating characteristic curve of the CAP for predicting steatosis (S0 vs. S1-3) was 0.765.
Conclusions: CAP is useful in prediction of steatosis for Taiwanese patients with chronic hepatitis.

PPT7-003

Correlation between Fibroscan and ARFI Two-Location Measurement with Metavir Liver Fibrosis Score

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Objectives: Non-invasive assessment of liver fibrosis with Fibroscan and acoustic radiation force impulse (AFRI) imaging are two most popular modalities to measure liver fibrosis. Fibroscan is a well-established modality which measure both liver fibrosis and steatosis. However, there is considerable failure rate, and without image quidding the data may be misleading in the present of focal lesion in R hepatic lobe. ARFI may select an optimal location for measurement but there are concerns on the variations. To decrease the variation, ARFI two-location measurement with standardized protocol was evaluated in this study.
Methods: A consecutive series of patients who received liver histology study were prospectively enrolled. All participant received hemogram, liver biochemistry, viral markers, ARFI and fibroscan within 4 weeks of histology study. A standardized protocol was used to both fibroscan and ARFI with a single technologist. Then both data from Fibroscan and ARFI were correlated with liver histology.
Results: A total of 80 patients that included 35 Non B and Non C, 8 autoimmune liver diseases, 27 chronic hepatitis B and 10 hepatitis C were enrolled. The correlation between Fibroscan and ARFI two-location measurement is good (R2=0.592). The area under the curve for metavir 4 fibrosis are 0.878 and 0.914 for fibroscan and ARFI respectively. A relatively lower value in fibroscan than in ARFI is noted in the present of severe steatosis.
Conclusions: The correlation between Fibroscan and ARFI is good. However, ARFI tends to have a better linearity with histology fibrosis grades than Fibroscan in patients with severe steatosis.

PPT7-004

Diagnostic Value and Reliability of Color Overlay Pattern of Shear - Wave Elastography for Assessing Palpable Breast Mass

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Objectives: To evaluate the correlation between quantitative values of stiffness of palpable breast lesion and pathologic results by using shear wave elastography (SWE), and to assess SWE color overlay pattern of the palpable breast lesions and investigate association with BI-RADS category.

Methods: Conventional breast US and SWE were performed in 99 women with 110 palpable breast lesions (52 benign, 58 malignant). All cases were either pathologically confirmed or showed no interval change over 6 months. Diagnostic performance, optimal cutoff value and pathological correlation for each quantitative SWE parameter were calculated by ROC curve and independent t test. Association between SWE color pattern and BI-RADS category were assessed by Chi-squared test.
Results: Of the 110 palpable breast masses, 52 masses (47.3%) were benign and 58 masses (52.7%) were malignant. Mean Emax of malignant masses (109.3 ± 75.6 kPa) was significantly higher than that of benign (26.2 ± 20.9kPa) ($p < 0.001$). SWE ratio between the lesion and adjacent fat was higher in malignant masses than benign, as follows; 11.3 ± 10.6 and 3.4 ± 3.1. Optimal cutoff values derived for mean Emax and SWE ratio were respectively, as follows; 45.1kPa and 5.3. SWE color pattern and both BI-RADS category and reference standard were significantly associated ($p < 0.001$). Also, SWE color pattern and echogenic halo around the lesion on conventional US were significantly associated ($p < 0.001$).
Conclusions: The quantitative SWE features provide good diagnostic performance in palpable mass. In addition, color overlay pattern on SWE can provide diagnostic value, when added to conventional breast US findings, such as echogenic halo.

PPT7-005

Diagnostic Value of Acoustic Radiation Force Impulse (ARFI) Elastography for Differentation of Hemangiomas from Malignant Liver Lesions during Conventional Abdominal Ultrasound

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Objectives: Background and aimSolid focal liver lesions (FLLs) are very common findings during conventional abdominal ultrasound (US). Among benign FLLs, hemangiomas are very frequent. Acoustic Radiation Force Impulse (ARFI) is an ultrasound-based elastography method, able to non-invasively evaluate the stiffness of FLLs. Aim of this study was to assess the diagnostic value of US ARFI, for characterizing hemangiomas Vs malignant FLLs.
Methods: Inclusion criteria were presence of hemangiomas or malignant FLLs; definite diagnosis by histological evaluation or ≥ 1 radiological exam with contrast medium (CT, MRI, CEUS). ARFI quantification was performed with an Acuson S3000 ultrasound system (Siemens®, Munich, Germany). Two experienced operators performed five measures per lesion and five measures in the surrounding liver.
Results: One-hundred-and-nine FLLs (44 Hemangiomas [HEs], 38 Hepatocellular Carcinomas [HCCs] and 27 metastases [METs]) were examined. HEs showed a significantly lower stiffness compared to malignant FLLs (HEs median value 1.32, IQR 0.97-1.84 m/sec; malignant lesions median value 2.72, IQR 2.00-3.54 m/sec; $p<0.001$) [Figure 1A]. Conversely, no differences were found for nodule-to-parenchyma ARFI ratios and between HCCs and METs. ARFI values were able to correctly differentiate malignant lesions with a c-statistics of 0.85 (95%CI 0.77-0.93) and sensitivity of 75.4%/specificity of 84.1% at a cut-off of 2.00 m/sec.
Conclusions: This study highlights the possibilities arising from the new technologies available in conventional abdominal US. In particular, our results suggest that ARFI can distinguish between HEs and malignant lesions (HCCs and METs) at a cut-off of 2.00 m/sec.

PPT7-006

Elastography in Microwave Ablation of Benign Thyroid Nodules: Relationship with Thyroid Function Levels and Contrast Enhanced Ultrasound Imagine

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Objectives: Elastography has been proposed to increase the sensitivity of ultrasound and improve the detection of Benign Thyroid Nodules after microwave ablation, and to investigate the applicability of these diagnostic methods for follow-up. Specifically, the correlation between T3, T4, TSH and elastography score, as well as other clinical and contrast enhanced ultrasound (CEUS) imagine features, was analyzed.
Methods: Patients with Benign thyroid nodule identified by from March 2016 to May 2017 and undergoing ultrasound, elastography, and thyroid function evaluation were selected before and after ultrasound-guided thermal microwave ablation. QontraXt software to determine the time intensity curve (TIC) of Nodules blood perfusion and microvascular changes. The association between suppressed thyroid stimulating hormone and patient's age, nodule's size, ultrasound presentation, CEUS, and elastography scoring was analyzed by Odds Ratio in univariate fashion and multivariate model.
Results: 91 subjects with single benign thyroid nodule were enrolled. Median age of 52 years, median size of 2.8 cm. Those nodules classified by ultrasound under- went fine-needle aspiration cytology and malignancy tumor was excluded. Before microwave ablation, elastography detected a median elasticity score of ES 2 ± 0.4, and after ablation the median score was ES 3 ± 0.7, and stimulating hormone significantly lower than the other ($p < 0.001$). A model of multivariate logistic regression including nodule's size, ultrasound characteristics, and elastographic presentation showed that thyroid nodule after ablation elasticity score was significantly associated with suppressed thyroid stimulating hormone (Odds Ratio of 50).
Conclusions: Strain elastography detects decreasing tissue elasticity and CEUS TIC provides quantifiable results and is promising as a diagnostic follow-up after microwave ablation associated with reduced/suppressed thyroid stimulating hormone.

PPT7-008

Investigate the Efficacy of Using Quantitative Elastography with Supersonic Shear Imaging in Renal Transplants

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Objectives: Compare the renal cortex in patients with and without rejection reaction after kidney transplantation. Evaluate the accuracy of using quantitative elastography with Supersonic shear imaging to show the rejection reaction after kidney transplantation.
Methods: Measure and compare the Young's modulus of renal cortex in 41 patients, including 36 without rejection and 5 with rejection, after receiving kidney transplantation, by using an ultrafast ultrasound device (Aixplorer®, SuperSonic Imagine, Aix-en-Provence,France).

Results: The Young's modulus of renal cortex in 36 patients without rejection and 5 patients with rejection after receiving kidney transplantation were(52.119±3.015)kPa and (19.412 ± 2.173)kPa, respectively, which are with statistically significant difference (p=0.004).
Conclusions: Quantitative elastography with Supersonic shear imaging represents a gold standard in histological diagnosis. Together with conventional 2D ultrasound, CDFI, RI, etc., Quantitative elastography with Supersonic shear imaging can provide more effective information for diagnosis.

PPT7-009

Learning Curve Evaluation Using Elastpq

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Objectives: The aim of our study was to evaluate the learning curve of obtaining reliable liver stiffness measurements (LSM), using ElastPQ.
Methods: LSM of a trainee were compared to LSM of an elastography expert (with an experience of more than 500 examinations). Our study group included 50 subjects (mean age- 52.7 years, 66.6% men, mean BMI=25.6 kg/m2). Both the trainee and the expert obtained LSM for each subject, using ElastPQ (EPIQ 7, Philips Healthcare, Bothell, WA, USA). Reliable LSM were defined as the median value of ten measurements acquired in a homogenous area avoiding large vessels and with an IQR/ median < 30%. The learning curve was evaluated using the Receiver Operating Curve analysis using the expert's results as reference.
Results: The trainee's performance in obtaining reliable LSM was good (AUC: 0.735, 95% CI (0.557-0.913), p= 0.01). The trainee started to have similar results with the elastography expert after the 30th subject. When looking at the IQRs, they became significantly lower after the 30th subject (6.5±9.2 kPa vs 2.6±2.1 kPa, p= 0.03).
Conclusions: Obtaining reliable LSM using ElastPQ can be easily achieved after 30 LS examinations.

PPT7-010

Liver Stiffness Measurement in Chronic Hepatitis C Patients Who Failed Pegylated-Interferon and Ribavirin Combination Therapy

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Objectives: Direct-acting antiviral agent (DAA) is indicated for chronic hepatitis C (CHC) patients with significant fibrosis in Taiwan. We aimed at evaluating liver stiffness in CHC patients refractory to pegylated-interferon/ribavirin (PR) combination therapy.
Methods: Totally 68 patients with CHC failing PR combination therapy at a single medical center between November 2009 and December 2015 were retrospectively analyzed. Liver stiffness was evaluated by sonography, transient elastography (TE), Fibrosis-4 (FIB-4), and AST to Platelet Ratio Index (APRI). Significant fibrosis (>=F3) was defined as TE>9.5 kPa or FIB-4>3.25 or APRI>0.7.
Results: Mean age of the patients (37 males) was 61±11 (range, 30-90). Proportions of genotype 1 and 2 were 73.5% and 19.1%, respectively. Median scale of TE was 12.3 kPa. Proportions of significant fibrosis (>=F3) based on measurement of TE, FIB-4, and APRI were 58.8%, 50% and 42.7%, respectively. Abdominal sonography, TE, FIB-4, and APRI shared significant correlation in evaluating liver stiffness (p< 0.001), whereas TE and FIB-4 shared highest consistency (85.3%) in assessing liver stiffness. The yield of combining sonography, FIB-4, and TE for identifying significant liver stiffness, which fit the National Health Insurance (NHI) criteria of DAA use, was 63.2 %.
Conclusions: TE and FIB-4 shared highest consistency in assessing liver stiffness. Combination of different measurement tools may help in identifying patients with significant liver fibrosis who fit the NHI reimbursement criteria for DAA use.

PPT7-011

Personalized Biomechanical Modeling of Prostate Deformation Based on Elastography For Mr-Trus Image Registration

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Objectives: To evaluate the clinical significance of personalized biomechanical modeling of prostate deformation based on ultrasound elastography for magnetic resonance imaging (MRI)-Transrectal Ultrasound (TRUS) image registration.
Methods: A total number of 35 patients and 5 commercial prostate phantom were imaged via transrectal ultrasound elastography, TRUS and MRI at the first affiliated hospital of SYSU from June 2014 to December 2015. We propose a personalized biomechanical model via the patient-specific ultrasound elastography for the deformable registration of prostate MR and 3D TRUS images. The registration accuracy was evaluated by the target registration error (TRE) and also the t-test was conducted to validate the statistical significance of our results.
Results: All the 35 sets of patient data, as well as the phantom data, were successfully registered. The TRE value of the phantom data was 1.69mm. The mean TRE value of 35 patients was 1.29 mm, compared with the 2.56 mm TRE value of the registration method without patient-specific biomechanical properties via elastography, was approximately 48% lower. The improvement was with statistical significance validated by t-test (p-value was 1.45e-8).
Conclusions: Personalized biomechanical modeling of prostate deformation based on ultrasound elastography for MR- TRUS image registration is with clinical significance and is a promising way to provide more quality guidance and improve the accuracy of prostate biopsy.

PPT7-012

Reproducibility and Diagnostic Performance of Shear Wave Elastography in Evaluating Breast Solid Mass

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Objectives: To estimate the reproducibility and evaluate the diagnostic performance of shear wave elastography (SWE) in solid breast masses.

Methods: SWE using conventional grayscale ultrasound was performed in 218 women with 264 solid breast masses. Two breast radiologists with 5 and 10 years of experience in breast ultrasound independently evaluated each breast lesion. After all examinations were completed, the SWE images were reviewed by these two readers for color overlay pattern (COP) classification and quantitative elasticity value measurement. The COP reproducibility and quantitative elasticity were analyzed by weighted k value and intraclass correlation coefficient (ICC). The diagnostic performance of the COP, maximum elasticity values (Emax), and Emax combined with COP were calculated by analysis of the receiver operating characteristics (ROC) curves.
Results: The interobserver agreement of the COP was almost perfect (k=0.908). The ICC of Emax (0.89) was highest among elasticity values. The area under the ROC curve (AUC value) of COP and Emax was 0.953, 0.966 in reader 1 and 0.948, 0.958 in reader 2, respectively. The estimated optimal cut-off value of Emax was 44.1. Between patterns 2 and 3 for COP, the AUC value of the COP (0.954) was significantly higher than that of Emax (0.915) (p=0.002). The AUC value of Emax combined with COP (0.957) was not significantly higher than the AUC value of COP (p=0.098).
Conclusions: The SWE color overlay pattern and Emax are highly reproducible. The COP has better diagnostic ability than does Emax, suggesting that it is a more reliable parameter for solid breast mass evaluation.

PPT7-013

Shear Wave Elastography of the Spleen in Healthy Subjects

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Objectives: To evaluate spleen stiffness (SS) value measured by shear wave elastography (SWE) in healthy population.
Methods: Sixty-eight healthy subjects who underwent donor workup (US including SWE and CT) for adult-to-adult living donor liver transplantation were included in this study. SWE of liver and spleen was performed on a Toshiba Aplio 500 unit by board certified radiologists, through right/left intercostal examination. SWE values were obtained the three measurements and the average in each organ, and we also measured the distance from skin to organic capsule. To determine the normal range of SS and spleen/liver stiffness ratio (SLSR), 2.5∼97.5 percentile values as well as mean and standard deviation were obtained. CT volumetry was performed to assess the liver and spleen volumes and liver/spleen volume ratio (LSVR). We evaluated the relationship between SS or SLSR and spleen volume or LSVR.
Results: On SWE, technical failure or unacceptable variability (coefficient of variability=SD/Mean ≥ 0.3) occurred more commonly for SS (n=26, 89.7%) than liver stiffness (LS, n=9, 31.0%) measurement. There was a significant difference in distance of skin-to-capsule between technical success and failure groups ($p < 0.05$). Among 31 subjects in whom both SS and LS measurements were successful, mean, SD, 2.5 percentile, and 97.5 percentile values were 16.0, 3.6, 8.2, and 24.5 kPa for SS, 5.7, 1.1, 4.1, and 8.6 kPa for LS, and 2.9, 0.8, 1.3, and 4.0 for SLSR.The SS and SLSR correlated significantly with spleen volume and liver/spleen volume ratio ($p < 0.05$, respectively).
Conclusions: SS and SLSR measured by SWE in healthy population ranged from 8.2 to 24.5 kPa and 1.3 to 4.0 (2.5∼97.5 percentiles), and may be associated with spleen volume and liver/spleen volume ratio.

PPT7-014

Shear Wave Elastography Versus Real - Time Elastography on Evaluation the Ablation Zone of Rabbit Liver: A Preliminary Experimental Study

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Objectives: To comparatively evaluate the ablation zone of rabbit liver with shear shear wave elastography (SWE) and real-time elastography (RTE).
Methods: A unipolar internal cooled radiofrequency probe was used to form the ablation zone for 10 rabbit liver. After the ablation, SWE and RTE were used to measure the value of elastography. Contrast enhanced ultrasound was used to assess the ablation zone. Then we compared the value of elastography using these two methods. And we compared the diameter of ablation zone among the CEUS images, specimens.
Results: SWE and RTE could display the scope of ablation zone just after the ablation. RTE image could get the ratio of the ablation zone and the surrounding liver. SWE could display the value of elasticity decrease from the center to the edge of ablation zone. We concluded the value of elasticity of ablation zone's rim is 20Kpa. There is not significantly different among the diameter of ablation zone from these two methods and the gross specimen ($P>0.05$). CEUS displayed non-enhancement for ablation zone, but the diameter of ablation zone is larger than gross specimen ($P<0.05$). the cause is the ischemic region surrounding the ablation zone also displayed non-enhancement.
Conclusions: RTE and SWE could confirm the boundary of ablation zone. And the SWE provide the guidance for confirming the boundary of ablation zone.

PPT7-015

Shear Wave Sonoelastography for Intrinsic Stiffness of Sternocleidomastoid Muscle in Infants with Congenital Muscular Torticollis

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Objectives: To evaluate the feasibility of quantifying sternocleidomastoid muscle (SCM) stiffness using acoustic radiation force impulse (ARFI) sonoelastography in infants with congenital muscular torticollis (CMT).
Methods: Twenty infants with an SCM thickness greater than 10 mm with or without involvement of the entire SCM length (limitation of neck rotation passive range of motion [PROM]: group 1S $>30°$, group 1M = $15°-30°$) and 12 infants with an SCM thickness smaller than 10 mm with or without involvement of any part of SCM (group 2) were included. The SCM thickness was measured using B-mode ultrasound, and the local SCM shear wave velocity (SWV) and subcutaneous fat layer using ARFI sonoelastography.
Results: The neck rotation PROM was significantly greater in group 1S ($36.5° \pm 5.3°$) than in group 1M ($18.8° \pm 4.9°$; $p < .01$); the SWV of the SCM in the affected side (2.87 ± 0.99 m/s) was significantly higher than that in the unaffected side (1.50 ± 0.30 m/s;

p< .01). The SWV of the SCM was significantly higher in group 1S than in group 1M. In group 1, the SWV of the affected SCM was positively correlated with the degree of deficits in PROM of neck rotation in the affected side (r = .77; p < .01).
Conclusions: This study revealed a difference in the SWV of the affected SCM according to the limitation of neck rotation PROM in infants with CMT and SCM thickness greater than 10 mm, although no difference in SCM thickness was observed.

PPT7-016

Sonoelastographic Findings in De Quervain's Disease

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Objectives: De Quervain's disease is a common condition involved the first extensor compartment of the wrist. The inflammatory process often affects tendons and causes degeneration. In the study, we aim to use sonoelastography to compare the tendon integrity between patients and healthy volunteers.
Methods: A total of 20 healthy volunteers and 20 patients with De Quervain's disease diagnosed by clinical symptoms and physical examinations were enrolled into the study. All patient received bilateral wrists sonography, including conventional B-mode sonography and elastography. The tendon was divided into three group: grade 1: blue (hardest) to green (hard); grade 2: yellow (soft); and grade 3: red (softest). We also use strain ratio between tendon and subcutaneous fat tissue for quantitative comparisons.
Results: In the symptomatic groups, there are higher rate of intratendinous hypoechogenicity and peritendon effusion. Elastography also showed higher proportion of grade 2 and grade 3 tendinopathy. The strain ratio of the tendon was also significantly lower than healthy group, indicating softer texture.
Conclusions: The study showed patients with De Quervain's disease had significantly lower strain ratio in their tendon within first extensor compartment across the radial styloid. Ultrasound elastography could be a promising method to evaluate such tendon abnormalities.

PPT7-017

Spleen Stiffness Evaluated by Acoustic Radiation Force Impulse (ARFI) Elastography in Cirrhotic Patients is not a Useful Tool to Predict Esophageal Varices Needing Treatment

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Objectives: BackgroundThe spleen stiffness (SS) and liver stiffness (LS), evaluated by Acoustic Radiation Forced Impulse (ARFI), have been related to the risk of varices needing treatment (VNT) in compensated cirrhotic patients. AimAim of our study was to test the diagnostic value of SS in predicting the presence of VNT in a consecutive population of cirrhotic patients.
Methods: We studied two groups: the non-cirrhotic group (NCG) in which histology or clinical features ruled out a liver cirrhosis; the cirrhotic group (CG) of historical patients followed by the Ultrasound Service of our Liver Unit. We studied two groups: the non-cirrhotic group (NCG); the cirrhotic group (CG) of historical patients followed by the Ultrasound Service of our Liver Unit. Over a total consecutive period of four months, all included patients underwent liver and spleen ARFI examination.
Results: We enrolled 145 patients. The first group was of 41 non-cirrhotic patients (24 biopsy-proven: 2 Fibrosis 0/6, 6 Fibrosis 1/6, 5 fibrosis 2/6, 9 Fibrosis 3/6, 2 Fibrosis 4/6 sec. Ishak); the second group of 104 cirrhotic patients (all clinically diagnosed). LS and Spleen Diameter (SD) were significantly lower in the NCG, otherwise the platelets (PLTs), the PLTs/SD ratio and transaminases were significantly higher in the NCG than CG (p< 0.001). SS was not significantly different in NCG and CG, neither in presence of VNT (p=0.161). In the multivariate analysis, LS [adjusted-OR 2.4 (1.17-5.34)], platelets [adjusted-OR 0.98 (0.97-0.99)] and spleen diameter [adjusted-OR 1.16 (0.96-1.36)] were associated with presence of VNT in CG, but SS was not.
Conclusions: ConclusionsWe suggest that SS is not a useful tool to detect VNT among cirrhotic patients. The explanation could lie in the higher stiffness of the spleen in respect to the liver, independently of liver fibrosis and not influenced by portal hypertension.

PPT7-018

The Cutoff Values of ARFI Two-Location Measurement in Different Metavir Fibrosis Scores and Etiologies

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Objectives: Assessment of liver fibrosis with acoustic radiation force impulse (AFRI) imaging is a popular modality to measure liver fibrosis. ARFI may select an optimal location for measurement under imaging guiding. However, there are some debates on standardized protocol for ARFI in compared with well-established protocol in Fibroscan. To decrease the variation of ARFI, we developed two-location measurement with standardized protocol. We would like to establish the cutoff values according to Metavir fibrosis score in different etiologies.
Methods: A consecutive series of patients who received liver histology study were prospectively enrolled. All cases had hemogram, liver biochemistry, viral markers and ARFI two-location measurement within 4 weeks of histology study. A standardized protocol was used and carried out by a single technologist.
Results: A total of 457 patients that included 84 negative for both HBsAg and anti-HCV (NBNC), 20 autoimmune liver diseases, 283 chronic hepatitis B (CHB) and 70 hepatitis C (CHC) were enrolled. Among patients in NBNC, 64 with fat cell >10% and non-alcoholism are considered as non-alcoholic fatty liver disease (NAFLD). The AUROC for Metavir 4 fibrosis were 0.949, 0.766 and 0.939 for NAFLD, CHB and CHC, respectively. The cutoff values for Metavir F4 were 1.750, 1.505 and 1.750 for NAFLD, CHB and CHC, respectively. The sensitivity and specificity were satisfactory and both were over 0.8 for patients with NAFLD and CHC, but was between 0.718 and 0.741 in CHB.
Conclusions: The diagnostic performance of two-location measurement is accurate for NAFLD and CHC, but is relatively poor in CHB.

PPT7-019

The Value of 2D-Swe.Ge for the Evaluation of Liver Fibrosis in Patients with HCV Compensated Chronic Hepatopathies

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Objectives: To evaluate the performance of the 2D- shear wave elastography technique from General Electrics (2D-SWE.GE), for the evaluation of liver fibrosis in patients with HCV chronic hepatopathies, using Transient Elastography (TE) as the reference method.
Methods: We included 145 consecutive subjects with HCV compensated chronic hepatopathies, in whom liver stiffness was evaluated in the same session by means of 2 elastographic measurements: TE (FibroScan, EchoSens) and 2D-SWE.GE (LOGIQ E9, GE Healthcare). Reliable LS measurements were defined as follows: for TE – the median value of 10 measurements with a success rate of ≥60% and an interquartile range<30% and for 2D-SWE.GE - the median value of 10 measurements acquired in a homogenous area and an interquartile range (IQR) <30%. To discriminate between various stages of fibrosis by TE we used the following cut-offs: F≥2: 7.1 kPa, F≥3: 9.5 kPa, F=4: 12.5 kPa.
Results: Reliable LS measurements were obtained in 138/145 (95.1%) subjects by 2D-SWE.GE and in 139/145 (95.8%) by TE (p=0.9). The final analysis was performed on 134 subjects with valid measurements by both methods. We found a good positive correlation between the LS values obtained by the 2 methods r=0.79, p<0.0001. Based on TE cut-off values we divided out cohort into 4 groups: F0-F1:36/134 (26.8%), F2: 23/134 (17.2%), F3:23/134 (17.2%) and F4:52/134 (38.8%). The AUROC was 0.909 for significant fibrosis (F≥2), 0.954 for severe fibrosis (F≥3) and 0.942 for cirrhosis (F=4). The best cut-off values for F≥2 was 7 kPa (Sensitivity 85.7, Specificity 80.5), for F≥3 it was 9.2 kPa (Sensitivity 85.3, Specificity 91.5) and F=4 it was 10.7 kPa (Sensitivity 84.6, Specificity 91.4).
Conclusions: 2D-SWE.GE seems a reliable method for liver fibrosis staging in patients with HCV compensated chronic hepatopathies. The best 2D-SWE.GE cut-off values for F≥2, F≥3 and F=4 in HCV chronic hepatopathies were 7, 9.2 and 10.7 kPa.

PPT7-020

The Value of Elastpq in Healthy Subjects

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Objectives: The aim of the present study was to establish liver stiffness values in healthy subjects, by means of ElastPQ.
Methods: We evaluated 40 healthy subjects (67.5% women, 32.5 % men, BMI=21.9 ± 5.5 kg/m2), without known liver disease and with a normal abdominal ultrasound, in whom liver stiffness (LS) was assessed using ElastPQ (EPIQ 7, Philips Healthcare, Bothell, WA, USA). Reliable LS measurements were defined as the median value of ten measurements acquired in a homogenous area avoiding large vessels and with an IQR/ median < 30%.
Results: Out of 40 subjects, reliable LS measurements were obtained in 39 subjects (97.5%) by means of ElastPQ. The mean LS values in healthy subjects was 4.24 ± 0.96 kPa, CI 95% (3.93 - 4.56). In our cohort, there were no significant differences across gender categories. The mean LS for men was 4.50 ± 1.05 kPa, CI 95% (3.76 – 4.49) while for women 4.13 ± 0.92 kPa CI 95% (3.83 – 5.18) (p=0.27).
Conclusions: ElastPQ has a very good feasibility (97.5%) in healthy subjects. The mean LS value obtained in our cohort was 4.24 ± 0.96 kPa.

PPT7-021

Ultrasound Diagnosis of Liver Fibrosis Using Shear Wave Elastography

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Objectives: To compare the ideal method of shear wave elastography utilizing Young modulus (kiloPascal, quantitative) versus point shear wave(meters/second, qualitative) in patients with various liver disease.
Methods: This was a review of all liver fibroses diagnosed in our institution between January 20l5 and March 2017. Frank liver cirrhosis were excluded in this study. Parameters during ultrasound procedure: 4.0-MHz convex transducer: patient in supine position, breath-hold for 5 seconds, and scanning at the 6th th to 8th intercostal spaces, right side. Right and left lobes of liver should be measured. Avoidance of portal vein or vascular structures during measurement.
Results: A total of 90 adult patients aged 30 to 84 years were studied. Normal values without liver fibrosis (Metavir score of F0) = 1.35 m/s(meters/second) or < 5.4 kPa (kiloPascal). Metavir score of F1 to F4 (mild to moderate fibroses =5.5 to 7 kPa) and advanced fibrosis: 1.99 m/s or 11.9 kPa.
Conclusions: In this study, we have demonstrated that shear wave elastography allows the user to visualize the tissue stiffness as a color-coded map in a 2-D region of interest as well as providing the user with a quantitative and qualitative measurement. It is easily taught and quick to perform. These two methods appear to be complimentary to each other rather than competing. Shear wave elastography is a promising technique for noninvasive quantification of tissue stiffness and has the potential to be useful in the diagnosis, staging and management of diseases associated with changes in tissue elasticity.

PPT7-022

What to Do When Transient Elastography is Not Feasible?

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Objectives: The purpose of this study was to find an alternative to Transient Elastography when this can not be use or when we can not obtain valid reliable measurements.
Methods: Liver stiffness values were assessed with transient elastography [TE- (Fibroscan)], 2D shear wave elastography (SuperSonic Shear Imaging-SSI) and point shear wave elastography (pSWE) using VTQ and ElastPQ, in a cohort of 148 patients with chronic liver diseases. With the help of linear regression, we made a multivariate analysis to test the relationship between TE and the other three methods (ElastPQ, SSI, VTQ). Giving the fact that the factors were very well correlated, we consider them predictors for our model.
Results: The model made with all the factors- ElastPQ+SSI+VTQ compared with TE explained the 90.5% of the model variability (R=0.905). We tempted the probability to exclude one by one the factors. SSI+VTQ explained 90% of the model variability (R=0.90). ElastPQ+VTQ explained 78% of the model variability (R=0.78) and SSI+ElastPQ explained 89% of the model variability (R=0.89).
Conclusions: SSI in combination with ElastPQ or VTQ is as good as the TE single. Therefore these combination can be used when TE can't be made or is not valid.

T8. Emergency and Critical Care Ultrasound

Pre-Congress Workshop/Symposium

T8-13-IN01

Clinically Integrated Ultrasound in the Differential Diagnosis of Acute Abdomen

Young-Rock Ha
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Rapid and accurate diagnosis is vital for a proper management of acute abdomen. However acute abdomen in the emergency department (ED) is the wide spectrum of characteristics. Patients can visit ED at any point of each disease process. Some patients, especially elder ones, hardly describe their symptoms. Although most recommendations depict diagnostic policy based on the location of pain, the location itself is reported not to specify the disease.

As a clinician, acute care physician (ACP) can use physical examination based on the knowledge of difference between not only the visceral and parietal pain, but also symptoms and signs. Fortunately possible surgical abdomen is a clinical diagnosis. They frequently shows rapid symptom evolution, severe pain, and associated with unstable vital signs, fever, and dehydration. Using the clinical feature and physical examinations, ACP should stabilize the unstable and/or potentially life threatening abdominal pain by either confirming or improving confidence with ultrasound. In addition, ACP can make differential diagnosis of stable acute abdomen with ultrasound. Even ultrasound might not reveal any reasonable pathology in some cases, which can be defined as sonographically non-specific abdominal pain. The second level imaging (including CT) can be reserved in selected patient negative or inconclusive ultrasound or in patients not responsive to standard pharmacological treatment.

To accomplish all of these, ACP need to perform a 'clinically integrated multi-focused ultrasound'. A multi-focused ultrasound is defined as systemic whole abdominal scanning regardless the location of abdominal pain. Here I'd like to introduce 'SAFER (focused) Lasso (multi-organ sequentially systemic scanning) approach'; SAFER signifies Size, Air, Fluid, Echogenicity, and Regional lesion. Lasso, a loop of rope that is designed to capture the cows, directs the sequence of scan.

T8-13-IN02

Dyspnea: What Can Ultrasound Tell Us?

Francis Lee
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Dyspnea is a common problem in emergency and critical care practice. The correct diagnosis of the underlying pathophysiologic process is imperative in guiding the correct therapeutic decisions. The traditional approach of physical examination, chest radiographs and laboratory studies form the basis of bedside assessment but has its limitations in diagnosis sensitivity and specificity. The advent of lung ultrasound changes the landscape for dyspnea assessment by providing "visual" clues to the problems at hand. The two key principles of lung ultrasound are: most acute lung problems start at the periphery of the lung and are therefore accessible for ultrasound examination; diagnosis of lung pathophysiology is based on the recognition of the loss or alteration of lung artefacts (such as lung sliding, curtain sign). After a comprehensive examination of the lung fields, one could piece the ultrasound information with the understanding of the pathophysiology of various lung conditions into a diagnostic lung matrix.

T8-13-IN03

The Role of Ultrasound in Evaluating Patients with Acute Chest Pain

Chien-Hua Huang
National Taiwan University Hospital

In acute cardiac care setting, echocardiography is a non-invasive exam with real time images. Echocardiography is an excellent tool to provide details of the cardiac structures information and functional abnormalities – vessels, valves, and muscle. Doppler color mapping is used to measure blood flow across valves, across septal defects (shunts), extent of regurgitations and extremely useful in the detection of abnormal operation of the valves and shunts. Patients with chest pain can carry life-threatening emergency situations. Using echocardiography brings a chance to do rapid and accurate diagnoses to differentiate the causes, including acute coronary syndrome with or without mechanical complications, pericardial disease, aortic diseases or trauma-related cardiac injuries. In addition to the chest pain, careful evaluation of associated symptoms, such as dyspnea, fever and shock status helps for searching the underlying diseases by echocardiography.

T8-13-IN04

First International Guidelines on intestinal ultrasound (GIUS)

Odd Helge Gilja, Prof., MD, PhD
National Centre for Ultrasound in Gastroenterology, Haukeland University Hospital, and Institute of Medicine, University of Bergen, Norway

EFSUMB has through the years released many guidelines and clinical recommendations. The world's first ever guidelines on gastrointestinal ultrasound (GIUS) was released by EFSUMB in 2016 (1). The first subset of the GIUS guidelines on methodology and scanning techniques were published online in EJU September 2016 and will appear in print with an editorial by Seitz KH, Ødegaard S and Lutz H. An EFSUMB Task Force Group (TFG) with experts from all over Europe is continuously working to make more GIUS guidelines and the next topic will be ultrasound in IBD. Other GIUS guidelines are also in pipeline: Inflammatory conditions, transrectal/perineal US, miscellaneous, Upper GI / functional ultrasound.

Gastrointestinal ultrasound (GIUS) offers a unique possibility to examine non-invasively and in physiological condition the bowel including extra-intestinal features such as the splanchnic vessels, mesentery, oment and lymph nodes. For properly trained users, GIUS has been shown to have good accuracy and repeatability not only in a primary work-up, but also in the follow up of chronic diseases.

When reporting findings in GIUS the most discriminatory parameters include bowel wall thickness, length and distribution of bowel wall thickening, an assessment of the preservation of layering and symmetry of any changes present. The presence of fat wrapping and fat creep is a highly specific finding in Crohn's disease and should be included in the report when present. The presence of complications such as fistulae, strictures and collections, together with functional findings such as enteric content and the presence of bowel dilatation and peristalsis should also be noted in the examination report.

All the EFSUMB guidelines and position statements can be downloaded from our website www.efsumb.org

T8-13-IN05

Assessment of Acute Scrotum

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Acute scrotal pain is a common clinical problem. Unfortunately symptoms are vague and clinical findings are non-specific. Immediate

surgical exploration is advised in patients with Acute scrotal pain unless a definitive diagnoses of causes other than torsion can be made.

In about 30 - 50 % cases the different underlying pathological conditions cannot be distinguished by clinical exam or lab tests .Ultrasound offers timely and accurate differentiation of the causes of scrotal pain.

The Spectrum of differentials

- Torsion of the Testis. 30%
- Epididymo-Orchitis. 37%
- Torsion of Testicular appendage. 11%
- Idiopathic scrotal edema. 09%
- Incomplete Torsion & de-torsion.
- Acute hydrocele.
- Strangulated Hernia.
- Henoch Schonlein purpura.
- Hemorrhage into a testicular neoplasm.

Testicular Torsion

- 20-30% of patients with Acute scrotal pain.
- Haste is essential as testicular salvage rate reduces with passage of time in Ac. Torsion

Testicular torsion occurs due to twisting of the testis on cord due to an underlying Bell and Clapper anomaly. Initially the testis swells up due to venous compression, later as the arterial flow is compromised ischemia sets in and tissue necrosis may occur. Sonography and color Doppler ultrasound reflect these developments. On gray scale ultrasound the testis appears slightly enlarged. Color Doppler scan will reveal reduced or absent flow. Careful examination of cord must be performed to look for the whirlpool sign – confirming the twisting of the cord.

Torsion of Testicular appendage

In a child torsion of the testicular appendage is a more common cause of acute scrotum as compared to torsion of the testis itself.

Sonography reveals a small focal hypoechoic mass adjacent to the epididymis. The epididymis and testis appear normal in size and reveal normal vascularity.

This is often a diagnosis of exclusion.

Acute Epididymo-Orchitis

Epididymo-orchitis is a more common cause for Acute scrotum, particularly in young children.

Gray scale ultrasound reveals enlarged epididymis and testis. Echostructure is usually altered and hypoechoic. Testicular involevement is often later and lesser. Color Doppler reveals increased vascular flow signals in epididymis and testis. Some studies have shown that increased vascularity on color Doppler may be the only sign of Acute Epididymitis or Orchitis in 20-40%.

Trauma

Trauma can cause bleeding in the tunical sac producing a hematocele, or it can cause a rupture of the testis itself. Testicular conturs may become irregular, but more often rupture is seen as focal areas of altered echogenecity in the testis.

Difficulties & Pitfalls

- Partial Torsion – some flow may still occur.
- Spontaneous detortion – flow may be normal or increased.
- Orchitis may cause sudden swelling and global ischemia of testis

T8-13-IN06

Musculoskeletal Ultrasound in Acute Care and MSK Emergency

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High resolution ultrasound is an excellent modality in MSK emergency conditions. The role of ultrasound starts in acute MSK infection to MSK trauma. It is very useful to differentiate between cellulitis verses abscess, necrotizing fascitis and cutaneous masses. It can easily locate the foreign bodies. Ultrasounds can pickup bony fractures and helps in identifying non healing fracture and mal union of the bones. Acute tendon ruptures, joint effusion, muscle rupture, crush injury evaluation can be easily done with high resolution ultrasound. High resolution ultrasound is very useful in compartment syndromes and vascular compromise for locating the vessels and assess the vascular insert. It is also very useful in nerve entrapment and can tell with confidence about shearing of the nerve, compression of the nerve and entrapment of the nerve. Large wound assessment can be done with high resolution ultrasound for proper healing.

High resolution ultrasound is also first lie of investigation in acute soft tissue trauma involving muscles, ligaments, tendons and cartilage injury which are not easily picked up on conventional X-ray or CT scan. The main advantage of ultrasound on CT AND MRI that it can be done in emergency room without shifting the patient to CT or MR room.

T8-13-IN07

Ultrasound-Assisted Resuscitation

Wei-Tien Chang, MD, PhD
National Taiwan University Hospital

Cardiac arrest and cardiopulmonary resuscitation (CPR) is the most critical condition in emergency and critical care medicine. Prompt recognition followed by effective diagnosis and management are the keys to successful resuscitation. In recent years ultrasound has been shown to play increasingly important roles during CPR. In addition to verifying the potential etiologies of cardiac arrest, ultrasound may also help identifying the coexisting confounding factors that hinder the return of spontaneous circulation. Examples are hypovolemia, tension pneumothorax, cardiac tamponade, massive pulmonary embolism, large area myocardial infarction, etc. Moreover, ultrasound also helps in confirming tracheal intubation, assuring adequate bilateral lung ventilation, and monitoring cardiac activity during CPR. In the post-resuscitation phase, ultrasound can be used to evaluate volume status and the presence or severity of post-resuscitation myocardial dysfunction, based on which proper fluid therapy, pharmacological intervention, or mechanical support can be employed. Further, other potential etiologies such as internal bleeding, aortic dissection, ruptured abdominal aortic aneurysm, e.t.c. could be identified through a systemic ultrasound evaluation. In fact, ultrasound has been formally suggested and increasingly incorporated into the advanced cardiac life support (ACLS). With proper training, ultrasound may serve as a powerful tool in the diagnosis and management of cardiac arrest patients undergoing CPR.

T8-13-IN08

Ultrasound Assisted Interventions for Regional Blockade

Yusef Sayeed, MD, MPH, MEng., CPH, CMRO, CME, DABPM

This session is specifically designed for health care providers who are exploring ultrasound to help management of patients with acute injuries that require ultrasound guided interventions for regional blockades. Covering the Superficial Cervical Plexus, Interscalene, Supraclavicular, Femoral and Lateral Femoral Cutaneous, and Posterior Tibial Nerves this course will present a systematic and focused assessment with ultrasound. The session will include when and how to intervene. The participant will develop ultrasound pattern recognition of the nerves for major regional blockades. The case discussions will focus on pathologies that are commonly encountered.

T8-13-IN09

Ultrasound-Assisted Sepsis Management

Kuo-Chih Chen
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Sepsis is a medical emergency that requires multidimensional and simultaneous efforts for better outcomes. Sepsis definition and management is evolving during previous 20 years. The core concepts for successful management remain the same: early diagnosis and source control, adequate hemodynamic monitoring and supportive cares.

Point-of-care ultrasound (POCUS) is getting popular in different challenging settings, such as trauma, emergency medicine and critical care medicine.

POCUS is also evolving from focused and single applications to integrated and problem-oriented approaches, such as EFAST, BLUE and RUSH protocols. Currently, there is no universal protocol for sepsis management. The potential benefits of POCUS for sepsis management could be infection control, hemodynamic monitor and treatment guidance. In this section, clinical cases will be used to demonstrate how to use POCUS for septic workup, infection intervention, vascular access, fluid guidance, non-invasive hemodynamic monitoring and respiratory management.

Symposium

T8-15-IN01

Advanced Eco-FAST. Beyond the FAST

S. Jorge Rabat
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Initial management of trauma patients is one of the greatest challenges in clinical practice, because it requires very quick decision based primarily on clinical criteria. FAST ultrasound has been shown to be useful for the detection of bleeding in the thorax and abdomen, as well as to detect cardiac tamponade in patients with penetrating thoracic trauma and to diagnose the presence of pneumothorax. The FAST A, B, C, D, E is a new approach where the patient is evaluated with "head to toe" Ultrasound, starting from the airway, ventilation, heart, vascular, abdomen, to the System Nervous central (eye). This has made it a valuable tool for therapeutic decision making in trauma patients, as well as for the selection of patients in catastrophic situations.

T8-15-IN02

Ultrasound Guided Resuscitation Pathways in the Critically Ill Patient

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Ultrasound is having a tremendous impact on resuscitation of critically ill patients from the emergency department to the intensive care unit and surgical suites. Prior to ultrasound introduction in the point of care, clinicians were left with little but pulse palpation and use of any already established invasive monitoring devices to guide resuscitation. Studies have indicated that clinicians could not accurately assess the presence of a pulse and auscultation was not accurate for the assessment of pulmonary or cardiac status in most critical situations. The lack of immediate x-ray availability and other imaging greatly hampers resuscitative efforts in many situations. Fortunately, point of care ultrasound allows clinicians to directly observe anatomy and physiology even in the most critical patient and thereby adjust resuscitative efforts based on real time data that has never been available previously. As a result, multiple resuscitation pathways have been developed to take advantage of ultrasound bedside capabilities incorporating a symptom based approach and leaving behind single organ scanning approaches.

T8-15-IN03

Focused Ultrasound in the Peri-Arrest Setting

Adrian Goudie
Fiona Stanley Hospital & King Edward Hospital for Women

Focused ultrasound can be used in the arrest and peri-arrest setting to distinguish the cause and direct management of critically ill patients. This talk will discuss both the technique, range of potential findings and prognostic information that can be obtained with ultrasound

T8-15-IN04

SEARCH (Sonographic Evaluation of Aetiology for Respiratory difficulty, Chest pain, or Hypotension) for 9Es

Young-Rock Ha
Department of Emergency Medicine, Bundang Jesaeng Hospital, Korea

Focused thoracic ultrasound in emergency includes a cardiovascular ultrasound, lung ultrasound, and FAST examination. The critical scenarios for it can be categorized into 3 situations along to the time; pre-cardiac arrest, during the cardiac arrest, and post-resuscitation. When patients are in potential arrest, we need to focus on the patients' symptoms and signs and perform the ultrasonography right after short history taking and physical examination. Critical symptoms that we should care are like these, acute dyspnea, chest pain, hypotension, or shock-related symptoms and signs such as unresponsiveness, syncope, dizziness, or sweating.

However, critical patient's symptoms and signs frequently show up together. That's why we should perform a focused thoracic ultrasound for any combination of these indications. We could figure out what happened to the patients and treat them based on their sonographic findings. We named this as SEARCH, which means sonographic evaluation of aetiology for respiratory difficulty, chest pain, or hypotension.

Additionally we determined target abnormalities, 9Es to search for with focused thoracic ultrasound. 8Es are mnemonic symbolizing the potentially critical situations which could be diagnosed by SEARCH; Empty thorax (pneumothorax), Edematous or wet lung (pulmonary edema/ alveolar consolidation), E-FAST (pleural and peritoneal effusion), Effusion (pericardial effusion), Equality (pulmonary embolism), EF (LV systolic dysfunction), Exit and entrance (estimation of IVC, aortic dissection, aortic aneurysm, severe valvular heart disease), Endocardial inward motion (Acute coronary syndrome), and lastly E/E'(the ratio of early transmitral flow velocity to early diastolic mitral annular velocity). We can skip the last E, because we can have most of critical information using 8Es and it needs much more experience. Scanning sequence of SEARCH is as follows. After scanning both lung (in the same way of Dr Lichtenstein's BLUE protocol), we obtain the parasternal long axis view and 4 chamber view on either apex or subxiphoid, and then check abdominal aorta and IVC. We could quickly obtain most of information in those processes. If necessary, In addition to those views, we can look into parasternal short axis view, apical two chamber view and suprasternal view. Those additional views are especially helpful in case of chest pain.

During 13 months, we had performed SEARCH 8Es just after history taking and physical examination for ED patients who complained of respiratory difficulty, chest pain, hypotension, or shock-related symptoms and signs and who are admitted to general ward or ICU. We compared diagnosis determined by SEARCH 8Es with final diagnosis at discharge with review of charts. Kappa value between the diagnosis after SEARCH 8Es and final diagnosis was 0.870. The level of confidence

and number of impressions were significantly elevated and reduced respectively after SEARCH 8Es

We concluded that focused thoracic ultrasound, SEARCH 8Es is the useful and convenient tool that can help emergency physician make accurate decision in patients with dyspnea, chest pain, or shock.

T8-15-IN05

US in Detection and Differentiation of Ileus

Dieter Nuernberg
Professor for Gastroenterology, Medical School Brandenburg Theodor Fontane, Neuruppin, Germany

Ultrasonography has become increasingly important in the routine diagnostics of gastrointestinal diseases. It is not only assessing the lumen but more important the wall and the surrounding structures of the stomach and bowel. Furthermore, functional processes (peristalsis, blood flow) can be visualized and provide important information about passage and perfusion. With modern high resolution (compressive) sonography the gastroenterologist has an ideal method available complementary to endoscopy.

Ultrasonography is an effective diagnostic tool in situation of emergency (ileus, perforation). In emergency indications sonography is the method of first choice achieving a high sensitivity. The same applies to the ileus, which can be diagnosed significantly earlier by sonography than with conservative X-ray. Meanwhile sonography can contribute considerable information to clarify genesis (e.g. invagination, intusception).

Signs of mechanical small bowel ileus are dilatated and round bowel loops. In the late phase, the bowel wall is thicker, oedematous and a peristaltic. Hyper peristaltic, pendula peristalsis und atony depend on the stadium. Distal of the stenosis the bowel is empty ("hunger bowel"). Frequent causes are adhesive bands and adhesions (not visible), incarcerated hernias, invaginations (in children) or tumours (seldom foreign bodies or gall stones). Differential diagnostic peritoneal carcinosis has to be excluded as cause of the obstruction. Often the cause for he ileus can be found by detailed examination in conjunction with medical history and clinical symptoms. Differential diagnostic wide, exudate-filled, intestinal loops with hyper-motility in case of endemic sprue, but also other forms of secretory diarrhoea.

Most frequently the cause of large bowel ileus is colon cancer. Typical is a lot of gas in the dilated colon. Other reasons are coprostasis, volvulus, peri-diverticulitis and IBD.

In paralytic ileus, small bowel loops are enlarged and a peristaltic and also the colon is enlarged. Typical examples are postoperative bowel atony or paralytic situations in pancreatitis, peritonitis and mesenteric ischemia.

The published sensitivity of sonography (89 – 97 %) is significant higher than that of X-ray (77 - 85 %). In mechanical small bowel ileus diagnosis with possible US is 6 h earlier then with X-ray. Radiological signs are considerably later apparent as the passage obstruction, detectable by sonography. In large bowel ileus, heavy flatulence of single bowel segments is the main sign, in some cases this can be demonstrated more clearly with a X-ray abdomen overview. But gas filling is usually a late sign of Ileus. Free intraabdominal fluid (interenteric ascites) is also a (late) sign of Ileus.

T8-15-IN06

The US-CAB Protocol During Resuscitation

Wan-Ching Lien
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Pulse check, auscultation and capnography are traditional methods for confirming the circulation-airway-breathing (C-A-B) status during cardiopulmonary resuscitation (CPR). However, application of these methods during resuscitation may have limitations. Ultrasonography has an increasingly important role in emergency conditions like CPR. We proposed a novel ultrasound C-A-B (US-CAB) protocol in an ALS-compliant manner. This systematic ultrasonographic evaluation during CPR not only serves as an adjunct to traditional C-A-B check, but also identifies potentially reversible causes of cardiac arrest and confounding factors of CPR.

T8-15-IN07

A Common Misunderstanding in Lung Ultrasound: The Comet Tail Artifact

Francis Lee
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Lung ultrasound diagnosis depends on the interpretation of changes or loss in the natural artifacts produce by lung air. Several vertical linear lung artifacts have been described, of which two stands out as being the most important: the comet tail artifact and B-lines. The term "comet tail artifact" are often loosely used to describe any kind of vertical lung artifacts, creating some confusion. Comet tails, B-lines and one of their cousins: The Z-line, have been presented as "comet tails" in common literature and publications. However, these three entities have distinct genesis, appearances and diagnostic significance. A clarification of term "comet tail" goes a long way to remove the barriers of interpreting, communicating and learning lung ultrasound findings.

T8-15-IN08

Ultrasound Guided Interventions

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The European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) guidelines on interventional ultrasound (INVUS) are an expression of interdisciplinary and multiprofessional viewpoints, some of which represent different approaches; this reflects reality in all its diversity. Particular attention has been given to clinical significance (level of evidence and the more practical grade of recommendation). The principle of "do no harm" is expressed in repeated pleas to apply the techniques judiciously in everyday practice and not become fascinated with technology for its own sake. The decision to proceed with an interventional procedure is always an individual one and should be measured by its benefit for the patient (1). The guidelines consist of six main parts that are published in Ultraschall in der Medizin / European Journal of Ultrasound (2-10), an introduction (1) and Editorial (11) and comment papers (12-14).

T8-15-IN09

Prehospital Ultrasound

Jen-Tang Sun
Far Eastern Memorial Hospital

Ultrasound is raising star in emergency medicine, many of study were published in EM, among them, some article related prehospital condition, including FAST, pneumothorax and lung edema. Due to unique condition of prehospital environment, like the noising, can influence our physical examination. Ultrasound can provide some correct diagnosis and give more information about the patient. This presentation is review of ultrasound in prehospital use.

T8-15-IN10

Gas as a Sign of Critical Illness in Abdominal Diseases

Dieter Nuernberg
Professor for Gastroenterology, Medical School Brandenburg Theodor Fontane, Neuruppin, Germany

Gas normally only occurs in the gastrointestinal system. Gas in the free abdominal compartment is a sign of perforation. But gas sometimes can also be seen in parenchymal organs (as abscess or covered perforation), also in the retroperitoneal room and very seldom in the wall of bowel or in vessels. Gas at wrong places (extragastral and extraintestinal) is an important sign in gastrointestinal diseases.

Perforation of the GIT is occurring very rarely (1-2%). Most frequently it is caused by ulcers of the stomach and the duodenum. X-ray, sonography and endoscopy are most important in the diagnosis of this complication. X-ray is fairly reliable in detecting air but needs a greater emission of gas. Given optimal conditions during the examination ultrasound can detect small amounts of air (1-2 ml). In daily routine sensitivity of this method is low (approx. 50 %). The diagnosis of a covered perforation is very complicated as it is lacking the typical criteria of free air in X-ray and sonography.

Patients with strong epigastric pain who were suspected to have a perforation were examined by ultrasound before and after undergoing endoscopy. We payed special attention to the presence of criteria of free air as well as any sonographical changes in the surrounding of the stomach.

The detection of free air by sonography sometimes is better after endoscopy. A covered perforation can only be visualized by enhancement of air. Criteria of a covered perforation are: *Echogenuous enhancement of a strictly limited cavity of perforation. *Reverberations of air within the cavity. *Detection of the leakage. (Orifice of perforation) *Detection of air motion. *Change of sonographical image after second look sonography.

The detection of a free or a covered perforation by endoscopy and other imaging methods is complicated. Second look sonography after insufflation of air by endoscopy can be useful and shows sometimes the perforation cavity. Under optimal conditions even the leakage can be visualized. The principle of a complementary sonography is little incriminatory. It provides the examiner with additional information, especially in a diagnostic procedure that is marked by a pressure of time.

Gas in abdominal organs is a sign of abscess. Abscesses with gas can also occur between the bowel loops as interenteric abscesses. Gas in abdominal vessels can occur in situation of sepsis.

T8-15-IN11

Ultrasound Integration into Medical School Curriculum

Harvey L. Nisenbaum
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Ultrasound is portable, uses non-ionizing radiation, gives important information both anatomic and physiologic, is relatively inexpensive, but is hands-on skill for image acquisition.

Early on, US equipment was large and expensive and located in departments like Radiology, Obstetrics & Gynecology, and Cardiology. Physicians, after their patient examination, would suggest possible diagnosis and then send the patient for separate US study.

High quality laptop and handheld US units can now be used at point-of-care. Appropriately trained physicians can use them to enhance their physical examination. No need to use a stethoscope when the heart can be imaged and observed looking for abnormalities.

Many other structures can be evaluated in the same way resulting in more timely patient care.

Appropriate use of US has become a core skill that all future physicians will need to learn.

Number of specialties require US training in their Residencies like Radiology, Emergency Medicine, and Obstetrics & Gynecology. Residencies would be able to concentrate more on patient care if the medical student entering their Residency was already proficient in the use of US.

Medical school mission is to educate and train their students to be the best prepared physicians to provide the best care for their patients. The use of US is a core skill they should be taught. This core skill also enhances their educational experience in medical school.

How does one introduce a new skill into a medical school curriculum that is already jam-packed? The US Integration into medical school curriculum has many requirements which will be discussed in the presentation- "champion"; support of deans; support of module leaders; hands-on teachers; space; budget (US equipment, server to save images for each student, simulation); funding; feedback.

Final thoughts- each medical school is unique; support of the leaders is mandatory; collaboration is essential; resources (space, equipment, time) need to be available; and how rapid and successful the integration of US into the curriculum depends on many factors which are unique to each institution.

T8-15-IN12

Future Directions of Ultrasound in Acute Care Medicine

Yueh-Ping Liu
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Dermoid cysts are composed of well-differentiated tissues of at least two of the three types of germinal cells (ectoderm, mesoderm and endoderm) and present various and complex ultrasonographic aspects. That is why the ultrasonographic diagnosis may be difficult and lead to confusion. Ovarian dermoid cysts are made up of solid, cystic and fat tissue. These components give rise to characteristic sonographic features such as a fat-fluid level, dermoid mesh and tip of the iceberg sign. The presence of two or more of these typical features can be used to confidently diagnose a dermoid cyst on ultrasound. The purpose of this paper is to present a case with typical ultrasonographic findings of the dermoid cysts and illustrate the characteristic sonographic features through articles review.

Keywords: Dermoid cyst, mature teratoma, ovarian cyst, ultrasound

Free Paper

OPT8-001

Sonographic Findings of a Dermoid Cyst in a 15-Year-Old Girl

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Objectives: Ovarian dermoid cysts are made up of solid, cystic and fat tissue. These components give rise to characteristic sonographic features such as a fat-fluid level, dermoid mesh and tip of the iceberg sign. The presence of two or more of these typical features can be used to confidently diagnose a dermoid cyst on ultrasound. This 15-year-old girl with good health condition and presented with abdominal pain for 2-3 weeks and aggravated for 2 days. KUB showed a bony structure over LLQ (Fig 1). Thus abdominal echo was arranged and demonstrated two of these features (Fig 2), had the diagnosis of a dermoid cyst later confirmed on CT (Fig 3) and histopathology.

Methods: Case report and literature review.
Results: A 15- year old girl with good health condition presented with abdominal pain for 2 – 3 weeks, and was found to have a bony structure over LLQ. Ultrasound showed a fat-fluid level and tip of the iceberg sign; the diagnosis of a dermoid cyst later confirmed on CT and histopathology.
Conclusions: Dermoid cysts or mature cystic teratoma present various and complex ultrasonographic aspects. Ultrasound has become a frequently used and highly effective modality through which the diagnosis of a dermoid cyst can be made. Timely diagnosis This case illustrates that ultrasound can be used to aid in the diagnosis of dermoid cyst, especially for girls with good health condition presentation of a bony structure on X ray.

OPT8-002

Bilateral Pulmonary Embolism Diagnosed by Emergency Department Physician Using Bedside Echocardiography in a Nstemi Case

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Objectives: NSTEMI is diagnosed by EKG with no ST segment elevation but elevation of blood Troponin I level. Pulmonary embolism is due to blood clot in the lung vessel. However, there is no relative relationship between the two by literature. We present a case of NSTEMI complain of shortness of breath and dyspnea where emergency department echocardiography diagnosed pulmonary embolism and finally confirmed by computed tomography.
Methods: Case report and literature review.
Results: A 72 years old woman transfer to our hospital due to NSTEMI but patient had persisted shortness of breath and dyspnea . Bedside echocardiography showed right ventricle dilatation ,positive McConnell's sign, positive 60/60 sign, left ventricle had D-shape appearance in parasternal short axis view during diastole. Chest computed tomography with and without contrast showed bilateral pulmonary artery filling defects , clinically compatible with acute pulmonary embolism. Finally the patient is treated successfully with anticoagulant therapy.
Conclusions: Echocardiography is available in emergency department nowadays but it should not be used as a screening test for pulmonary embolism due to low sensivitiy in unselected patient. However, echocardiography did play a role in submassive and massive pulmonary embolism with high specificity.

OPT8-003

Early Detection of Superior Mesenteric Artery Dissection by Ultrasound: Two Case Reports

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Objectives: Superior mesenteric artery (SMA) dissection is a rare disease. Some of the cases are isolated type, the others are associated with aortic dissection. Most of the cases are diagnosed by contrast-enhanced computed tomography (CECT). The use of emergent bedside ultrasound has been described to diagnose aortic dissection. However, there is limited literature regarding the use of bedside ultrasound to identify superior mesenteric artery dissection, a known high-risk feature of aortic dissection. We present one case of isolated SMA dissection and one case of SMA dissection complicated with aortic dissection. Both of them were diagnosed by bedside ultrasound first and confirmed by CECT
Methods: Case report and literature review.
Results: Case one: A 46-year-old male patient without past history of hypertension. He suffered from intermittent epigastralgia for 3 days. Laboratory data, ECG, KUB showed no specific finding. Bedside ultrasound found faint intimal flap in SMA. The diameter of SMA was 15.4mm. Color duplex revealed thrombosis or false lumen in SMA. Cardiovascular specialist was informed and SMA dissection was proved by CECT. Patient's symptom improved after anticoagulant usage. Case two: A 46-year-old male patient with past history of hypertension and old ischemic stroke. He had sudden onset of consciousness change and recurrent stroke was impressed initially. However, due to relative low systolic blood pressure (97mmHg), we performed bedside ultrasound to the patient and found intimal flap in abdominal aorta and SMA. The diameter of SMA was 10.5mm. Cardiovascular specialist was consulted immediately. Patient's consciousness recovery to clear after endografting surgery.
Conclusions: These two cases illustrate that bedside ultrasound can be used to early detect SMA dissection. The normal diameter of SMA was reported as 5.7-7.3mm. The aneurysm is considered more than 1.5 times of normal diameter. Intimal flap of SMA dissection may not be easily seen in ultrasound due to poor image quality. However, the diameter of SMA $>$ 10 mm should warrant clinician the high suspicion of SMA dissection and further image study or specialist consultation should be considered.

OPT8-004

Use Point of Care Sonography (POCUS) for Rapid Screening Subacute Lead Perforation

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Objectives: Pacer maker perforation is defined as right atrium or the right ventricle is perforated after pacemaker lead inserted. It is an uncommon condition with published rates of 0.1–0.8% for pacemakers and 0.6–5.2% in ICDs. The perforation usually developed within 1 month after implantation. According to onset time, lead perforation can classified into 3 categories: acute (Developed within 24 hours after implantation); subacute (Onset within 1 month), and delayed. CT remains the gold standard of diagnostic tool. However, the point of care sonography (POCUS) imaging is useful in epidemiological screening of pericardial effusion, temponade sign and free pacemaker/ICD lead to diagnose suspected cases of lead perforation.
Methods: Case report and literature review.
Results: A 73-year-old male with a history of neurocardiogenic syncope and palpitations underwent pacemaker implantation 1 week ago. Dyspnea with chest pain and syncope developed post–pacemaker implantation. The patient was admitted for pleuropericarditis. POCUS showed temponade sign with free pacemaker lead at right ventricle wall (yellow arrow). Emergent pericardiocentesis showed fresh blood about 200cc. Contract . Computed tomography also showed findings of free pacemaker lead protruding to right ventricle wall with pericardial effusion. Emergent sternotomy revaled laceration about 1cm over RV inferior wall with slow active bleeding. After cardiorrhaphy he was discharged on 7th day of admission.
Conclusions: Symptoms of lead perforation include chest pain, dyspnea, syncope, inadequate ICD shocks, muscle or diaphragm stimulation, abdominal pain, hiccup and pleural or pericardial effusion. That means no specific symptoms of this rare clinical condition. Despite of CT remains the golden diagnostic tool, POCUS is faster and more convenience in ED setting. By early recognition of new onset pericardial effusion and even free pacemaker/ICD lead, emergent pericardiocentesis and surgical intervention can be carried as fast as possible, reducing the morbidity rate and minimize cardiovascular sequelae.

OPT8-005

Bedside Ultrasound in Intensive Care Unit (ICU): Impact of Size, Image Quality and Boot Time

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Objectives: There are several factors, which limit the application of ultrasound in an ICU, such as the amount of space next to the patient's bed, the image quality and boot time of ultrasound devices. This study examines the influence of size, image quality and booting time to the use of sonographic imaging in ICU.
Methods: The number of sonographic examinations in ICU over a time interval of two years was calculated and the types of exams categorized. The first year an older, big-sized ultrasound device with a long booting time was provided. The second year the machine was replaced by a newer, small-sized model with a fast booting system. Using a standardized questionnaire, the most relevant factors determining the use of ultrasound imaging were analyzed.
Results: In total 3285 exams were done in ICU over the two-year time interval, whereas a plus of 23% could be documented in the second year of the study. There was no significant increase in typical ultrasound exams like depiction of the inferior vena cava, looking after pleural effusion or the function of the diaphragm, sonographically guided puncture of the internal jugular vein or abdominal examinations. Instead new imaging methods were applied more often: accessing deep peripheral vessels for catheterization, lung sonography (e.g. detection of peripheral lung embolism, pneumothorax or pulmonary congestion by depiction of B-lines), neck ultrasound to confirm endotracheal tube position. 90% of the colleagues ranked the small size and immediate booting time of the machine as most relevant.
Conclusions: To improve the use of ultrasound imaging in ICU, ultrasound machines should be small and fast booting.

Poster Session

PPT8-001

Bedside Sonographic Characteristics of Early and Late Appendicitis

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Objectives: The patients with appendicitis can visit emergency department (ED) either before or after the migration of pain into right lower quadrant (RLQ). The purpose of this study was to determine the characteristics of bedside ultrasound (BUS) and clinical characteristics of the early appendicitis (EA) comparing to the late appendicitis (LA) in ED.
Methods: A BUS registry of RLQ tenderness for one year was reviewed. Among these cohorts, patients pathologically proven to have appendicitis were selected and divided into two groups: an EA group, patients who complained of a diffuse abdominal pain, and a LA group, patients who complained of a localized right lower quadrant pain. The two groups were compared according to gender, age, BUS findings, inflammatory markers, clinical features, and postoperative pathological findings.
Results: A total of 102 patients were enrolled in this study. Among them, 42 patients (41.2%) were in the EA group and 60(58.8%) were in the LA group. Appendiceal diameter and non-compressibility did not differ between the two groups. However, periappendiceal fat infiltration and fluid were less prevalent in the EA group ($p=0.031$ vs. $p=0.022$, respectively).
Conclusions: Both dilated appendiceal diameter and non-compressibility were visualized in BUS of EA patients. Emergency physicians can detect EA before the localization of pain to RLQ by using BUS.

PPT8-002

Detection of Interstitial Pregnancy with Rupture by Point-of-Care Ultrasound at Emergency Department: A Case Report

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Objectives: The interstitial portion of the fallopian tube is the proximal segment that is embedded within the muscular wall of the uterus. A pregnancy implanted at this site is called an interstitial pregnancy. Interstitial pregnancies are more dangerous than other types of ectopic pregnancies, as they tend to rupture later because of greater dispensability of the covering myometrium and lead to devastating hemorrhages. In this obstetric emergency, detection of hemoperitoneum by using point-of-care ultrasound (POC-US) may be life-saving.
Methods: Case report and literature review.
Results: A 25-year-old woman, gravid 2, para 1, was pregnancy at 9 3/7 weeks of gestation, visited our Emergency Department (ED) due to progressive lower abdominal pain for one day. Point-of-care Ultrasound (POC-US) was performed by ED physician with free fluid in cavity and no gestation sac in uterine cavity seen (Figure 1). Right interstitial pregnancy was suspected and was proved by emergent laparotomy. Right cornual resection was performed. She was discharged days later and improvement was documented on the medical record at Outpatient Department.
Conclusions: Interstitial pregnancy compromises about 2-3% of all ectopic pregnancies and may be misdiagnosed as intrauterine because it is partially implanted in the endometrium. Undiagnosed interstitial pregnancies usually rupture following 8 to 16 weeks of amenorrhea and are associated with mortality rate as high as 2.5% due to risk of severe hemorrhage. It is vital for ED physician to detect the acute abdomen in pregnant patients. Utilizing POC-US, ED physicians could rapidly identify hemoperitoneum and expedite the operative management in this patient. POC-US is a useful tool at ED because it provides real-time images for lesions detection and demonstrates the dynamic changes if is being performed repeatedly. Its non-invasive and radiation-free properties make it safer for pregnant woman and may be used as the primary tool to screen obstetric emergency.

PPT8-003

Dilatation of Aortic Root in a 36-Year-Old Male with Chest Tightness

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Objectives: The risk of thoracic aortic dissection is strictly related to the diameter of the ascending aorta. The role of echocardiography is very essential detecting aortic root dilatation in emergency Department Physician can obtain many information along with bed-side echocardiography. We present a case of a young male with syncope and chest

tightness. The diagnosis is made by echocardiography and confirmed with computer tomography.
Methods: Case report and literature review.
Results: A 36-year-old male was sent to emergency department due to syncope. He was fully consciousness when arriving ER and complained chest tightness. Bedside echocardiography revealed dilated aortic root about 6 centimeters with pericardial effusion which is highly suspect ascending aorta dissection. Emergent computer tomography revealed intimal flap in the ascending aorta and aortic arch with hemopericardium. Patient received emergent surgical intervention and recovered very well.
Conclusions: Echocardiography plays an important role in the emergency department for detecting aortic dissection. The disease has high mortality rate and should receive emergent surgical intervention. Perform echocardiography in patient complained chest pain can early detect aortic dissection and reduce morbidity and mortality of patient.

PPT8-004

Early Detection of Free Wall Rupture by Point of Care Ultrasound

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Objectives: Free wall ruptured is a rare but fatal complication of post myocardial infarction (MI). Point-of-care ultrasound provides a rapid diagnosis and increase chances of patient's survival.
Methods: Case report and literature review.
Results: A 49-year-old man with past history of type A dissection status post grafting operation and hypertension under regular medication control; He visited our Emergency Department with complaint of sudden onset chest pain that radiates to back for a day with hypotension. Electrocardiogram revealed ST elevation over anteriolateral leads (V2-V4). Point-of-care ultrasound shows free wall rupture of lateral wall with pericardial effusion. Computed tomogram angiography also revealed hemopericardium and free wall rupture. Patient received emergent vascular exposure for extracorporeal membrane oxygenation removal and vessel repair operation and recovery has been uneventful and is discharged under stable condition.
Conclusions: Free wall rupture is a deathly complication of post cardiac infarction; incidence rate of approximately 2-4% and 12–21% of deaths following MI. Complication typically does not occur within 24 hours of post MI but at the highest incidence of the following 7 days. Mortality is extremely high; hence, early finding is essential. The definite diagnostic criterion is echocardiography, with sensitivity of 100% and a specificity of 93%. The actual tear site, hemopericardium and right-heart collapse can be seen through echocardiography. Free wall rupture is a critical complication of post MI, requires rapid diagnosis and operation treatment. Point-of-care ultrasound provides an effortless and ultimate diagnosis, thus, increases the chance of survival.

PPT8-005

Emphysematous Pyelonephritis in a Diabetic Patient

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Objectives: Emphysematous pyelonephritis is an uncommon and life-threatening infection of the kidney. Gas forming organisms infect the renal parenchyma, tissue, and collecting system, leading to rapid necrotizing destruction of the renal parenchyma and perirenal tissue. We present a case of emphysematous pyelonephritis diagnosed by bedside emergency department ultrasound.
Methods: Case report and literature review.
Results: A 84 years-old female patient, history of diabetes mellitus and hypertension, was presented with general malaise, poor appetite and high blood sugar for about 1 week at home. A bedside emergency department ultrasound was performed and showed reverberation of air within the right kidney that obscures the entire kidney shadow, right side pleural effusion. Later, abdominal CT scan without contrast showed prominent air collection in right renal parenchyma and perirenal space with a big calcified stone in right renal pelvis. Right subcapsular nephrectomy is done by urologist and the patient is discharged uneventfully on the 20th hospitalization day.
Conclusions: Emphysematous pyelonephritis is a severe and acute necrotizing parenchymal renal infection caused by gas-forming bacteria. Diabetes mellitus and urinary tract obstruction are the two most predisposing factors. The initial diagnosis can only be made by emergent department ultrasound and confirms by abdominal CT scan. Aggressive broad-spectrum antibiotics should be initiated as soon as possible once diagnosis had made combined with or without percutaneous drainage and finally nephrectomy if medical theapy failed.

PPT8-006

Lung Ultrasound Findings in Radiographic Occult Pneumonias

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Objectives: To demonstrate the ability of lung ultrasound in discovering pneumonic lesions in radiographic occult pneumonias.
Methods: A systematic protocol for lung examination is presented with three cases illustrating how the pneumonias could be missed by simply relying on the chest x-rays as the final arbiter for diagnosis.
Results: The reasons for radiographic occult pneumonias could be related to radiographic techniques of acquiring a chest x-ray, age or location of the pneumonia. Three cases were used to demonstrate how ultrasound could help clinch the diagnoses.
Conclusions: In patients presenting with clinical signs of lower respiratory tract infection, a lung ultrasound should be performed if the chest x-rays appear normal.

PPT8-007

Role of Point of Care Ultrasound in the Diagnosis of Perforated Peptic Ulcer

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Objectives: Perforated peptic ulcer is a common cause of acute abdomen and intra-abdominal infection in the emergency departments. The diagnosis is usually made by typical history, diffuse abdominal tenderness, muscle guarding and confirmed by x-ray or computed tomography. Despite previous studies point out that ultrasound is superior to plain radiography to diagnose pneumoperitoneum, most emergency physicians are still not familiar with this application. We report a case presenting with diffuse abdominal pain and muscle guarding to the emergency department and the diagnosis of perforated peptic ulcer was made by point of care ultrasound and confirmed by computed tomography and surgery.
Methods: Case report and literature review.
Results: A 75 year old woman presented with dull epigastric pain for one week and developed acute abdominal pain for half day Her vital signs were stable. Physical examination reveled diffuse abdominal tenderness and muscle guarding, especially over epigastrium. Ultrasound showed dirty ascites at Morrison's pouch, right para-colic gutter and pelvic region, free air above surface of left lobe liver and a perforated hole at pre-pyloric region. Computed tomography and surgical finding confirmed the diagnosis.

Conclusions: This case indicates that point of care ultrasound in emergency department can be use to diagnose intraperitoneal free fluid and air. It is also possible to diagnose perforated ulcer at prepyloric region. In addition to abdominal aortic aneurysm screening, we recommend routine use of point of care ultrasound to screen free fluid in dependent regions and free air in nondependent regions for patient presenting with acute abdominal pain in the emergency departments.

PPT8-008

Role of Point of Care Ultrasound in the Diagnosis of Thigh Foreign Body and Its Removal

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Objectives: Accidental punctured injuries may result in foreign body retention. Correct diagnosis, prompt localization and early removal may prevent complications and infections. The diagnosis is usually made by radiography for radiopaque foreign body. In addition to detection, point of care ultrasound can assist foreign body localization and removal. We report a case presenting with left thigh punctured nail and ultrasound is used to detect, localize and remove the nail.
Methods: Case report and literature review.
Results: A 49 year old man accidentally injured by the nail gun during work and presented with left thigh punctured wound and a retained nail. The radiography confirmed the nail in the left thigh. We used ultrasound to detect the retained nail and found the majority of the nail was located within subcutaneous tissue and only a small portion of the nail was punctured into the muscle. Under ultrasound guidance, we used syringe needles to approach the nail in both ends and removed the 4.5 cm nail successfully at bedside with small incision in the emergency Department.
Conclusions: This case indicates that point of care ultrasound is useful for foreign body detection, localization and removal. High resolution linear transducer and skilled needling technique are the mainstays for successful foreign body removal.

PPT8-009

The Applications of Us-Cab Protocol during Resuscitation

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Objectives: The purpose of this present study was to evaluate the feasibility of the US-CAB protocol during resuscitation, and the incidence of potentially treatable conditions detected.
Methods: This study was conducted from August 2015 to July 2016 at the ED of National Taiwan University Hospital (NTUH) in Taiwan. The US-CAB protocol was named after the circulatory-airway-breathing (C-A-B) sequences in the advanced life support (ALS). A curvilinear 2-5MHz prove was used for evaluation of the heart through the subxiphoid four-chamber view. The same probe was placed transversely on the anterior neck superior to the suprasternal notch for the tracheal US exam. Sequentially, the probe was placed on both sides of the chest in the mid-axillary line around 4th–5th intercostal spaces to confirm proper ventilation using the lung sliding. Prior to study initiation, the junior emergency physicians (EPs), the 1st and 2nd year of residents that would be responsible for resuscitation and critical care 6 months later, attended the US-CAB training curriculum in August 2015. It was a half-day course, including one-hour didactics, and three-hour small-group rotatory hand-on training on live healthy model volunteers. Assessments included immediate and re-evaluation, including a written test, and the US image acquisition at the end of the training and with an interval of 6 months after the training. Non-traumatic, out-of-hospital cardiac arrest (OHCA) adult patients receiving the US-CAB examination by the junior EPs were eligible for inclusion. A US scanner (SSA-550A, Toshiba, Tokyo, Japan) equipped with 2-5 MHz curvilinear transducers, was used.
Results: There were 10 junior EPs participated in the US-CAB training course. Their age was 28.9±2.1 years in average, and four were males. The previous cardiac and lung US experience was less than 30 examinations. None of them had performed tracheal US. All of the participants completed the assessments at the pre-determined time points. There was a significant improvement in written test scores after completion of the course ($p<0.0001$) and no significant decrement after 6 months. The time to obtain adequate images for subxiphoid views and tracheal US was decreased during resuscitation, comparing with those in the immediate evaluation. There were 98 patients included in this study. During resuscitation, the US-CAB exam disclosed sonographic cardiac activity in 14 (14%) patients, esophageal intubation in 5 (5%) patients and one-lung intubation in 4 (4%) patients. Esophageal intubation was noted approximately 30 seconds prior to auscultation in one case.
Conclusions: This study demonstrated a novel, resuscitative US-CAB protocol, its feasibility and applications during resuscitation among novice examiners after a limited training. Thus, US-CAB examination can be considered as the secondary confirmation method during resuscitation.

PPT8-010

Use Point of Care Ultrasonography (POCUS) for Rapid Diagnosis of Acute Global Renal Infarction: Accelerate the Treatment and the Disposition

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Objectives: Acute global renal infarction is an uncommon condition, with the most common cause of thromboembolism. The diagnosis of renal infarction is usually delayed because it could mimic many other diseases. It is important to proceed an optimal diagnosis and treatment for kidney salvage. Point of care ultrasound is a rapid and convenient tool for the emergency and critical care physicians to screen the patients with abdominal pain or flank pain. We present a case of a patient with acute global renal infarction, in whom the diagnosis was made rapidly with bedside ultrasound.
Methods: Case report and literature review.
Results: A 40-year-old man with history of DM presented with whole abdominal pain, and the ECG showed normal sinus rhythm. Bedside point of care ultrasound (performed by ED physician) showed nearly no color signal in right kidney when color Doppler was activated in comparison with left side under the same setting and circumstances, suspicious for right side acute global renal infarction. Emergent percutaneous transluminal angiography was arranged and thrombectomy was done immediately.
Conclusions: This case illustrates that bedside point of care ultrasound can be used to rapid diagnosis of acute renal infarction. It may help emergency and critical care physician to differentiate many other conditions and prevent delayed diagnosis, impaired renal function or even death.

T9. Endocrinology Ultrasound

Symposium

T9-16-IN01

The Practicability of RFA as a Therapy for Graves' Disease

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Objective: To investigate the safety and efficacy of thyroid radiofrequency ablation (RFA) via animal experiment.
Method: Six adult female domestic pigs, weighing 45±5 kg, were randomized to undergo RFA or sham operation (SO). RFA was performed in the RFA group 4-5 times based on the volume of thyroid, and 5 min each time. The same procedure was performed in SO group except that the whole RFA system was turned off. Contrast enhanced ultrasound (CEUS) was performed to evaluate the ablation zone and describe the blood supply of the thyroid before and after the process. Serum free triiodothyronine (FT_3), free thyroxine (FT_4), and thyroglobulin (TG) were measured before, during, immediately after and 1 week after RFA to assess the safety and efficacy of RFA. Serum calcium (Ca) and phosphorus (P) were measured before, immediately after, and 1 week after the process to observe whether parathyroids were affected. Pathological analysis was also performed to investigate the cytological changes.
Result: A large non-enhanced area was showed in CEUS after RFA compared with that before RFA. No significant differences were detected in FT_3, TG, Ca and P between the RFA group and the SO group, while a reduction of FT_4 was observed 1 week after RFA. Coagulative necrosis and granulation tissue were found in RFA area through hematoxylin-eosin (H&E) staining.
Conclusion: This animal study illustrated that RFA represents a safe and effective method for the treatment of Graves' disease. Nevertheless, due to the limited animal model and sample size, further animal and clinical studies are needed to investigate the long-term benefits.

T9-16-IN02

Risk Stratification of Cytologically Indeterminate Thyroid Nodules on FNA with Ultrasound: What We Did and How to Do?

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To assess the value of conventional ultrasound, conventional strain elastography (CSE) and acoustic radiation force impulse (ARFI) elastography in differentiating likelihood of malignancy for Bethesda category III thyroid nodules. 103 thyroid nodules with Bethesda category III results on fine-needle aspiration cytology (FNAC) in 103 patients were included and all were pathologically confirmed after surgery. Conventional ultrasound, CSE and ARFI elastography including ARFI imaging and point shear wave speed (SWS) measurement were performed. Univariate and multivariate analyses were performed to identify the independent factors associated with malignancy. Area under the receiver operating characteristic curve (Az) was calculated to assess the diagnostic performance. Pathologically, 65 nodules were benign and 38 were malignant. Significant differences were found between benign and malignant nodules in ARFI. The cut-off points were ARFI imaging grade ≥ 4, SWS > 2.94 m/s and SWS ratio > 1.09, respectively. ARFI imaging (Az: 0.861) had the highest diagnostic performance to differentiate malignant from benign nodules, following by conventional. ultrasound (Az: 0.606 - 0.744), CSE (Az: 0.660) and point SWS measurement (Az: 0.725 - 0.735). Multivariate logistic regression analysis showed that ARFI imaging grade ≥ 4 was the most significant independent predictor. The combination of ARFI imaging with point SWS measurement significantly improved the specificity (100% vs. 80.0%) and positive predictive value (100 % vs. 72.9%) in comparison with ARFI imaging alone. ARFI elastography is a useful tool in differentiating malignant from benign thyroid nodules with Bethesda category III results on FNAC.

T9-16-IN03

Computer-Aided Diagnosis in Thyroid Nodular Diseases

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To avoid abuse of fine-needle aspiration cytology (FNAC) and to save time of learning curve, a computer aided Detection and Diagnosis (CAD) system to detect suspicious lesions for FNAC from thyroid ultrasonography, has been developed by the Department of Industrial Engineering, cooperative with Department of Surgery, National Taiwan University. Now I try to introduce how to perform CAD system in thyroid ultrasonography, and what is the real role of CAD system in thyroid nodular disease. After marking the transverse axis and longitudinal axis of the nodule appeared in the ultrasonography, four parameters are calculated and displayed by the computer system spontaneously, which include micro-calcifications, hypoechoic lesion, heterogeneity and indistinct margin. The results are displayed by the pointers in the semilunar figures. The necessity of FNAC is depended on the size and numbers of positive findings (pointers displayed in the right side). This CAD system is objectively and easy to be used. It may supply an easy method to determine the necessity for FNAC, but what we must keep in mind is that this method can reduce the necessity of FNAC about 4 in 5 cases, but not to completely replace FNAC to diagnose thyroid cancer.

T9-16-IN04

Can Thyroid Ultrasonography with Computer System Predict Thyroid Follicular Cancer?

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Thyroid cancer in the world gradually increased. The reason in addition to the progress of medical equipment, in essence, is still the disease itself is indeed increasing. The majority of thyroid cancer is well-differentiated cancer, most of the prognosis are good, as well as the next follicular cancer is slightly worse prognosis. The fine-needle aspiration cytology and frozen section examination is not easy with the differential diagnosis of benign adenoma. Although the tumor marker & genome can help, the fee does not cheap and not suitable in the clinical as a screening tool. If there is a simple way to help physicians to interpret, will provide clinicians with excellent help .This study enrolled thyroid ultrasound & connected computer system in the hospital surgery in 72 cases of thyroid follicular carcinoma and random 94 cases of follicular tumors were analyzed.

T9-16-IN05

Ultrasound-Guided Percutaneous Laser Ablation of Unifocal Papillary Thyroid Microcarcinoma

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Papillary thyroid microcarcinoma (PTMC) is usually associated with a favourable outcome. Management of PTMC varies from observation to total thyroidectomy and post-operative radioiodine therapy, but occasionally becomes a dilemma for patients who are unwilling to undergo surgery or are at high risk for surgery. Although the nature of PTMC is indolent, a few cases of local spread or distant metastases have also been reported in the long-term follow-up. Percutaneous laser ablation (PLA) is a minimally invasive technique that has been widely applied to benign thyroid nodules and demonstrated to be effective for reducing the volume of benign nodules. In our study, ultrasound-guided PLA was applied in treatment of unifocal PTMC. Conventional ultrasound and contrast enhanced ultrasound were used to evaluate the target lesion before and after PLA. Cytology and pathology were used to evaluate the efficacy of PLA. Short-term and long-term follow up was also performed after PLA. Ultrasound-guided PLA is an effective and safe method for treating unifocal PTMC.

T9-16-IN06

Radiofrequency and Ethanol Ablation for Thyroid

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Thyroid nodules are common in clinical practice. Most thyroid nodules are benign and treatment is unnecessary; however treatment is required for cosmetic or symptomatic reasons. For cystic and predominantly cystic thyroid nodules, ethanol ablation (EA) has been suggested as a first line non-surgical treatment. However EA is ineffective for solid thyroid nodules. To overcome these drawbacks of EA, thermal ablation techniques, such as laser ablation (LA) and radiofrequency ablation (RFA), have been suggested. The goal of this lecture is to review the role of the ethanol and thermal ablations and determine how to select the best treatment modality among the different techniques currently available (EA, LA and RFA) based on the clinical evidence.

Free Paper

OPT9-001

Problems of Thyroid Ultrasound Screening–Based on the Results of Thyroid Screening Conducted at Our Facility 25 Years Ago in Japan

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Objectives: Surgical cases of papillary thyroid cancer have increased in many countries recently. The main factor is that the ultrasound examination device is widely used. Improved image quality is also a factor. We present the results of thyroid cancer screening through ultrasound examinations performed 25 years ago and mention the problem of over-diagnosis in thyroid cancer screening.
Methods: From 1990 to 1995, we presented the results of our ultrasound screening for thyroid cancer in Kagawa Prefecture, Japan (1 million people). The subjects were 11,189 women with no neck symptoms. They were examined using a surface ultrasonic apparatus. After detecting abnormalities, fine needle aspiration cytology was carried out. If the patient were diagnosed with cancer, a lobectomy was performed with a side neck lymph node dissection.
Results: 140 cases of thyroid cancer were detected in this screening. The histological type of all detected cancer was papillary carcinoma. The detection rate of tumors with diameters of 3mm or more was 3.6%; 10mm or more was 0.88%; 15mm in the tumor diameter was 0.27%. Lymph node metastasis was observed 33% in tumors sized 3∼9mm, 56% in tumors sized 10∼14mm, and 94% in tumors sized 15mm or more.If we enforce the thyroid cancer screening by ultrasound examination, the detection of thyroid cancer in 3mm or more is 3600 per 100,000 women, the detection of 10mm or more is 880 per 100,000 women. But the annual number of suffering from thyroid cancer in Japan is approximately only 7 per 100,000 women. The deviation between the two is very large. We inferred that small papillary thyroid cancer is passed without problems accompanied by lymph node metastasis. For thyroid cancer screening using ultrasound, the problem of over-diagnosis is raised.
Conclusions: The detection of thyroid cancer through aggressive use of ultrasound is not recommended. Surgical indications of subclinical thyroid cancer should be determined with restraint. Asymptomatic small papillary carcinoma should be regarded as innocuous.

OPT9-002

To Establish the True Positive Percentage of Cases Where Ultrasound Detected Nodules in Sestamibi Negative Cases of Hyperparathyroidism. Retrospective Data from A Single Institution"

Alka Ashmita Singhal,[1] Sanjay Baijal,[1] Deepak Sarin,[2] Ambrish Mithal,[3] Sunil Mishra,[3] Shafi Kuchay,[3] Beena Bansal,[3] Parjeet Kaur,[3] Sowrabh Arora,[2] Jasjeet Wasir[3]
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Objectives: To evaluate the value addition of ultrasound, over sestamibi scan in patients with hyperparathyroidism. To establish the percentage of cases where ultrasound detected nodules in sestamibi negative cases of hyperparathyroidism.
Methods: Retrospective study from year 2013 to 2017. A total of 250 patients of Hyperparathyroidism who had both ultrasound and Sestamibi scan for parathyroid localization and were operated at our institution were included. Ultrasound localized parathyroid as a hypoechoic ovoid nodule with arc of vascularity. Diagnostic findings were recorded. Among them 175 patients (70%) were positive on both Sestamibi Scan and Ultrasound and 65 patients (26%) were Sestamibi negative and were detected on ultrasound. Remaining 10 patients were negative on both ultrasound and Sestamibi. Of which 5 patients (2%) had Methionine PET & 5 patients (2%) had no further imaging done.
Results: Of the 250 patients,175 patients (70%) were positive on both Sestamibi Scan & Ultrasound and 65 patients (26%) were Sestamibi negative & were positive on ultrasound only. Remaining 10 (4%) patients were positive on Sestamibi, but negative on ultrasound. Of which in 5 patients (2%) the nodules were located in the mediastinum and 5 (2%) patients the nodules were located in neck. Of the nodules localized on both Sestamibi and ultrasound 173 patients (98.8%) were true positive at Surgery. Of the nodules localized only on ultrasound 61 patients (93.8%) were true positive at surgery. Ultrasound Detected Nodules in Sestamibi Negative Cases in 26% Cases and of Which True Positive at Surgery Were 24.4%.
Conclusions: Ultrasound finds true positive parathyroid nodules in significant number of Sestamibi Negative cases (24.4 % in our study) and finds additional nodules in cases where sestamibi showed only one

nodule which changes the plan of surgery and preoperative counselling of patient. It gives precise localization and size of the nodule(s).

OPT9-003

Significance of Perithyroidal Lymph Nodes in Benign Thyroid Diseases

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Objectives: The incidences of perithyroidal lymph nodes (PTLNs) in benign thyroid diseases were investigated.
Methods: A total of 108 patients were divided into 36 with benign thyroid nodules, 33 with Hashimoto's thyroiditis, six with subacute thyroiditis, 9 with silent thyroiditis, 14 with Graves' disease, and 10 with hypothyroidism of undetermined etiology. We assessed the relationships among PTLNs and these groups, thyroid volume, thyroid parenchyma echogenicity, and anti-thyroid-stimulating hormone receptor, anti-thyroglobulin, and anti-thyroid peroxidase antibodies (TRAb, TgAb, and TPOAb).
Results: The PTLN-positive rates of Hashimoto's thyroiditis (69.7%), subacute thyroiditis (83.8%), silent thyroiditis (77.8%), and Graves' disease (35.7%) groups were significantly higher than those of benign thyroid nodules (5.6%) and hypothyroidism of unknown etiology (0%) groups. The PTLN-positive rates were significantly higher in cases with TgAb and/or TPOAb ($P < 0.01$) and in those with lower parenchyma echogenicity ($P < 0.01$).
Conclusions: PTLNs were seen in inflammatory thyroid diseases but were rarely detected in other thyroid diseases. These findings represent PTLNs an indicator for differentiating inflammation of the thyroid. Lower echogenicity of the thyroid known as a finding of inflammation showed a correlation with positive rate of PTLNs. PTLNs in cases of Graves' disease may be due to coexisting thyroiditis related to TgAb and/or TPOAb.

OPT9-004

Ultrasound-Guided Core-Needle Biopsy in the Diagnosis of Langerhans Cell Histocytosis with Thyroid Involvement

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Objectives: To investigate the sonographic findings of Langerhans's Cell Histocytosis with thyroid involvement and evaluate the role of ultrasound-guided core-needle biopsy in diagnosing this disease.
Methods: The clinical data, sonographic features, and biopsy modes of 13 patients with pathologically or clinically confirmed Langerhans's Cell Histocytosis with thyroid involvement from 1984 to 2016 were retrospectively analyzed. The sonographic findings of LCH with thyroid involvement were divided into three types: diffuse type, nodular type and mixed type.
Results: There were 7 males and 6 females. The initial symptom was diabetes insipidus in 10 patients (76.9%). 8 patients (61.5%) were sonographically diagnosed as diffused thyroid lesions, 2 15.4%) as inflammatory lesions and 3(23.1%) as thyroid nodules. 6 patients underwent ultrasound-guided fine-needle aspiration biopsy. On cytology of FNA , 1 was diagnosed for LCH, 3 was suggestive for the diagnosis of LCH and were confirmed by the histopathology and ancillary examination result of the CNB. 2 cases could not suggestive for LCH. In 6 patients who underwent ultrasound-guided core-needle biopsy, 5 (83.3%) had achieved definitive pathological diagnosis of LCH.1 was suspected for LCH. The distribution of the sonographic findings of LCH with thyroid involvement was as follows:diffuse type, n=5, (38.4%) ; nodular type, n=4, (30.8%); and mixed type, n=4, (30.8%).
Conclusions: LCH with thyroid involvement should be considered in thyromegaly patients with multiple organs involvement. Ultrasound-guided core-needle biopsy is safe and accurate, and therefore a preferred method for diagnosing LCH.

OPT9-005

Papillary Thyroid Carcinoma in a Patient with Type 1 Diabetes and Hashimoto's Disease

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Objectives: Papillary thyroid carcinoma(PTC) is the most prevalent malignant thyroid neoplasm. Hashimoto's thyroiditis(HT) is the most common autoimmune thyroid disease. HT is associated with a higher risk of PTC.
Methods: A 21-year-old lady was seen in the pediatric endocrinology clinic because of a suspiciously malignant nodule in the right thyroid. The patient has type 1 diabetes mellitus diagnosed at 1.2 years of age. Annual thyroid function test revealed thyroid autoimmunity with elevated antimicrosomal and anti-thyroglobulin antibodies at 4.5 years of age. Hashimoto disease was diagnosed with an elevated TSH level when she was 11.4 years old. The TSH levels returned normal during follow-up but persistently elevated at 17 years of age. Then levothyroxine was prescribed to maintain free T4 levels with normal limits. Regular clinical follow-ups revealed only vaguely palpable thyroid without nodules. Thyroid ultrasound showed diffuse heterogeneous echogenicity and mild increased vascularity. A hypoechoic nodule measuring 0.87x0.74 cm without calcifications was found in the right thyroid gland. The nodule enlarged to 1.63x1.55x0.88 cm with suspicious spotty calcifications in the follow-up sonography 4 months later. Fine needle aspiration was suspicious for malignancy.
Results: Total thyroidectomy and central neck lymph node dissection were performed. Microscopically, left thyroid revealed several adenomatoid nodules that were surrounded by thick fibrous capsules and solid pattern or microfollicles. The right thyroid contained a ill-defined nodule showing papillary thyroid carcinoma. The other thyroid tissue showed multinodularity. The diagnosis was T1b(1.4cm) N0(0/15) Mb stage 1. The patient's average HbA1c had been between 7% and 8.5%. She had normal microalbuminuria and eye fundi.
Conclusions: The potential for PTC development in HT patients warrants close clinical monitoring. Physicians should be aware that patients with HT need to be carefully monitored for the development of PTC.

OPT9-006

Calcifications Formation on Ultrasonography after Fine Needle Aspiration in Benign Thyroid Nodules

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Objectives: The presence of calcification on thyroid ultrasonography is one of the most important indicators of malignancies. However, fine needle aspiration(FNA) could also lead to the formation of calcification that may mimic malignancies on ultrasonography. The purpose of this study was to investigate the characteristics of post-FNA calcifications on ultrasonography.
Methods: From October 2008 to August 2016, totally 39 patients with 43 benign thyroid nodules that had new calcifications formation during sonographic follow-up after at least one history of fine needle aspiration were enrolled in this study. The pattern of calcifications was

retrospectively reviewed, and we further classified them into three types. Micro-calcifications were defined as hyperechoic punctate foci of less than 1 mm with or without acoustic shadowing; macro-calcifications included those large, coarse or eggshell calcifications of more than 1 mm with acoustic shadowing; mixed-calcifications denoted by having both micro- and macro-calcifications. The clinical data included the thyroid status, type of nodule, numbers of FNA attempt, nodule diameter change, and the periods from FNA to the time of calcifications were evaluated. Fine needle aspirations were repeated to confirm benign lesion for any doubt lesion during follow-up.

Results: According to the pattern of calcifications, 29 of 43(67.4%) nodules had micro-calcifications while 27 of 43(62.8%) nodules had macro-calcifications. Among all 43 nodules, 16(37.2%) were purely micro-calcification, 14(32.6%) were purely macro-calcification, and totally 13(30.2%) nodules showed mixed-calcification. For these calcification nodules, 16(37.2%) were initially considered as purely cysts, 19(44.2%) were cystic predominantly mixed nodules, 3(7.0%) were solid predominantly mixed nodules, and 5(11.6%) were purely solid nodules. None of them became malignancies at follow-up cytology. The mean numbers of FNA attempt before calcification were 2.70 ± 1.92 times (median = 2, range from 1-11 times), and the average Interval between the first FNA to the time of calcifications on US was 16.16 ± 11.97 months (IQR = 8.28-20.4, range from 1.4-59 months). More diameter reduction was seen in nodules with purely macro-calcification compared to those with purely micro-calcification (p-value = 0.035).

Conclusions: Long-term follow-up US after fine needle aspiration revealed calcifications formation that may be misdiagnosed as malignancies. Recognizing these important phenomena may aid in preventing unnecessary management or surgery.

Poster Session

PPT9-001

Ultrasound and 2D-Shear Wave Elastography Images in a Rare Case of Papillary Thyroid Carcinoma Associated with Intrathyroidal Metastases from a Colon Cancer

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Objectives: Intrathyroidal metastases from a colon cancer are uncommon, although the precise incidence is unknown. The coexistence of a primary thyroid malignancy with metastases from colon cancer is quite rare. Real-time shear wave ultrasound elastography 2D (2D-SWE) represents a technique that assesses the elasticity and the stiffness of different tissues.

Methods: Case presentation. We report a 57-year-old female patient who was admitted in the Clinic of Endocrinology due to multinodular goiter. At presentation, the patient was recently diagnosed with pulmonary and bone lesions, being suspected for metastases. The clinical exam detected a firm multinodular goiter, with a reduced movement at swallowing. Ultrasound examination of the thyroid detected at least five nodules. One of them, located in the upper part of right thyroid lobe was hypoechoic, with infiltrative margins that overpass the thyroid capsule and absence of vascularization. Elastogram of this nodule indicated an inhomogeneous aspect with areas of high stiffness. In the upper part of left lobe another hypoechoic nodule was detected, with regular margins and perinodular vascularization. The 2D-SWE indicated low stiffness in this last nodule.

Results: The patient was operated and the pathological exam revealed a papillary thyroid carcinoma in the first nodule and a metastasis from a colon cancer in the second one.

Conclusions: Ultrasound and 2D-SWE of this rare association is depicted in this paper, with quite different aspects of the two analyzed lesion, suggesting a different pathology.

T10. Fetal Echocardiography

Pre-Congress Workshop/Symposium

T10-13-IN01

Fetal Cardiac Screening: What Are We (And Our Guidelines) Doing Wrong?

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Current prenatal detection rates for major forms of congenital heart disease remain low, even in communities where practitioners observe formal guidelines published by professional societies. This presentation will review the current state of prenatal detection of congenital heart disease, and examine the current guidelines for fetal cardiac screening. The talk proposes and teaches important aspects of fetal cardiac imaging, most of which are not currently required in low risk pregnancies by most guidelines: image quality, angle of acquisition, color-flow Doppler, real-time storage of clips, and acquisition of the abdominal situs, four-chamber, left- and right-ventricular outflow tracts, and three-vessel trachea views.

T10-13-IN02

Right-Sided Obstructive Lesions: TOF/PS/PA

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Obstructive lesions of the right heart represent among the most common forms of congenital heart disease. This talk will provide the necessary background to detect and evaluate right-sided obstructive lesions in fetal life. This lecture will discuss pulmonary stenosis and pulmonary atresia, both with intact ventricular septum, as well as tetralogy of Fallot. The presentation will provide important clues on detection, evaluation, management and prognosis. Pulmonary stenosis can progress during fetal life, rarely to the point of pulmonary atresia. Outcomes tend to be good, in the absence of significant right heart hypoplasia or coronary sinusoids. Tetralogy of Fallot, the most common form of cyanotic congenital heart disease, commonly occurs in conjunction with other structural defects and/or aneuploidy. Outcomes for tetralogy of Fallot tend to be good, varying largely with the integrity and size of the main/branch pulmonary arteries. Many cases of tetralogy of Fallot will require replacement of the pulmonary valve. Outcomes for right-ventricular outflow tract obstructions relate to details that commonly can be detected prenatally.

T10-13-IN03

D-TGA/L-TGA

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Complete and corrected forms of transposition go by many names, confounding their understanding. This talk will offer a novel approach to classification of these defects that should aid in their understanding. Both types of transposition commonly occur in association with other cardiac abnormalities, but only rarely with

extracardiac structural abnormalities or genetic syndromes. The echocardiographic evaluation of both forms of transposition will be demonstrated and explained in detail, with tips/pearls to assist the practitioner in the detection and evaluation of fetal cases of transposition of the great arteries.

T10-13-IN04

Fetal Arrhythmias: Basics of Diagnosis

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Fetal arrhythmias may be diagnosed using a variety of approaches, including m-mode, color-mode, 2D, 2D with color, spectral Doppler, and various combinations of these modalities. Arrhythmias may be classified as ectopy, bradycardia or tachycardia. Detailed evaluation will facilitate making the correct diagnosis which, in turn, will allow for appropriate counseling and management, leading to optimal outcomes. Whether to treat a fetal arrhythmia pharmacologically must consider a multiple of sometimes competing fetal and maternal considerations. This talk will describe the various modalities available for the evaluation and diagnosis of arrhythmias, and will then describe the management and prognosis associated with ectopy, bradyarrhythmias and tachyarrhythmias.

Symposium

T10-14-IN01

Echocardiographic Assessment of Fetal Cardiac Function

Yiu-fai Cheung
Division of Paediatric Cardiology, Department of Paediatrics and Adolescent Medicine, The University of Hong Kong, Hong Kong, China

Advances in fetal cardiac echocardiographic imaging have enabled the evaluation of the fetal heart beyond its morphology and structure. Assessment of fetal cardiac function constitutes an important element of fetal echocardiography, given that intrinsic fetal myocardial abnormalities, structural congenital cardiac malformation, cardiac arrhythmias, and altered loading conditions in utero may lead to fetal myocardial dysfunction. Over the past two decades, non-invasive echocardiographic assessment of fetal cardiac function has continued to evolve for better definition of systolic and diastolic ventricular function in utero. These techniques include conventional two-dimensional echocardiography and Doppler interrogation of systemic venous and ductus venosus flow and estimation of cardiac output. New techniques include the use of three- and four- dimensional ultrasound for derivation of ventricular volumes and ejection fraction, tissue Doppler imaging, and strain and strain rate imaging. While postnatal echocardiographic parameters have been adopted for prenatal use, several intrinsic characteristics of the fetal heart and the available imaging modalities pose important challenges to their accurate derivation. These include the variable positioning of the fetus, smallness of the fetal heart, a fast heart rate, the lack of electrocardiographic monitoring, the need for standardization based on normal ranges in different phases of pregnancy, and the absence of validation for some of the indices. Despite these limitations, cardiac function can in the present era be more objectively assessed. Compilation of the different parameters into a cardiovascular profile has been used for serial assessment of the cardiac function to diagnose, monitor, and predict outcomes in selected fetal conditions. There was no doubt, however, that further validation studies are required for the new research echocardiographic modalities and that successful translation of these novel tools is eagerly awaited.

T10-14-IN02

Evaluation of Fetal Cardiac Function: New Technologies Using Speckle Tracking

Greggory R. DeVore, MD
Department of Obstetrics and Gynecology, David Geffen School of Medicine, UCLA, Los Angeles, CA, USA

Speckle tracking software can be applied to the evaluation of the fetal heart enabling measurements of the following for the right and left ventricular chambers : 24-segment transverse diameters, 24-segment sphericity index, 24-segment transverse fractional shortening, longitudinal shortening. These measurement tools are useful when evaluating fetuses with cardiac pathology.

T10-14-IN03

Fetal Pericardial Effusion: Roles of Prenatal Cardiac Intervention?

Tuangsit Wataganara
Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, BKK, Thailand

Isolated fetal pericardial effusions are frequently detected on routine obstetric scans. The exact incidence and significance of this finding is not clearly understood. The perinatal outcome in such cases depends on the presence or otherwise of associated malformations and chromosomal aberrations. Management of a fetus with pericardial effusion involves a multidisciplinary review of the problem to consider the competing fetal and maternal implications. Close monitoring of the fetal biophysical profile along with serial echocardiographic assessments and pericardiocentesis may allow the delivery to be delayed until adequate lung maturity is achieved. Current evidence indicates good outcome in cases of isolated pericardial effusion. Large prospective studies are needed to resolve the issue of association with chromosomal aberration that has significant impact on antenatal management and counseling policies in such cases.

T10-14-IN04

Fetal Patient Foramen Ovule: Anatomical & Physiological Aspects

Kai-Sheng Hsieh
Division of Cardiology, Department of Pediatrics, Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Conventionally, Patent Foramen Ovale (PFO) is known as an important pathway for the passing through from right atrium to left atrium. However, its exact anatomic and morphologic nature remain unclear. This study is thus to evaluate the morphologic characteristics of PFO using fetal echocardiography.

I have studied Fetal foramen ovale for over 30 years. The gestational ages ranged between 16 and 42 weeks. All of the fetal echocardiography was performed using commercially available ultrasonographic plateform. The fetal echocardiographic examination included black-and-white 2 dimensional and M-mode, color flow 2 dimensional and M-mode, pulsed and continuous wave Doppler echocardiography. I have found showed that fetal PFO showed wide variation in their morphlology. But in general it consisted a central plate connected with other parts of atrial septum proper through many web-like strands or membrane, forming a pocket like structure.

Our study showed that PFO, although well known for many of us, is not a simple "hole" as its name implies. The term of PFO appears more compatible to the post-natal appearance of this structure. Prenatally in the fetus, on 2 dimensional echocardiographic images, PFO actually appearsas an open basket facing the right atrium connected with the atrial septum.

T10-14-IN05

AS/Coarctation of the Aorta/HLHS

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Left-sided obstructive lesions, particularly bicuspid aortic valve/valvar aortic stenosis and coarctation of the aorta, can be challenging to detect prenatally. In some cases, these lesions can progress, or may be associated with forms of HLHS. Hypoplastic left heart syndrome represents a spectrum of congenital heart abnormalities that share in common an inability of the mitral valve/left ventricle to provide adequate systemic cardiac output. This talk will review how to detect and evaluate left-sided heart lesions in fetal life, and will discuss management and prognosis, as well. While outcomes for HLHS have improved dramatically in recent years, single ventricle defects face potential complications throughout their lives. Insights into the spectrum of left-sided obstructive disease are important to consider when counseling pregnant patients with affected fetuses. Optimizing delivery and neonatal management provides the best way to optimize long-term quality of life and survival.

T10-14-IN06

Outflow Tract Anomalies

Dr. Nitin Chaubal, MD.DMRD.FICR.FICMU.FAIUM(USA) FSRU(USA)
Thane Ultrasound Centre, Thane, India, Jaslok Hospital & Research Centre, Mumbai, India

The four chamber view is a standard view used for screening for fetal cardiac anomalies.

All of us are very familiar with the four chamber view. Adding outflow views increases the accuracy significantly.

This talk will discuss the common views which we obtain to evaluate the outflows, like the LVOT, RVOT view, the 3V, 3VT views and the arch views- the ductal arch and the aortic arch.

Anomalies which are seen in the outflows will be discussed in detail, including anomalies of the aorta, anomalies where there is an absence of cross over with parallel vessels, anomalies where there is malaligned VSD with an overriding of aorta as well as anomalies of the pulmonary artery.

A systematic step by step examination of the outflows complimented with the four chamber view comes a long way in the diagnosis of cardiac anomalies. This of course will go a long way in preventing neonatal morbidity and mortality.

T10-14-IN07

The Use of 3D/4D Electronic Probe to Evaluate the Fetal Heart

Greggory R. DeVore, MD
Department of Obstetrics and Gynecology, David Geffen School of Medicine, UCLA, Los Angeles, CA, USA

The electronic probe is used to evaluate the fetal heart. The advantages are artifact-free volumes using 4D, high-resolution volumes using E-STIC, and rendering of cardiac vessels using 4D technology. In addition, measurements of ventricular volume can be easily obtained.

T10-14-IN08

Out Flow Tract Abnormalities

Dr. T. L. N. Praveen
Department of Fetal Medicine, Abhishek's Institute of Imageology, Hyderabad, Telangana, India

Cong. Heart disease is the leading cause for neo-natal morbidity & mortality.

Pre-natal detection improves neo-natal out come. Out flow tract evaluation complimenting the four chamber view improves the detection of cardiac abnormalities particularly the Cono-truncal abnormalities. Sweep & Rotational techniques are practiced to evaluate the out-flow tracts. The left and right ventricular out flow tract evaluation helps in detecting abnormal septo-aortic continuity, Abnormal cross overs and Abnormal semi-lunar valves.

T10-14-IN09

Fetal Cardiac Isomerism

Jin-Chung Shih, MD, PhD.
Department of Obstetrics and Gynecology, National Taiwan University Hospital, Taipei, Taiwan

During early embryogenesis, the body axes of embryo are not established until the appearance of primitive streak. During the formation of primitive node, the cilia inside the primitive node generate a consistent clockwise rotation and form a leftward hydrodyanamics which perfuse the left-side formation proteins into the future left side of embryo. If this dynamics is broken, different extents of persistent symmetry will be retained. Heterotaxy syndrome or isomerism are used to describe this spectrum of cardiac/visceral situs disorders.

Since the left side is predetermined thereby right side, the left atrial isomerism is assumed more mature than the right atrial isomerism. In human fetus with left atrial isomerism, the heart generally are lacking of right-sided structures. The right-side structures including sinoatrial node, inferior vena cava, gall bladder are generally or often lacking. In fetuses with right atrial isomerism, the left-sided structures, such as returning pathway of pulmonary veins and spleen, are frequently absent. These features can be used as the clues of antenatal diagnosis.

As for the outcome of atrial isomerism, the heart of left atrial isomerism is generally more developed and hence the outcome is better, unless persistent bradycardia and fetal hydrops occurred. Fetuses with right atrial isomerism generally manifested with double outlets of right ventricle, endocardial cushing defect, pulmonary stenosis and transposition of great arteries. These neonates have to receive 3-staged Norwood operation. The long-term survival is 70 % for neonates with right atrial isomerism and 80% of neonates with left atrial isomerism.

T10-14-IN10

Secondary Fetal Cardiopathy

Tuangsit Wataganara
Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, BKK, Thailand

Fetal cardiomyopathies are uncommon. Their echocardiographic presentations are as follows; (1) dilated cardiomyopathy (DCM) with dilatation of either or both ventricles and impaired ventricular function, and (2) hypertrophic cardiomyopathy (HCM) with different degree of disproportionate hypertrophy of the myocardial walls. Intrauterine loss may occur in one third of affected fetuses. Fetal echocardiography, B and M-mode is the main diagnostic tool. Systolic and diastolic fetal cardiac function assessments, including Doppler studies are required for hemodynamic evaluation. Fetal DCM can be isolated or associated with other cardiac and extracardiac malformations, as well as genetic, metabolic, and infective etiologies. The outcome of DCM is worse in presence of fetal hydrops, significant atrioventricular valve regurgitation, for the earlier age at presentation and when diastolic dysfunction is associated with systolic dysfunction. Fetal HCM can either be primary from heterogeneous intrinsic fetal pathology or from extrinsic factors (i.e. maternal diabetes). Many fetal HCM may regress completely after birth. Detailed evaluation of fetal and maternal conditions provides

prognostic information for prenatal counseling and may lead to improved outcome of at least some affected pregnancies.

T10-14-IN11

New Look into Old Technique—Reappraisal of Fetal Echocardiography

Kai-Sheng Hsieh
Division of Cardiology, Department of Pediatrics, Chang Gung Memorial Hospital, Kaohsiung, Taiwan

Fetal Echocardiography has been introduced into clinical practice for about 50 years. During the past 50 years, fetal echocardiography has merged as both diagnostic and screening tool for detection of fetal heart diseases. The platform of fetal echocardiography also has been improved and modernized in the past half century. Basically, the modalities has demerged from static black-and-white two-dimensional B-mode to dynamic real-time sector of or linear scanning mode. Pulsed and continuous wave Doppler echocardiography as well as color Doppler flow mapping and many other new generations of echocardiographic imaging modalities. No doubt that all these newer and newer modes of fetal echocardiographic images will promote the wider and wider application of fetal echocardiography. In this aspects, no doubt that fetal echocardiography has achieved almost a pleated for prenatal diagnosis of congenital cardiovascular anomalies in the fetus.

However, fetal echocardiography has some limitations, such as fetal positional variation resulting in non-consistency of the relative spacial changes of the fetal cardiovascular changes and thus difficulty in images interpretation. The resolution of fetal echocardiography also is a limiting factor. Even with the most modern, most current echocardiographic equipment, the resolution usually can not be finer than 1mm. The target of fetal echocardiography, the fetal heart, is such a small organ in the small fetus, especially during early gestation that accurate measurement of its size is doubtful. Thirdly, just like fetal sex detection, screening or diagnosis of fetal congenital cardiovascular anomalies may result in "Eugenetic behavior" and finally over-selection of fetal wellness. Such phenomenon is ethically unsound. Lastly, my experience shows that fetal echocardiography is a very time-consuming procedure, obviously routine full evaluation is not appropriate. Therefore, a staged screening plus widespread registration system should be established. This process is yet to be established in Taiwan.

T10-14-IN12

3D/4D Fetal Cardiac Imaging—Past/Present/Future

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

3D and 4D fetal cardiac imaging has been in development since the mid-1990s. Dramatic advances in computing technology, processing and display algorithms have led to the development of STIC and other methods of acquisition, along with novel approaches to the display of 3D/4D data. This talk will review the past, present and future of fetal 3D/4D fetal cardiac imaging, emphasizing the basics of terminology and acquisition/display. The talk's focus will be to examine the current and future clinical role of fetal 3D/4D fetal cardiac imaging in real-life practice.

T10-15-IN01

Fetal CHD-An Ethical Dilemma

Kai-Sheng Hsieh
Dept of Pediatrics, Veterans General Hospital, Kaohsiung, Taiwan

With the advance on the development of echocardiographic equipment and experience, fetal echocardiography has become more and more popular. In Taiwan, fetal echocardiography performed by either obstetricians opticians or pediatric cardiologists. The obstetricians usually screen the fetus with routine obstetric ultrasound. Cases suspected to have congenital heart diseases usually will be referred to a pediatric cardiologist. The pediatric cardiologist then make suggestions according to the result of fetal echocardiography. The major factors for the family members to consider are: social economic, educational, employment, presence of associated anomaly and elderly attitudes since cardiovascular surgery in Taiwan usually is considered a very high risk operations and therefore termination of pregnancy usually is considered rather than to keep the pregnancy ongoing if more complex congenital heart disease or congenital heart diseases necessating staged operations are expected.

The tilt toward termination of pregnancy is exaggested in recent years due to recent. Great Economic Recession and progressive lower birth rate in Taiwan. Because of the lower birth rate, late marital age and late pregnancy age, more and more couples will, choose a " perfect fetus" and will give up the fetus if anomalies, especially more signicificant abnormalities are founds.

In our experience, the pattern of congenital heart disease in a also has changed significantly with the wide application of fetal echocardiography (especially after the new wave of high- level fetal sonography in Taiwan). Compared to the congenital heart diseases near 20 years ago, complex congenital heart diseases almost disappeared now. At the same time, our experience in fetal echocardiography has shown that many of the fetus found to have complex congenital heart diseases were terminated by the parents decision. The above facts show the severity of the "ethical dilemma" in fetus with congenital heart diseases.

It is strongly recommended that a sound conscilling process should be made to facilitate the perinatal care for fetus with congenital heart diseases. Appropriate decisions should be advised to avoid over use of termination to further depress the birth rate and exert contradictory effection prenatal care. The other real fact is the high termination rate for fetus with complex congenital heart diseases will make all related health care professionals to expose less and less newborns with complex congenital heart diseases. Such" artificially induced reduction in complex congenital heart diseases" will result in another" ethical dilemma" for the immediate postnatal care of the newborns.

T10-15-IN02

Fetal Coarctation of Aorta

Dr. T. L. N. Praveen
Department of Fetal Medicine, Abhishek's Institute of Imageology Hyderabad, Telangana, India

Common anomaly – incidence in newborns with Congenital heart disease is 5 to 8%.

It is narrowing of aortic arch at the isthmus between left subclavian artery and the Ductus arteriosus.

Sometimes there can be involvement of long segment of aortic arch and is termed as " Tubular hypoplasia of the aortic arch".

Coarctation is associated with chromosomal and extra-cardiac abnormalities.

Coarctation of aorta can be classified as

Simple – when it occurs with out important intra-cardiac lesions.

Complex – when associated with significant intra-cardiac pathology.

Four chamber view –

• Ventricular disproportion – left ventricle appears narrow when compared to right ventricle. Apex still formed by left ventricle.

• Coarctation of aorta can be associated with persistent left SVC, cross section of LSVC is seen as a bulge into the external border of LA

Five Chamber view -

• Normal diameter of ascending aorta. The aortic root can be narrow when associated with peri membranous VSD &/or Aortic stenosis.

• The aortic valve is occasionally bicuspid – difficult to diagnose antenatally.

3Vessel Trachea view –

• Diameter of transverse aortic arch is narrow when compared to pulmonary artery.

• Narrowing of transverse aortic arch is best appreciated at the isthmus.

• Left persistent SVC can also be demonstrated.

• A sagittal view of the aorta should be attempted at the 3VT View – Length and degree of narrowing is better assessed.

• In the longitudinal section the aortic arch appears narrow and sometimes tortuous (Contraductal shelf).

T10-15-IN03

How Has Fetal Echocardiography Shaped the Practice of Pediatric Cardiology?

Yiu-fai Cheung
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Fetal echocardiography has enabled the diagnosis of structural cardiac malformations in utero. While certain cardiac conditions, in particular coarctation of the aorta and total anomalous pulmonary venous drainage, remain to be a challenge of prenatal diagnosis, a high degree of diagnostic accuracy can be expected for a large spectrum of congenital heart disease. The ability to diagnosis structural congenital cardiac malformation in utero has helped in the following regards: i) detection of associated extra-cardiac malformations and underlying syndromal abnormalities, ii) allow time for parents to better understand the nature of the cardiac lesions, discuss management options, and aware of the immediate- and long-term prognosis, iii) risk stratification with implications on perinatal and postnatal management, iv) potential improvement in the outcomes of the fetuses after delivery, and v) the potential to offer fetal interventions. Most of the available data to date have, however, been reported by developed countries and the ways in which paediatric cardiac practice have been shaped would be discussed. On the other hand, the impact of prenatal diagnosis in developing countries and its influence on the practice of paediatric cardiology is unclear and requires further studies for better understanding.

T10-15-IN04

Insight into the Genetic Relevance of Congenital Heart Defects

Jin-Chung Shih, MD, PhD.
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Congenital heart disease is the most common developmental defect, occurring in 1 % of neonates. With improvements in cardiovascular surgery techniques, the survival of these affected neonates is generally prolonged. Therefore the parents having a fetus with congenital cardiac defects become a large group for which advice is sought, usually regarding the risks for the associated anomalies, further affected children, or the offspring of a successfully treated patient. Although most of congenital cardiac defects are not familial, it seems that the genetic factors are involved in most cases. In this review, we present recent advances in identifying the chromosomal and genetic factors of congenital heart diseases, thereby providing the optimal counseling of these parents with affected neonates.

The cause of CHD is multifactorial, generally attributed to the environmental and genetic factors. Environmental insults during embryogenesis are known to increase the development of CHD. These insults include viral infections such as rubella, exposure to chemical teratogens such as retinoic acid and lithium, and maternal diseases that include diabetes and systemic lupus erythematous. Although most of congenital heart defects are not familial, it seems likely that genetic factors are involved in most cases. The contribution of genetic factors to the development of CHD is recognized by the common association of CHD with chromosomal abnormalities such as fetal aneuploidy and the microdeletion at the region of chromosome 22q11.2.

Based on the literature review, the chance of association with chromosomal anomaly is 10% in TOF while less than 1 % in TGA. When the diagnosis of congenital cardiac defect is made, the perinatologist should understand the potential risk of associated aneuploidy and the possible pattern of related extracardiac malformation. Currently, there are 763 syndromes listed on the London Dysmorphology Database where cardiac abnormalities can link to a part of the spectrum. Each of the spectrums has its distinct clinical features, and related genetic errors. The appropriate genetic tests should be provided and the outcome other than cardiac itself should be counseled.

T10-15-IN05

Guidelines for Fetal Cardiac Imaging

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Current rates of detection of congenital heart disease remain low. Guidelines for fetal cardiac screening have been published by multiple professional organizations. This talk will review current guidelines for fetal cardiac imaging—both in low-risk and high-risk pregnancies—and will propose changes to guidelines to meet the global need for improved rates of prenatal detection. Specifically, this talk will highlight the importance of image quality, angle of acquisition, color-flow imaging, storage of real-time clips, and evaluation of the abdominal situs, four-chamber, left- and right-ventricular outflow tracts, and three-vessel trachea views.

T10-15-IN06

How to Detect a Case with Total Anomalous Pulmonary Venous Connection by Fetal Screening?

Satoshi Yasukochi
Heart center, Nagano Children's Hospital, Nagano, Japan

The detection rate of total anomalous pulmonary venous connection (TAPVC) remains low (<5%) in spite of the current progress of fetal screening by advanced imaging technologies and guidelines. The several techniques has been reported as effective to detect TAPVC by using color Doppler or power Doppler, however these were limited to use at the routine fetal screening.

The key to make a diagnosis of TAPVC by fetal echocardiography, is to detect an abnormal pulmonary venous chamber usually located between left atrium(LA) and descending aorta(DAo), which could not connect directly to a left atrium. One may use the ratio of a distance of LA-DAo;LD and a diameter of DAo;DA (post-LA index; *Kawazu Y Ultrasound Obst Gynecol 2014*) at routine four-chamber view.

If this ratio (LD/DA) is > 1.27 on fetal screening, the risk of the presence of TAPVC became evident. Then more scrutinized fetal echocardiographic exmamination is provided to make a precise diagnosis of TAPVC by color and power Doppler imaging.

The fetal diagnosis of TAPVC is more important in perinatal managements not only for avoiding emergency surgery but also for life-saving, if we could improve our detection rate.

T10-15-IN07

Ventricular Septal Defects-Why Are They Missed?

Greggory R. DeVore, MD
Department of Obstetrics and Gynecology, David Geffen School of Medicine, UCLA, Los Angeles, CA, USA

Imaging of the 4-chamber view is not adequat4 for detecting ventricular septal defects. The technique described in this presentation will illustrate movement of the transducer beam that sweeps the heart in longitudinal and transverse planes and using color/power Doppler ultrasound.

T10-15-IN08

How to Assess Fetal Rhythm?

Satoshi Yasukochi
Heart center, Nagano Children's Hospital, Nagano, Japan

The currently available modalities to assess fetal rhythm are (1) fetal echocardiographic evaluation using either M-mode or Pulse Doppler, or strain, (2) fetal magnetogram, (3) fetal electrocardiogram.

In general, fetal echocardiographic evaluation for fetal rhythm is popular. Before using fetal echocardiography as a tool for rhythm assessment, there must be the assumption that an electrical conduction mode is the same as those of mechanical contraction. On the basis of this assumption, M-mode assessment for fetal rhythm is from images lining the atrium to ventricle which enables to measure the timing of atrial and ventricular contraction.

The pulse Doppler measurement for fetal rhythm is more accurate but needs more experience because of its requirement to set image plane and sample point and sample point on SVC-AO. The assessment of fetal rhythm by fetal echocardiogram is now popular and set on guide lines from fetal echocardiography.

We will present how to use fetal echocardiography as a tool to detect fetal rhythm.

T10-15-IN09

Fetal Cardiac and Pericardial Tumors

Tuangsit Wataganara
Obstetrics and Gynecology, Faculty of Medicine Siriraj Hospital, BKK, Thailand

Isolated fetal pericardial effusions are frequently detected on routine obstetric scans. The exact incidence and significance of this finding is not clearly understood. The perinatal outcome in such cases depends on the presence or otherwise of associated malformations and chromosomal aberrations. Management of a fetus with pericardial effusion involves a multidisciplinary review of the problem to consider the competing fetal and maternal implications. Close monitoring of the fetal biophysical profile along with serial echocardiographic assessments and pericardiocentesis may allow the delivery to be delayed until adequate lung maturity is achieved. Current evidence indicates good outcome in cases of isolated pericardial effusion. Large prospective studies are needed to resolve the issue of association with chromosomal aberration that has significant impact on antenatal management and counseling policies in such cases.

T10-15-IN10

Outcome After Newborn of Prenatally Diagnosed Congenital Heart Block with Postnatal Pacemaker Implantation

An-Shine Chao
Chang-Gung Memorial Hospital, Taiwan

Introduction of Congenital atrioventricular block
Prenatal diagnosis
Prenatal intervention
Postnatal intervention
Long-term survival

T10-15-IN11

Fetal Arrhythmias: Diagnosis and Management Made Easy

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Fetal arrhythmias may be diagnosed using a variety of approaches, including m-mode, color-mode, 2D, 2D with color, and spectral Doppler. Arrhythmias may be classified as ectopy, bradycardia or tachycardia. Detailed evaluation will facilitate making the correct diagnosis which, in turn, will allow for appropriate counseling and management, leading to optimal outcomes. Whether to treat a fetal arrhythmia pharmacologically must consider a multiple of sometimes competing fetal and maternal considerations. This talk will describe the various modalities available for the evaluation and diagnosis of arrhythmias, and will then describe the management and prognosis associated with ectopy, bradyarrhythmias and tachyarrhythmias.

T10-15-IN12

DORV–Double Outlet Right Ventricle

Dr. T. L. N. Praveen
Department of Fetal Medicine, Abhishek's Institute of Imageology, Hyderabad, Telangana, India

Double outlet right ventricle is a cono-truncal abnormality in which the great arteries arise either predominantly or entirely from the right ventricle.

DORV is categorized based on the spatial relationship of great arteries, location of VSD and presence or absence of outflo Care Ultrasonography (POw obstruction.

Great arteries relationship and location of VSD are of four types.

4 chamber view is usually normal, 5 chamber view reveals VSD and origin of great arteries.

3VT shows discrepancy of great arteries.

D/D – TOF and CTGA.

T10-15-IN13

Fetal Heterotaxy Syndrome

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Heterotaxy refers to disordered laterality of abdominal viscera, thoracic organs, and cardiac segments. Though commonly categorized broadly into two subtypes, it probably makes more sense to consider heterotaxy as a spectrum. Complex forms of heterotaxy can be best evaluated using an ordered, segmental approach to evaluation of the heart. Particular attention should be paid to venous returns and great arterial arrangements, as both are commonly abnormal in the case of heterotaxy. Affected fetuses are at risk for single ventricle anatomy, obstruction of pulmonary venous return, heart block, and heart failure, as well as GI and occasionally CNS/GU/musculoskeletal pathology. This talk will review these concepts of heterotaxy and provide a detailed demonstration of the echocardiographic findings.

T10-15-IN14

Intracardiac Shunts

Gwang Jun Kim
Obstetrics & Gynecology, Chung-Ang University, Seoul, Korea

In fetal life, a communication route on interatrial septum (foramen ovale) exist. This shunt exists for delivering high oxygenated umbilical venous blood to vital organ (brain and the heart). Normally interventricular septum is intact during and after fetal life. Prevalence of intracardiac shunts is high (VSD 1/200 livebirths, ASD 1/1500 livebirths).

Atrial septal defect (ASD) is classified according to its embryologic origin;

septum primum, septum secundum, sinus venosus, and coronary sinus defect

Ventricular septal defect (VSD) is classified according to its location inside of the right ventricle;

Inlet, outlet, perimembranous, muscular type.

Ultrasonographic characteristics and clinical impacts of intracardiac shunts will be presented.

T10-15-IN15

Does Fetal Intervention Make a Difference of Postnatal Outcome?

Satoshi Yasukochi
Heart center, Nagano Children's Hospital, Nagano, Japan

The recent advance of fetal intervention for many disease including congenital heart disease(CHD) believes to improve the outcome of postnatal life. However the reality of postnatal outcome by fetal intervention remains diverse, especially in CHD. The target disease of FI for CHD at current era are critical aortic stenosis (AS) , hypoplastic left heart syndrome with intact atrial septum (HLHS+IAS), and pulmonary atresia with intact ventricular septum(PAIVS). Those FI underwent by ultrasound guide and in limited institute. To discuss the outcome of FI, we must consider case-selection and technical bias. There was no randomized case-control study of FI on postnatal outcome, yet.

The large-volume institute of FI reported a promising result of FI on postnatal life, however those of the all institute but such a large-volume one undergoing FI could not demonstrate a clear difference of postnatal outcome, especially in cases with HHS-IAS or PAIVS , even in cases with AS. Some cases became even worse after FI in the light of survival rate or has no change. The answer to the title question is "unclear" at present, but may improve by accumulating the experience of FI institute via registry and by establishing the optimal protocol or FI.

T10-15-IN16

Arch Anomalies: from First Trimester to Postnatal Management

Ming-Ren Chen
Department of Pediatric Cardiology, MacKay Medical College and MacKay Children's Hospital, Taipei, Taiwan

Aortic arch anomalies account for 1-2% of general population, including coarctation of the aorta 5%, interrupted arch 1%, and other anomalies of arch. They are frequently associated with chromosomal defects, structural heart diseases, or tracheobronchial anomalies. Three-vessel-trachea view, aortic arch and ductal arch views, and four chamber view are the basic sonographic planes to detect such anomalies. We present sonographic assessment of fetal aortic arch anomalies since first trimester to postnatal life. By longitudinal follow-up and close combination of fetal sonographic specialist, pediatric cardiologist and pediatric cardiac surgeons, the fetus received better management before and after birth.

T10-15-IN17

Outflow Tract Abnormalities: Overview

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

Outflow tract abnormalities, though generally more difficult to detect than abnormalities of the four-chamber view, represent the group of congenital heart defects most likely to require early neonatal intervention. As a result, the outflow tracts must be evaluated closely along with the four-chamber view during every fetal cardiac screening examination. This lecture will review the basic approaches to evaluation of the outflow tracts, including scanning techniques that promise improved detection by optimizing image quality and angle of acquisition. Both normal and abnormal views will be presented, including obstructive abnormalities of the right- and left-ventricular outflow tracts, as well as D-TGA and L-TGA and truncus arteriosus. Associations with additional cardiac/extracardiac structural abnormalities, as well as genetic abnormalities, will be reviewed, as well.

T10-15-IN18

Three Vessel Trachea View Its Relevance in Fetal Cardiac Evaluation

Dr. T. L. N. Praveen
Department of Fetal Medicine, Abhishek's Institute of Imageology Hyderabad, Telangana, India

Three vessel vie of the fetal upper mediastinum was first suggested by Yoo et al. Yagel et al added trachea resulting in Three vessel trachea or Vena cava-aortic arch –pulmonary artery and trachea view (3VT View)

The three vessels in three vessel view are arranged in an oblique line, pulmonary artery is the most anterior; the SVC posterior and aorta in between.

In three vessel trachea view, both aortic and ductal arches are located to the left of spine and trachea, an important landmark as no vessel is seen to the right of trachea or posterior to trachea.

These views can be easily obtained by moving the transducer cephalad from four chamber.

Some forms of CHD are dependent on the patency of the arterial duct (ductus dependent circulation) in the immediate neonatal period (such as hypoplastic left heart syndrome, severe coarctation of the aorta, interruption of the aorta, pulmonary atresia with intact ventricular septum, severe pulmonary stenosis) and in some conditions the ductal patency is important for 'mixing' (such as transposition of the great arteries and total anomalous pulmonary venous drainage). It is observed that 3VT view provides important clues to the diagnosis of most of these critical anomalies and have an impact on improved outcome.

T10-15-IN19

The Four Chamber View

Dr. Nitin Chaubal, MD. DMRD. FICR. FICMU. FAIUM (USA) FSRU (USA)
Thane Ultrasound Centre, Thane, India, Jaslok Hospital & Research Centre, Mumbai, India

Four chamber view of fetal heart is the most important view in both fetal echocardiography as well as the standard second trimester anomaly scan. This view does not require specialized skills, it can be obtained in all fetal positions, at all gestational ages from 12 weeks to term. Also, this view identifies almost 60% -70% of cardiac anomalies that can be detected antenatally.

This talk will discuss the technique of obtaining a good four chamber view, ascertaining the position and situs of fetal heart, its size, axis, normal sizes of all four chambers, the heart valves, their alignment and functioning and most important, the use of colour Doppler in fetal echocardioagraphy.

The anomalies associated with abnormal sizes of each chamber as well as abnormal number of chambers, abnormalities of valves and the IVS (interventricular septum) will be discussed.

It has been shown by many that a normal four chamber view does not always mean a normal fetal heart. There are anomalies such TOF, TGA etc which may be missed if one relies only on this view. This talk will further discuss the anomalies which are diagnosed if one goes beyond the four chamber view.

T10-15-IN20

Fetal Cardiac Evaluation

Dr. T. L. N. Praveen
Department of Fetal Medicine, Abhishek's Institute of Imageology, Hyderabad, Telangana, India

Evaluation of fetal heart is a challenging endeavor as it is a dynamic structure. Congenital heart diseases are the commonest congenital malformations with significant neonatal morbidity & mortality. Advancing imaging technique helps us to achieve the most. Sectional sequential examination is the crux of the approach. There are two methods namely Sweep technique and the Rotational technique are the basic techniques which are used with magnification and cine loops. Evaluation of Situs, size, Axis and location of heart in the thorax are basic requirements. The protocols followed in evaluation of fetal heart are methodically evaluating four chambers, Five chambers, Out-flow tracts, and Three vessel trachea view. This approach helps us to achieve high sensitivity and specificity in diagnosing fetal heart diseases.

T10-15-IN21

CMA Application in Congenital Heart Defect

Ching Hua Hsiao[1,2]
[1]*President of Taiwan Maternal Fetal Medicine Society,* [2]*Assistant Professor, Taipei City Hospital, Obstetrics/Gynecology*

Cytogenetic fetal karyotyping used to be the gold standard of prenatal genetic testing. Karyotyping is able to detect aneuploidy and large chromosomal rearrangements of up to 5–10 megabases (Mb). Array comparative genomic hybridization (aCGH) is a cytogenetic molecular technique that detects the presence of CNVs within the genome with increased resolution, much higher than that of conventional karyotyping, depending on the probe spacing and platform used.

As the common aneuploidies are most frequently associated with CHD, especially in cases of additional extracardiac malformations. In the prenatal setting, the incidence of chromosomal anomalies is reported to be as high as 18–22% of all CHD cases, most being trisomies 21 and 18 and 22q11 microdeletion. Array CGH can be considered if aneuploidy/triploidy detection results are normal, in order to reduce healthcare utilization and costs.

T10-15-IN22

National Registry of Fetal Echocardiography in Japan

Satoshi Yasukochi, Kiyohiro Takigiku, Kouta Takei, and Japanese Society of Fetal Cardiology registry system group
Heart center, Nagano Children's Hospital, Nagano, Japan

Since 2004, the Japanese Society of Fetal Cardiology (JSFC) has begun the nationwide registry for fetal echocardiogram at the level II screening , which defined as a diagnostic examination by guideline for fetal echocardiographic screening first published in Japanese in 2006,later revised as English version (Pediatric International 2015;57:1-21). Total number of registered cases from 2004 to 2015were 25775. The registry number was increase especially after approval of insurance reimbursement of level II-fetal echocardiogram in 2013.

Among 25775, congenital heart disease were 12040 (47%) such as VSD(1993), DORV(1212), HLHS(984), AVSD(968), TOF(983), TGA(530), TAPVC(65). Fetal arrhythmia were 1561(6%) such as PAC(643), CAVB(189), PSVT(106), and VT(42). Through our registry, the registered cases with TGA and CoA has been significantly increased while those with TAPVC has only small increase.

This registry system has many benefits on improving the quality of fetal echocardiographic screening in survey of disease, dissemination, education, and skills up, which results in improving postnatal outcome.

T10-15-IN23

Sonographic Screening of Fetal Venous Malformations

Gwang Jun Kim
Obstetrics & Gynecology, Chung-Ang University, Seoul, Korea

Examination of the fetal heart is a part of the standard evaluation during the 2nd trimester fetal anomaly scan. The four-chamber view has been used as a screening method for detecting major cardiac anomalies. Consequently introduced three-vessel view has improved detection rate of cardiac defects involving great arteries. Only systemic venous anomalies are left to be screened in fetal echocardiographic field. To answer the questions: How to screen fetal venous malformations.

Here are some suggestions:

1. New classifications of venous malformations by position of malformations.
2. Screening plans for venous malformations according to the new classification system.

New classification of abnormal fetal venous system:

Abnormal Supra Cardiac Veins.
Abnormal Pulmonic veins.
Abnormal Infra Cardiac Veins.

Suggested sonographic planes to screen venous malformations:

3 vessel with azygous vein view for Supracardiac great veins diseases
4 chamber view (esp. LA) for Pulmonic vein diseases
IVC with converging vein view (CVV) for Infracardiac great vein diseases

T10-15-IN24

Segmental Approach to Congenital Heart Disease

Mark Sklansky, MD
Pediatric Cardiology, UCLA Mattel Children's Hospital, David Geffen School of Medicine at UCLA

The evaluation of the fetal heart should be performed using a segmental approach— obtaining high quality clips/sweeps, and moving in a veno-arterial sequence from venous returns, to atria, to atrioventricular connecting

segments, to ventricles, to ventricular-arterial connections, and finally to the great arteries. Each segment's structure and function should be evaluated in detail. Views and sweeps should be obtained to facilitate, not replace, a detailed and segmental evaluation of fetal cardiac structure and function. This talk will review these concepts, and provide detailed descriptions of cardiac structures, views and sweeps.

Workshop 2

T10-16-IN01

Lecture 1: How to Manipulate the STIC and the Pyramid of Fetal Heart, the Segmental Approach

Motoyoshi Kawataki
Tohoku University Hospital

STIC is a kind of three dimensional ultrasound technique, which is a very useful tool not only for fetal heart screening but also the education of fetal heart screening. I will show you how to get the STIC data successfully and how to manipulate the STIC data on the PC using the normal heart data in this lecture.

I would like to propose the unique concept of "Pyramid of Fetal Heart", which is useful and efficient for fetal heart screening. We always use the Segmental Approach to analyze and describe the complexed CHD, which is convenient but a little bit difficult for OBGY doctors and sonographers. You can realize the concept of Segmental Approach from the Pyramid of Fetal Heart.

T10-16-IN02

Lecture 2: The Long-Term Prognosis of Significant Congenital Heart Disease in Kanagawa Children's Medical Center (KCMC)

Seiyo Yasui
Vice-chair person, Kanagawa Prefectural Hospital Organization, Yokohama, Japan

More than 90 percent of congenital heart disease patients now reach adult age. In particular, the prognosis of severe heart disease requiring intervention in neonatal period has improved markedly in the last decade. As a factor of this, improvement of accuracy of preoperative diagnosis contributes. Among these include the spread of fetal echocardiogy performed before birth, improvement of diagnostic accuracy, planning of childbirth and preliminary treatment plan include enhancement of team medicine. Meanwhile, it is necessary to promote personalized medicine for further improvement of treatment outcome and improvement of long-term prognosis.

In this lecture, I will focus on the death period of childhood heart disease, analyze the cause of death and explain further efforts necessary for improvement of prognosis.

T10-16-IN03

Lecture 3: Strategy of Neonatal Emergent Therapy from the Fetal Echo Findings

Ki-Sung Kim
Department of Cardiology, Kanagawa Children's Medical Center, Yokohama, Japan

The most important purpose of the prenatal diagnosis for congenital heart disease (CHD) is to recognize the patients who will deteriorate immediately after birth, and to plan the emergent surgical or catheter interventions. In this way, we came to be able to save more lives of patients with most severe CHDs. Such severe CHDs include hypoplastic left heart syndrome with intact atrial septum, total anomalous pulmonary venous return with severe pulmonary venous obstruction with or without heterotaxy syndrome, transposition of great arteries with restrictive foramen ovale and ductus arteriosus, severe Ebstein's anomaly, and critical aortic stenosis with left ventricular dysfunction. I will introduce in this lecture our experiences for these fetal CHDs, and discuss about the prenatal decision-making, the preparation for treatment, and the treatment itself.

T10-16-IN04

Lecture 4: Segmental Approach of Complex Congenital Heart Disease

Ming-Ren Chen
Department of Pediatric Cardiology, MacKay Medical College and MacKay Children's Hospital, Taipei, Taiwan

Any combination of atrial situs, atrioventricular connection and ventriculoarterial connection may occur in complex congenital heart disease. Similar to the construction of a three-storied building, to identify gateway into the house (systemic and pulmonary venous return) and lay the first floor (atria) are the first and essential steps. Stairs (atrioventricular connection) to the second floor (ventricles), and connection to the third floor (conotruncus) are the followings. Comparing to other image modalities, accurate systemic segmental echocardiographic diagnosis may supply maximum information for clinical decision of management, preoperative evaluation and postoperative assessment.

T10-17-IN01

Lecture 5: The Role of the Catheter Intervention Among the Severe Congenital Heart Disease

Hideaki Ueda
Department of Cardiology, Kanagawa Children's Hospital, Yokohama, Japan

The prognosis of the congenital heart disease including Hypoplastic left heart syndrome HLHS have been improved in the last decades. Still there are several diseases such as asplenia syndrome, Total Anomalous Pulmonary Venous Drainage TAPVD, Pulmonary Vein Obstruction PVO, HLHS with intact atrial septum, severe Ebstein's anomaly, Transposition of the Great Arteries TGA with restrictive Patent Foramen Ovale PFO or PDA, of which prognosis is very poor and difficult to treat. The prenatal echocardiography and the precisely evaluation is critical for the treatment of these issues. Before delivery, treatment strategies will be designed with the urgent surgical procedure or catheter intervention, and recently in the combined fashion as Hybrid procedure where both surgical and catheter intervention would be performed almost simultaneously. With the new generation stent, drug eluting stent DES stent, the indication and the possibility of the catheter intervention has been expanded and expected to improve the mortality by reducing the possibility of receiving open heart surgery during neonatal period. The talk will be focused on the catheter intervention for the severe congenital heart disease and the importance of the prenatal echocardiography.

Smooth and open communication between echocardiologists, surgeons and interventionists are essential for the success of above mentioned transcatheter interventions.

T10-17-IN02

Lecture 6: The Tele-Medicine for the Fetal Diagnosis of CHD

Motoyoshi Kawataki
Tohoku University Hospital

The technology of ICT has been rapidly advanced recently and the Tele-medicine will be useful tool in the field of fetal diagnosis of CHD. I think there are three steps in tele-medicine, the first, Tele-seminar, the second, Tele-hands on, and finally Tele-diagnosis. We have held fetal Tele-seminars many times successfully in these years. Forty to eighty venues are connected by internet, and three hundred to one thousand people are joining in each seminar. We have just stared the Tele-hands on to assist the fetal heart screening with connecting the sonographers in the room of ultrasound and fetal cardiologists in the distant venues by internet. Although we have many problems in order to establish the system, Tele-hands on seems to be hopeful method to promote the fetal screening of CHD. We would like to start the Tele-diagnosis in near future using our experience of Tele-seminar and Tele-hands on.

T10-17-IN03

Lecture 7: Management of Critical CHD Neonates: Focus on PDA Stenting

Jou-Kou Wang, MD
Department of pediatrics, National Taiwan University Hospital, Taipei, Taiwan

Duct-dependent pulmonary circulation is one of the most common form of critical congenital heart disease in neonates. Cyanosis is the predominant presentation symptom. Infusion of Prostaglandin E1 is helpful in maintaining short-term ductal patency. An urgent systemic-to-pulmonary artery shunt is required to maintain the blood flow supply to pulmonary arteries. But the complications related to placing a shunt to pulmonary arteries were not infrequent in neonates. With the advent of transcatheter techniques, stenting of patent ductus arteriosus (PDA) can be an alternative to systemic-to-pulmonary artery shunts. Recently, bare coronary stents have been successfully used to stent PDA. The vascular access to stent PDA can be either from a prograde route (femoral vein) or retrograde route (axillary artery). Sometimes, more than one stent is required to covert the whole length of ductus. Generally, a 3.5 mm or 4.0 mm coronary stent was used. Neonates with a non-restrictive large ductus (narrowest diameter $\geq$ 2.5 mm) or juxta-ductal branch pulmonary artery stenosis should be excluded. Anti-platelet agents should be given to prevent thrombosis within the stent. Although stenting PDA is a safe procedure and can be an alternative to shunt placement, complications such as stent migration, thrombus and heart failure were not uncommon.

Free Paper

OPT10-001

Annular Plane Systolic Excursion Z-Score in Evaluation of Heart Systolic Function of Fetus with Heart Failure

Xianfeng Guo,[1] Bowen Zhao[2]
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Objectives: To establish Z-score model for fetal tricuspid annular plane systolic excursion(FAM-TAPSE) and mitral annular plane systolic excursion(FAM-MAPSE) based on gestational age(GA), then to evaluate the ventricle systolic function of fetus with heart failure.
Methods: 1024 normal fetuses and 24 fetuses with heart failure were involved FAM-TAPSE and FAM-MAPSE were measured by free angle M-mode echocardiography, Normal FAM-TAPSE and FAM-MAPSE Z-score models were constructed by using first standard regression analysis using GA as independent variable.The fetuses with heart failure were divided into left heart failure(LHF) group and right heart failure(RHF) group by Tei index.Subsequently, the two parameters between normal and fetuses with heart failure were compared.
Results: The models used to calculate Z-score for FAM-TAPSE and FAM-MAPSE were constructed,and GA had close correlation with them Compared with normal fetuses, the mean Z-scores of FAM-TAPSE and FAM-MAPSE were statistical different in fetuses with heart failure.
Conclusions: The FAM-TAPSE and FAM-MAPSE Z-score declined in fetuses with heart failure and they can provide quantitative evidence in evaluation of heart systolic function, FAM-TAPSE and FAM-MAPSE Z-score would be markers for assessing heart systolic function in fetuses with heart failure.

OPT10-002

Tricuspid Annular Plane Systolic Excursion Z-Score in Evaluation of Right Ventricle Systolic Function of Fetus with Ebstein Anomaly

Xianfeng Guo,[1] Bowen Zhao[2]
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Objectives: To establish Z-score model for fetal tricuspid annular plane systolic excursion(FAM-TAPSE) based on gestational age(GA), then to evaluate the righet ventricle systolic function of fetus with Ebstein anomaly(EA).
Methods: 1024 normal fetuses and 20 fetuses with EA were involved. FAM-TAPSE were measured by free angle M-mode echocardiography(FAM), Normal FAM-TAPSE models were constructed by using first standard regression analysis using GA as independent variable. FAM-TAPSE between normal and fetuses with EA were compared in ANOVA, and regression equation estimate was used to compare the relationship of FAM-TAPSE with right ventricle area(RVA).
Results: The models used to calculate Z-score for FAM-TAPSE were constructed,and GA had close correlation with them. Compared with normal fetuses, the mean Z-scores of FAM-TAPSE were statistical different in fetuses with EA, and FAM-TAPSE showed positive correlations with RVA.
Conclusions: The FAM-TAPSE Z-score declined in fetuses with EA as the increasing areas of atrial right heart and they can provide quantitative evidence in evaluation of right heart systolic function, FAM-TAPSE Z-score would be markers for assessing right ventricle function in fetuses with EA,and provide help to the prognosis and the perinatal management.

OPT10-003

Build-out Remotely Connected Support System of Fetal Diagnosis

Chika Kanno, Masaki Shimizu
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Objectives: It is reported that fetal diagnosis becomes widely used in recent years and there are survival cases of new born baby with severe congenital disease in intensive care during the early neonatal period. On the other hand, it is a fact that we still often experience cases for emergency neonatal transport after birth. Thus, we report the development of a build-out remotely connected support system of fetal diagnosis as Japan's first system with use of wide-area IT network

for improving a fetal diagnosis rate and prognosis of severely ill child.

Methods: Comprehensive Perinatal Maternal and Child Medical Center and 21 obstetrics and gynecology clinics in the prefecture were connected through the system's securely-protected Internet connection. The obstetrics and gynecology clinics send fetal ultrasonographic image data to a dedicated server when they determine a symptom as abnormal at the time of prenatal checkup. A fetal-neonatologist at the center analyzes the image data, prioritizes them with diagnostic support or severity, then send the report with results. In addition, bidirectional connection with a TV conference system is installed at 4 Perinatal Maternal and Child Medical Centers in the prefecture and allows us to share information and hold a conference as well as a hands-on ultrasonographic examination. The obstetrics and gynecology clinics provide information and explanation to a pregnant woman in reference to the received report (support for fetal diagnosis). Then, for those cases to be determined as a requirement of delivery management during the comprehensive perinatal period, they will be referred to the department of obstetrics at the center as outpatient or they will receive detailed examination (e.g. Fetal MRI)/ hospitalization management after maternal transport. In the periodical conference, medical team at the center discuss a delivery method and therapeutic strategy for early neonatal period.

Results: The system has been partially initiated from April 2017 and there were approximately 30 cases requested for congenital disorder so far. Those disorder cases were 1 case for neurological disorder, 20 cases for cardiac disorder, 10 cases for surgical disorder, and 2 cases for other while 4 cases were for cases with a requirement of therapeutic intervention during the early neonatal period. Some severe cases such as total anomalous pulmonary venous return with pulmonic venous obstruction were included in the cardiac disorder cases.

Conclusions: The system introduction is the first attempt in Japan and may possibly provide a proper medical treatment on the basis of team medicine against severe congenital disorder with a requirement of therapeutic intervention during the early neonatal period. While enhancing the widespread use/the effective operation of the system in future for overcoming a low fetal diagnosis rate by uneven distribution of medical resources, we need to analyze and feed back useful information collected from accumulated data of fetal diagnosis in server as an issue.

OPT10-004

Assessment of the Cases of Fetal Cardiac Abnormalities Identified Before 22 Weeks' Gestation

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Objectives: As a result of wide spread use of first and second trimester fetal screenings in Japan, the number of cases with fetal abnormalities pointed out prior to 22 weeks' gestation has increased. In this study, we assessed the cases of fetal cardiac defects identified before 22 weeks' gestation in our hospital.

Methods: Transabdominal ultrasonography was made in 55 patients who were pointed out to have fetal abnormalities through the first or second trimester screening. In 36 of these 55 patients, fetal cardiac abnormalities were found. The recordings of the 36 patients were assessed retrospectively.

Results: Mean gestational age at fetal abnormality detection was 19.1±3.6 weeks. The 36 cases consisted of 30 morphological abnormalities (83%) and 6 fetal arrhythmias without abnormal cardiac structures (17%). The abnormal findings at the detection included 23 cases of suspicious fetal morphological abnormalities (64%), 8 cases of fetal arrhythmia (8%) and 8 cases with increased nuchal translucency (NT) (8%). Five patients (14%) in 36 chose termination of the pregnancy.

Conclusions: In this study, only 8% of fetal cardiac abnormalities were identified by increased NT. It is thought that fetal echocardiography for patients with increased NT is useful for the early detection of fetal cardiac defects. At this point in Japan, first trimester screening by NT measurement is not very common, but it has gradually been increasing. We think it desirable and appropriate to establish a fetal cardiac screening prior to 22 weeks' gestation.

Poster Session

PPT10-001

Prenatal Solitary Complete Heart Block

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Objectives: To diagnose solitary complete heart block as early as we can, then we could establish the principal therapeutic decision for whether earlier intervention or not, and the timing of pacemaker insertion.

Methods: Use fetal cardioechography with M-mode to diagnose prenatal solitary complete heart block.

Results: The solitary complete heart block should be diagnosed as dissociation between atrial and ventricular contractions under M mode, without structural heart abnormalities.

Conclusions: The congenital complete heart block without structural heart abnormalities might have fine outcome. If autoimmune related, the treatment would be maternal use of steroids, or autoantibody neutralization. The other choice of treatment would be pacemaker insertion for the newborn.

PPT10-002

The Usefulness of Ultrasound Fetal Screening in the Prenatal Diagnosis of Severe Congenital Heart Disease

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Objectives: We have carried out the Ultrasound Fetal Screening(UFS) since 5 years ago, by threeultra-sonographers. We have reviewed the data, focusing on the detectability of Congenital Heart Disease(CHD) and tried to improve our way of screening.

Methods: We have analyzed the 3,321 cases carried out around 27th gestational weeks. From April 2012 till March 2014, UFS was carried out optionally and all cases were obligatory examined. from2014 until December 2016.

Results: 76 cases out of 3321 cases were convinced as CHD by pediatric cardiologist, containing 11 severe cases. In these cases, 19 cases were prenatally detected and 9 cases of it were transferred. There were 4 false negative cases, that is; TAPVC, congestive heart failure, TOF in 2014 and one case of DORV+PA+VSD in 2016. Sensitivity of the severe CHD were 33%(2014), 75%(2015) and 100%(2016).

Conclusions: We have tried to promote our screening capability of CHD by improving the following points. (1) Tenacious follow up study of the false negative cases (2) UFS of all patients (3) Several times US-exam of suspicious cases by mutiple sonographers and doctors. (4) Adoption the new method presented in the scientific meetings.These improvement of the system seemed to have progressed the accuracy of our clinic.

T11. Gynecologic/Obstetric Ultrasound

Symposium

T11-15-IN01

Should 3D be part of a routine ob/gyn ultrasound exam?

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Nowadays, most ultrasound equipment manufacturers incorporate 3D/4D technology into their scanning systems and 3D/4D ultrasound technology is used worldwide today. In contrast to conventional 2D US which only allows imaging of single planes, 3D/4D US offers several additional image displays. Through use of various manipulation tools, the technology does not only provide images that can never be achieved with 2D US, but it also offers a new basis for the detailed demonstration of fetal defects and specific views in pelvic examination, not obtainable with 2D US (e.g. coronal view of the uterus). Furthermore, digital storage of volumes enables the long-term maintenance of regions of interest without the loss of quality, as well as the option of reloading volumes at any time and performing "virtual examinations" in the absence of the patient. The value of 3D/4D US is of undisputable value in specific clinical situations, such as facial clefts, brain anomalies and spinal defects and coronal views of the uterus in suspected Müllerian anomalies. This technique is not only ready for routine use, but has already become part of daily routine in obstetrics and gynecology in expert or referral centers. However, it should be made clear that there are still no studies comparing 2D and 3D US in centers where practitioners are not 3D experts. Therefore, the question of the value of 3D/4D in routine scanning or as a screening mode remains unanswered.

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T11-15-IN02

Pelvic Doppler- Exploring Newer Indications

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President, Indian Radiological & Imaging Association, India

In earlier years of invention of Color Doppler technology, its main role was thought to be in differentiating the benign vs malignant lesions of the pelvis. With the advancement of technology, improved skill & increased experience more and more indication of TVS- CD are being explored, thus finding this modality of great help in assessment of various pelvic pathologies.

Pelvic Doppler examination is used to characterize the morphological similar looking lesions of endometrium, myometrium and ovaries. By demonstrating the neoangiogenesis and low resistance spectral Doppler pattern in the pelvic masses, the characterization malignant masses is easier. By TVS- CD we can assess physiological changes occurring during the menstrual cycle, thus helping in workup of infertility cases. Pelvic Doppler ex. can be used to locate & determine the extent of trophoblastic tissue invasion in cases of invasive mole. TVS- CD is also useful in the diagnosis and follow up of Artero- Venous communications in the uterine walls, in making the diagnosis of Placenta Accreta/ Percreta. It is also indicated in determining the viability of early pregnancy and in ectopic pregnancy when gestational sac is not seen in the adnexal mass.

T11-15-IN03

Three-Dimensional (3D) Sonography in Gynecology

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In Chang-Gung Memorial Hospital, Lin-Kou, three-dimensional (3D) sonography with power Doppler angiography had been applied in clinical evaluation since 2002. The technique can be utilized in many complicated conditions, and we had cumulative experiences in mainly three circumstances. The first one was to evaluate Mullerian duct anomaly such as HWW syndrome, uterine septum, and vaginal agenesis. The second was to assist differenciating benign from malignant tumors in uterus and ovaries. Finally, abnormal placentation such as placenta accreta was evaluated to predict the obstetric outcome.

Currently, over five hundred cases of uterine anomaly and over one thousand cases of uterine tumor were collected. With all these experience, we summarized several diagnostic criterias for vessel characteristics in uterine and ovarian malignancy. Marked increased sensitivity and specificity were obtained in comparison with traditional two-dimensional sonography. Furthermore, we could provide precise and real-time images of congenital Mullerian duct anomaly and adjustable to fit individual angle of uterus with 3D sonography. MRI is also utilized for diagnosis of Mullerian duct anomaly. However, MRI has angle limitation that may affect the accurate diagnosis. It is also more expensive then 3D sonography. In our experiences, 3D sonography is a useful modality in diagnosis of Mullerian anomaly and can provide more details for treatment strategy.

T11-15-IN04

Use of 3D Transvaginal Ultrasound in Prediction of the Need to Morcellate in Women Undergoing Laparoscopic Hysterectomy

George Condous
Nepean Hospital

In light of recent statements from the United States Food and Drug Administration warning against the use of power morcellation of uterine leiomyomas during laparoscopy, we have evaluated the use of preoperative two- (2D) and three- (3D) dimensional transvaginal ultrasound (US) assessment of uterine volume to predict the need for morcellation in women undergoing laparoscopic hysterectomy (LH). This was a prospective observational study performed between October 2008 and November 2011 in a tertiary referral laparoscopic unit. All women scheduled to undergo LH were included and underwent detailed preoperative transvaginal US. Uterine volumes were calculated using 2D-US measurements (ellipsoid formula), and using Virtual Organ Computer-aided AnaLysis (VOCAL™) having acquired 3D-US volumes of the uterus. Age, parity, need to morcellate and final uterine dry weight at histology were recorded. The estimated uterine volumes were then incorporated into a previously published logistic regression model to predict the need to morcellate for both nulliparous and parous women. The probability threshold cut-off of 0.14 (95% sensitivity) was evaluated in terms of sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and likelihood ratios (LRs). The performance of the models incorporating 2D- and 3D-US calculations were compared with 2D- and 3D-US-generated volumes alone, using receiver-operating characteristics (ROC) curves. Of 76 women who underwent LH during the study period, 79% (n = 60) had complete background and 3D-US data. Their mean age was 43.7 years, 91.7% were parous and 35% underwent morcellation. The greatest uterine

volume that did not require morcellation was 404 mL estimated using 3D-US, which corresponded to a uterine volume of 688.8 mL using 2D-US. The smallest uterine volume that required morcellation was 118.9 mL using 3D-US, which corresponded to a uterine volume of 123.4 mL using 2D-US. The 3D-US uterine volume for parous women with a sensitivity of 95% based on ROC-curve analysis was approximately 120 mL, which equated to a predicted probability of morcellation cut-off of 0.14. For this cut-off, specificity was 55.00%, PPV was 51.35%, NPV was 95.65%, LR+ was 2.11 and LR- was 0.09. Areas under the ROC curves for the morcellation logistic regression model were 0.769 (95% CI, 0.653-0.886) and 0.586 (95% CI, 0.419-0.753) using uterine volumes obtained by 3D-US and by 2D-US, respectively, and they were 0.938 (95% CI, 0.879-0.996) and 0.815 (95% CI, 0.681-0.948) using 3D-US and 2D-US volumes alone. In conclusion, the need to morcellate can be predicted preoperatively using 3D-US uterine volumes obtained by transvaginal US with a fair degree of accuracy. Uteri with volumes smaller than 120 mL at 3D-US are very unlikely to require morcellation. The incorporation of 3D-US-estimated uterine volume into the previously published logistic regression model does not seem to confer any significant improvement when compared with 3D-US uterine volume alone to predict the need to morcellate in women undergoing total LH.

T11-15-IN05

Non-Surgical Treatment for Symptomatic Uterine Fibroids

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The current review focuses on the non-surgical treatment for symptomatic uterine fibroids. Uterine fibroids (also known as myomas or leiomyomas) are the most common benign tumors of the reproductive tract of women. Although many are asymptomatic, it is estimated that one third of women with uterine fibroids will request treatment due to symptoms, such as abnormal uterine bleeding, pelvic masses, pelvic pain, infertility and others. Of the different treatment methods available, non-surgical treatment has become more and more popularity. To review the literature on non-surgical treatments that area available or being developed for women with uterine fibroids. Literature review of articles pertaining to non-surgical therapeutic strategies of uterine fibroids (Articles were searched by means of a computerized PubMed and Cochrane Library search with the following keywords: uterine myomas, leiomyomas, fibroids, and treatment.) At present, there are many strategies available in routine clinical practice, such as uterine artery embolization, high-intensity focused ultrasound, and medical treatment. This review of the literature alone with personal experience will offer the audience a panoramic view of the up-to-date treatment, which can be considered as different possibilities to treatment women with symptomatic uterine fibroids who look for uterus-preservation non-surgical approach.

T11-15-IN06

US Appearances of Ovarian Cystic Teratoma: Revisited with CT/MRI Comparison

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Although it is known that US diagnosis of mature cystic teratoma (MCT) is easy and straightforward because of characteristic hyperechogenicity of the mass. Not infrequently, however, we experience difficulty in making a diagnosis at US and in understanding correlation of US findings with CT or MRI findings. The most characteristic finding of MCT is a cystic mass with echogenic mural nodule representing dermoid plug which may accompany strong posterior sonic attenuation when they contain calcifications, large amount of fat, or tuft of hair. However, most MCTs show mixed echotexture and the proportion of echogenic or solid-looking component is various depending on the composition of the tumor. Less commonly, entirely cystic appearance is found. The cystic content of a MCT is usually greasy sebaceous material, which is liquid at body temperature, mixed with skin squames and matted hairs. Multiple, streaky and mottled echoes may be found in the cyst and are usually due to hair mixed with cyst fluid (dermoid mesh). Fluid-fluid levels may be present in the cyst with bright fluid interfaces. A floating echogenic sphere may be seen at the fluid-fluid level. Multiple spherical structures may float in a large cyst (intracystic floating globules). These spherical structures are thought to be formed by the aggregation of sebum around hair core, and composed of keratin, sebum, fibrin and hemosiderin. MCTs may appear as solid or completely echogenic masses. This finding is thought to be due to a large sphere that occupies most portion of the tumor. In these cases, the differentiation from solid malignancies of the ovary may be difficult. Peripheral curvilinear hypoechogencity, which is suggestive of the fluid portions of the tumor, is helpful in differentiation. The lesions that may mimic MCTs on US are hemorrhagic ovarian cysts, endometriomas, air-containing bowel loops, ovarian neoplasms with echogenic mural nodules, and exophytic lipomatous uterine masses such as lipoleiomyoma.

Preoperative diagnosis of MCT is important because rupture and spill of its cystic content during laparoscopic surgery may cause peritoneal granulomatosis. Therefore familiarity with typical and atypical US findings of MCT is important. Careful comparison with CT or MRI findings, if available, will be valuable in understanding their US findings.

T11-15-IN07

Ectopic Endometrium—Spectrum of Ultrasound Findings

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President, Indian Radiological & Imaging Association, India

The presence of functional endometrial glands and stroma outside of uterine cavity is termed as ectopic endometrium. It can be in the uterine musculature – Adenomyosis or outside of uterus – Endometriosis. Ectopic endometrium is a common and clinically important problem in women of child bearing age and the common clinical symptoms are infertility, pelvic pain and urinary symptoms. Ectopic endometrium can be found in -

1. Uterine walls.
2. Ovaries, fallopian tubes and Broad ligaments.
3. Pelvic peritoneum.
-Posterior cul – de- sac.
-Anterior cul –de – sac.
-Pelvic side walls.
4. Bowel/ Rectum/ Urinary bladder.
5. Abdominal Peritoneum.
6. Abdominal wall/ Umbilicus.
7. Other organs – e.g. chest.

Ultrasound (Trans abdominal, Transvaginal and Transrectal) is the most useful modality to detect ectopic endometrium.

U/S Findings in Adenomyosis.
- Diffuse enlargement of uterus.
- Coarse and inhomogenous echotexture of myometrium.
- Asymmetric thickening of uterine walls.
- Small hypoechoeic areas in myometrium.
- Small myometrial cysts.
- Poor definition of endometrial /myometrial margins.
- Subendometrial cysts.
- Subendometrial linear striations.
- Probe tenderness.

U/S findings in endometriosis.
- depends upon the site involved.
- Endometriotic cysts – most common findings . Cyst which may be unilocular or multilocular with low level internal echoes evenly distributed in the fluid.
- Peritoneal nodules.

- Restricted mobility and fixation of ovaries.

U/S is modality of choice in adenomyosis and ovarian endometriosis while MRI has greater specificity in diagnosing, extra ovarian pelvic endometriosis or diffuse endometriosis.

T11-15-IN08

The Application of Ultrasound in Müllerian Duct Anomaly

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Müllerian duct anomaly is often associated with menstrual complications or fertility disorders those affect woman's quality of life. A correct classification of female genital malformations is essential to prevent unnecessary and inadequate surgical operations and to compare reproductive results. However, the appropriate cataloguing is still controversial. The American Fertility Society classified seven basic groups of malformations considering the Müllerian development (due to agenesis, lack of fusion, the absence of resorption and lack of posterior development of the Müllerian ducts) and the relationship of the malformations to fertility. Other classifications are based on different aspects: functional, defects in vertical fusion, embryological or anatomical.

Traditionally, the female reproductive tract is first assessed via hysterosalpingography to image the uterine cavity. But it is uncomfortable and invasive with radiation exposure. Two-dimensional ultrasound is recommended for screening asymptomatic women. Three-dimensional (3D) ultrasound is recommended in suspected woman because it can reconstruct the coronal plane of the uterus for assessing congenital uterine anomalies. 3D ultrasound provides not only highly accurate and noninvasive immediate results, but also is cost-effective with the same benefits of magnetic resonance imaging (MRI) in diagnosing Müllerian duct anomaly. MRI and endoscopic evaluation are only recommended for the subgroup of women with suspected complex anomalies or in diagnostic dilemmas.

T11-15-IN09

Systematic Approach to Sonographic Evaluation of the Pelvis in Women with Suspected Endometriosis: A Consensus Opinion from the International Deep Endometriosis Analysis (IDEA) Group

George Condous
Nepean Hospital

The IDEA (International Deep Endometriosis Analysis group) statement is a consensus opinion on terms, definitions and measurements that may be used to describe the sonographic features of the different phenotypes of endometriosis. Currently, it is difficult to compare results between published studies because authors use different terms when describing the same structures and anatomical locations. We hope that the terms and definitions suggested herein will be adopted in centers around the world. This would result in consistent use of nomenclature when describing the ultrasound location and extent of endometriosis. We believe that the standardization of terminology will allow meaningful comparisons between future studies in women with an ultrasound diagnosis of endometriosis and should facilitate multicenter research.

T11-15-IN10

Detecting Endometriosis in Adolescents

Hsien-Ming Wu

Endometriosis is characterized by the presence of endometrial glands and stroma external to the uterus. Up to 17% of postmenarcheal females and nearly 40% of adolescents with chronic pelvic pain are found to have endometriosis. While endometriosis traditionally was thought to be a disease of adulthood, two-thirds of adult women with endometriosis report symptoms beginning before 20 years of age. While endometriosis in adults often presents with cyclic pelvic pain, dysmenorrhea, dyspareunia, infertility, and ovarian lesions, such predictive signs and symptoms are rare in the adolescent. Endometriosis in adolescents is no exception and is certainly a common subject for debate in the relevant circles. These controversies relate to its prevalence, natural course and treatment.

Diagnostic delay represents a major problem for endometriosis patients including adult women and adolescent girls. Symptomatic endometriosis should be detected at an early stage, if required also during adolescence, as a longer delay before surgical diagnosis is associated with more advanced stages of endometriosis and with a higher likelihood of fertility problems. Therefore, understanding the origins and progression of adolescent endometriosis is needed to screen all female adolescents and to identify female adolescents at risk to develop endometriosis.

Here, I present 1) origins and prevalence of adolescent endometriosis, 2) pathophysiology and risk factors of adolescent endometriosis, and 3) clinical course, diagnosis and treatment of adolescent endometriosis.

T11-15-IN11

A Longitudinal Follow-Up of Pelvic Floor Biometry: Factors Affecting It

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The pelvic floor biometry of women changes during pregnancy. As pregnancy advances, the pelvic organs, namely bladder neck, cervix and ano-rectal junction descent significantly and hiatal area enlarged significantly. Some of the symptoms of pelvic floor disorders are associated with these changes. After a first vaginal delivery (VD), about 20% of women had levator ani muscle (LAM) avulsion; although among them, about 20% had morphological 'healing' on ultrasound by 12 months after delivery. Caesarean delivery (CS) was not associated with LAM avulsion. By 12 months after delivery, irrespectively of mode of delivery, bladder neck and cervix remained at a lower position. Compared with CS, hiatal area was more increased after VD; and LAM avulsion increased the risk. After a second VD, the occurrence of new LAM avulsion was low. By 3-5 years after first delivery, regardless of parity and mode of delivery, there were lower pelvic organs on Valsalva and a greater hiatal area. For the effect of parity, compared with only one VD, women who had 2 or more VD had a great hiatal area. Women whoever had a VD had a greater hiatal area than women only delivered by Caesarean delivery.

T11-15-IN12

Levator Ani Muscle Avulsion Is a Risk Factor for Vaginal Pessary Expulsion

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Pelvic organ prolapse (POP) is a highly prevalent condition; vaginal pessary is a common treatment for this condition. A recent randomized controlled trial and prospective studies have confirmed the efficacy of vaginal pessary as treatment for this condition. However, expulsion of vaginal pessary remains a major issue. The reported rate of pessary expulsion has been around 30-60%. Several risk factors were known to be associated with unsuccessful pessary fitting namely short vaginal length and wide vaginal introitus. Levator ani muscle (LAM) avulsion is known to be associated with POP. It is also related to symptoms of prolapse and surgical outcome of prolapse repair. The association between successful vaginal pessary use and pelvic floor muscle and hiatal dimensions were examined. LAM avulsion was associated with 3 times higher risk of pessary expulsion in one year. More severe staging of prolapse

also increased the risk of expulsion. Pessary expulsion is usually occurs within 2 weeks after insertion, but it can also happen within 6 months.

T11-15-IN13

The Relationship between Pelvic Examination and Ultrasound Finding in Patient with Pelvic Floor Dysfunction

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In Pelvic examination, the POPQ system is an objective, site-specific system for describing and staging pelvic organ prolapse (POP) in women to create a "topographic" map of the vagina. Ultrasound is capable of identifying different compartmental defects of the pelvic floor. On ultrasonography, there are three methods for the quantification of POP: determining position by 1 distance and 1 angle (polar coordinate), by 2 distances (orthogonal coordinate), or by measuring the height of pelvic organ with reference to a horizontal line drawn at the lower border of symphysis pubis.

The differences between resting and stress bladder neck angles yield the rotational angle, which represents urethral or bladder neck mobility in a similar way as the Q-tip test. There are no definite values of normal bladder neck descent or urethral mobility. Although the positions of the bladder neck in patients with stress incontinence are lower than those of continent women, there is an overlap between these two groups. Nevertheless, urethral mobility was reported to be related to grade of incontinence.

The levatorani muscles play an important role in supporting pelvic organs and maintaining normal pelvic floor function. Palpation through the vagina or rectum helps in assessing pelvic floor squeeze strength and levator muscle thickness. Guidelines have been published by the International Continence Society to assess pelvic floor musculature tone. Women with poor pelvic floor muscle function may benefit from pelvic physical therapy. On ultrasonography, the function of levatorani muscle has been assessed indirectly by the displacement of pelvic structures (e.g. bladder neck or bladder base) on its contractions. The bladder and urethra moves upwards and ventrally during pelvic floor contractions. Correlations between shift of bladder neck and palpation/perineometry have been shown to be good.

During straining, the bladder neck may move in a semicircular fashion with the tip of the symphysis pubis as the center (rotational descent), or move downward along the urethral axis (sliding descent). On ultrasonography, the occurrence of bladder neck funneling suggests poor urethral closure pressure. In addition to stress incontinence, bladder neck funneling may also be found in women with urge incontinence. It does not occur in normal continent women unless the bladder is full.

Enteroceles are often difficult to recognize by clinical examination, but are easily detected by perineal or introital ultrasound. The imaging of the cervix and the vaginal apex may be incomplete with the presence of large rectoceles, and the extent of pelvic floor relaxation may be underestimated because of transducer pressure and without the help of sim speculum. Levator avulsion, detachment of puborectalis muscle from its insertion, and hiatal (levator ani compelx) overdistensibility, are two risk factors associated with POP.

T11-15-IN14

Evaluation of Stress Urinary Incontinence by Pelvic Ultrasound before and After Operation

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Ultrasound examination of the lower urinary tract has been established within urogynecology as a simple, prompt, reproducible, and dynamic diagnostic procedure. Ultrasound imaging provides accurate and clear visualization of both organs in the lower urinary tract and synthetic implants. It also provides dynamic changes in uthethral mobility during Valsalva maneuver. In this presentation, we introduce pre-operative, intra-operative, and post-operative use of ultrasound in midurethral sling surgery. Pre-operatively, linear and convex probes are used for anatomical diagnosis in lower urinary tract. Intra-operatively, a linear probe is used for the conformation of the hydrodissection. Post-operatively, both convex and linear probes are used for the position of synthetic sling. In conclusion, ultrasound can be an essential tool for safe and effective mid-urethral sling surgery.

T11-15-IN15

Ultrasound Images in Visualization of Vaginal Synthetic Grafts After Pelvic Reconstructive Surgery

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Ultrasound has been widely utilized in the routine urogynecological practices. The advantages of ultrasound include simplicity, convenience, minimal invasiveness, low cost, and lack of radiation exposure. With improved image resolution, four-dimensional real-time technology, and off-line analysis program, now we can more precisely evaluate the conditions and movements of the pelvic structures. Non-absorbable synthetic grafts have been introduced to correct pelvic organ prolapse, especially anterior vaginal prolapse, because of high recurrence rates of conventional pelvic reconstructive surgeries. Ultrasound is the only technique that allows the visualization of polypropylene mesh implants. The potential applications of ultrasound for pelvic reconstructive surgeries incorporating synthetic grafts include preoperative evaluations for better patient selections as well as postoperative surveillance for mesh functionality and adverse events such as prolapse recurrence, mesh dislodgement, voiding difficulty, or urinary incontinence.

T11-15-IN16

How to Keep Ultrasound Safe in Obstetrics? What have We Learned?

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If asked, the vast majority of end users (and patients) will respond that ultrasound is not X-rays and is completely safe. In reality, there is a marked lack of knowledge on effects of ultrasound in tissues being examined (bioeffects) among the majority of these end-users. Being a form of energy, ultrasound has effects in all insonated tissues (bioeffects), secondary to two main mechanisms: thermal and non-thermal (or mechanical). On-screen indicators of these potential bioeffects are the Thermal and Mechanical indices (TI and MI). Biological effects have been reported in animals, mostly for exposure exceeding those usually applied in humans. In humans, autism, abnormal hearing, vision or language development, intrauterine growth restriction, childhood cancer and increase in non-right handedness have been associated with ultrasound but no cause-effect has been proven by science-based analysis (except, possibly for a slight increase in non-right handedness, specifically in males). Yet, essentially all epidemiological studies are based on information obtained with pre-1992 machines, when acoustic output of instruments was allowed to be increased, for fetal use, by a factor of almost 8. Increasingly, ultrasound is performed early in gestation, a time when the fetus is known to be particularly sensitive to external influences. Most examinations are performed with B-mode, but some studies employ Doppler technology, known to expose the fetus to much higher levels of acoustic energy, hence requiring special precautions. There should always be a medical indication and operators should follow the rule of the shortest time possible, at the lowest possible output, compatible with an adequate diagnosis (ALARA). Keeping the TI and MI below 1 will, almost certainly, not cause deleterious effects to the fetus. Education of the operators is vital to maintain the unblemished record of ultrasound in obstetrics.

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T11-15-IN17

Analysis of Training Formats for Point of Care Obstetrics in the Third Trimester of Pregnancy

Susan Campbell Westerway
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Introduction: The availability of point of care (POC) obstetric ultrasound services has improved the outcome for mothers and babies in remote regions around the world. However, there is an increasing demand to create efficient, cost effective POC training courses for monitoring of the fetus. This is particularly important for Outreach programs in regions where access to training and resources are limited.

Aim: To evaluate the efficacy of targeted ultrasound point-of-care training programs, that assesses the fetus during the third trimester.

Methodology: Over a 12month period the skill teaching curriculum of five obstetric POC courses was evaluated. The specific parameters include:

- 45 learners': 4-20 / course
  Nil with prior ultrasound experience
- 12 learners' had English as a second language (EASL)
  5 medical graduates & 7 midwives
- Course duration: 4-10 hours
- Didactic lecture time: 0-4 hours (0-60%)
- Practical time: 2.5-7 hours (60-100%)
- Tutor/learner ratio 1:6 maximum

All courses included the teaching of probe manipulation, image optimization (depth, focus & gain), & limited knobology. Practical sessions included supervised scanning of various commercial & hand made phantoms prior to scanning standardized patients who were in the 3rd trimester of pregnancy.

The teaching outcomes that were assessed included: image optimization, determine fetal lie, measure fetal heart rate, measure the single deepest pocket of amniotic fluid, & identify the cervix and placental position.

Results: All 45 participants achieved the limited course objectives, regardless of the mix of the course curriculum. However, there were five EASL learner's (4 midwives and 1 medical graduate) who were unable to complete a post lecture written test as they identified that this was due to the language barrier.

Conclusion: This study has confirmed that obstetric POC training courses can guide the initial psychomotor skills that are required for limited third trimester scanning. However performance beyond the course practice session requires further research. The educational value of this teaching format has yet to be evaluated as to its ability to equip the learner with the skills that are required to practice beyond the course duration.

T11-15-IN18

Predictive Factors for Intrauterine Growth Restriction in the First Trimester

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Intrauterine growth restriction (IUGR) is a major contributor to perinatal mortality and morbidity worldwide. Prophylaxis with aspirin during the first or second trimesters and/or combined with heparin before conception, may reduce the incidence of IUGR in high risk groups. Despite improvement in the understanding of the pathophysiology, abilities in the first trimester to precisely predict pregnant women who will develop IUGR are limited. While different measures of placental dysfunction are associated with increased risk for adverse pregnancy outcomes, the abilities of various markers to accurately predict IUGR have been studied, such as biochemical serum markers, ultrasound and Doppler study of uterine and spiral arteries, and placental volume and vascularization. Risk factors for IUGR are easy to assess but have poor predictive value. The use of first trimester biochemical markers in combination with ultrasound markers is promising as a potential screening tool. Modern assessments suggest combined algorithms using these strategies, all with the goal of a better prediction of IUGR.

T11-15-IN19

The Implementation of Precision Medicine into Prenatal Diagnosis of Abnormally Invasive Placenta

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Precision medicine (PM) is a medical model that proposes the customization of healthcare, with medical decisions, practices, and/or products being tailored to the individual patient based on their predicted response or risk of disease. In this model, diagnostic testing is often employed for selecting appropriate and optimal therapies based on the context of a patient's genetic content or other imaging, molecular or cellular analysis.

At the current time, Gray-scale ultrasound (US) has been the cornerstone in diagnosing abnormally invasive placenta (AIP) due to its wide availability, low cost and high accuracy with a sensitivity of 73-93% and a specificity of 79-86%. Color Doppler US highlights problematic areas of uteroplacental neovascularizatin with reported sensitivity ranged between 82.4% and 100%, and the specificity ranged between 72% and 100%. 3D/4D power Doppler US providing a virtualized spatial angioarchitecture network of AIP.

We emphasize the 3 current US screening techniques for diagnosing AIP antenatally appears to be complementary rather than competitive and are not mutually exclusive. Through the implementation of PM will enable a new era of prenatal diagnosis and management in which researchers, providers and patients work together to develop individualized care of AIP.

T11-15-IN20

Umbilical Cord Stem Cell Cloning and Uses in Pre-Immune Embryos to Prevent Inherited Disorders of Childhood: Hypothesis Driven Studies

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Ultrasound imaging has allowed for the *in-vivo* observation of the gestational sac compartments during the first weeks of pregnancy. Ultrasound-guided Celocentesis has expanded our knowledge of the biochemical composition of the extra-embryonic fluid, allowed for the prenatal diagnosis of genetic disorders before 9 weeks gestation, and opened the doors to experimental *in-utero* cell-based therapies in pre-immune embryos to prevent Autosomal Recessive disorders.

Hemopoietic precursors (CD34 +Lin-) isolated from bone marrow, circulation, and from the umbilical cord blood can be used to correct or reconstitute various cell lines within the hematopoietic and endothelial cell lineage. Although the extent to which individual hematopoietic growth factors control cell cycling and differentiation is not known, we have reported the *ex-vivo* and the *in-vivo* proliferative and clonogenic response of CD34 +Lin- to cytokines in 4 platforms with and without a 3-dimensional biocompatible matrix. Using an experimental non-human primate model, we have also demonstrated that expanded umbilical cord hematopoietic stem cells can survive for 20 hours in extra-embryonic celomic fluid and that this fluid can be enriched making the extra-celomic cavity a "bio-reactor" to enhance the likelihood of antenatal cell-based therapy in pre-immune embryos (< than 8 weeks from fertilization).

T11-16-IN01

Fetal Brain Imaging

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Fetal CNS is remarkably developing in the first trimester and changing its appearance from premature tubal structure to the bilateral cerebri, cerebellum and brainstem. Neuro-sonoembryology has been improved with great advances of 3D ultrasound technology such as HDlive silhouette technology and studio-live technology. However, detectable CNS abnormalities are limited in the first trimester because neuronal migration and proliferation will take place from 3rd or 4th months of gestation.

Phenotype of migration disorders in the cortex conspicuously appears after 28 weeks of gestation when cortical gyration is clearly visualized. It has been believed that it is quite hard to detect migration disorder before 28 weeks. However, "early detection of migration disorder before gyration" has been recently possible by observation of Sylvian fissure development, abnormal sulcation and ganglionic eminence during the second trimester. Close observation of those brain structure in detail is not generally performed however it might help to establish a new field of fetal neuroscience.

T11-16-IN02

Prenatal US Findings of Musculoskeletal Anomalies

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Fetal musculoskeletal malformations take a number of pathologic forms, among which a variety of lethal dysplasias and several anomalies have a poor perinatal and postnatal outcome. Precise antenatal ultrasonographic diagnosis of bone dysplasia may be very difficult, but differentiation between a lethal and a nonlethal variety is very important in terms of antenatal care and the prediction of fetal outcome.

Variety of lethal skeletal dysplasias commonly show very short long bones and narrow thorax. For the differential diagnosis of fetal skeletal dysplasia, comprehensive evaluation of fetal bones including cranium, face, ribs, and spine is very important. Genetic counseling is critical and individualized multidisplinary prenatal and postnatal care is important for the management of fetal skeletal dysplasias.

Several anomalies leading to limb loss or contracture as the expression of other pathologic entities have a poor outcome, and their early detection is also very important for the management of a pregnancy.

Focal musculoskeletal anomalies can occur in isolation or in association with a large variety of syndromes, malformations and disorders. Thus, the early and accurate prenatal diagnosis of anomalies is important not only for detecting the anomaly itself, but is also helpful with regard to these other, associated, anomalies.

T11-16-IN03

The Applications of 3D/4D Ultrasound in Prenatal Diagnosis and Fetal Surgery in Open Spina Bifida

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Prenatal diagnosis of open spina bifida (OSB) by ultrasound examination during the second trimester of pregnancy was greatly improved in the mid 1980s by the description of the lemon and banana signs. More recently the researchers mentioned about the intracranial translucency is lower in the fetus with OSB during first trimester scanning. In this talk, we would like to share the experience of using 3D/4D ultrasound in prenatal diagnosis of OSB either in first trimester Down syndrome screening or second trimester routine scanning. The 3D/4D have advantages in helping the detection rate in spina bifida and more clearly to follow up the later on examination. Alone with this technique, the open fetal surgery or fetoscopic repair of the defect in OSB are reliable during whole surgery. In the end of talk, we will also update the current trend of fetal surgery in OSB and compare the different approach with different clinical outcomes.

T11-16-IN04

Diagnostic Roles of Color Doppler Mapping of Fetal Circulation

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Prenatal assessment of primitive circulation in the human fetus with color Doppler flow mapping has added a new dimension to fetal assessment. Normal values generated from pulse-wave Doppler studies have been generated for fetal vessels. Early development of placental circulation can be evaluated with color Doppler studies, and it appears to be promising for elucidation of placental pathology as is found in a number of fetal and placental diseases Doppler color-flow mapping appears to be promising for elucidation of abnormal flow in fetuses suspected of having structural and/or functional cardiovascular disease. Certain congenital anomalies can be detected early on in gestation using color Doppler mapping, and hence provide a unique opportunity for in utero intervention. Fetal exposure to Doppler ultrasound should be as low as reasonably achievable (ALARA) because of the potential for tissue heating when the thermal index is exceeding.

T11-16-IN05

Fetal MR Neuroimging: Practical Issues

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Fetal magnetic resonance (MR) imaging, initially introduced in the 1980s, has become a widespread and valuable imaging modality in prenatal evaluation of the fetal nervous system. Advances in fetal diagnosis and management throughout the years have urged a need for precise depiction of structural abnormalities. Although obstetric ultrasonography (US) remains the screening modality of choice in evaluation, MR imaging, having multiplanar imaging ability and superior tissue differentiation, is now an important complementary imaging modality in the evaluation of the fetal nervous system.

This presentation will focus on the practical issues of fetal MR neuroimaging, including technical aspects, clinical utility with examples, advanced imaging technigues, and limitations.

T11-16-IN06

Cervical Examination by US for Cervical Insufficiency

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Although numerous investigators have tried to find accurate means of cervical insufficiency diagnosis, there is no reliable and objective standard as of yet. Transvaginal ultrasonography (TVU) is the most powerful diagnostic tool for the assessment of cervical competence. TVU is superior to transabdominal or translabial ultrasound for the assessment of the cervix. It is an accurate, reliable, and reproducible method for the measurement of cervical length (CL) and funneling. I has been well documented that a short CL (<25mm) preferentially increases the risk of midtrimester birth. The risk of preterm birth is inversely associated

with CL, from <1% at 30 mm to 80% at 5 mm. Serial measurements of CL can help identify high-risk patients fro whom cerclage placement is beneficial, given that 12-40% of "at-risk" patients will not present CI in subsequent pregnancies.

In 2012, the Society for Maternal-Fetal Medicine stated that universal CL screening in singleton pregnancies with prior preterm birth is beneficial for the prevention of preterm birth. However, they also emphasized that CL screening in singleton pregnancies without prior preterm birth should be considered when necessary. CL measurement usually begins at 15 weeks, as CL screening prior to 15 weeks doses not predict the risk of PTB.

It is recommended that TVU CL in singleton pregnancies with prior preterm birth can be started at 16 weeks and be repeated every 2 weeks until 23 weeks: TVU CL ,25 mm is detected: the placement of cerclage should be considered, as cerclage significantly reduces the risk of PTB at less than 35 weeks. Unfortunately, TVU CL screening in twin pregnancies cannot be recommended due to a lack of evidence. For as a CL screening, the proper TVU technique is pivotal. The bladder should be emptied before TVU, as a full bladder compresses and elongates the cervix. After obtaining a sagittal long-axis view of the cervix, excessive pressure against the cervix should be avoided as it exaggerates. Funneling, which is defined as the opening of the internal cervix, is characterized by funnel length and funnel width. Funneling occurs along with cervical effacement, which is easily remembered by the use of the mnemonic "trust your vaginal ultrasound" The T shape represents a normal closed cervix. The Y shape represents a small breaking funneling, and further is shown by the V shape. A more advanced funnel takes the shape at a U, which is the worrisome finding of PTB. Unlike CL, there is high interobserver variability, funneling is useful for predicting PTB when combined with CL. The combination of a short CL (<25 mm) and the presence of funneling increases the sensitivity of predicting PTB compared to when there is a short CL alone.

T11-16-IN07

Risk of Fetal Loss After Iatrogenic Procedures

An-Shine Chao
Chang-Gung Memorial Hospital, Taiwan

ISUOG Practice Guidelines: invasive procedures for prenatal diagnosis.

Chorionic villous sampling / Amniocentesis / cord blood sampling

Endoscopic LASER surgery for TTTS / Trap sequence.

Endoscopic surgery for the antenatal treatment of myelomeningocele: the CECAM trial.

Prevention & intervention.

T11-16-IN08

Can Spontaneous Preterm Birth Be Predicted by Ultrasound?

Chiu Yee Poon Liona
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Preterm birth is a major public health problem in terms of perinatal mortality, long-term morbidity and health economics. It is responsible for more than half of all neonatal deaths. In a UK multicentre study of survivors born before 26 weeks' gestation, 80% were disabled at the age of 6 years. The economic burden of prematurity relates not only to the initial neonatal intensive care but also to the longer-term increased use of medical, social and specialist educational services, as well as the lost economic productivity.

A series of studies have demonstrated that administration of progestogens to women with a singleton pregnancy with a short cervix approximately halves the rate of spontaneous preterm birth. The availability of an effective intervention now provides a rationale for population-based screening for preterm birth. The most widely adopted approach to identifying pregnancies at high-risk of spontaneous preterm birth is based on a previous history of preterm birth. Evidence suggests that more effective screening can be provided by the sonographic measurement of cervical length at mid-gestation. However, there is currently no clearly accepted method for population-based screening.

The rates of extreme (<28 weeks), early (28-30 weeks), moderate (31-33 weeks) and mild (34-36 weeks) spontaneous preterm birth were 0.2%, 0.2%, 0.6% and 3%, respectively. The best prediction of spontaneous preterm birth has been shown to be provided by cervical length (area under the receiver–operating characteristics curve (AUC), extreme 0.903, early 0.816, moderate 0.784 and mild 0.617) and this is improved by adding obstetric history (AUC, extreme 0.919, early 0.836, moderate 0.819 and mild 0.650). For a 10% screen-positive rate, models using cervical length and obstetric history have a sensitivity of 81%, 59%, 53% and 29% for extreme, early, moderate and mild spontaneous preterm birth, respectively.

In conclusion, a model combining cervical length and obstetric history provides a better prediction of spontaneous preterm birth and the sensitivity of screening improves for increasing degrees of prematurity.

T11-16-IN09

Intrapartum USG

Tak Yeung Leung
The Chinese University of Hong Kong

The use of USG in labour ward is becoming more popular, not only for assessment of mal-presentation or placenta previa. Transperineal USG at the second stage of labour to assess the fetal station and fetal head position has been shown to be predictive of the success of instrumental delivery, and to improve the safety of the procedure.

In the first stage of labour, transperineal USG may be a more objective and less invasive way to assess the progress of labour, when compared to digital pervaginal examination. Parameters such as the head symphyseal distance (HSD), angle of progression (AoP) and fetal head progression distance (PD) represent the degree of fetal head descent (or station). Slow progression of these USG parameters may indicate a lower chance of successful vaginal delivery.

Before induction of labour (IOL), USG assessment of the cervical length and consistency may also be useful in predicting successful IOL, while a higher middle cerebral arterial pulsatility index may indicate fetal compromise and higher chance of intrapartum fetal distress, which may then require emergency caesarean section.

Finally, USG can assist in complicated delivery such as vaginal twin delivery, to guide external cephalic version or internal podalic version.

T11-16-IN10

USG Evaluation of Postpartum Complications

Gwang Jun Kim
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Immediate postpartum complications are vaginal bleeding and genial tract tear. Ultrasound is greatly helpful for evaluation of the causes, the location and the severity of these immediate complications.

Deep vein thrombosis, which can lead to pulmonary artery embolism, is not so infrequent postpartum period, especially after Cesarean section. Now the most useful diagnostic modality for deep vein thrombosis is ultrasonography.

Post-partum period ends 6 weeks after birth. This period is vulnerable for genital, pelvic infections.

Late postpartum bleeding also can occur due to retained placenta. H-mole and arterio-venous malformations are not frequent but possible in this period. Ultrasonography is useful to detect and evaluate these complications.

T11-16-IN11

First Trimester Prediction of Preeclampsia by Ultrasound

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Preeclampsia is an important cause of death and disability for the mother and baby. The risk for such complications is considerably higher when the disease is severe and of early onset, leading to preterm birth at less than 37 weeks of gestation rather than term preeclampsia. A major challenge in modern obstetrics is early identification of pregnancies at high-risk of preterm preeclampsia and undertaking the necessary measures to reduce the prevalence of the disease.

Professional bodies now recommend the prophylactic use of low-dose aspirin (60-80 mg per day) in women considered to be at high-risk of preeclampsia. In the UK, the National Institute for Health and Clinical Excellence (NICE) recommends selection of the high-risk group on the basis of 10 factors from maternal characteristics, medical history and obstetric history; however, the performance of such screening is poor with detection of about 40% of preterm preeclampsia and 33% of term preeclampsia at screen positive rate of 11%. In the USA, the American College of Obstetricians and Gynecologists (ACOG) recommends use of aspirin for women with a history of preeclampsia in more than one pregnancy or history of preeclampsia requiring delivery before 34 weeks of gestation; however, this subgroup constitutes about 0.3% of all pregnancies, contains only 5% of those that would develop preterm preeclampsia and 2% of term preeclampsia.

In normal pregnancy the spiral arteries in the placental bed are invaded by trophoblast, which becomes incorporated into the vessel wall and replaces the endothelium, muscular layer and neural tissue. These physiological changes convert the spiral arteries from narrow muscular vessels to wide non-muscular channels independent of maternal vasomotor control. In preeclampsia there is impaired trophoblastic invasion of spiral arteries and this impairment is most marked in early preeclampsia. Indirect evidence for impaired placental perfusion in pregnancies destined to develop preeclampsia has been provided by ultrasound Doppler studies of the uterine arteries which showed increased pulsatility index (PI) in the first-trimester of pregnancy. Uterine artery PI has been proven to be one of the most predictive parameters for the development of early onset preeclampsia. Our proposed method of screening is one that utilises Bayes theorem to combine the *a priori* risk from maternal factors, with uterine artery PI, mean arterial pressure and placental growth factor at 11-13 weeks of gestation; a study involving about 60,000 singleton pregnancies has reported that such screening is superior to the methods proposed by NICE and ACOG and can detect 90%, 75% and 40% of cases of early preeclampsia (<34 weeks), preterm preeclampsia (<37 weeks) and term preeclampsia (≥37 weeks), respectively, at screen positive rate of 10%.

T11-16-IN12

Fetal Face in the First Trimester

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Fetal face examination is important because the facial appearance is strongly related with genetic condition, brain disorder and developmental delay. In the first trimester, fetal face structure is almost created. The points of facial structure which can be assessed are profile, nasal bone, nasal appearance, mandible, maxilla, chin by sagittal view, eyeballs, lips and alveolar by coronal-axial view, and ear position and chin development by three-dimensional ultrasound.

The eyeballs are bilaterally created in early embryological stage. The eyeball is visualized by silhouette ultrasound. At the beginning of 12 weeks, a small cystic part appears and at the middle of 12 weeks, the eyeball is depicted much larger and at 13 weeks, The lens and vitreous body in the eyeball can be identified and thereafter the lens and vitreous body are continuously demonstrated by silhouette ultrasound. This new technology has a great potential to open a new field of 'fetal 3D sonoophthalmology', which has been never invented by conventional ultrasound technology.

Thus, three-dimensional HDlive ultrasound further "humanizes" the fetus,and enables detailed observation of detailed facial appearance even in the first trimester. A small fetus is not a fetus but a "person" with its personality from the first trimester.

T11-16-IN13

NIPT and First Trimester Ultrasound

Qingqing Wu
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Non-invasive prenatal testing (NIPT) is rapidly being incorporated into prenatal care with highly efficient. It has changed the traditional methods of prenatal screening and diagnosis. How to reassess the role of prenatal ultrasound? ISUOG has compiled Consensus Statement: "All women should first be offered a first-trimester ultrasound scan according to ISUOG guidelines, regardless of their intention to undergo NIPT". NIPT is not a diagnostic test and need to be confirmed by invasive testing for the presence of any abnormal results [(1)]. Our research results show that after invasive testing, a chromosomal abnormality was detected in 164/1247 (13.2 %) fetuses. 65/1247 (5.2 %) cases concerned trisomy 21, 18 or 13, 12/1247 (0.96 %) an aneuploidy of sex chromosomes and 1/1247 (0.08 %) triploidy. In 71/1247 (5.6 %) a chromosome aberration was seen and in 2/1247 (0.16 %) cases of UPD was found. Fetal structural abnormality was detect in 91/19232 (0.47%), NT≥3mm was in 370/19232(1.92%) by ultrasonography.

NIPT positive in 17 cases including 8/17 trisomy 21, 4/17 trisomy 18. The false positive in 5 cases including 1/5 trisomy 21, 1/5 trisomy 18, 2/5 trisomy 13, 1/5 Sex chromosome. The false negative in 3 cases. NIPT could not detect all chromosome aberrations in the first trimester.

Reference:

1. Ultrasound Obstet Gynecol 2014; 44: 122–123.
2. Srebniak et al. Molecular Cytogenetics (2016) 9:69.

T11-16-IN14

Shifting the Fetal Anomaly Scan To the First Trimester

Dr. Suresh Seshadri
Mediscan Systems

Since the last three decades, the diagnostic capability of Obstetric ultrsound has significantly inreased thanks to technological advances and improven in understanding fetal anatomy, physiology and anomalies. The traditional approach for fetal anatomical evalution is to perform a detaild anatomical scan between 18-20 weeks. The quest for early diagnosis was strengthened by research in first trimester diagnosis of aneuploidies. We now realise that fetal anatomical evaluation can be effectively done in the first trimester since embryogenesis is complete by 12 weeks form LMP. Hence major malformations can be seen at this time. A meticulous protocol based "rule of 2" checklist approach will help diagnose about 60% of anomalies in the first trimester. By using this protocol it is possible to classify anomalies as those that can always be detected in the first trimester and those that cannot be detected in this period. Major CNS anomalies, cardiac anomalies, abdominal wall defects and limb defects can be diagnosed during the 11-13 week scan. Considering the possible yield, the first trimester should be considered as the first milestone for screening for structural defects. However this

can be achived only by good training and good quality equipment. The second trimester targeted scan should also be performed as per current protocol. This approach of first and second triemster target scan wiill not only help maximise the detection of anomalies, but also give the opportunity to detect severe anomalies early this helping patients to make an informed choice early in pregnancy.

T11-16-IN15

Why We Do the 1st Trimester Echocardiography

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Congenital heart diseases (CHDs) comprises the main causes of death in the first year of life. Given that the developmental process of cardiac structures are completed by the end of 8th gestational week, most of critical cardiac malformations can be diagnosed in the first trimester with some exceptional cases. From the extensive works for early diagnosis of congenital anomalies in the last decades, the relationship between thick nuchal translucency, altered ductus venosus flow and tricuspid regurgitation with CHDs has been brought to light. These sonographic markers of CHD help us perform the first trimester echocardiography

Early CHD detection has several advantages; it can reassure high-risk women with normal ultrasound findings, early counseling is possible including early more safe termination of pregnancy in cases of pathological findings. It can also give information for place of birth and delivery methods according to the severity of CHDs.

The first trimester fetal echocardiography also has some disadvantages as well: It requires specialists with high level of techniques and experiences and the quality machines as well. In this presentation, the contents of the 1st trimester echocardiography, sonographic markers of the 1st Trimester CHDs and CHDs can be detected or overlooked in 1st TFE will be discussed.

T11-16-IN16

Fetal Hydrothorax: Diagnosis, Treatment, and Implications for Pathogenesis

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Fetal hydrothorax is a complicated disorder with various etiologies. Its diagnosis remains at ultrasound and invasive pleurocentesis. The treatment modalities include thoracocentesis, pleurodesis, and thoracoamniotic shunting. The speaker had published a series of paper since 2005 in Ultrasound Obstet Gynecol, Prenat Diagn, Fetal Diagn Therapy, Lymphology, Taiwan J Obstet Gynecol, and PLoS ONE. The spreaker will make a concise review of this topic and its implications for pathogenesis, as well as the issues awaiting future studies.

T11-16-IN17

Usual and Unusual Hydrops Fetalis

Dr. K. Y. Leung
Chairman, Education Committee, AFSUMB

Hydrops fetalis is a common end point of a wide variety of conditions, and traditionally classified as immune and non-immune type. It is associated with high mortality if being untreated. In South- East Asia, the commonest cause of hydrops fetalis is homozygous alpha^0 thalassemia or hemoglobin Bart's disease. Recently, we encountered atypical presentation of the latter due to uniparental disomy or non-paternity. We also encountered unusual causes including congenital dyserythropoietic anemia associated with compound heterozygotes for Krüppel-like factor 1 mutations.

Using a systematic approach, including a relevant history, detailed obstetric ultrasound examination, maternal blood investigation and invasive prenatal diagnosis, can identify causes in around 80% of hydrops fetalis. Management depends on the cause, progression/regression, and maternal wish. It is important to identify treatable causes, which can be performed in an experienced center, In selected cases, after adequate counseling, an affected fetus can be salvaged by an appropriate therapy like in-utero transfusion for severe anemia, and drainage of for a large congenital cystic adenomatoid malformation of lung or bilateral pleural effusions.

T11-16-IN18

Early Intra-Amniotic Gene Transfer using Lentiviral Vectors in Murine Model

Masayuki Endo
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Gene transfer after intra-amniotic injection has, in general, been of low efficiency and limited to epithelial cells in the skin, pulmonary and gastrointestinal system. We have shown that early gestational administration results in a more efficient gene transfer to developmentally accessible stem cell populations in the skin and eye. In this presentation, we present a comprehensive analysis of patterns of tissue expression seen after early intra-amniotic gene transfer (IAGT) using lentiviral vectors. To assess the influence of developmental stage on tissue expression, injections were administered from the late head fold/early somite stage (E8) to E18. In early gestation (E8-10), green fluorescent protein (GFP) expression was observed in multiple organs, derived from all three germ layers. Remarkably, GFP expression was observed in tissues derived from mesoderm and neural ectoderm at E8, whereas expression was limited to only epithelial cells of ectoderm- and endoderm-derived organs after E11. The amount and duration of gene expression was much higher after IAGT at early gestational time points. The observed temporal patterns of gene expression correspond to the predicted developmental accessibility of organ-specific cell populations. This model may be useful for the analyses of mechanisms of genetic and/or developmental disease and for the development of prenatal gene therapy for specific disorders.

T11-16-IN19

Laser Therapy for TTTS: The Role of Quintero System

Yao-Lung Chang
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A total of 100 TTTS cases treated by FLT, from October 2005 to August 2014, were included in this study. Cases were divided into first and second half periods to evaluate the learning effect-related outcomes, and logistic regression was applied to determine the independent factors in predicting the perinatal outcomes: The total fetal survival rate was 68.5%, two fetal survival rate was 55%, and at least one fetal survival rate was 82%. High Quintero stage (Stages III and IV) and small gestational age at delivery were two independent factors predicting lower two fetal survivals. Gestational age at delivery was the only independent factor predicting at least one survival. The odds ratios of high Quintero stage predicting lower two fetal survivals were 11.3 ($p<0.001$) and 4.8 ($p=0.043$) in the first and second periods, respectively. So we conclude that High Quintero stage and small gestational age at delivery were associated with low two survival rate in TTTS treated by FLT; after gaining experience with FLT, the effect of high Quintero stage on lower two survival rate would decrease.

T11-16-IN20

USG for Complicated Twins

Tak Yeung Leung
The Chinese University of Hong Kong

Monochorionic (MC) twin pregnancies is associated with higher complications rates such as twin-twin transfusion syndrome (TTTS), selective fetal growth restriction (sIUGR), twin reversed arterial perfusion sequence (TRAPS) and twin anhdyramnios polyhydramnios sequence (TAPS). Hence the first step of managing twin pregnancies is the accurate assessment of chorionicity, which seems straight forward but pitfalls such as false twin peak sign, discordant sex, bipartite placenta may confuse the assessment.

The diagnosis of TTTS is also straight forward, and USG assessment for cord insertion site, placental site, co-existing sIUGR, fetal ventricular size, MCAPSV and uterine cervical length are important in guiding the fetoscopic laser treatment and post-laser monitoring.

TAPS can occur spontaneously but more commonly after laser treatment. The diagnosis is less easy when compared to TTTS. MCAPSV, placental and hepatic echogenicity are useful signs.

sIUGR is classified into 3 types according to the umbilical arterial flow, whether it is present (type 1), absent or reverse (type 2) and intermittently reverse (type 3). The USG assessment will guide the management, including the indication of selective fetocide, time and mode of delivery.

TRAPS is usually picked up by the presence of malformed or hydropic twin without cardiac motion, we should not be 'trapped' when an apparently well-formed acardiac twin may mimic a missed abortion.

Free paper

OPT11-001

Case Series and Literature Review: Fetal Bowel Dilatation and Its Clinical Significant

Geok-Huey New, Chiung-Hsin Chang
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Objectives: Ultrasound has limited accuracy for bowel evaluation even in a normal adult. Therefore, during prenatal diagnosis, accidental finding of fetal bowel dilatation is very challenging for obstetrician in identifying and explaining the exact lesions and its clinical significant correlations. Fetal bowel dilatation is an indirect sonographic sign or possible the only sign in predicting probable mechanical or functional bowel obstruction.
Methods: We reviewed cases of fetus with dilated bowels noted during prenatal care in the past three years, from January 2015 until March 2017 in National Cheng Kung University Hospital (NCKUH) and College of Medicine, Tainan, Taiwan.
Results: A total number of 11010 cases visited NCKUH for prenatal ultrasound screening from January 2015 until March 2017. We identified a total number of 629(5.7%) cases with congenital fetal anomalies and 19(0.17%) cases with fetal bowel dilatation. Fetal with gastroschisis and omphalocele were not including in this study. Out of the 19 cases with fetal bowel dilatation, 6(31.6%) fetuses showed poor outcome after delivery.
Conclusions: Despite lower rate of sensibility and specificity, ultrasound plays an important role in the management and diagnosis of fetal bowel dilatation. It offers an opportunity for parental counseling and for choosing patients who need transfer to a specialized center which is of upmost importance as it allows prompt treatment and reduces the risk of complications.

OPT11-002

Three-Dimensional Power Doppler Angiography Improves the Diagnostic Accuracy for Malignant Uterine Body Tumor Prediction

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Objectives: Uterine sarcoma comprises 3–5% of all malignancies of uterine body, with a worldwide annual occurrence rate of 1.55–1.95 per 100,000 population. The advance of resolution of gray-scale ultrasonography improves its utility in the diagnosis of lesions of the uterine corpus. However, its sensitivity and specificity were poor in the diagnosis of malignant uterine body masses. Power Doppler angiography can analyze the vascular pattern of the uterine corpus lesions and further improves the diagnostic rate. With the advance of computerized imaging processing, three-dimensional (3D) power Doppler angiography was available to assist the decision making for a huge or a rapid growth uterine body lesion.
Methods: Our study design was proved by institutional review board. We launched a retrospective chart review. We reviewed chart from 2002 to 2014 in a tertiary medical center in the north Taiwan to collect patient who received 3D power Doppler angiography for uterine body tumors. Reports of 3D power Doppler angiography and pathology reports were analyzed. Sensitive, specificity, positive predictive value, negative predictive value, positive likelihood ratio and negative likelihood ratio were calculated. Characters of 3D power Doppler angiography and its relationship with malignant uterine masses were also analyzed.
Results: There were 639 cases received 3D power Doppler angiography for uterine body tumors in 2002-2014. The initial reports were 285 cases had benign uterine body lesions and 101 cases had malignant uterine body lesions. 392 cases received operation such as hysterectomy or myomectomy for the uterine mass. Pathology reports showed 327 cases of benign lesions and 54 cases of malignant lesions. The sensitivity of our 3D power Doppler angiography for malignant uterine body lesions was 75.4% and specificity was 83.2%. Prevalence of malignant lesions in our study group was 15.9%. Positive predictive value was 46% and negative predictive value was 94.7% in our study group. Finally, positive likelihood ratio was 4.4 and negative likelihood ratio was 0.3.
Conclusions: 3D power Doppler angiography is a useful tool in the screening of malignant uterine body tumors. It can exclude the patient with lower risk for malignant uterine body masses.

OPT11-003

Role of Targeted Fetal Ultrasound Examination in Combination of Chromosome Microarray Analysis for Prenatal Diagnosis

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Objectives: Chromosomal microarray analysis (CMA) allows genome-wide analysis to reveal unbalanced submicroscopic aberrations in prenatal diagnosis. However, the clinical impact of certain copy number variants (CNVs) remains difficult to assess prenatally. This study aims to evaluate the role of fetal ultrasound examination in the raising challenges for prenatal genetic counseling.

Methods: A total of 148 single and multiple pregnancies at high risk for fetal chromosomal abnormalities during the period of 2013–2017 were analyzed retrospectively. Conventional karyotyping and CMA were performed. Cases with CNVs but normal karyotypes were counseled in combination with targeted fetal ultrasound findings.
Results: A definitive or highly-likely diagnosis was made in 3 (2.0%) cases with CNVs combined with fetal major structural abnormality by ultrasound examination. The patients consented to undergo termination of pregnancy. The other 3 cases that had CNVs but without fetal structural anomalies were followed-up to delivery, resulting in birth of 3 apparently healthy neonates.
Conclusions: In cases with CNVs, the severity of the ultrasonographic fetal anomalies is important in the decision on pregnancy continuation. Mostly, cases with milder or without anomalies choose to continue the pregnancy. Targeted fetal ultrasound examination is useful in prenatal diagnosis and counseling in cases with CNVs.

OPT11-004

Comparison of Gi-Rads Ultrasonographic Stratification and RMI4 in Differentiating Benign from Malignant Adnexal Masses

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Objectives: To compare the value of gynecologic imaging reporting and data system (GI-RADS) ultrasonographic stratification with the risk of malignancy index (RMI4) in differentiating benign from malignant adnexal masses.
Methods: A retrospective analysis was conducted on 342 patients after ultrasonographic diagnosis of adnexal masses. Using GI-RADS classification and RMI4 to differentiate benign from malignant respectively, the sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV) and area under the curve (AUC) were calculated for GI-RADS classification and RMI4 compared with gold standard (path- ology diagnoses).
Results: Considered GI-RADS 1∼4a as benign,GI-RADS 4b∼5 as malignant and taking RMI4= 450 as critical points, the sensitivity were 70.71%, 53.54%, respectively, specificity were 98.77%, 95.47%, respectively, PPV were 95.89%, 82.81%, respectively, NPV were 89.21%, 83.45%, respectively, RMI 4 and GI-RADS classification had statistically significant difference ($p<0.05$). the AUC were 0.903, 0.813 respectively.
Conclusions: GI- RADS classi- fication was found to be better than RMI4 in differentiating benign from malignant adnexal masses.

OPT11-005

Ultrasound Dynamics of Combined Mid-Urethral Slings and Anterior Vaginal Mesh Surgery on Severe Symptomatic Pelvic Organ Prolapse

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Objectives: The objective of the study is to evaluate the post-operative morphological features between mid-urethral slings (MUS) and anterior vaginal mesh surgery.
Methods: 97 POP-Q stage ≥ III and USI patients were included. 57 patients (TVM+TOT group) had TOT and anterior TVM and 40 patients (TOT+AC, control group) had TOT in combination with anterior colporrhapy. Objective cure of USI was no urinary leakage demonstrable on provocative filling cystometry and pad <2 g. The ultrasound exploring the tape, mesh and BN position was measured. The mobility of the tape, mesh and BN was calculated.
Results: The average follow up was 31.1 months (TVM+TOT) and 33.9 months (TOT+AC), respectively. The objective cure of prolapse was 94.7% in TVM+TOT and 90% in the TOT+AC. 49 in TVM+TOT and 36 in TOT+AC were cured of USI. There were no morphology differences in ultrasonography or successful outcome between groups. The percentage of urethral kinking were no different. Sub-analysis on successful USI outcome (n=85) and failure (n=12, 8 in TVM+TOT and 4 in TOT+AC) showed tape and BN mobility significantly more in the success. The mobility of mesh was more in those whom had anterior TVM surgery. About 50% of urethral kinking was demonstrable in successful cases but none in failed.
Conclusions: There were no morphology differences in ultrasonography or successful outcome between SSF with MUS in combination with anterior colporrhaphy and the additional of TVM surgery. The mobility of tape, mesh and bladder neck within a certain permissible range post surgery corresponds to favourable outcome.

OPT11-006

Determination of Fetal Gestational Age by Ultrasonographic Measurement of Fetal Humeral Length among Patients Seen at a Tertiary Government Hospital: A Preliminary Study

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Objectives: This study was done to determine fetal gestational age by ultrasonographic measurements of fetal humerus. Data collection will serve as initial database for the construction of intrauterine fetal growth chart using this parameter. This study also evaluated the strength of correlation of fetal age by humeral length (HL) measurement with menstrual age and compared with that of biparietal diameter (BPD) and femur length (FL).
Methods: A cross-sectional study was done on 335 uncomplicated pregnant patients at gestational ages 20-40 weeks by conducting routine fetal biometrics including measurement of the fetal HL to determine fetal age. Its correlation with menstrual age was evaluated. Results were compared with that of BPD and FL and were plotted against age of gestation by last normal menstruation. Analyses of the data were done using SPSS version 10.
Results: HL showed a direct correlation coefficient of 0.918 compared to BPD (0.943) and FL (0.924). The combination of BPD, HL and FL increased the correlation to 0.951. While combination of the BPD and HL have the same correlation coefficient of 0.951.
Conclusions: HL can be used as a reliable alternative parameter for estimating GA. The study also indicates that combination of BPD and HL is more accurate in predicting GA than any single parameter and as accurate when BPD and HL and FL parameters were used.

OPT11-007

Maternal Hydration with Genetic Ultrasound Increases Scan Quality, Decreases Exam Duration, and Lowers Repeat Exams

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Objectives: Amniotic fluid volume (AFV) has a major impact on the prenatal diagnostic ultrasound examination. Fetal crowding due to low AFV gives rise to poor quality scans, limited anatomical views and longer exam duration. Literature review by Gizzo, Noventa et al., from 1991 thru 2014, suggests "Maternal Hydration may be a safe and useful strategy to improve AFV." In this study, we examined how oral hydration could increase the AFV for the genetic ultrasound, and whether patient hydration rather than full bladder achieves better imaging outcomes.
Methods: The focus of this study is to further previous research performed by Jacobson. The preliminary study examined 68 patients in 2 different groups (control vs. hydration) to compare the effects of maternal hydration on Amniotic Fluid Index (AFI), as outlined by Phlen, during the 20 week genetic scan. That study found a 35% increase in AFI within the hydration group. Based on those findings, the current study was conducted to examine the relationship of AFI to maternal and gestational age, parity, adipose tissue and quality diagnostic scan time. Data was collected from 136 patients during genetic ultrasound.
Results: Patients with higher AFI showed better image quality, fewer repeat exams and shortened scan times.
Conclusions: Maternal hydration as preparation for genetic ultrasound is effective to increase quality in diagnostic data, decrease scan time, lower repeat exams, and eliminates the painful full bladder technique.

OPT11-008

Ultrasonography and Clinical Outcomes Following Surgical Anti-Incontinence Procedures (Monarc Vs Miniarc): 3-Year Review

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Objectives: To evaluate the ultrasound morphology and clinical outcome who had undergone single-incision-sling (Miniarc) vs. trans-obturator tape (Monarc) in stress urinary incontinence (SUI) at 3-year-review.
Methods: Patients with clinically SUI and USI were studied. Introital ultrasound at 3-years explored the sling and bladder neck's position, mobility, sling tension, percentile of urethra where the sling was located and urethral kinking. Objective cure of SUI was defined as no urinary leakage on provocative filling cystometry and 1-hour pad test of <2 g. Subjective cure of SUI was the negative response to UDI-6.
Results: 138 women were rerolled. The ultrasound data for successful treatment was available from 123 women (51 Monarc, 72 Miniarc). At 3rd year, rest and during Valsalva, analogous distances of the bladder neck and sling were similar for both procedures. In both groups, Both slings demonstrated caudally shift in the x-axis and y-axis. Miniarc position shifted more caudally on the x-axis at rest with concomitant more caudally shift on the y-axis on straining than Monarc. Percentage of urethral kinking remained similar. Failure rate increased with Miniarc but statistical analysis failed to detect any significant difference (Objective vs. Sbjective; Miniarc 87.8% and 82.9% vs Monarc 91.1% and 89.3%; p>0.05).
Conclusions: Miniarc and Monarc maintained comparable subjective and objective outcomes at 3-years follow-up. Ultrasonography revealed more shift in the position of Miniarc caudally on x-axis at rest and y-axis during straining compared to Monarc. Majority of urethral impingement was still noted in the Miniarc group with concurrent higher MUCP.

OPT11-009

Application of 3D-US Vocal Technique in the Detection of Fetal Thorax and Lung Malformation

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Objectives: To establish the reference range of the fetal thorax, analyze its relationship with different gestational age,and evaluate its values in the diagnosis of fetal thorax and lung malformation.
Methods: Totally 398 normal singleton fetuses between 16 and 36 gestational weeks (GW) were enrolled. Two dimensional ultrasonography (2D-US) and Three dimensional ultrasonography (3D-US) virtual organ computer-aided analysis (VOCAL) thchnique were used to measure the 2D datas (thoracic transverse diameter, anteroposterior diameter, area and circumference) and 3D volumns (thoracic volume and lung volume) on the transverse section at the level of the four-chamber view. The ratio of lung volume to thoracic volume was caculated. The correlation between all measurements and GW was analyzed by Pearson correlation coefficient and regression analysis. 9 fetuses with skeletal dysplasia (SD), 13 fetuses with congenital diaphragmatic hernia (CDH), 14 fetuses with pulmonary sequestration (PS) and 15 fetuses with congenital cystic adenomatoid malformation (CCAM) were assessed by 2D-US and 3D-US VOCAL thchnique and compared with the normal fetuses.
Results: (1) In healthy controls, fetal thracic 2D measurements, 3D volumns and the ratio of lung volume to thoracic volume increased along with the growth of the GW. The regression equations were: thoracic transverse diameter (cm) = -0.002GW2+0.301GW- 1.510, R2=0.969; thoracic anteroposterior diameter (cm) = 0.003GW2 + 0.046GW+0.666, R2= 0.989; thoracic area (cm2) = 0.071GW2-1.466GW +14.728, R2= 0.987; thoracic circumference (cm) = 0.01GW2+0.313GW+3.341, R2=0.972; thoracic volume (cm3) = 0.285GW2-7.797GW + 66.592, R2 = 0.988; lung volume (cm3) = 0.178GW2 -5.317GW + 45.539, R2 = 0.958; the ratio of lung volume to thoracic volume = 0.005GW + 0.396,R2 = 0.928. (2) Compare with the healthy controls group, ① SD group had obviously lower fetal thracic 2D measurements than the normal reference range (P <0.01). But those measurements of CDH group, PS group and CCAM group were in the normal reference range (P>0.05). ② The lung and thoracic volumn of SD group was also obviously lower than the normal group (P<0.01), as well as the CDH group (P <0.05), while PS group and CCAM group were in the normal reference range (P >0.05). ③ The ratio of lung volume to thoracic volume of the SD group, CDH group, PS group and CCAM group were all lower than the normal reference range (P <0.01) .
Conclusions: (1) Fetal thoracic 2D basic measurements are feasible for the fetal thoracic malformation but not for fetal lung malformation. (2) 3D-US VOCAL technique play an important role in assessing the fetal lung and thoracic malformation, especially the ratio of lung volume to thoracic volume. (3) Fetal lung and thoracic volumns are decreased in SD and CDH, especially the lung volumn; however, they do not change obviously in PS and CCAM.

OPT11-010

Assessing the Feasibility of Normal Fetal Thoracic Development Measured by 2DUS, 3DUS and MRI

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Objectives: To compare the feasibility of fetal thorax measured by two dimensional ultrasonography (2D-US), three dimensional ultrasonography (3D-US) and magnetic resonance imaging (MRI) in evaluating the normal fetal thoracic development.

Methods: Thirty normal singleton pregnancies at 20-35 gestational weeks(GW) were selected and whose thoracic transverse diameter, anteroposterior diameter, area, circumference, volume and lung volume were measured on the transverse section at the level of the four-chamber view by ultrasonography and MRI. The repeatability and consistency of the measurement were analyzed by intraclass correlation coefficient(ICC) and Bland-Altman plot, and the correlativity of 3D-US virtual organ computer-aided analysis (VOCAL) technique and MRI in measuring the lung and thoracic volume was analysed by Pearson correlation analysis.

Results: The inter-/intra-operator reproducibility and consistency of fetal thoracic transverse diameter, anteroposterior diameter, area and circumference measured by 2D-US were higher than the MRI's, however, the intra-/inter-operator reproducibility and consistency of fetal thoracic volume and lung volume measured by MRI were higher than the 3D-US VOCAL technique. The inter-operator reproducibility and consistency of fetal thoracic transverse diameter were the highest when using ultrasonography, the intraclass correlation coefficient(ICC) was 0.9964 (95%CI, 0.9925∼0.9983), mean difference±standard deviation(d±SD) was -0.0047±0.0573 (95%CI, -0.0261∼ 0.0167), respectively. The correlativity of 3D-US VOCAL technique and MRI was excellent in measuring the lung and thoracic volume(R2L= 0.915,R2T=0.957, P <0.0001).

Conclusions: The 2D-US, 3D-US and MRI are reliable techniques for measuring fetal thoracic development. The ultrasonography is better than MRI in 2D basic measurement, but MRI is better than VOCAL in 3D volumn measurement.

OPT11-011

Ultrasonography and Clinical Outcomes for Repeat Midurethral Sling Surgery on Recurrent or Persistent Stress Urinary Incontinence (SUI)

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Objectives: To study the outcomes following repeat midurethral sling (MUS) surgery in patients with persistent or recurrent stress urinary incontinence after failure of primary MUS surgery.

Methods: 24 patients were enrolled. The ultrasound exploring the sling (xt, yt) and bladder neck position (xbn, ybn) were measured using the rectangular coordinate system at rest and maximal Valsalva. The mobility and change in the inclination angle between the urethra and pubic axis was measured with introital ultrasonography. Objective cure was defined as no demonstrable involuntary leakage of urine during increased abdominal pressure in the absence of a detrusor contraction observed during filling cystometry, and subjective cure was defined as a negative response to UDI-6 question 3 during follow-up between 6 months and 1 year postoperatively.

Results: The objective and subjective cure rates were 79.2 % and 75 %, respectively. There were no differences in demographics between the patients with failure of surgery and those with successful surgery. No significant differences were found in the mobility of the tape or the position of the slings in the midurethral region. Significant independent risk factors for failure of repeat MUS were a change in inclination angle of <30°, a change in cotton swab angle <30°, ISD and a mean urethral closure pressure of <60 cm H2O. In one patient the bladder was perforated.

Conclusions: Repeat MUS surgery is safe and has a good short-term success rate, both objectively and subjectively, with independent risk factors for failure related to bladder neck hypomobility and poor urethral function.

OPT11-012

Ultrasonographic Evaluation of Urethral Angle and Bladder Neck Mobility after Single Incision Mini-Sling

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Objectives: To investigate the predictors of persistence or resolution of lower urinary tract symptoms(LUTS) in women following single incision mini-sling(SIMS) surgery for urodynamic stress incontinence(USI). Background: From prior study, we already know that SIMS surgery has similar subjective cure rate to tension-free vaginal tape(TVT). However, postoperative incontinence severity is greater in SIMS than in TVT. It may be related to the design of SIMS, less trauma and poor fixed instability. Greater angular closure provided by TVT may more effectively prevent urine from entering the upper posterior urethra, therefore, decrease postoperative urgency and urge incontinence. We suppose that better fixation of single incision mini-sling causes greater urethral angle when Valsalva, which result in better treatment outcome after SIMS.

Methods: Patients with urodynamic stress incontinence undergoing SIMS between October, 2015 and September, 2016 in a tertiary hospital were recruited. All patients underwent evaluation including a structured urogynecological questionnaire, pelvic examination using the POP-quantification system, pelvic ultrasound, and urodynamic testing before and 6 months after surgery. Patient demographics, ultrasonographic findings, and urodynamic findings were analyzed. To test the possible role of urethral angle in maintaining LUTS women.

Results: Of 57 patients who underwent SIMS, 20 (35.1%) had postoperative urgency. All patient had subjective cure for USI. Ultrasound analysis showed good repeatability and is not influenced by vesical volume. The beta angle is between the proximal part and the distal part of urethra. Beta angle and urethrovesical mobility are inversely proportional. Urethral angle identifies postoperative urgency better than urethrovesical mobility (sensitivity 92% vs 81%).

Conclusions: Better fixation of single incision mini-sling contributes to greater urethral angle when Valsalva and better treatment outcome. Measurement of the urethral angle can provide useful additional information for adjusting the tightness of sling during anti-in.

OPT11-013

The Role of Obstetric Ultrasound in Low Resource Settings: Pilot Survey Done in Elgeyo Marakwet County on October 2016

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Objectives: Reduction of child mortality rates, to improve maternal health, to sustain post millennium goals 2015, to revitalize Kenya"s health infrastructure as part of Kenya"s Vision 2030.
Methods: Ultrasound services were introduced at Elgeyo. Data sheets for each ultrasound scan performed during routine clinical care were collected and analyzed to determine patient demographics, which ultrasound applications were most frequently used, and whether the use of the ultrasound changed patient management plans. Ultrasound scans performed by the Sono Imaging Kenya during the period were reviewed for accuracy of interpretation and image quality by a specialist.
Results: Adult women appeared to benefit most from the presence of ultrasound services. During these outreaches a total of 247 women were scanned. Twenty percent of these scans showed abnormalities. These woman were referred to the nearest health center or hospital where they received more check-ups.
Conclusions: We suggest ultrasound is a useful modality that particularly benefits women's health and obstetrical care in the developing world, it appears that an ultrasound program led by Sono Imaging Kenya is sustainable and lead to accurate diagnoses in a rural international setting. Ultrasound training in a rural setting supported remotely is feasible, efficient, and sustainable. It can help local healthcare workers and therefore has the potential to improve outcomes at delivery and provide site-specific epidemiologic data that can be used to develop new healthcare provision strategies.

Poster Session

PPT11-001

Accuracy of Ultrasonography in Detecting Ectopic Pregnancy

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Objectives: To determine the accuracy of ultrasonography in detecting ectopic pregnancy.
Methods: Prospective review of the outcome of women presenting with suspected ectopic pregnancy from June 2015 to December 2016, and who underwent ultrasonography in a single institution, was performed. The ultrasound findings were categorized as intrauterine pregnancy, miscarriage, ectopic pregnancy or pregnancy of unknown location. Women with pregnancy of unknown location were followed up to determine the location of the pregnancy. Those who default follow-up and persistent pregnancy of unknown location were excluded. The final outcome was confirmed either through surgical findings or follow-up obstetric ultrasound scans. The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) with 95% confidence intervals (CIs) for the diagnosis of ectopic pregnancy were assessed each month.
Results: From June 2015 to December 2016, there were 2315 consecutive women who were suspected of ectopic pregnancy. Outcome data were available for 1729 (74.7%) women. The accuracy of ultrasound scan in detecting ectopic pregnancy ranges from 96.8% to 100%. There were 529 confirmed ectopic pregnancies and 1200 had either intrauterine pregnancies or miscarriages. The overall sensitivity for ultrasound in detecting ectopic pregnancy was 98.87% (95% CI: 97.55-99.58) with a specificity of 99.0% (95% CI: 98.26-99.48), a positive predictive value of 97.76% (95% CI: 96.13-98.71) and a negative predictive value of 99.5% (95% CI: 98.89-99.77).
Conclusions: In women who are suspected of ectopic pregnancy, 98.9% of ectopic pregnancies can be accurately diagnosed by ultrasonography.

PPT11-002

Comparative Analysis of Ultrasound and Magnetic Resonance Imaging in Fetal Tethered Cord Examination

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Objectives: To explore the value of two-dimensional ultrasound and magnetic resonance imaging (MRI) in fetal tethered cord examination.
Methods: 316 normal fetuses were selected as normal group and 11 fetuses diagnosed as tethered cord in postnatal autopsy were selected as tethered cord group. Conus distance (CD) of fetuses in two groups was measured using two-dimensional ultrasound to establish the normal range of CD in fetuses at different gestational weeks. 40 cases were randomly selected from the normal group, for whom MRI examination and CD measurement were performed. Intra-doctor and inter-doctor reliability of measurement results were analyzed, and two examinations were compared in fetuses of tethered cord group.
Results: 1. CD values of normal fetuses increased with gestational weeks, ultrasound: CD (cm) =-0.894 + 0.198 x gestational weeks, R2=0.922; MRI: CD (cm) =-0.901 + 0.186 x gestational weeks, R2=0.886 (both $P<0.05$). 2. CD values of fetuses in tethered cord group were reduced compared with those of fetuses in normal group. 3. CD values measured by the same doctor or different doctors using two examinations had good repeatability and consistency (both $P<0.05$). 4. CD values of fetuses in tethered cord group measured by two-dimensional ultrasound and MRI were (2.014±0.210) and (2.106±0.154), respectively (t=-1.504, P=0.163).
Conclusions: The accuracy of ultrasound in fetal tethered cord examination is comparable to that of MRI.

PPT11-003

Fetal Cavum Septum Pellucidum–Tentorium Angle Measured with Three-Dimensional Ultrasonography and Its Clinical Value

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Objectives: To establish the ranges of normal reference values of fetal cavum septum pellucidum- tentorium angle(CTA) in normal fetuses at different gestational weeks, and evaluate their clinical values in the diagnosis of mega cisterna magna and Dandy-Walker malformation.
Methods: Totally 350 normal singleton fetuses between 21 and 32 weeks of gestation during September 2016 to December 2016 were enrolled in this study. Their average weeks of gestation was 26.0±3.2. Fourteen fetuses with mega cisterna magna contemporarily and twelve fetuses with Dandy-Walker malformation previously were control group A and B respectively, their average weeks of gestation were 27.6±3.1 and 28.5±2.9. Three-dimensional ultrasound (3D US) with volume contrast imaging (VCI) of GE Voluson Expert E8 was used to measure their CTA. CTA is an angle of two single line, one is a line joined from the front edge and the posterior border of the cavum septum pellucidum, the other is a tangent line of the tentorium. The correlations of CTA with gestational

age were analyzed by Pearson correlation. The consistency and repeatability was investigated by Bland-Altman plot analysis and intraclass correlation coefficient. CTA of 14 fetuses with mega cisterna magna and 12 fetuses with Dandy-Walker malformation were compared with those of the normal fetuses by t-test. There were significant differences if $P < 0.05$.

Results: In these normal fetuses, CTA showed no correlations with gestational age ($r = 0.014$, $P > 0.05$).CTA of 14 fetuses with mega cisterna magna were not significantly different from those of normal fetuses ($56.66 \pm 4.18°$ vs $55.82 \pm 5.32°$, $t = 0.56$, $P > 0.05$), while CTA of 12 fetuses with Dandy-Walker malformation were significantly smaller than those of normal fetuses and the fetuses with mega cisterna magna ($32.76 \pm 6.23°$ vs $55.82 \pm 5.32°$, $t = 25.12$, $P < 0.05$; $32.76 \pm 6.23°$ vs $56.66 \pm 4.18°$, $t = 26.04$, $P < 0.05$). The repeatability of the same physician and the consistency between two different physicians were good, their intraclass correlation coefficient and 95% confidential interval were 0.95 (0.88-0.97) and 0.88 (0.76-0.94) respectively.

Conclusions: 3D US with VCI is feasible for measuring CTA of fetuses and the measured values can be used as the reference standards for CTA measurement. The ranges of normal reference values of fetal CTA is $43.79° \sim 68.88°$ ($55.82 \pm 5.32°$). The measuring of CTA can help differentiate mega cisterna magna from Dandy-Walker malformation.

PPT11-004

Herlyn-Werner-Wunderlich Syndrome Withinitial Presentation of Endometriosis

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Objectives: Herlyn-Werner-Wunderlich syndrome is a rare congenital urogenital abnormality regarding Mullerian and Wolfianstructures. It is consisted of uterus didelphyus, obstructed hemi-vagina and ipsilateral renal agenesis; and initial clinical presentation is generally depends on the mass effect and pain due to hydrometrocolpos secondary to obstructed hemivagina. The occurrence of menstruation in cases with incomplete vaginal septa mostly delays the diagnosis. Late complications are the endometriosis and pelvic adhesions.

Methods: Case report and literature review.

Results: 15-year-old female with progressively increasing pelvic pain associated to consecutive menstrual periods has referred to our clinic. Uterus didelphys, cystic lesion compatible with endometrioma at right adnexal region and right renal agenesis were determined in routine ultrasonography examination. Pelvic magnetic resonance imaging revealed uterus didelphys, hematocolposat both uterin cavity and vagina and endometrioma with diameter of 5 cm at right adnexal region. Final diagnosis of Herlyn-Werner-Wunderlich syndrome was confirmed at surgery.

Conclusions: In this presentation; it was aimed to emphasized that the congenital abnormality in each of the urinary of genital systems can affect the other system as because the substantial relationship between them in terms of embryologic origins. Genital abnormalities, particularly the Herlyn-Werner-Wunderlich syndrome as in this case, should be kept in mind in female adolescent patients with determined endometriosis. Thus, early diagnosis of the entity has significant role in avoiding endometriosis and other complications, hence in keeping the potential of fertility.

PPT11-005

Intrauterine Fetal Death with 24 Weeks of Gestation of One Fetus in Twin Gestation Due Parvovirus Infection and Other Remained Assymptomatic

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Objectives: Parvovirus B 19 fetal infection usually tends to be serious. The infection can cause nonimmune fetal hydrops culminating with death. A major problem is that one third of maternal infections have no symptoms. Apart from fetal hydropsy, spontaneous abortion, intrauterine growth retardation and meconium peritonitis are possible manifestations of fetal infection.

Methods: Case report and literature review.

Results: A 32 year old woman with a twin pregnancy and no complications until 30 weeks and 2 days was diagnosed with fetal death in one of the twin, while the other one had normal movements, dopllerfluxometry, biometry, placenta and amniotic fluid. The dead fetus was hydropic with pronounced placental edema that suggested infection. Mother had no clinical disturbance. Serological analysis was positive for B19 Parvovirus. The living fetus was delivered through a cesarean incision at 34 weeks of gestation. He presented leucopenia and was discharged from hospital one week after birth.

Conclusions: This case illustrates how B 19 Parvovirus can be aggressive; outcome depends of fetal immunological response. Unfortunately, such infections run silently in most mothers and there's no way to prevent his occurrence.

PPT11-006

Non Visulalization of Caven Septum Pellucidum Does Not Mean Absecene of Corpus Callosum: A Case Report

Pei-Yin Yang, Charles Tsung-Che Hsieh
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Objectives: To report a case with prenatal diagnosis of mega cisterna magna and echogenicity of corpus callosum, which is unfamiliar to general obstetric sonographers.

Methods: We reported the case and reviewed the literature.

Results: A 23 year-old female Taiwan aboriginal pregnant women was referred to our hospital for further evaluation due to absence of caven septum pellucidum suspecting absence of carpus callosum at 23 weeks of gestational age. The sonography showed non-visible caven septum pellucidum, intact pericallosal artery, clear outer margin of corpus callosum,suspecting echogenic corpus callosum or partial absence of corpus callosum, mega cisterna magna (1.02 CM) and right hydronephrosis. There was no others abnormalities. The amniotic fluid chromosome study reported normal appearing. The family decided to continue pregnancy. The following MRI at 30 weeks of gestation revealed normal corpus callosum without agenesis, intact caven septum pellucidum, consistent with mega cisterna magna. Echogenicity of corpus callosum and mega cisterna magna were impressed. A male newborn was born by cesarean section due to malpresentation and severe preeclampsia with Apgar score 8/9 at 1/5 minute at 37+3 weeks of gestational age. The postnatal day 2 brain ultrasonography reported well defined coppus callosum, normal ventricular size, prominent cisterna magna and normal cerebellum. There was no abnormal finding in neurological examination.

Conclusions: In part of the variety or abnormality of fetal corpus callosum, there remain manyunknowns in our knowledge. The variety or abnormality of fetal corpus callosum was suspected at the time of the routine anomaly scan; careful evaluation of fetal anatomy should be carried out in an expert setting and fetal MRI is also indicated for allowing confirmation of the finding and assessment of other brain abnormalities.

PPT11-007

Pre- and Post- Natal Us and Mri Findings of Fetal Brain Lesions: A Pictorial Review

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Objectives: The purpose of this exhibition is to demonstrate and compare pre- and post-natal US and MRI findings of various anomalies involving fetal brain.

Methods: The contents of this exhibition will be variable neural tube defects, midline anomalies including agenesis of corpus callosum and Dandy-Walker continuum, lissencephaly, intracranial hemorrhage, dural arterior venous fistula, dural sinus thrombosis, variable intracranial cystic lesions and brain tumors.

Results: Various anomalies may occur in the fetal brain. US is not only the first line but also a confirmative study in many cases of fetal brain anomalies. MRI is increasingly being used to evaluate the fetal brain, and is a valuable complement to prenatal US.

Conclusions: Almost fetal brain anomalies show specific imaging features and can be diagnosed on the prenatal US and MRI. The exact prenatal diagnosis and thorough postnatal work-up of fetal brain anomalies are important for the prenatal and postnatal managements.

PPT11-008

Prenatal Diagnosis of Tetrasomy 12P Mosaicism: A Case Report

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Objectives: Tetrasomy 12p mosaicism (also Pallister–Killian syndrome or Pallister mosaic aneuploidy syndrome) is an extremely rare genetic disorder caused by the presence of two extra copies of the chromosome 12 short arm. The signs and symptoms vary, although most people with this disorder have severe to profound intellectual disability and other serious health problems. The ever reported anomalies include varying degrees of developmental disability, epilepsy, hypotonia, distinctive facial structure, characterized by a high, rounded forehead; a broad nasal bridge; a short nose; widely spaced eyes; low-set ears; rounded cheeks. Patients may also exhibit congenital heart defects, cataracts and diaphragmatic hernia.

Methods: Case report and literature review.

Results: A 40 years old pregnant women, gravida3,para 2 had unremarkable medical history. The previous two pregnancies were uneventful. She received routine prenatal examinations in other local clinics and the report of non-invasive prenatal testing (NIPT) was low risk for trisom13,18 and 21 .She first came to our hospital when 24 weeks' gestation for the fetal diaphragmatic hernia. The detailed ultrasound scan showed fetal left side diaphragmatic hernia, polyhydramnios (AFI:25cm), bilateral ventriculomegaly(1.04/1.06cm) and short long bones. The amniocentesis was then arranged for chromosome survey. The final report of karyotypes Giemsa banding was 47,XY,+i(12)(p10)[11]/46,XY[6] .No mutation defects were noted in the FGFR3 genes. The array-CGH showed a 33.99Mb-duplication at chromosome 12p12.33-12p11.1 and the report was arr[GRCh37]12p13.33p11.1(230,450-34,217.,434)x4[0.78],(XY)x1.

Conclusions: Tetrasomy 12p mosaicism is an extremely rare genetic disorder.The role of array CGH is important to make clear diagnosis when two or or more fetal anomalies were noted in the prenatal sonography.

PPT11-009

Prenatal Ultrasound Evaluation of the Position of Conus Medullaris for the Diagnosis of Tethered Cord Syndrome

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Objectives: To determine the conus distance between the end of the conus medullaris and the distal end of the last vertebral body in normal fetuses with various gestational ages using ultrasonography for its diagnostic value in tethered cord syndrome (TCS).

Methods: This retrospective study included 540 normal and 8 autopsy-confirmed TCS fetuses. Ultrasonographic measurement of the conus distance was performed when the fetus was in a prone position within the spine in the near field at 14–41 weeks of gestational age. Linear correlation analysis was performed to analyze the relationship between the conus distance and the gestational age, biparietal diameter, femur length, head circumference, and abdominal circumference.

Results: The normal results were compared with eight cases of postnatally confirmed TCS. In 526 (95.9%) of 548 fetuses, the conus distance was successfully measured. The 95% limits of agreement in measurement of conus distance were -2.2–2.6 mm for the intraobserver variabilityande -3.7–3.1 mm for the interobserver variability. Significant correlations between the conus distance and the gestational age, biparietal diameter, femur length, head circumference, and abdominal circumference was observed. The most marked association was found to be between conus distance and femur length. The conus distance was significantly less in TCS fetuses than in normal fetuses.

Conclusions: Ultrasonographic measurement of conus distance is an easy and reliable method to evaluate the position of the conus medullaris, and therefore can be helpful in the prenatal diagnosis of TCS.

PPT11-010

Role of Ultrasound in the Diagnosis of Adnexal Torsion

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Objectives: Ovarian torsion refers to the complete or partial rotation of the ovary on its ligamentous supports, often resulting in impedance of its blood supply. It is one of the most common gynecologic emergencies and may affect females of all ages. The fallopian tube often twists along with the ovary; when this occurs, it is referred to as adnexal torsion. Prompt diagnosis is important to preserve ovarian and/or tubal function and to prevent other associated morbidity. However, making the diagnosis can be challenging because the symptoms are relatively nonspecific.

Methods: Case report and literature review.

Results: A 53-year-old female denied any systemic disease before. She was suffered from lower back pain for one month. Severe lower abdomen cramping attacked suddenly thus she was sent to emergency room. Transabdominal ultrasound showed a huge mass over lower abdomen, and a right adnexa mass torsion was proved after emergency operation.

Conclusions: This case illustrates transabdominal ultrasound can be used in diagnosis of adnexal mass torsion, especially in childbearing age woman who is not sure about pregnancy. This could prevent radiation exposure accompanied with more advanced image examination.

PPT11-011

Significance of Ultrasonography in Measuring Index with Open Spina Bifida in Fetuses at Early-Second Trimester

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Objectives: To investigate the feasibility of ultrasonic measuremen for index with open spina bifida of intracranial translucency(IT), brainstem(BS), brainstem-to-occipital bone distance(BSOB), aqueduct of sylvius to the occiput distance(AOSO)and establish the normal range at early-second trimester, and to guide the early screening of spina bifida open.
Methods: The IT, BS, BSOB, AOSO of two hundred fetuses at 13～18 weeks were measured by sonography , and were analyzed their correlation with the the biparietal diameter.
Results: In 96% of cases were able to visualize the fetal IT, BS, BSOB, AOSO. Two different doctors had good repeatability and consistency in measuring four indexes, their intraclass correlation coefficient (ICC) were 0.961、0.953、0.963、0.958;and their 95% limits of agreement were −1.34～0.65mm、−1.59～1.03mm、−1.46～1.41mm、−1.74～0.99mm. Four indexes were positively correlated with biparietal diameter. BS/BSOB was less than 0.9, which had no correlation with gestational age and biparietal diameter.
Conclusions: Sonography could measure the fetal IT, BS, BSOB, AOSO at early-second trimester. The method was feasible, with good reproducibility. BS/BSOB < 0.9 was one of the most simple index for screening fetal open spina bifida at early-second trimester.

PPT11-012

Sonohysterographic Findings of Endometrial Carcinomas in Women with Polycystic Ovarian Disease

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Objectives: To describe the sonohysterographic features of endometrial carcinomas in women with polycystic ovarian disease (PCOD) and to determine the diagnostic role of sonohysterography (SH) in the evaluation of these lesions.
Methods: SH findings of 48 PCOD patients with histologically confirmed endometrial carcinomas were evaluated. The mean age was 33.5 years (range 22-45 years). Histology included endometrioid type in 47 cases and Grade 1 in 43 cases, and 43 patients was stage IA. 20 Patients had high dose progestin treatment and 28 patients undergo surgery.
Results: SH demonstrated the endometrial thickening in 35 cases, endometrial mass in 6 cases, and endometrial thickening with mass in 7 cases. The endometrial thickness ranged from 5.5 to 27 mm (mean 9.6 mm) and the mass size ranged from 2 to 4.3 cm (mean 2.9 cm). They appeared as a diffuse polypoid thickening and a sessile mass with an inhomogeneous hyperechogenicity, an irregular surface, and obliteration of the cavity. The tumor involved only to the endometrium in 32 cases and there were superficial myometrial invasion in 14 cases, deep myometrial invasion in 2 cases, and cervical invasion in 3 cases.
Conclusions: The SH features of endometrial carcinomas associated with PCOD included a diffuse polypoid endometrial thickening and a sessile endometrial mass with an inhomogeneous hyperechogenicity, an irregular surface, obliteration of the cavity, and absent myometrial invasion. SH may provide more diagnostic value in the evaluation of endometrial carcinomas in women with PCOD.

PPT11-013

Spectrum of Lesser Pelvis Masses during Pregnancy Detected by Ultrasonography

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Objectives: To evaluate the spectrum of lesser pelvis masses and their sonographic features during pregnancy.
Methods: 91 pregnant women with suspected pelvic tumors underwent ultrasound examinations using standard modes. The ultrasound diagnosis was verified morphologically in 41.8% of cases or confirmed during further monitoring.
Results: Most frequently detected pathology were cysts (62.6%), among which predominated cysts of yellow body (31.9%). Lesions of solid structure (28.6%) were represented mainly by uterine myomas (25.3%) and of mixed structure (8.8%) – by teratoma (4.4%). False diagnoses of mass lesions of lesser pelvis in 8 (8.8%) pregnancies were associated with a growing uterus. The sonographic features of mass lesions of lesser pelvis have been described, including rare nosological forms. Differential criteria and ultrasound signs of complications have been identified, the predominant being ovarian torsion and cyst capsular rupture. Sonographic data has determined the indications for surgical treatment in 7 (7.7%) pregnant women with true tumors and in 25 (27.5%) - with complications of masses.
Conclusions: The spectrum of lesser pelvis masses and their sonographic features during pregnancy were evaluated. Ultrasonography helps to define the tactics of pregnancy care, methods and terms of treatment.

PPT11-014

The Clubfoot Severity of Prenatal Quantitative Evaluation by Sonography

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Objectives: To investigate the value of the severity of fetal clubfoot evaluated by prenatal sonography.
Methods: By routine sonography totally 32 feet with clubfoot were chosen as case group,and 414 normal feet between 16 and 38 gestation weeks were enrolled in control group stochastically.The length and width of the foot in both group were measured,and then the length-to-width ratio was calculated. The angle that the long-axis of the foot made with the long-axis of the lower leg was measured and classified into mild,moderate,severe. The foot length, foot width and the length-to- width in both groups were compared. After birth,the fetuses of case group were followed up and Dimeglio score was recorded. The correlation analysis between the ratio and the angle and the Dimeglio score were also made respectively.
Results: The length-to- width ratio in case group were smaller than the control group(ZFL=-2.10, $p< 0.05$; ZFL/FW=-8.46, $p< 0.001$), and the foot width was wider(ZFW=-2.06, $p< 0.05$). Significant negative correlation was identified between the ratio and the Dimeglio score ($r=-0.600$, $p< 0.01$)and significant positive correlation was identified between the angle and the Dimeglio score ($r=0.764$,$P< 0.01$). By combining the ratio with the angle ,the false positive rate dropped from 6/32(18.8%) to 1/27(3.7%).
Conclusions: The angle and ratio can provide information in quantitative evaluation of fetal clubfoot severity and reduce the false positive rate in diagnosis of fetal clubfoot.

PPT11-015

Ultrasonography of a Single Pedunculated Subserosal Uterine Myoma

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Objectives: Uterine myoma is the most common pelvic tumor in females. Ultrasonography is the most commonly used method to confirm the diagnosis. The location and type of the myoma are closely related to its clinical presentations, management and the impact on reproduction after treatment. Single large pedunculated subserosal myoma (ESGE/FIGO classification, type 7) most often presents with compression symptoms or pelvic pain. Pelvic MRI is the most accurate diagnostic tool. However, ultrasonography is a less invasive, less costly, convenient and easily accessible alternative.
Methods: Case report.
Results: Pelvic sonography revealed a normal contoured uterus with a myoma adjacent to it. There are clear margins between these two except a loss of the clear margin in a small area where the pedicle arises on some scan sections. This is best demonstrated on a transvaginal sonography. The differential diagnosis includes an adnexal mass, which most likely presents with cystic components ultrasonographically. Although degeneration in pedunculated subserosal myoma might mimic an adnexal mass, the presence of bilateral ovaries in ultrasonography helps to exclude the possibility.
Conclusions: Accurate diagnosis of a large pedunculated subserosal myoma is important in the subsequent counselling and management. With the increased accessibility of ultrasonographic examination, it can be readily diagnosed and this helps greatly in clinical management.

PPT11-016

Ultrasound Detection of a Foreign Body Reaction in a Cesarean Patient with Anti-Adhesive Barrier Placement

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Objectives: To demonstrate exploration of a case with local peritonitis post cesarean section and to showcase the intra-abdominal ultrasound finding.
Methods: a 25 year-old, Gravida 1, Parity 1, female patient was referred to our hospital ; she received cesarean section at a local women's hospital two weeks ago due to labor arrest; then she began to experience severe low abdominal pain and ran a fever in the past two days.
Results: Physical examination disclosed no apparent wound infection, but peritoneal sign could be easily elicited. There was a mild leukocytosis accompanied with a 38.5 degree Celsius temperature. Transvaginal ultrasound revealed some echogenic round material about one cm in diameter bathed in a pocket of fluid on the anterior surface of uterus. After confirmation with the prior hospital of placement of barrier during cesarean, we did explorative laparotomy to remove the infected, broken, barrier and debride the granulomatous tissue on the uterine wall. The patient recovered well and was discharged on Day 5.
Conclusions: Anti-adhesive barrier placement is beneficial and usually risk free. However, rare instances of foreign body inflammatory reaction, abnormal fluid collection with fever can sometimes happen. Ultrasound assisted investigation can be very helpful in delineating the yet to absorb material submerged in a collection of ascites, thereby prompting appropriate treatment.

PPT11-017

Us Evaluation of Uterine Cervical Lesions

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Objectives: US is currently the most widely accepted primary and valuable imaging modality for female genital organs. But it may be overlooked easily to evaluate the uterine cervix. The purpose of this presentation is to identify the full spectrum of benign to malignant lesions in the uterine cervix and describe US features and possible value for differentiation of these lesions in the uterine cervix.
Methods: We reviewed the ultrasonographic findings of normal uterine cervix and pathologic uterine cervical lesions.
Results: In this presentation, we describe uterine cervical lesions: malignant uterine cervical lesions (primary carcinoma, small cell carcinoma, carcinosarcoma and metastasis), benign uterine cervical lesions (leiomyoma, polyp, pregnancy and abortion, short cervix and funneling), multilocular cystic uterine cervical lesions (malignant: adenocarcinoma, adenoma malignum, lymphoma / benign: cervicitis, endocervical hyperplasia, nabothian cyst, tunnel cluster, adenofibroma). We also describe normal anatomy and imaging features of uterine cervix (normal sonographic findings, normal vascular anatomy, normal Doppler and pulsed US).
Conclusions: The major teaching points of this exhibit are:1. US is a useful for evaluation of uterine cervical lesions.2. Although definite radiologic differentiation malignant lesions from benign lesions is not clearly possible, we suggest that familiarity with the clinical setting and imaging feature of uterine cervical lesions will facilitate prompt and accurate diagnosis and treatment.

PPT11-018

Vertebral Abnormality without Spine–Curvature Deformity on Prenatal Ultrasonography

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Objectives: To evaluate the incidence, outcome, prenatal US features, and postnatal radiographic correlations of fetuses with a sonographically detected vertebral abnormality (VA) without spine-curvature deformity (SCD).
Methods: Abnormal vertebrae were retrospectively identified by searching the prenatal ultrasound database at our ultrasound center over a 5-year period. Of these, 26 fetuses showing a VA without SCD were evaluated for pregnancy outcomes, sonographic data, and coexisting anomalies. Cases with neural tube defects were excluded. Medical records and postnatal radiographs of all live 16 births were reviewed.
Results: Co-existing major anomalies were suspected prenatally in 8/26 fetuses (30.8%). Sonographic abnormality were noted in vertebral body in 27/31 (87.1%) and in posterior element in 4/31 (12.9%). US features were absent (n=2) or small vertebral body echo (n=21), two separate vertebral body echoes (n=4), or smaller or lobulated posterior arch echoes (n=4). Among 16 live-born neonates, postnatal radiographs revealed vertebral abnormality in 20 (95.2%) of 21 prenatally detected VA without SCD. The abnormalities are vertebral body hypoplasia (18/19) with an incomplete sagittal cleft, asymmetric/unilateral hypoplasia, or hypoplasia with a complete sagittal cleft; or abnormalities in the spinous process (2/2).
Conclusions: Most fetuses with prenatally detected VA without SCD revealed hypoplastic vertebrae on postnatal radiographs. In the fetus with prenatally detected VA without SCD, detailed prenatal US should be performed for possible associated abnormalities. Prenatal recognition of VA without SCD can lead to an early postnatal diagnosis of vertebral abnormality and guidance for follow-up.

T12. General and Abdominal Ultrasound

Pre-Congress Workshop/Symposium

T12-13-IN01

Elastography Guidelines for the Assessment of Diffuse Liver Disease

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Guidelines for the use of elastography have been produced by the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) and the World Federation for Ultrasound in Medicine and Biology (WFUMB), as well as by clinical associations, including the European Association for Study of Liver (EASL) together with the Asociacion Latinoamericana para el Estudio del Higado (ALEH), the Asian Pacific Association for the Study of the Liver (APASL), and the American Gastroenterological Association (AGA). The guidelines produced by these clinical associations are focused on the assessment of diffuse liver disease. Moreover, the Society of Radiologists in Ultrasound (SRU) in the United States has released a consensus statement on the use of elastography in diffuse liver disease. The amount of elastography guidelines that have been issued witnesses the great interest for the use of the available techniques in several clinical settings.

EFSUMB has recently produced an update of the previously published guidelines that is dedicated to the assessment of diffuse liver disease but also provides an update of the basic principles where the technology has changed. The EFSUMB and WFUMB guidelines, as well as the SRU consensus statement, describe the advantages and disadvantages associated with the use of each elastography technique and provide a practical guide for both beginners and expert users. The role of elastography in different diseases and in several clinical scenarios is analyzed.

T12-13-IN02

Liver Stiffness Measurement in the Prediction of Clinical Significant Portal Hypertension and Related Complications

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Hepatic cirrhosis is the end stage of chronic liver disease and leads to portal hypertension (PH) resulting in disease progression manifested with esophageal varices (EV) formation/bleeding, ascites formation and portosystemic encephalopathy. The detection, prevention and management of portal hypertension and its complication are important for patient with cirrhosis. Hepatic venous pressure gradient (HVPG) has been the standard reference in portal pressure measurement and good predictor of prognosis and therapeutic effects for patients with PH. However, HVPG measurement is an invasive procedure requiring adequate equipment and needing a certain degree of expertise. Liver stiffness (LS) measured with transient elastography is a non-invasive method and in good correlation with portal pressure assessing with HVPG. Although there is also correlation between LS and presence of EV or high-risk EV, it was not as good as that for clinical significant PH. Most studies have demonstrated LS is useful in the prediction of PHT and its complication for patients with hepatic cirrhosis or advanced fibrosis. Clinically significant PH is >90% likely in patients with LS >20-25kPa. A proposed algorithm using LS, platelet count and abdominal sonography provided a useful strategy to detect early PHT. LS-based score incorporating LS, spleen size and platelet count demonstrated to be useful in identifying patients with clinical significant PHT or EV. Braveno VI consensus recommended avoiding screening scope for those patients with LS<20 kPa and platelet count >150000/mm3. Although useful in the EV prediction, LS measurement is not a replacement of scope in the diagnosis of varices for patients with hepatic cirrhosis.

T12-13-IN03

Ultrasound Elastography-Based Prediction Model of Liver-Related Outcome

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In patients with chronic liver diseases, identification of significant liver fibrosis and cirrhosis is essential for determining treatment strategies, assessing therapeutic response, and stratifying long-term prognosis. Recently, it has been known that hepatic fibrogenesis is a dynamic process reflecting an imbalanced extracellular matrix turnover. Thus, evaluating the evolution of fibrosis over time can be more important than a "once only" diagnosis.

Furthermore, the degree of liver fibrosis is significantly related to the risk of liver-related outcome (LRO) including HCC occurrence. However, histologic assessment of liver fibrosis by liver biopsy is not always feasible in clinical practice. Recently, noninvasive tests are helpful to assess the stage of liver fibrosis by measurement of liver stiffness using ultrasound elastography such as transient elastography (TE), acoustic radiation force impulse (ARFI) or shear-wave elastography(SWE). TE is the most common tool to measure LSM. Although ARFI and SWE seem to have similar accuracy and advantage compared with TE, further validation will be required.

Stratified baseline liver stiffness measurement (LSM) values in patients with CHB have been demonstrated as an independent predictor of HCC occurrence in our recent cohort study. This prospective study showed a significant association between LSM and the risk of HCC development in patients with CHB. A similar prospective study conducted in Hong Kong investigated the use of LSM in predicting HCC development and mortality in patients with HBeAg-negative CHB.

T12-13-IN04

Multi-Bipolar RFA for Hepatic Tumors: Concepts, Techniques and Results

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Until recently all techniques of tumor ablation including monopolar RFA relied on centrifugal energy deposition from unique or several applicators inserted in the centrum of targeted tumors. Due to rapid decreased of amount of energy delivered along radial axis, complete ablation of tumors lager than 3 cm or irregularly shaped is quite challenging with centrifugal methods. Thus, local recurrence rates up to 30% have been reported for the treatment of hepatic tumors even smaller than 3 cm. Multibipolar RFA consisting to insert several electrodes at the periphery of the target to be activated sequentially by pair in bipolar mode, allows a centripetal energy distribution from the margin to the centrum of tumor. Indeed, for a given tumor diameter the margin receives much higher amount of energy with multibipolar mode than with monopolar mode. As consequences, multibipolar RFA can achieve high rate of sustained local response for small liver tumors, and allows the treatment of larger lesion (beyond 5 cm) including some locally advanced forms of hepatocellular carcinoma.

T12-13-IN05

Contrast-Enhanced Ultrasound: Applications to Hepatic Diseases

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It is well-known that contrast-enhanced ultrasound (CEUS) is most widely used for the evaluation of various hepatic diseases, especially for focal hepatic lesions. Of two 2nd generation US contrast agents, *e.g.*, Sonazoid™ (GE Healthcare, USA) and SonoVue™ (Bracco Imaging, Italy) that are available in Korea, Sonazoid™ provides more information in characterizing various hepatic tumors, and even in guiding for interventional procedures, *e.g.*, radiofrequency ablation of hepatocellular carcinoma, because it allows acquisition of the Kupffer phase, during which it is taken up actively by Kupffer cell, after acquisition of conventional multi-phase dynamic imaging. SonoVue™ is also easily applicable to evaluate various vascular compromises for which the Kupffer phase is unnecessary. In this lecture, we demonstrate essential characteristics of both US contrast agents, CEUS findings of various hepatic tumors with differential points, guiding methods using CEUS for radiofrequency ablation of hepatocellular carcinoma with brief introduction of fusion imaging techniques, and other applications for vascular compromises.

T12-13-IN06

Novel Guidance for Percutaneous Treatment of Hepatic Tumors: Fusion Images and Cone-Beam CT

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US fusion images guidance is now routinely used for percutaneous ablations of liver tumors. Indeed, real time display of US slice with corresponding refreshed MPR of co-registered 3D data set of pretherapeutic CT or MR examinations improves the conspicuity of the target. However, several conditions could limit even wreck the co-registration of US with 3D data set of referral examinations. Thus, spatial mismatching between the images of two modalities can be due to static or dynamic anatomic differences between pretherapeutic referral examinations commonly achieved several days before the intervention. Finding similar land marks between US and referral images to set the registration could be also some time too tricky. Automatic co-registration of US with referral volume of images acquired just before the procedure avoids these common pitfalls. Cone beam CT volume as referral image offers additional advantage to be used for 3D fluoroscopic display of the target. For very challenging liver ablation requiring the insertion of several applicators, double real-time guidance relying on US fused with cone beam CT and virtual 3D fluoroscopic display allows safe punctures within acceptable ranges of time and X-ray dose.

T12-13-IN07

Doppler Ultrasound in Liver Diseases

Antonio Carlos Matteoni de Athayde

The hepatic ultrasonography associated with color Doppler, amplitude Doppler and spectral Doppler are very important tools in the daily routine of the professional that performs the ultrasound, being possible to diagnose pathologies and discard others, as well as, it allows to infer the possibility of extra illnesses -hepatic, such as heart disease. It is also of great importance in the evaluation of the transplanted hepatic patient. Color Doppler and Doppler amplitude and spectral Doppler are safe techniques and can be performed several times in a short time in patients of any age group. The identification of flow, whether arterial or venous, sense of the same, as well as, spectral study etc, provide us with relevant information that should always be used. We try to demonstrate situations that these techniques are extremely important and avoid other studies.

T12-13-IN08

CEUS in the Diagnosis of Liver Tumor in Taiwan

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During the past three decades, exciting advances have been made in contrast-enhanced ultrasound (CEUS) imaging. Before the currently available second-generation ultrasonic contrast agent-s(USCA), transarterial infusion of carbon dioxide microbubbles had been used to enhance US examination of hepatic tumors as early as mid-1990s, chiefly by the Jen-Ai Hospital group (Dr. Wang, Dr. Chen, Dr. Liaw). Levovist (Schering AG, Germany), the most important first-generation intravenous USCA is the first agent introduced to Taiwan ultrasound community in 1996 by Dr. Yi-Hong Chou. The clinical experience of Levovist was promising in characterization of focal liver lesions and in assessing treatment efficacy of malignant hepatic tumors. Sonovue (Bracco, Italy) was introduced to many laboratories in Taiwan since 2008 mainly for animal studies. "Lab-produced" USCAs were produced in some of the leading laboratories such as Tsing Hua University (Prof. Chih-Kuang Yeh) and National Taiwan University (Prof. Jen-Ho Tsao). One of the lab-produced USCAs is now registered in Taiwan with pending approval of Taiwan Food and Drug Administration (TFDA). Now, there are totally 12 medical centers and 8 teaching hospitals joining the USCA Working Group and a total of more than 40 research members are invited to form a subcommittee in Committee of Research and Development in Ultrasound Medicine under the umbrella of Society of Ultrasound in Medicine of the Republic of China (SUMROC, also known as CTSUM). Now we have 2 USCA available in Taiwan, i.e., Sonazoid and Definity. Although the Taiwan ultrasound community has been discussing on setting up a guideline of CEUS of the liver for at least 4 years, we still have not yet officially started to do that. We are now adopting the guideline from EFSUMB and WFUMB as references. The Advanced Ultrasound Technology Committee of SUMROC and US Contrast Agent Subcommittee (Chaired by Prof. Yi-Hong Chou) plan to invite the Taiwan Liver Cancer Association (TLCA) and Taiwan Academy of Tumor Ablation (TATA) to create a guideline most suitable for Taiwan physicians to follow. This can be after Q3 of 2017. Any aiready-proposed guidelines from any of the experienced regional or national societies may be also used as references.

T12-13-IN09

Fusion Imaging in the Diagnosis and Treatment of Liver Tumors in Taiwan

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In Taiwan, hepatologists are in charge of daily ultrasonography (US) practice and familiar to upper abdominal US images. Most radiofrequency ablation (RFA) procedures for liver tumor are conducted by hepatologist. US contrast agent has been launched for only few months. Because we are not radiologists, CT guidance or evaluation immediately after RFA is not so convenient for us. Fusion image technology (FIT) becomes the inevitable technology in our daily RFA practice. We introduced FIT, or real-time virtual ultrasound (RVS) into our hospital since 2008 and use it in almost every RFA patient.

Initially, FIT was reported to locate inconspicuous focal tumors, inclusion untreated and residual. This problems have been mostly resolved by CEUS. Actually, FIT for US-guidance intervention likes a global positioning system (GPS) for car driving. It can be widely used to resolve more problems. For example, it can be used (i) to find more adequate and safer puncture route, (ii) to predict the usefulness of artificial ascites/pleural effusion, (iii) to realize the nearby extrahepatic structure of ablation zone, (iv) to design the overlapping ablation for large lesion with irregular sharp, (v) to real-time evaluate the spatial relationships between ablation zone and nearby intrahepatic structure during ablation, and et al.

Because of GPS-like function, FIT should be useful despite of CEUS launched, and should be a routine technology to achieved safe and effective RFA for hepatic tumors.

T12-13-IN10

EUS in Diagnosis and Treatment of GI Tract

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Endoscopic ultrasound (EUS), with endoscopic visualization and a high frequency ultrasound transducer, can be utilized to study both intramural structures and structures adjacent to the gastrointestinal tract without the interference of soft tissue interposition or bowel gas. The echoendoscopes compose of two designs: linear array and radial array. Radial array EUS can be used for luminal imaging and evaluation of the wall layers of the gastrointestinal tract. However, linear array EUS can allow imaging, tissue acquisition and therapeutic applications. Moreover, the miniprobe belongs to radial array EUS with a transducer of higher frequency and it can be inserted through the working channel of a esophagogastroduodenoscope or colonoscope.

Mastering the manipulation of echoendoscope and the anatomy based on the linear and radial array EUS is the basic requirement of attaining useful images of EUS. With the technique advance of interventional EUS, several therapeutic EUS have been developed such as celiac plexus block and neurolysis, peripancreatic fluid collection drainage, intra-abdominal abscess drainage, EUS-guided angiotherapy, EUS-guided pancreaticobiliary access, EUS-guided fiducial placements, and local ablative therapy. However, therapeutic EUS requires great expertise and it carries a higher risk of adverse events such as bleeding, perforation, infection, and bile peritonitis.

EUS elastography can differentiate the nature of lesions based on their stiffness, but the technique is operator dependent and its accuracy needs more assessments. Moreover, contrast-enhanced EUS provides better differentiation, localization, and post-treatment assessment of the target lesions. However, contrast-enhanced EUS cannot completely replace tissue acquisition to ascertain the tumor nature, particularly for the solid pancreatic tumors.

T12-13-IN11

EUS in Diagnosis and Treatment of Biliary Diseases

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Although ERCP has long been considered the best endoscopic modality for diagnosis and treatment of biliary diseases, in the past decade, EUS, especially convex type, has been effectively applied.

As for diagnosis of biliary diseases, in patients suspected to have common bile duct (CBD) stones, EUS is recommended when CBD stones are undetectable with other imaging modalities to avoid unnecessary ERCP. In patients with acute pancreatitis of unknown origin, EUS is useful for diagnosing gallstone pancreatitis. In patients with CBD stricture, EUS has been proved to be a useful modality in assessing differential diagnosis of bile duct strictures, and subsequent EUS-FNA could confirm pathological diagnosis with few complications. EUS is also useful for diagnosing gallbladder lesions. Recent advances in EUS imaging technology has led to the evolution of the image-enhanced EUS modalities called contrast-enhanced harmonic EUS and EUS-elastography. These modalities has been described clinically helpful for diagnosing biliary diseases.

As for treatment of biliary diseases, since first described in 2001, EUS-guided biliary drainage (EUS-BD) has been increasingly used as an alternative in patients with biliary obstruction who failed standard ERCP. Its potential and efficacy has drawn attention and many articles about EUS-BD have been published in the last decade. Various endoscopic approaches have been described for EUS-BD including EUS-guided transluminal biliary stenting, EUS-guided rendezvous technique, and EUS-guided antegrade biliary stenting. Recent meta-analyses have revealed that the cumulative technical success and adverse event rates were 90–94% and 16–23%, respectively. The development of new dedicated devices for EUS-BD would help refine the technical aspects and minimize the possibility of complications, making it a more promising procedure.

T12-13-IN12

EUS in Diagnosis and Treatment of Pancreatic Diseases

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Endoscopic ultrasound (EUS) is a very useful modality for the diagnosis and staging of pancreatic diseases.

EUS can give high resolution image of the pancreas and can detect small solid or cystic lesions very sensitively. Therefore EUS is widely used for the diagnosis of pancreatitis, pancreatic duct changes, pancreatic solid tumors and cystic tumors. For cystic tumors of the pancreas, EUS can detect the internal structures such as locules, septum, mural nodule and wall thickening with high resolution images.

With the advent of EUS-guided fine needle aspiration (EUS-FNA) technology, this modality has made a tremendous progress from imaging modality to histologic diagnosis and therapeutic intervention. Pancreatic ductal adenocarcinoma is one of the most difficult tumor to treat and has an extremely poor prognosis. Most patients die within a year or two after diagnosis and the overall 5 year survival rate is less than 5% even after extensive treatment including surgery, chemotherapy and/or radiation therapy. EUS offers high resolution images of the pancreas and unparalleled access to the pancreas. After location of the tip of echoendoscope in the duodenum or stomach, EUS-guided FNA is possible to get the cytologic or histologic diagnosis.

Acute or chronic pancreatitis can cause several complication including pseudocyst and walled off necrosis. Under EUS guidance, cysto-gastrostomy or cysto-duodenostomy can be performed to cure pseudocyst. Multiple studies showed the superiority of this approach to percutaneous or surgical approach and widely performed in many centers.

EUS-guided fine needle injection (EUS-FNI) for various solid or cystic lesions is a rapidly expanding field. Interventional EUS of aspiration followed by injection is applied to pancreatic cystic tumors. For cystic tumors of the pancreas, EUS-guided ethanol lavage with/without paclitaxel injection is tried and complete resolution of cystic tumor was observed up to 70∼80% of patients. Ethanol injection is also performed for the management of solid neuroendocrine tumor of the pancreas. Ethanol injection can effectively manage functioning neuroendocrine tumor such as insulinoma. The complete resolution of tumor

and functional recovery was reported although the number of cases is small.

Local ablative modalities such as radiofrequency ablation (RFA) or photodynamic therapy (PDT) are also applied to pancreas in animal studies. For pain management, EUS-guided celiac plexus block or neurolysis are tried and showed pain response.

In conclusion, EUS became an indispensable tool for the diagnosis and management of pancreatic disease and will play a key role in the treatment of benign and malignant pancreatic disease in the future.

Symposium

T12-14-IN01

Elastography Application in Liver Pathology: between Expectations and Result

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The term "elastography" describes an imaging technique that generates information about the stiffness of tissues, being a method that is related more to palpation than inspection. Several commercial systems are currently available and various types of elastography have been used clinically. Thus, transient elastography, strain elastography, acoustic radiation force impulse (ARFI) imaging, point shear wave elastography, 2D and 3D shear wave elastography have been used in various liver applications. The assessment of fibrosis in chronic liver diseases is important for both the prognosis and management of the patients, including decisions for antiviral therapy.

Transient elastography can be used as first line assessment for the severity of liver fibrosis, in chronic hepatitis C, but also in chronic hepatitis B. It can be used to exclude cirrhosis in non-alcoholic fatty liver disease, as well as in alcoholic liver disease. Due to the intrinsic variability of the method, ten measurements should be obtained.

Strain elastography is a qualitative method based on tissues grade compression to a generated force, considering that the tissue deformation is smaller in hard tissue as compared to soft tissue. To improve the reproducibility of elastography, second-generation devices allow for semi-quantitative analysis of tissue stiffness. There are two semi-quantitative elastography methods: strain histogram and strain ratio.

Elastography should not be performed without the knowledge of patient complaints, past medical history and basic laboratory testing. In conclusion, as a non-invasive method, elastography is perfectly suited for the assessment of chronic liver diseases.

T12-14-IN02

Correlation Between Fibroscan and ARFI with Metavir Liver Fibrosis Score

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Non-invasive assessment of liver fibrosis with Fibroscan and acoustic radiation force impulse (AFRI) imaging are two most popular modalities to measure liver fibrosis. Fibroscan is a well-established modality which measure both liver fibrosis and steatosis. However, there is considerable failure rate, and without image quidding the data may be misleading in the present of focal lesion in R hepatic lobe. ARFI may select an optimal location for measurement but there are concerns on the inter-observer and inter-location variations. We try to decrease the variation by measuring ARFI at two different locations.

In a consecutive series of patients who received liver histology study were prospectively enrolled. All participant received hemogram, liver biochemistry, viral markers, ARFI and Fibroscan within 4 weeks of histology study. A standardized protocol was used to both Fibroscan and ARFI on the same day by a single technologist. Then both data from Fibroscan and ARFI were correlated with liver histology. Additional series of non-biopsy cases with chronic hepatitis B, chronic hepatitis C and non-alcoholic liver disease were also included for validation analysis.

A total of 83 patients with liver histology study were included. This series included 34 NonB and NonC, 8 autoimmune liver diseases, 29 chronic hepatitis B and 12 hepatitis C. We excluded patients with alcoholism, dual HBV and HCV infection and unknown etiology. The correlation between Fibroscan and ARFI two-location measurement is good ($R2=0.589$, $P<0.001$). The area under the curve for Metavir 4 fibrosis are 0.877 and 0.919 for Fibroscan and ARFI respectively. A relatively lower value in Fibroscan than in ARFI is noted in the present of severe steatosis ($CAP\geq293$, $P<0.001$). Similar situation was found in non-biopsy patients received both studies. The phenomenon of lower slope in patients with high CAP value are presented in all HBV, HCV or NBNC non-biopsy groups.

We conclude that the correlation between Fibroscan and ARFI two location measurement is good. ARFI tends to have a better linearity with histology fibrosis grades than Fibroscan in patients with severe steatosis.

T12-14-IN03

Clinical Feasibility of Liver Elastography

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The clinical management of chronic hepatitis depends on the correct assessment of liver fibrosis. Liver biopsy is accepted as the gold standard to determine the fibrotic status, but it is invasive, and the diagnostic accuracy is strongly influenced by inter-observer variation. Therefore, noninvasive methods have been proposed, such as transient elastography (TE), real-time tissue elastography (RTE) and acoustic radiation force impulse (ARFI) Imaging. TE measures liver stiffness, which is correlated to fibrosis stage, and recent meta-analyses have shown high accuracy in the diagnosis of liver cirrhosis. This method, however, has several limitations: failure or unreliable results occur in 10–20% of patients due to the patient being overweight, narrow intercostal spaces, or high variability of measurements. New methods for assessing liver fibrosis have been proposed and are now under evaluation. RTE and ARF imaging technology are two different add-on modules that can be embedded into standard ultrasound imaging devices. They both measure liver stiffness and have the advantage of combining direct visualization of the liver parenchyma and liver stiffness measurements. This enables the operator to directly correlate the anatomical correspondence between tissue elasticity and B-mode display, thus avoiding the subcapsular region and reducing the variability of measurements. The results are not affected by overweight patient status or narrow intercostal spaces. Early studies have shown that the results of both techniques are reproducible and correlate with liver fibrosis. The aim of this present was to perform a direct comparison of these techniques in diagnosing fibrosis in the population consisting of normal subjects and patients with liver fibrosis.

T12-14-IN04

Hepatic Fibrosis: US and MR Elastography

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Hepatic fibrosis is final results of a wide variety of types of liver ingury and is a consequence of all chronic liver diseases and progresses more or less rapidly towards cirrhosis, and finally cancer.

In terms of the tools used to quantitate fibrosis today, there are three kinds of tools; biochemical markers, conventional imaging, and functional imaging such as elastography (E) or stiffness imaging. Recent

imaging tools for evaluation of hepatic fibrosis are US based techniques, MR based techniques, and perfusion imaging.

US Elastography (USE) is classified into strain-based E and SW-based E. Strain-based E is subclassified into Static USE (Manual compression of the tissue) and Quasi-static USE (Physiologic vibrations (heartbeat, blood vessels pulse). SW-based E is subclassified into 1D such as fibroscan (Echosens), Point E such as virtual touch quantification (Siemens). ElastPQ (Philips) and 2D SWE such as supersonic shear imaging (Supersonic Imagine), and shear wave elastography (GE, Toshiba)).

For the liver, USE is divided into 2 categories quasi-static E and shear wave based imaging. Quasi-static E is not popular. Shear wave based imaging is subdivided into two types based on generation method of shear wave: Controlled ernal vibration with a vibrator and acoustic radiation force impulse. Transient elastography is using mechanical push, and both ARFI imaging and supersonic shear wave elastography are using ARFI. Strengths of 1D SW-based elastography are the most extensively investigated technique with high portablility. Limitations are no B-mode imaging, high technical failure rate (2.4-9.4%) and narrow applications outside of liver investigation. Strengths of point SW-based elastography are low technical failure rate ($< 1\%$), very short acquisition time and extensively investigated technique. Limitations are small ROI and greater energy absorption. Strengths of 2D SW-based elastography are larger ROI, which may reduce sampling variability, real time and 2D elastogram. Limitations are 2-3% technical failure, longer acquisition time, hyper sensitivity for tissue attenuation and motion. Then, which elastography technique should be used? Or how to choose? USE is better than MRE in terms of convenience, acquisition time, cost, and availability. But, MRE is better than USE in terms of sample volume, technical failure, and multiparametric evaluation. Limitations of elastography are many confounders in stiffness measurements, such as inflammation, portal pressure, right heart pressure, and cholestasis and so on, and both techniques of USE and MRE need further standardization. Therefore, other comprehensive imaging techniques are needed, such as DWI or DCE –US or MR.

In Summary, liver stiffness is determined by matrix deposition (fibrosis) and pressure change (hydrostatic, osmotic). Hepatic fibrosis (HF) is a consequence of all chronic liver diseases and progresses towards cirrhosis and finally cancer. Noninvasive diagnosis and staging is important clinical issue for hepatic fibrosis which is reversible. Elastrography is clinically acceptable for the prediction of liver fibrosis ($\geq$F2) and confounders of stiffness measurement (intercostal approach to right lobe (S7/8), 1-3 cm below the liver capsule, biologic confounders can change stiffness values, fasting at least 2 hours, breathhold at expiration). Elastography is one of important noninvasive methods to quantify HF more sensitively and objectively. USE is the first line examination for the assessment of HF. MRE is the second line examination, especially in cirrhosis. To avoid confounders of liver stiffness, comprehensive other imaging exams are needed.

T12-14-IN05

QIBA Ultrasound Shear Wave Speed Biomarker Update

Shigao Chen, Manish Dhyani, Brian Garra, Timothy Hall, Mark Palmeri

The Quantitative Imaging Biomarkers Alliance (QIBA) was organized by RSNA to improve the value and practicality of quantitative imaging biomarkers by reducing variability across devices, patients, and time. The QIBA Ultrasound Shear Wave Speed (SWS) Biomarker Committee was formed in 2012 by researchers, healthcare professionals, regulatory agencies, and industry stakeholders to advance SWS as a quantitative biomarker for liver fibrosis staging. This presentation will give a brief introduction of the general QIBA concept and procedure, the work that the Ultrasound SWS Biomarker Committee has performed, and the current status of the SWS "Profile", which is a detailed document describing what quantitative results (e.g., bias and precision of SWS measurements) can be achieved by following the imaging protocol included in the Profile.

T12-14-IN06

Ultrasound Statistical Parametric Imaging in the Assessment of Fatty Liver

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Hepatitis steatosis may progress to nonalcoholic steatohepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma. Nonalcoholic fatty liver disease (NAFLD) is the type of hepatic steatosis that most commonly leads to chronic liver disease. NAFLD is also related to metabolic risk factors. How to characterize fatty liver is attracting growing medical and health research interest. Notably, the speckle pattern is formed by ultrasound backscattered echoes, which are typically treated as random signals. Thus, analyzing the statistical distribution of the echo amplitude (i.e., the envelope signal) may provide useful clues associated with fatty liver diseases. Many investigators have began to study the relationship between the probability property of inverse scattering and the characteristics of tissue. Commonly used statistical models include the Rayleigh distribution, Rician distribution, K distribution, homodyned K distribution, Nakagami distribution, and compounding Nakagami distribution. One requisite of using statistical models to fit echo amplitude distributions is that the ultrasound envelope data must conform to the used distribution. To overcome the limitations mentioned above, we need to set a new direction for constructing the images of ultrasound parameters outside the statistical model ultrasonic method. Recall that Shannon established information theory and defined entropy as a measure of information uncertainty. Hughes pioneered using Shannon entropy for analyzing ultrasound signals, indicating that entropy is able to quantitatively describe changes in the microstructures of scattering media. Recently, we also developed the small-window entropy image of ultrasound by using a simple model of histograms and defined the weighted entropy to provide greater sensitivity in diagnosing the changes of the scattering microstructures of tissues. The results showed that fatty infiltration increases the uncertainty of backscattered signals from livers. Ultrasound entropy imaging has potential for the routine examination of fatty liver disease.

T12-14-IN07

ARFI in the Assessment of NAFLD Severity

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Non-alcoholic liver disease (NAFLD) has recently been recognized as the most prevalent liver disease worldwide. The features are in a similar trend found in Asia-Pacific. Non-alcoholic steatohepatitis (NASH) was defined by histopathologic evidence as an extreme form of NAFLD. The risk of development of fibrosis, cirrhosis and liver-related deaths in NASH patients cannot be overlooked. NASH patients had higher overall mortality compared with controls, and most deaths were due to cardiovascular events. In addition, Asian people are more prone to metabolic syndrome (MetS), DM and NAFLD than other races.

Accurate determination of the presence and extent of liver fibrosis is essential for prognosis and for treatment planning in NAFLD patients. Exploration of non-invasive methods to evaluate disease severity is

challenging in clinical practice. In addition to serum biomarkers, several ultrasound-based methods have been vigorously developed and validated for assessing the degree of fibrosis and cirrhosis by measuring liver stiffness in the past decade. These ultrasound-based methods shed a new light in the aspect of non-invasive evaluation of liver fibrosis. Acoustic radiation force impulse (ARFI) imaging is a newly-developed transient elastography (TE) method integrated into a conventional ultrasound machine and can be performed with ultrasound probes during an abdominal ultrasound examination. Previous studies have indicated that it possesses a good performance in predicting liver fibrosis stages in chronic liver disease patients. The performance of ARFI in NAFLD patients will be discussed and reviewed. Further works of clinical validation regarding various methods are needed to improve the accuracy.

T12-14-IN08

Transient Elastography for Diagnosis of Stages of Hepatic Fibrosis and Cirrhosis in People with Alcoholic Liver Disease

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Background: The presence and progression of hepatic (liver) fibrosis into cirrhosis is a prognostic variable having impact on survival in people with alcoholic liver disease. Transient elastography (TE) is a non-invasive method for assessing and staging hepatic fibrosis.

Objectives: To determine the diagnostic accuracy of TE for diagnosis and staging hepatic fibrosis in people with alcoholic liver disease when compared with liver biopsy (LB).

Selection Criteria: Diagnostic cohort and diagnostic case-control study designs that assessed hepatic fibrosis in participants with alcoholic liver disease with TE and LB, irrespective of language or publication status.

Data Collection and Analysis: We followed the guidelines in the draft *Cochrane Handbook for Systematic Reviews of Diagnostic Test Accuracy.*

Main Results: Five retrospective and nine prospective cohort studies with 834 participants provided data for the review analyses.

We performed an HSROC analysis and reported an SROC curve for hepatic fibrosis stage F4 (cirrhosis). The HSROC analysis suggested that when the cut-off value changes, there is a wide variation in specificity and a more limited variation in sensitivity. We performed an additional analysis with the studies with the most commonly used cut-off value of 12.5 kPa. The summary sensitivity and specificity of TE (seven studies with 330 participants) were 0.95 and 0.71 with LR+ 3.3 and LR- 0.07.

Authors' Conclusions: TE may be used as a diagnostic method to rule out liver cirrhosis(F4) in people with alcoholic liver disease when the pre-test probability is about 51% (range 15% to 79%). TE may also help in ruling out severe fibrosis (F3 or worse). LB investigation remains an option if the certainty to rule in or rule out the stage of hepatic fibrosis or cirrhosis remains insufficient after a clinical follow-up or any other non-invasive test considered useful by the clinician.

T12-14-IN09

Elastography in Diffuse Liver Disease

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Due to the limitations of liver biopsy, the non-invasive assessment of diffuse liver disease by means of shear wave elastography (SWE) has gained interest. Liver stiffness is directly related to liver fibrosis. Several studies and meta-analyses have assessed the accuracy of the available SWE techniques, i.e. vibration controlled transient elastography (VCTE), point SWE and 2D-SWE, for the staging of liver fibrosis. VCTE was the first technique available and it needs a dedicated device that doesn't give a morphological assessment of the liver parenchyma. The advantages of the SWE techniques incorporated in ultrasound systems are that the same system can be used for the evaluation of the morphologic changes or the detection of focal liver lesions and the B-mode image is a guidance for the stiffness assessment. Confounding factors should always be taken into account in the interpretation of the results, that should be evaluated in the clinical setting. In fact, liver stiffness increases in cases of acute hepatitis or transaminase flares, congestive heart failure, feeding and extrahepatic cholestasis. In patient with liver cirrhosis, liver stiffness is associated with the risk of decompensation, liver cancer, and death.

T12-14-IN10

Elastography Evaluation of Liver Fibrosis in Patients with Hepatitis B

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Learning objectives

- Indications for elastography
- Types of elastography
- Accuracy of elastography in Hepatitis B patients
- Pitfalls & limitations

Elastography would seem to have been firmly accepted as a useful tool in the assessment of fibrosis in patients with liver disease. And yet there are many sceptics and its use has not yet been accepted universally.

Numerous studies have been done on patients with Hepatitis C, primarily because it is the commoner type of Hepatitis in Europe.

Our study on hepatitis B patients was carried out to confirm if assumptions made about Hepatitis C also apply to patients with Hepatitis B and to look at patients with HIV as well as those with co-infections.

Our results show that the accuracy of assessment of fibrosis using elastography correlates favourably with those of histology based on Metavir scores. Therefore, the use of elastography to assess liver fibrosis should be popularized as it is a simple, cost effective method that is readily available.

T12-14-IN11

Liver Elastography and Doppler

Antonio Carlos Matteoni de Athayde

Shear-wave hepatic elastography is a worldwide technique, even with FDA approval at the end of 2015, and used for some time in Asian and European countries. It uses shear waves and in real time, the

equipment has to have an ultra-fast system to capture the image of the same, around 5,000 frames / sec.

In countries where it is widely used, it has reduced and replaced liver biopsy, thereby avoiding the side effects of the biopsy, bringing more safety and benefits to the patient. Initially it was indicated only for patients with Hepatitis C, later Hepatitis B and has now been used in other causes of diffuse liver diseases.

Color Doppler, amplitude and spectral allows assessment of hepatic vascularization, facilitating the diagnosis of focal steatosis, nodular hyperplasia when identifying the nutrient artery, cardiac diseases, etc. It is an extremely useful supplement in the hepatic ultrasound study.

T12-15-IN01

Recall Strategies for Patients Found to Have a Nodule in Cirrhosis: Is There Still a Role for CEUS?

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Growth and evolution of hepatocellular carcinoma (HCC) is a multistep process in which different HCC-etiologies induce continuous rounds of hepatocyte damage and regeneration. Over an extended time, this triggers cirrhosis which is a pathological state of the liver in which lesions can progress to become dysplastic nodules. Later, these nodules may evolve into HCC and occasionally generate metastatic events. To provide optimal care, patients with liver cancer should be managed using a multidisciplinary approach in specialized centers in which all the diagnostic and therapeutic resources are available. Among the different imaging modalities the introduction on contrast agents for ultrasound use has opened new further applications in different clinical settings. In fact, contrast enhanced ultrasound (CEUS) has been applied for more than ten years and plays increasingly important roles in the management of HCC. Since early 2000, international societies including the American Association for the Study of Liver Diseases (AASLD), the European Association for the Study of the Liver (EASL), the Asian Pacific association for the Study of the Liver (APASL), the Japanese society of Hepatology (JSH), the Italian society for the study of the liver (AISF), the World Federation for Ultrasound in Medicine and Biology (WFUMB), and the European Federation of Societies for Ultrasound in Medicine and Biology (EFUSMB) have discussed the important role of CEUS in the diagnosis of HCC. In the present review an update of the literature and a detailed discussion of the present Guidelines regarding the role of CEUS in the evaluation of nodules in cirrhotic patients is offered.

T12-15-IN02

The Use of Contrast Enhanced US in Interventional Application of Liver

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Contrast Enhanced US (CEUS) may be helpful in several US-guided interventional procedures in the liver. Applications are

CEUS guided biopsy:

* To get biopsy material from perfused areas and avoid necrotic areas
* Biopsy of poorly visualized lesions
* Avoiding biopsy from lesions if CEUS study unequivocally shows benign lesion e.g. hepatic hemangioma

CEUS in relation to US-guided tumor ablation:

* CEUS visualization of ablation target
* Intraprocedual guidance and immediate post-ablation evaluation
* Ablation evaluation and follow-up

Other applications:

* CEUS fistulography
* CEUS in abscess drainage
* CEUS in biliary intervention
* CEUS in hepatic hemorrhage

Examples of the above mentioned applications will be given during the presentation.

T12-15-IN03

Ultrasound-Based Liver Fat Quantification

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Hepatic steatosis is very common and has a broad disease spectrum according to etiology and severity (1). Clinically, the occurrence of non-alcoholic fatty liver disease (NAFLD), the most common type of hepatic steatosis, is strongly correlated with metabolic disease, including type 2 diabetes mellitus and atherosclerotic cardiovascular disease (2). Simple hepatic steatosis can evolve into a more severe stage such as steatohepatitis or cirrhosis. Furthermore, hepatic steatosis is an important risk factor for postoperative complications after major liver resection and living donor liver transplantation (3-7). Hepatic steatosis of $\geq$ 10% is known to be critical in patients undergoing living donor liver transplantation due to the risks of initial graft dysfunction, poor graft survival and other complications (8-10).

The widespread use of liver biopsy, a reference standard for quantification of liver fat, as a screening tool and for monitoring treatment response is limited mainly because of invasiveness. Therefore, noninvasive imaging methods that can quantitatively measure liver fat have been actively investigated. Among them, ^{1}H-magnetic resonance spectroscopy (^{1}H-MRS) has gained ground in the past decade as an alternative noninvasive reference standard for evaluating liver fat content because of its high diagnostic accuracy and reproducibility (1, 2, 11-15). However, MRS is expensive to perform as a screening and monitoring tool for hepatic steatosis.

Ultrasound (US) is an imaging modality that is simple and inexpensive to perform and is safe for the patient. To overcome the intrinsic subjectivity associated with the use of US in grading fatty liver, several methods using US image data have been proposed for the quantification of hepatic steatosis (14-20). However, these methods are not widely used in clinical practice, mainly because of their complexity or their use of non-commercial software.

Recently, ultrasound-based liver fat quantification tools such as controlled attenuation parameter (CAP) or Acoustic structure quantification (ASQ) have been introduced into clinical practice. CAP measures the degree of ultrasound attenuation due to hepatic fat, which is implemented on Fibroscan. CAP values have been reported to have an excellent diagnostic accuracy for steatosis detection, which an adjusted AUROC of 0.914. However, technical failure rate was reported to be 7.7 % of cases (21). ASQ method is based on statistical analysis of the difference between theoretical and real echo amplitude distribution (22, 23). In a population of living donors for liver transplantation, ASQ provides an excellent quantitative tool for hepatic steatosis, and there is a strong linear correlation ($r = -0.87$, $P < 0.0001$) between focal disturbance ratio measured using ASQ and hepatic fat fraction measured using MR spectroscopy (24).

T12-15-IN04

CEUS in the Diagnosis and Treatment for Malignant Liver Tumors

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Outline of the Lecture

1. CEUS with Sonazoid is useful in the characterization of Liver Tumors.
2. In RFA treatment, there are some HCC lesions, that are demonstrated or CT or MRI, can not be visualized by B-mode US alone.
3. However, using defect re-perfusion imaging technique (re-injection of sonazoid for the defect at Kupffer phase, HCC nodules

can be clearly demonstrated, resulting in making the RFA procedure possible.
4. In addition, overlay imaging by use of CEUS, correct judgement of ablative margin becomes possible.

T12-15-IN05

Advances in US-Guide RFA

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Radiofrequency ablation (RFA) is accepted as nonsurgical curative treatment option for early stage HCC in most treatment guidelines. Furthermore, RFA is recommended even as the first line treatment for very early stage HCC. Accurate targeting (Placement of electrode) is one of essential step for successful ablation. Among various guiding modalities, ultrasound is the most popular modality due to its unique advantages. As the tumor size detected on State of Art Liver MRI is getting smaller, the conspicuity of tumor becomes more challenging. Technical advance in ultrasound including fusion imaging and contrast enhanced ultrasound (especially Sonazoid) contribute to more sophisticated procedure for the inconspicuous tumor. For a tumor with unfavorable location, artificial ascites will improve sonic window as well as prevent thermal injury to the adjacent organ. For a larger tumor, multiple RF electrodes or new energy source (microwave) will be getting more popular in Asian countries. Despites several sustained challenges in US-guided tumor ablation for HCC, the indication are continuously expanding for the tumor with poor conspicuity, the tumor with unfavorable location, and the larger tumor. Local ablative therapy will provide a definite role in HCC management as a curative as well as adjuvant modality along with currently advance of US technologies.

T12-15-IN06

US-Guide Microwave and Radiofrequency Ablation for Liver Tumors

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Hepatocellular carcinoma and hepatic metastases are the common malignancy in Taiwan. Surgical resection remains the reference standard in the treatment of malignant liver tumors; however, a large number of patients have disease that is not amenable to surgical therapy. Therefore, several ablative treatment modalities have been developed for local control of liver tumors in patients with malignant hepatic tumors.

Radiofrequency ablation (RFA) is the most frequently used of these methods because of its effectiveness, safety in both percutaneous and surgical settings, and relative ease of use. However, RFA is fundamentally restricted by the need to conduct electric energy into the body. The majority of tissue heating is thus due to thermal conduction, which decreases exponentially away from the source. RFA is most effective in the treatment of the hepatic tumors smaller than 3cm. Using multi-probes with switch-controller RFA system can create a larger ablated area for the malignant tumor and can enhance the therapeutic effect in the treatment of medium size (3 to 5 cm) malignant hepatic tumors.

Microwave (MW) ablation offers many of the advantages of RF ablation while possibly overcoming some of the limitations. Since MW ablation does not rely on conduction of electricity into tissue, it is not limited by charring. Therefore, temperatures greater than 100°C are readily achieved, which potentially results in a larger zone of ablation, faster treatment time, and more complete tumor kill. In addition, MW ablation has a much broader power field than does RF ablation. This may allow for larger zones of thermal ablation and a more uniform tumor kill. Because the cooling effect of blood flow is most pronounced within the zone of conductive rather than active heating, a larger power field may also enhance treatment of perivascular tumors.

MW ablation and multiple-probes RFA with switch controller are both promising new options in the treatment of malignant hepatic neoplasms.

T12-15-IN07

Ultrasound Evaluation of the Hepatic Vasculature and Liver Disease

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This presentation will discuss the sonographic appearance of the following:
1. Normal hepatic vasculature
2. Portal Vein Thrombosis
3. Cavernous Transformation of the Portal Vein
4. Budd Chiari Syndrome
5. Transjugular Porto Systemic (TIPSS) shunts

T12-15-IN08

Vascular Phases in Imaging and Their Role in Focal Liver Lesions Assessment

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The incidental finding of a focal liver lesion with conventional B-mode ultrasound is one of the most common clinical issues (1). Some of the liver lesions which present typical morphological B-mode features (e.g. cysts, typically localized focal fatty sparing/accumulations, hyperechoic hemangiomas) can be easily diagnosed by conventional ultrasound without the need of further imaging. Others frequently necessitate further investigation with contrast enhanced imaging techniques or biopsy in order to differentiate benign from malignant lesions and obtain a final diagnosis which is important for prognosis (2, 3). This presentation will highlight differences between vascular phases of different cross-sectional contrast enhanced methods, as well as their subsequent benefits for FLLs assessment (4, 5).

T12-16-IN01

Rare Biliopancreatic Diseases

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In this presentation rare but important hepatobiliary and pancreatic diseases are summarized including the imaging features of papillomatosis of the biliary tree (1), tuberculosis of the pancreas (2), autoimmune pancreatitis (3-5) and other infectious (parasitic) diseases, e.g., ascariasis (6), hydatid cysts, schistosomiasis (7, 8), fascioliasis (9), and others. The presentation focusses on clinical features and hot topics of the diseases including a pictorial essay demonstrating the imaging features. Worldwide many infectious diseases, e.g., ascariasis are no longer widespread, therefore doctors may have little or no experience with case management. On the other hand, increasing numbers of travelers and immigrants from high prevalence countries challenge clinicians to remain updated in infectious diseases.

T12-16-IN02

Contrast-Enhanced Ultrasound of the Pancreas

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Contrast enhanced ultrasound (CEUS) allows real-time recording and evaluation of the wash-in and wash-out phases of

the ultrasound contrast agent (UCA) over several minutes. A second-generation blood-pool UCA is injected through a peripheral vein, which subsequently can be visualized through the microcirculation in the early arterial and late venous phase, especially when used with specific contrast harmonic imaging modes (based on low-mechanical index). Two phases are described for the pancreas: the arterial phase starts from around 10-20 seconds until around 35-40 seconds after contrast injection, showing a progressive degree of enhancement; the venous phase starts from around 30 to 45 seconds after contrast injection, showing a plateau and then a progressive decrease. Beside transabdominal techniques, endoscopic ultrasound (EUS) is used in most of the patients based on contrast harmonic imaging specific modes.

CEUS and/or CE-EUS are useful for the characterization of lesions previously detected on ultrasound. The enhancement pattern of focal pancreatic lesions is compared with the adjacent pancreatic tissue: iso-vascular, hypovascular (hypoechoic with few internal microbubbles) or hypervascular (hyperechoic) lesions. Ductal adenocarcinoma, the most common primary malignancy, is typically hypo-enhancing in all phases, because of the desmoplastic reaction with low vascular density present in 90%. Neuroendocrine tumours typically present as hyper-enhanced lesions in the arterial phase, owing to their abundant arterialization, often not seen on colour Doppler US. Also, pseudotumoral chronic pancreatitis and autoimmune pancreatitis have an iso- or hyper-enhanced appearance.

Consequently, CEUS and/or CE-EUS are currently considered useful for the differential diagnosis of focal pancreatic masses, but also cystic pancreatic masses, and can improve the accuracy of ultrasound guided fine needle aspiration procedures. Even more promising is the use of dynamic contrast-enhanced harmonic EUS for the longitudinal monitoring of the effects chemotherapy and / or anti-angiogenic therapy in advanced pancreatic cancer.

T12-16-IN03

The Value of Differentiation Diagnosis of Gallbladder Polyps Larger Than 1.0cm by CEUS: 7 Years Clinical Experiences

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Aim: To assess the value of differentiation diagnosis of gallbladder polyp lesion (GPL) by contrast enhanced ultrasound (CEUS).

Methods: A total of 988 consecutive cases of patients with GPL larger than 1.0cm were collected between June 2010 and May 2017 in our hospital. All patients underwent gray scale ultrasound and contrast enhanced ultrasound examinations before cholecystectomy. The patients' data and the features of GPL on gray scale ultrasound images were recorded, which include the size, color Doppler blood flow, number of GPL, echoic features of GPL and gallbladder stone. The CEUS features of GPL including enhancement intensity, enhancement homogeneous, stalk width, vascular type in arterial phase were recorded. All of the gray scale and CEUS images were analyzed by two doctors independently who have more than 10 years CEUS examinations experiences. According to the pathology findings, all the patients enrolled in this study were divided into cholesterol polyps and gallbladder adenoma groups. All the patients' data and image features between two groups were statistically compared.

Results: There were 856 cases of cholesterol polyp and 132 cases of gallbladder adenoma. There were differences in patient age, lesion size, echogenicity, gallbladder stone and vascularity of lesion between two groups ($P<0.05$). There were differences in stalk width, enhancement intensity and vascular types between two groups ($P<0.05$). Multiple logistic regression analysis proved that size of lesions, enhancement intensity, stalk of lesion, vascularity and vascular type were the independent risk factors related with GB adenoma ($P<0.05$).

Conclusions: CEUS could offer useful information to distinguish adenoma from cholesterol polyp. The treatment algorithm for GPL would likely benefit from CEUS as a routine imaging investigation, especially in cases where the polyp is larger than 1cm.

T12-16-IN04

Ultrasound of Gallbladder and Biliary Tract. What Is Relevant to the Surgical Procedure?

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The diagnosis of gallbladder disease has traditionally been made because of clinical symptoms and signs confirmed by imaging methods, specifically ultrasound, computed tomography and scintigraphy. For several years Ultrasound has taken a leading role worldwide in the diagnosis of gallbladder diseases, not only for its cost-benefit and accessibility even in hospitals with low resources, but also for the quality of the images Which we obtain today.

Being limited the other methods to a small% of cases where we do not obtain the precise diagnosis. On the other hand, cholecystectomies in acute or complicated cases have a higher% of morbidity and mortality. Following current guidelines, significant data can be obtained on ultrasound imaging that can guide the surgeon to make important decisions such as performing intraoperative cholangiography, deferring cholecystectomies, referring to more experienced surgeons, operating difficult cholecystectomies, or deciding percutaneous procedures.

T12-16-IN05

Diagnosis of Biliary Diseases by Ultrasound

Antonio Carlos Matteoni de Athayde

The icteric patient after the laboratory study, the next step when necessary, is the image examination, usually the ultrasound is the initial exam of choice, because it is easier, cheaper and often with excellent performance. Ultrasonography seeks to characterize if jaundice is of obstructive or non-obstructive origin. In non-obstructive diseases it is possible to identify neoplasia, chronic disease etc and in some cases acute hepatitis. In the presence of obstruction, it can be characterized if intrahepatic or extrahepatic and being extrahepatic, identify the level, if pancreatic or supra-pancreatic and if possible the etiology, which can not always be done by ultrasound, especially in pathologies located in the distal common bile duct,by gas interposition. The choledochal diameter may vary with age and post-cholecystectomy status.

T12-16-IN06

Interventional EUS in the Digestive Diseases

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Endoscopic ultrasound (EUS) is combined with needle puncture, which facilitates interventional EUS in the digestive diseases. Interventional EUS consists of two main procedures including EUS-guided drainage and EUS-guided injection/ablation.

EUS-guided drainage has an advantage over percutaneous drainage in keeping patients' quality of life by avoiding an external drainage tube. The first main targets of EUS-guided drainage were pancreatic/peri-pancreatic infected cysts/WONs. Recent advances in the specific

devices lead to expansion of its targets, such as bile duct, gallbladder, pancreatic duct, and so on.

EUS-guided celiac plexus neurolysis (EUS-CPN) was reported as the first EUS-guided injection/ablation. During EUS-CPN, ethanol is injected into celiac plexus under the guide of EUS to relieve pain in patients with an upper abdominal cancer. EUS-CPN reportedly achieved more pain relief than using narcotic drugs alone. Modification of this technique such as ganglia neurolysis and broad plexus neurolysis further improved its efficacy. Ethanol injection recently expanded for ablation of cystic or solid tumors in the pancreas. EUS-guided radiofrequency ablation is currently applied to ablation of these tumors. Moreover, EUS-guided coiling has been used for embolization of gastric varices.

In conclusion, interventional EUS became essential or rescue treatment of various digestive diseases. Its target is expected to expand to the other more fields in the future.

T12-16-IN07

EUS-Guided Radiofrequency Ablation for the Management of Pancreatic Tumors

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Endoscopic ultrasound (EUS) became an indispensable tool not only for the diagnosis but also for the management of pancreatic tumors. With the modification of EUS-guided fine needle aspiration (EUS-FNA) technology, EUS-guided fine needle injection (EUS-FNI), EUS-guided ablation and other interventions can be applied for various solid or cystic lesions in the pancreas.

Local ablative modalities such as radiofrequency ablation (RFA) or photodynamic therapy (PDT) are also applied to pancreas in animal studies. RFA is primarily delivered to liver percutaneously or intraoperatively. EUS-guided RFA in a pig model proved that this modality can also be delivered to the pancreas trans-gastrically and cause well-demarcated coagulation zone. This modality, however, should be improved and refined to reduce the possible complications such as pancreatitis, gastric burn or perforation. Our group conducted EUS-guide RFA human trial for unresectable pancreatic cancer and showed technical feasibility and safety of EUS-RFA for pancreatic cancer. Further studies are required to see the long-term efficacy and survival benefit of this adjunctive modality for pancreatic cancer. EUS-RFA can be applied for the management of small pancreatic or peripancreatic tumors such as neuroendocrine tumor, adrenal tumor and small lymph node metastasis. Initial studies using EUS-RFA for the treatment of pancreatic neuroendocrine tumor showed very promising result without any serious complication. EUS-RFA seems to be very useful especially for the management of insulinoma.

Since the patient presents with recurrent hypoglycemic attack, insulinoma is generally small in size at the time of diagnosis. It can be easily ablated under EUS-RFA and the functionality can be controlled very effectively. EUS-RFA is also applied for the management of cystic tumor of the pancreas. However, only animal study are reported using GB and cystic duct of pig and more studies are required before direct human application. In conclusion, EUS-guided approach offers minimally invasive access for delivery of local ablation modalities including EUS-RFA. This area is a continuously evolving field and many studies are currently undergoing. Although many of these approaches are still investigational but will play a key role in the treatment of benign and malignant pancreatic disease in the future.

T12-16-IN08

EUS-Guided Interventions for Walled-off Pancreatic Necrosis

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In recent years, evidence suggests that a minimally invasive step-up approach is superior to conventional open necrosectomy, with decreased rates of the composite end point of major complications or death among patients with necrotizing pancreatitis and walled-off necrosis (WON). Since first described in 1992, EUS-guided transluminal drainage for pancreatic fluid collection has played a pivotal role and spread worldwide as a minimally invasive alternative to surgical and percutaneous drainage with reportedly high technical and clinical success rates. However, the clinical response rate of the conventional single transluminal gateway technique with single stenting for treating WON is not satisfactory (described as 45%–63%). Recently, various techniques, such as the use of wide-caliber lumen-apposing metal stents, multiple transluminal gateway technique and direct endoscopic necrosectomy have improved the clinical success rate of endoscopic management of WON. When conventional EUS fails to depict the WON reflecting solid necrotic components, contrast-enhanced EUS may be useful to clearly visualize target lesions and to decisively puncture them. We evaluated the clinical outcomes of the algorithmic step-up approach based on EUS-guided drainage for WON. The result shows the step-up approach based on EUS-guided drainage is an effective strategy for the management of WON, particularly in patients with serious comorbid conditions or in those with WON cavity extending to the pelvis, who are difficult to manage with endoscopy alone. More options, such as surgical necrosectomy should be considered.

In conclusion, EUS-guided intervention has become an essential treatment method of WON. The development of new dedicated devices for EUS-guided drainage would help make it a more sophisticated and promising procedure.

T12-16-IN09

Intraductal Ultrasonography (IDUS) for the Diagnosis of Biliopancreatic Diseases

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Although endoscopic retrograde cholangiopancreatography (ERCP) is the diagnostic procedure of choice for patients with pancreatobiliary lesions, it is limited in diagnostic accuracy. Intraductal ultrasonography (IDUS) is an imaging modality having unique characteristics and suitable for imaging of a narrow ductal cavity, its wall and the neighbouring structures. As IDUS uses high-frequency ultrasound (20 MHz), its image quality is very high within approximately 2-cm range of radius. The bile duct and the pancreatic duct, and therefore are good targets for the assessment by IDUS. Biliopancreatic IDUS is mainly performed through the papilla of Vater in the same session as endoscopic retrograde cholangiopancreatography (ERCP). Technically easy, IDUS is a valuable adjunct to endoscopic retrograde cholangiography that increases the ability to distinguish malignant from benign pancreatobiliary lesions.

T12-16-IN10

EUS for Biliary Tract Stricture

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Biliary and pancreatic diseases are common, but accurate image diagnosis are often challenging due to the complexities of structures and locations. There are wide ranges of possible diagnosis of biliary tract

strictures, including benign and malignant etiologies. Most biliary tract strictures are of malignant etiologies, such as pancreatic adenocarcinoma, cholangiocarcinoma, peri-ampullary cancer, gallbladder cancer, hepatocellular carcinoma, lymphoproliferative diseases, and metastatic disease. The benign causes of biliary tract stricture include inflammatory stricture, gall stone related Mirizzi's syndrome, chronic pancreatitis, primary scelrosing cholangitis, IgG4-related sclerosing cholangitis, iatrogenic bile duct injury following cholecystectomy and choledocholithotmy, and post-transplant strictures. The differentiation between benign and malignant strictures is very importance. Missing a diagnosis of malignant biliary stricture may result in delayed operation and impaired prognosis. However, up to 20% of patients with benign etiologies may receive unnecessary operation under the suspicion of malignant biliary strictures.

Transabdominal ultrasonography, multi-detector computed tomography (MDCT), or magnetic resonance imaging (MRI) are traditionally used to detect and to differentiate the biliary tract strictures. Endoscopic retrograde cholangiopancreatography (ERCP) is considered the gold standard diagnostic and therapeutic method for the biliary strictures. Endoscopic ultrasound (EUS) is increasingly being used in the evaluation of patients with biliary obstruction, especially for the distal biliary strictures. It has high sensitivity and accuracy for the diagnosis of malignant biliary tract strictures. EUS guided fine needle aspiration can provide the tissue diagnosis of biliary stricture, though the puncture tract seeding and peritoneal seeding is still a topic of concerns. With the continuing improvement of EUS and the development of accessories, EUS plays not only a diagnostic tool, but also an interventional modality to manage of biliary strictures. EUS guided tumor ablation, EUS guided pain control, EUS guided pancreatico-biliary drainage, and EUS guided gastrointestinal tract bypass are promising applications of EUS in the biliary tract strictures.

T12-16-IN11

Expanding Role of US in Diagnosis of Portal Hypertension and Cirrhotic Complications

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Color Doppler Ultrasonography (CD-US) has an advantage of being non-invasiveness, so many attempts to investigate the hemodynamic alterations in cirrhosis and the response to medical treatment of portal hypertension as well as morphologic change of liver have been made. In particular, any CD-US parameter that could be a suitable substitute for the invasive current gold standard for assessing portal hypertension by measuring hepatic venous pressure gradient (HVPG) and hepatic fibrosis evaluated by liver biopsy, would be highly desirable.

The presence of intrahepatic shunts resulting from portal hypertension can be helpful to diagnosis of portal hypertension and cirrhosis through novel characteristic CD-US index. It has been recently suggested that the extent of abnormality in Doppler hepatic vein (HV) waveform is associated with degree of HVPG as well as severity of hepatic fibrosis, and a change in HV waveform is closely correlated with that in HVPG.

Abnormal flattened HV wave form is thought to be due to hemodynamically blunting the effect of variations in central venous pressure during the cardiac cycle, which is arising from increased HV inflow via intrahepatic shunts secondary to portal hypertension. Moreover, under microbubble contrast enhancement, CD-US detection of decreased hepatic vein transit time due to presence of intrahepatic shunts can be useful to assess the severity of portal hypertension and grade of fibrosis.

However, for being reproducible and accurate, a cooperative training program of operators with strict examination protocol would be helpful to reduce the rate of intra-and inter-observer variation.

Consequently, developments of novel CD-US indices and techniques are ongoing to overcome the limitations of conventional CD-US methods in diagnosis of portal hypertension and cirrhosis, and some of them are enough to potentially allow widespread clinical use.

T12-16-IN12

Role of Microbubble-Based Contrast-Enhanced Ultrasound for the Assessment of Portal Hypertension

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Given the high incidence of chronic liver diseases, particularly in Asian Pacific region, diagnosis of portal hypertension (PH) is a key process in the daily medical care. The severity of PH is determined by the portal pressure, which is closely associated with the clinical manifestations and prognosis of cirrhosis patients. Hepatic venous catheterization is the only method to assess the hepatic venous pressure gradient (HVPG), a surrogate marker for directly measured portal pressure. However, because it is an invasive method involving a radiation exposure, non-invasive markers repeatedly available during the long-term clinical course are required.

Ultrasound (US) offers non-invasive and real-time evaluations for an anatomical structures and hemodynamics under physiological conditions. It may be the most frequently used imaging tool in the practical management of cirrhosis patients. Furthermore, with the development of digital imaging technologies and the availability of microbubble contrast agents, contrast-enhanced US may now be the definitive primary modality for detailed evaluation. Efforts have been directed at finding the benefits of this technique for the severity of liver disease in order to decrease the requirement for invasive procedures.

With these backgrounds, this presentation shows the recent progress in the application of contrast-enhanced US as the non-invasive assessment of PH.

T12-16-IN13

Doppler in Portal Hypertension

Antonio Carlos Matteoni de Athayde (Brazil)

Portal hypertension is a frequent complication in patients with chronic parenchymal liver disease, as can also occur in other entities, such as portal vein pathology. The B-mode echography demonstrates the portal vein dilation and the presence of collateral circulation. It is very important to seek to identify if there is collateral circulation, especially of the veins responsible for drainage of the lower esophagus, which will lead to the formation of esophageal varices, which may cause bleeding, a situation that can lead to life risk for the patient. The color Doppler is very useful to identify presence of flow in the portal vein, direction of the same, and associated with spectral Doppler measure the velocity, which can help to diagnose portal hypertension in portal veins of normal caliber. In the collateral circulation the color Doppler reveals the existence of flow and associated with the spectral Doppler characterize to treat effectively of venous vessels, and also the direction of the flow.

T12-16-IN14

The Role of Doppler Ultrasound in Cirrhosis

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In clinical hepatology, ultrasound (US) examination is necessary and widely used tool for disease diagnosis, assessment and monitoring. With prevalent viral hepatitis in Taiwan, both conventional

and color Doppler US are important for liver disease and cirrhosis evaluation. The change of portal flow, hepatic venous flow (wave form) and splenoportal index are proved to be correlated with the severity of liver cirrhosis. Color Doppler US provided important information about cirrhosis diagnosis, staging and prognosis in liver cirrhosis.

Besides the parenchymal change, color Doppler US could examine the hepatic vasculature and identify various kinds of vascular anomaly and shunts. The detection by color Doppler US of vascular thrombosis in cirrhosis and in liver cancer vascular invasion are also a key issue in clinical presentation and management.

T12-16-IN15

Application of Endoscopic Ultrasonography in Portal Hypertension

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Application of endoscopic ultrasonography (EUS) in portal hypertension includes predicting outcome of varices, EUS –guided treatment for varices and directly portal vein catheterization.

About sixty percentage portal hypertension patients have esophageal varcies. One third of them may have esophageal varcies bleeding. If untreated, the mortality rate is about fifty percent. Para-esophageal varices and peri-esophageal varices were collateral vessels outside the esophageal lumen. Although never bleeding, they are predictive factors for outcome of esophageal vaices. Esophageal varices, peri-esophageal varices and para-esophageal varices can be visualized adequately by EUS. The severity of peri-esophageal vairvces and para-esophageal varices shown in EUS is associated with esophageal varices formation. The peri-esophageal varices and para-esophageal varices in EUS are proven to be able to predict the efficacy of endoscopic treatment of esophageal varices, either for primary or secondary prophylaxis. Recently, studies also show that peri-esophageal varices and para-esphageal varices in EUS also predict pharmacological response of esophageal varices.

Free hand gastric varices obliteration by histocryl injection is the standard care of secondary prophylaxis. The shortcomings of free hand hisrocyl injection are high rebleeding rate and complications of embolism. The retrospective data of EUS guided angiotherapy is promising and showed to have lower rebleeding rate and complication of embolism. Several prospective studies are on going now.

In animal studies, EUS guided portal vein catheterization is a feasible method. It can be used to measure portal pressure directly and to create intrahepatic portosystemic shunt.

T12-16-IN16

Spleen: The Forgotten Organ

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Since Hippocratic times the role of the spleen has been controversial. Galen called it an organ of mystery. The spleen is to the circulatory system as the lymph nodes are to the lymphatic system. It is an ingeniously designed filter for the blood and a site of immune responses to blood-borne antigens. Spleen is a forgotten organ as because we can survive with a spleen. It is important both in health and in disease. The more we learn, the more we realize that we are just scratching on the surface of life. We do not know the whole story about anything. Because of its protected situation in the body, clinical evaluation of a normal spleen is often unsatisfactory. Ultrasonography of the spleen remains a valuable diagnostic tool for malignancies and benign lesions of the spleen.

T12-16-IN17

CEUS in Crohn's Disease

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Ultrasonography has advanced the diagnostic potential of ultrasound in the assessment of Crohn's disease. Ultrasonography is not only a method used by radiologists, but also a clinical tool that can be applied to evaluate the patient bedside. The GI wall is most often visualized as a layered structure normally consisting of 3-9 layers, depending on the frequency applied, but usually 5 layers are observed. When examining the intestines, it is preferable to use frequencies above 7.5 MHz to enable optimal visualisation of wall layers, thickened bowel walls and target lesions.

Disease activity in Crohn's disease using bowel wall thickness and Doppler measurements as a marker of inflammation can also be obtained by ultrasound. By adding CEUS, enhancement in different wall layers can be evaluated and quantified in Crohn's disease and this correlates to clinical activity index (CDAI) with good sensitivity and specificity. Quantitative measurements of bowel enhancement obtained by CEUS also correlate with severity grade determined at endoscopy.

In patients with a stricture of the bowel and resultant bowel obstruction, it is important to determine if there is active inflammation at the site of stricture or if the obstructed segment is fibrotic. Preliminary studies indicate that CEUS appears to be useful in the recognition of a cicatricial stenosis in patients with Crohn's disease. Using CEUS, the active inflammatory components will enhance whereas the fibrotic stricture will enhance less.

Distinguishing abscesses from inflammatory infiltrates is an important clinical task in the management of Crohn's disease. If the tissue close to an affected bowel loop is completely devoid of microbubble signals, most likely this lesion represents avascular abscesses rather than inflammatory infiltrates. In the upcoming update of EFSUMB guidelines on CEUS, new indications are monitoring of treatment response and follow-up of transplanted patients.

In conclusion, CEUS is a useful clinical tool in the management of patients with Crohn's disease, particularly to estimate disease activity and to diagnose complications.

T12-16-IN18

Emergency Medicine in GI Tract

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In addition to procedural guidance, diagnostic ultrasound is increasingly used within the emergency department for a wide range of conditions. Ocular, lung, cardiac, abdominal, genitourinary, vascular and musculo-skeletal ultrasound is now routinely performed in emergency departments around the world. This talk will discuss both the similarities and differences to ultrasound performed in imaging departments and give examples of both the range and utility of ultrasound in the emergency department, and the challenges faced in training emergency practitioners in this modality.

T12-16-IN19

Advanced Endoscopic Ultrasound Techniques: Elastography, Contrast-Enhancement, Confocal Laser Endomicroscopy, etc.

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Endoscopic ultrasound (EUS) has recently evolved through technological improvement of equipment, with a major clinical impact in pancreatic diseases.

State-of-the-art EUS equipment now includes real-time sono-elastography, which might be useful for better characterization of lesions and increased accuracy of differential diagnosis. Contrast-enhanced EUS imaging is also available, being used already for the differential diagnosis of focal pancreatic masses. The recent development of low mechanical index contrast harmonic EUS imaging offers hope for improved diagnosis, staging and monitoring of anti-angiogenic treatment. 3D-EUS techniques can be applied to enhance the spatial understanding of EUS anatomy, especially for improved staging of tumors, obtained through a better assessment of the relationship with major surrounding vessels.

Despite the progress gained through all these imaging techniques, they cannot replace cytological or histological diagnosis. However, real-time optical histological diagnosis can be recently achieved through the use of single-fiber confocal laser endomicroscopy techniques placed under real-time EUS-guidance through a 19G needle. The term "optical biopsy" is thus defined as a method that uses light to enable visualization of tissue details and thus allow the operator to make an instant diagnosis, which was previously available only by histology or cytology. Most of these techniques might generate a huge advantage through usage of molecular imaging approaches based on various targeted fluorescent molecules, thus allowing disease- and patient-specific targeted treatment, as well as follow-up of specific effects of the treatment. The term "translational imaging" was further coined to describe the availability of various techniques that might simultaneously offer structural and functional information at subcellular resolutions, while being translated into current clinical practice.

T12-16-IN20

Vascular Assessment of Gastrointestinal Tracts by Color Doppler Ultrasound

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Transabdominal ultrasound(US) may be regarded as the first imaging procedure for the diagnostic work-up and follow-up of gastrointestinal(GI) tract disease in clinical practice. Unlike computed tomography(CT) and magnetic resonance imaging(MRI), it provides an available, noninvasive, inexpensive method for evaluating the gut without the use of ionizing radiation. Color Doppler US(CDUS) can yield useful information about blood flow in splanchnic vasculature, the bowel wall and its supporting mesentery when used in conjunction with gray-scale US finding and clinical symptoms.

For splanchnic vasculature, CDUS can be applied in the diagnosis of portal hypertension-related gastric or duodenal varices and cavernous transformation, midgut malrotation, abdominal aortic dissecting aneurysm, mesenteric ischemia/ aeroportia and arterial-venous shunting. For intramural vasculature, CDUS with state-of-the-art imaging equipment(eg. Superb microvascular image) allows sensitive detection of blood flow in the abnormal bowel wall. Hypervascularization in disease activity of inflammatory bowel disease, infection/inflammation process (eg. bacterial/TB enterocolitis, pseudomembranous colitis, diverticulitis) and abdominal mass (eg. colon cancer, gastrointestinal stromal tumor, actinomycosis, hematoma) can be evaluated by CDUS. Viability of bowel loops can also be evaluated by CDUS and lack or decrease of bowel Doppler signal suggests impending vascular insufficiency (eg. incarcerated hernia, strangulation of bowel, intussusceptions). Diminished vascularity is a specific, although probably not sensitive, sign of bowel ischemia.

Although gray-scale US with CDUS should not be considered a replacement of CT/MRI, there is value in a multimodality imaging approach when assessing and following up patients with acute and subacute abdominal symptoms. In this talk, the characteristic sonographic features of the GI disorders will be demonstrated by static images and dynamic cine clips.

Free paper

OPT12-001

The Effectiveness of Noninvasive Transabdominal Ultrasound Evaluation in the Diagnosis of Sinusoidal Obstruction Syndrome after Hematopoietic Stem Cell Transplantation

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Objectives: Sinusoidal obstruction syndrome (SOS) is one of the complications after hematopoietic stem cell transplantation (HSCT). The widely used clinical criteria can efficiently diagnose SOS, but cannot determine the severity or assess the treatment response. To address the issues, we propose a new transabdominal ultrasound (US) scoring system of SOS.
Methods: From 2008 to 2013, 113 patients underwent HSCT were enrolled in the study. The patients were scored by three factors in US findings: gall bladder wall thickness, existence of ascites, and appearance of blood flow signal in paraumbilical vein. We further assessed the effectiveness of the addition of some liver function tests to the US scoring. Statistical analysis was performed by t-test ($P<0.05$).
Results: Ten patients were diagnosed as SOS (7.5%) by clinical criteria. The US SOS score (mean±SD) of SOS-group and non-SOS-group were 3.6±1.1 and 0.6±0.8, respectively ($P<0.01$). The most effective cut off value was 3 (area under the receiver operating characteristic curve: 0.95). When total bilirubin level (no less than 1.0 mg/dl) was included in the score, specificity, accuracy, and negative predictive value were improved. Furthermore, the US scores were elevated prior to diagnosis in some cases, which suggests the US scoring system is useful for diagnosis in early stage. Other parameters didn't contribute to SOS diagnosis in combination with US scoring. More analysis is needed to demonstrate the correlation with severity and outcomes.
Conclusions: Our US SOS scoring system is effective in making a diagnosis of SOS, especially in combination with bilirubin levels.

OPT12-002

Measurement of Ultrasound Attenuation for Quantifying Amount ff Fat in Chronic Liver Disease

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Objectives: Several studies about the evaluation of steatosis based on ultrasound attenuation measured by using ultrasound scanners

have been reported (Fujii Y. et al, 2002, Kanayama Y. et al, 2013). However, some more investigations seem to be needed toward the practical use. CAP (controlled attenuation parameters), installed in Fibroscan (Echosens) is an example of practical use, but it is not a genre of imaging modality, also requires a dedicated probe. In this study, we tried to measure ultrasound attenuation from B-mode-based RF signals taken by a conventional ultrasound scanner.

Methods: RF signals for 125 consecutive chronic liver disease (CLD) patients who underwent liver biopsy on the same day were acquired at transmission and reception frequency of 4.0 MHz. Ultrasound scanner used was LOGIQ E9 (GE Healthcare) with a 3.5 MHz convex probe (C1-6-D). Steatosis and liver fibrosis were staged and graded during the pathological analysis of bioptic specimens. Steatosis was categorized as S0: $< 5\%$; S1: 5-33%; S2: 34-66%; or S3: $\geq 67\%$. Attenuation coefficient (AC) [dB/cm/MHz] of a region of interest (ROI) was measured from the RF signals of the corresponding B-mode image. As the calculation method, first we compensated the envelope of the signal with the reference signals taken from a reference agar-graphite phantom with known attenuation (SONO403, Gammex Inc., 0.5 ± 0.05 dB/cm/MHz). This procedure can eliminate complicity of the beam shape due to the focal ultrasound. Secondly, we measured AC by calculating a slope of the signal envelope compensated. A position of the ROI was selected manually by an operator to avoid the diaphragm or large vessels. The slope was calculated by least squire method.

Results: The mean and standard deviation of attenuation coefficient values in steatosis stages S0 ($n = 52$), S1 ($n = 45$), S2 ($n = 20$), and S3 ($n = 9$) were 0.47 ± 0.08, 0.56 ± 0.08, 0.67 ± 0.06, and 0.73 ± 0.08 dB/cm/MHz, respectively. The mean of AC values demonstrated a stepwise increase with increasing severity of steatosis ($P < 0.0001$). A significant correlation between AC and the percentage steatosis was found ($r = 0.81$, $P < 0.0001$). On the other hand, the mean and standard deviation of AC values in liver fibrosis grades F0 ($n = 16$), F1 ($n = 14$), F2 ($n = 13$), F3 ($n = 3$), and F4 ($n = 21$) were 0.49 ± 0.07, 0.47 ± 0.10, 0.46 ± 0.11, 0.50 ± 0.02, and 0.52 ± 0.06 dB/cm/MHz. A significant correlation between AC and the percentage liver fibrosis wasn't found ($r = -0.03$, $P > 0.5$).

Conclusions: Attenuation coefficient measured from B-mode-based RF signals demonstrated a stepwise increase with increasing severity of steatosis and had a strong correlation with the percentage steatosis. On the other hand, AC much less correlated with the percentage liver fibrosis. B-mode images are thought to be a good assistance for the measurement. We conclude that our method is useful for a quantifying amount of fat in CLD.

OPT12-003

Sonography of Inflammatory Bowel Disease (IBD) in Early State of Ultrasound Knowledge - Reasonable or Intimidating?

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Objectives: Gastrointestinal ultrasound is one of the most difficult techniques to learn in sonographic imaging. Therefore, gastrointestinal ultrasound is no longer listed under the basic but advanced section in German ultrasound training courses. This poses the question, whether an introduction into the complex ultrasound imaging technique of gastrointestinal tract, in particular IBD, should only be reserved for advanced sonographers.

Methods: In this pilot study, 57 pathologic findings of IBD (e.g. wall thickening, fistula, stenosis, bowel obstruction, abscesses) were showcased to a total of 20 ultrasound novices during one year. A practical training to replicate those findings followed. Particular emphasis was placed on imparting knowledge on filtering patients upon sonographic findings who need to undergo further radiologic imaging and/or surgical intervention. Finally, the novices were asked, whether the training sessions increased their willingness to keep learning ultrasound or rather made them feel intimidated.

Results: 57 cases of IBD were demonstrated to the novices, 37 wall thickened intestinal walls, 7 abscesses, 3 fistulas and 10 stenosis, whereas two of them had acute bowel obstruction that required rash surgical intervention. In total, 88% of the demonstrated sonographic findings could be replicated. All cases, that needed further radiologic imaging and/or surgical interventions were identified. 19 out of 20 sonographic beginners stated to be more motivated to apply gastrointestinal ultrasound in their daily routine.

Conclusions: Doing hands-on, practical trainings on detecting sonographic findings in patients with IBD early-on, seems to boost the novice's interest in ultrasound imaging and increase their willingness of future learning rather than to intimidate them.

OPT12-004

Real-Time Fusion Imaging of Ultrasound and CT for Chest Wall Liposarcoma via Automatic Liver Registration as an Anchor

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Objectives: Real-time fusion imaging can reconstruct pre-acquired CT or MR and fuse them with ultrasound to simultaneously display ultrasound and its corresponding CT or MR images. This method has been widely reported in the diagnosis and intervention of focal liver lesions, and its use has been demonstrated by studies for diseases of breast, extremities, and prostate. Recently, automatic registration can use algorithms to automatically extract 3D spatial coordinates from liver vasculature or surface contour, and simplify the work for a precise imaging fusion of liver. Liposarcoma is one of the most common soft tissue tumors but its involvement of chest wall is rare. Complete resection is usually considered the treatment of choice for liposarcoma to minimize local recurrence. However, precise preoperative localization can be challenging for inconspicuous lesions in chest wall.

Methods: Pre-acquired contrast enhanced CT from chest to liver was imported, processed, and reconstructed by the ultrasound machine (EPIQ 7, Philips). A manual sweep with the ultrasound transducer (C9-2, Philips) was performed to acquire a partial liver volume. The shapes of the diaphragm and liver surface were extracted, and then automatically aligned with that from the CT volume. Then real-time ultrasound was performed in conjunction with fused CT images to characterize chest wall lesions.

Results: A 61-year-old man with history of liposarcoma was presented with recurrence in right posterior chest wall. He had multiple resections for repeated recurrence in the trunk where the skin surface was extensively scarred. Fusion imaging with automatic registration was attempted. Real-time fusion imaging of ultrasound and CT revealed two hypoechoic nodules in the chest wall. The locations of recurrence were marked on the skin. The tumors were successfully exposed and removed upon exploration at the marks. The histopathological findings suggested that the removed chest wall tumors were dedifferentiated liposarcoma.

Conclusions: This case demonstrates success of fusion imaging with ultrasound and CT for chest wall liposarcoma. The novel use of automatic liver registration as an anchor point for fusion is a feasible approach to identify chest wall soft tissue tumors. This method can be helpful in characterizing inconspicuous chest wall lesions and providing precise guides for further intervention.

OPT12-005

Algorithmic Approaches to the Diagnosis of Gallbladder Intraluminal Lesions on Ultrasonography

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Objectives: To summarize the algorithmic approach to the diagnosis of polypoid lesions of the gallbladder on ultrasonography.
Methods: We reviewed the imaging database from the picture archiving and communication system (PACS) in our hospital. After extensive literature review, typical ultrosonographic characteristics with pathological diagnosis were categorized according to the proposed algorithmic approaches flowchart. Our recent experiences in contrast-enhanced ultrasonography are also described.
Results: Polypoid lesions of the gallbladder are common findings at abdominal ultrasonography. The term "polypoid" is defined as a focal elevation or a protrusion into the gallbladder lumen from the wall. However, not all polypoid lesions are malignant. In fact, most of the incidentally found polypoid lesions in the gallbladder are benign. Since most malignant tumors in the gallbladder are asymptomatic and usually diagnosed when advanced, differentiation between malignancy and benignity is crucial. Mellnick VM, et al. classified different spectrums of the gallbladder lesions into pseudotumors, benign tumors and malignant tumors. To evaluate a gallbladder polypoid lesion on ultrasonography, we suggest to confirm a "true" polypoid lesion first. After a "true" polypoid lesion is established, the next step is to distinguish pseudotumors from true tumor lesions. Finally, the differential diagnoses should be grouped into benign and malignant tumors separately. Several clinical factors have also been described to aid the differential diagnosis, including age, comobilidities and presence of clinical symptoms. The algorithmic diagnostic approach of gallbladder polypoid lesions is addressed.
Conclusions: Ultrasonography is the first-line diagnostic tool for gallbladder polypoid lesions. It is important for radiologists to understand imaging characteristics of these lesions.

OPT12-006

Utility Of Endoanal Ultrasound In Evaluation of Patients with Anorectal Abscess

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Objectives: Study was to assess the accuracy of endoanal ultrasonography for preoperative assessment of anorectal abscess(ARA) with reference to the types. Specifically, availability as a surveillance tool to monitor the residual or missed secondary(daughter) abscess after primary operation, was evaluated.
Methods: 283 patients with ARA had the operation. All patients underwent pre and post-operative physical examination and endoanal ultrasonography. Agreement between the physical and endosonographic findings and the surgical findings were evaluated with reference to 4 types of classification; perianal(PA), ischiorectal(IR), intersphincteric(IS), supralevator(SL) type of abscesses. The changes and differences in findings of endosonographic assessment between pre and post-operative periods were also evaluated.
Results: The incidence of the sonographic subtypes were; PA= 178(62.9%); IR= 68(24.0%); IS= 20(7.1%); SL type= 17(6.0%). Overall accuracy of ultrasonography was significantly higher than that of physical examination in detecting the primary abscess (92.8% vs. 83.0%, respectively, $p < 0.01$). The accuracy was as follows: sensitivity, 95 percent; specificity, 68 percent; positive predictive value, 91 percent; negative predictive value, 65 percent. Localization of IR type with horseshoe extension(n=14) and distantly positioned SL type(n=10) were attributed to the low value of specificity and negative prediction.
Conclusions: Endoanal ultrasonography is reliable and useful for pre and post-operative localization and assessment of ARA. Specifically, endoanal ultrasound quickly gained usefulness for monitoring residual or missed secondary abscess pocket after primary operation.

OPT12-007

Local Phase-Based Anisotropic Diffusion for Speckle Reduction

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Objectives: Speckle in ultrasound images could be a useful pattern for tracking important structures, such as dilatate bile ducts and gallbladder, polycystic liver and multiple large hydatid cysts of liver, but may also be an annoying noise that degrades the image quality. This paper proposes an adaptive diffusion process to enhance the quality of ultrasound images by reducing the speckle noise while simultaneously preserving the features in the image, so as to simplify the use of ultrasound images in clinical diagnosis and therapy.
Methods: We incorporate a local phase-based edge detector, called feature asymmetry (FA), into the forward-and-backward diffusion. Unlike intensity-based operators, the FA measurement is theoretically intensity-invariant and it can effectively discriminate the edges from noise even if they have similar gradient. Attributing to this property, forward diffusion is promoted in speckled regions while smoothing is prohibited on the edges, resulting in feature preserving speckle reduction. Meanwhile, the backward diffusion in the proposed method can better protect the intensity contrasts of different features by reserving the diffusion process happened at features. In addition, the parameters involved are automatically computed in order to enhance the robustness of our method so that it can be adapted to different images without repetitive parameter tuning.
Results: We validate the performance of the proposed method with many clinical ultrasound images, and evaluate the segmentation accuracies on the despeckled results. Specifically, we compare our method with several state-of-the-art speckle reduction filters: SRAD, OBNLM, SUSAN AD and ADLG. Experimental results show that our method greatly reduces the noise and best preserves the boundaries of important structures. Furthermore, the segmentation results on despeckled images are evaluated with two widely used metrics: Hausdorff distance (HD) and average minimum Euclidean distance (AMED). Small values of HD and AMED indicate high segmentation accuracy. As can be seen in the experiments, our method achieves the lowest values of HD and AMED measurements, indicating best performance.

Conclusions: In this paper, we propose a new variant of anisotropic diffusion for speckle reduction by integrating a local phase-based edge detector to guide the diffusion processing. Our method can suppress the noise and maintain the features in the image as the FA measurement can guide the forward-and-backward diffusion to perform despeckling adaptively. The robustness of the proposed method is further improved by automatically computing the parameters that affect the performance.

OPT12-008

Sonographic Findings of Xanthogranulomatous Cholecystitis: A Pictorial Review

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Objectives: Xanthogranulomatous cholecystitis(XGC) is a rare inflammatory disease of the gallbladder characterised by a focal or diffuse destructive inflammatory process, with accumulation of acute and chronic inflammatory cells, fibrous tissues, and lipid laden macrophages. Its significance lies in the fact that it is a benign disease that is difficult to differentiate from gallbladder carcinoma which has a poor prognosis.1 Ultrasound nevertheless is a useful screening tool for suspected gallbladder pathology.The purpose of this exhibit is to:1. Describe the sonographic appearances of XGC and2. Present the corresponding CT, MRI or histological findings, with a review of the literature.

Methods: We identified six cases of XGC with ultrasound in our institution between August 2009 and April 2017, five of which were confirmed on histology and one diagnosed based on serial imaging. A review of the literature was also made.

Results: Focal or diffuse thickening of gallbladder wall as well as co-existence of gallstones, was seen in all cases, which concurred with those reported in the literature. We observed marked gallbladder mural thickening of $>$ 10 mm thick with hypoechoic intramural nodules in all cases. The mural thickening could be symmetrical or asymmetrical, with varied degrees of echogenicity.

Conclusions: While the diagnosis of XGC remains challenging on imaging, a better understanding of its sonographic appearances will increase its awareness and potentially enable a more accurate preoperative diagnosis that is essential in surgical planning and better patient outcome.

OPT12-009

Diagnosis of Pancreatic Neuroendocrine Tumors with Endoscopic Ultrasound - A Rare Case of Multiple Endocrine Neoplasia Type 1 (Men-1 Syndrome)

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Objectives: Pancreatic neuroendocrine tumors (PNETs), one of MEN 1, is a rare disease. Early diagnosis of PNETs is difficult.

Methods: A case of PNETs was included.

Results: A 54-year-old female was a patient with past history of type 2 DM, hypertension for a long time and regular follow up in our hospital. Her mother also had past medical history of rectal adenocarcinoma post surgical resection and advanced pancreatic adenocarcinoma post gastrojejunostomy. Seven years ago, she had abdominal fullness and abdomen l ultrasound revealed an anechoic lesion about 5.8mm in the pancreatic head. Abdominal computed tomography showed several subcentimeter low densities at pancreatic head and body and pancreatic cysts was impressed. However, the size of the pancreatic cystic lesions increased and up to 1.3cm in abdominal CT. CA 199 1.05 U/mL and CEA 2.11 ng/mL were found. Endoscopic Ultrasound showed multiple anechoic to hypoechoic nodule in the pancreas, size up to 12.8x10.9 mm and pancreatic neuroendocrine tumors was diagnosed after fine needle aspiration. Two hyperfunctioning parathyroid glands in parathyroid scan and a pituitary microadenoma (5*7mm) were also found in the patient. Thus multiple endocrine neoplasia type 1 (MEN 1) was diagnosed.

Conclusions: MEN 1 is a rare disorder that causes tumors in the endocrine glands and parts of the GI tract. The tumors are usually benign. A mutation in a tumor suppressor gene on chromosome 11q13, leads to hyperplastic and neoplastic disorders of endocrine organs, including the parathyroid gland (95 %), anterior pituitary gland (30%), and pancreas. Pancreatic neuroendocrine tumors (PNETs) are found in 30%– 75% of patients with MEN1 and are most often nonfunctional. An early diagnosis and timely intervention is thought to lead to a better long-term outcome. Endoscopic ultrasound (EUS) is the most sensitive tool to screen for PNETs and enables visualization of small lesions, like our case, that are frequently missed with computed tomography, magnetic resonance imaging (MRI), or somatostatin receptor scintigraphy.

OPT12-010

Spectrum of Ultrasound Findings of Premalignant Cholangiocarcinomas

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Objectives: To study spectrum of sonographic findings of cholangiocarcinoma premalignant lesions including Biliary Intraepithelial Neoplasm (Bil-IN) and Intraductal Papillary Neoplasm of Biliary tract (IPNB).

Methods: Ultrasonography (US) finding of the pathologic proved Bil-IN and IPNB are collected and analyzed from our ongoing cohort of cholangiocarcinoma surveillance program at Ban-Luang districted, Nan province, Northern Thailand, which involves 4,200 populations who are age between 30-60 in Ban Luang district. Liver ultrasonography is performed every 6 months for cancer detection and the patient with abnormal finding will be sent for CT/MRI/MRCP studies and subsequently surgery for cholangiocarcinoma suspicious lesions.

Results: At present of 4 years surveillance period, there are 7 and 6 cases of premalignant lesions proved cases of Bil-IN and IPNB respectively. US finding of Bil-IN includes focal bile duct narrowing without mass, cystic dilatation peripheral bile duct and focal bile duct obstruction associated with parasitic egg or cell debris.IPNB presents as focal bile duct dilatation without cause of obstruction, complex cystic lesion with demonstrable connection to biliary system orintraductal nodule which all of them are hyperechogenic. The echogenic nodule from IPNB may present at tubular-shaped due to bile ductal alignment.

Conclusions: US findings of premalignant lesions of cholangiocarcioma varies and majority non-specific. Understanding disease spectrum of premalignant cholangiocarcioma lesions on US may help improve early detection.

OPT12-011

Pancreas Ultrasound among Young Adult Diabetes Melitus Type II with Abdominal Tuberculosis

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Objectives: To describe ultrasound finding of young adult (18-35 years) diabetes melitus type II with lung and abdominal tuberculosis had ever severe epigastric pain and vomiting history suspected acute pancreatitis and complained dyspeptic syndrome for years.
Methods: This descriptive study conducted at Stela Maris Hospital and Lukas Hilisimetano Government Hospital South Nias, North Sumatera from April-July 2015. Data were abstracted from medical records of diabetes melitus type II patients who were known as diabetic since 18-35 years old; with abdominal and pulmonary tuberculosis. Clinical diagnosis and ultrasound was examined with b/w ultrasound and convex probe by one certified ultrasound internal medicine specialist.
Results: N=26, 17(65,4%) female and 9(34,6%) male, with recurrent epigastric pain history, some with chronic recurrent bouts of epigastric pain radiating to the back, nausea, anorexia, abdominal distension, vomiting, chronic diarrhoea, with/ without underweight. All patients with pulmonary TB (positive X ray, negative microscopic smear sputum), peritoneal dry type and small bowel tuberculosis. Amilase and lipase were not available. Pancreas ultrasound finding were heterogeneous hyperechoic, focal/segmental/diffuse hyperechoic lesion, irregular pancreatic margin with normal or decreased pancreas size, in addition of some irregular oval/round lesions (patchy hyperechoic non-shadowing with an irregular rim of lower echodensity).
Conclusions: Ultrasound finding of pancreas among young adult diabetes melitus type II with abdominal tuberculosis suspected a chronic tuberculosis process of pancreatitis.

OPT12-012

Is There Consensus among Sonographers and Radiologists in Grading Fatty Liver Disease and Detecting Liver Pathological Features in B-Mode Images?

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Objectives: Hepatic steatosis is the leading cause of chronic liver disease. Reliable detection and staging of liver disease using ultrasound is important to facilitate diagnosis and treatment. The aim of this study was to evaluate the interobserver agreement between trainee sonographers, qualified sonographers and radiologists in grading non-alcoholic fatty liver disease (NAFLD) and detecting common liver pathological features on B-mode images.
Methods: 150 B-mode liver ultrasound images from 50 adult patients referred for abdominal ultrasound were obtained retrospectively from a PACS system. The images were independently graded for the severity of hepatic steatosis (normal, mild, moderate or severe) and the detection of incidental findings, focal fatty sparing, liver surface irregularity and rounded liver edge (present or absent) by 17 qualified, six trainee sonographers and six radiologists. Fleiss' kappa statistic was used to calculate interobserver agreement.
Results: The interobserver agreement rates among trainee sonographers for the detection of incidental findings, focal fatty sparing, liver surface irregularity and rounded liver edge were: $\kappa = 0.243$, 0.486, 0.155 and 0.079 respectively. Among qualified sonographers, the agreement rates were: $\kappa = 0.323$, 0.428, 0.167 and 0.152 respectively. Among radiologists, the agreement rates were: $\kappa = 0.156$, 0.266, 0.015 and 0.154 respectively.
Conclusions: Visual assessment of NAFLD and common liver pathology in B-mode imaging has low interobserver agreement among sonographers and radiologists. The low agreement levels are likely caused by a lack of standardised assessment criteria. The development of standardised criteria for staging common liver pathological features are recommended.

OPT12-013

Motion Mode Abdominal Ultrasonography for Hepatic Portal Vein Gas Detection: The Meteor Shower Sign

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Objectives: The detection of hepatic portal vein gas is well-established in the bright mode ultrasonography. This method, however, may need patient cooperation and need to be recorded with multiple image frames, or by a cine technique. Herein, we introduce a novel solution to detect hepatic portal vein gas by the motion mode ultrasonography in two cases.
Methods: Case report and literature review.
Results: The first case involved an 87-year-old male with altered mental status. The second case involved a 68-year-old male who complained periumbilical pain and gross hematuria. In both cases, hepatic portal vein gas were recognized as various oblique direction linear echogenicities (the meteor shower sign) on the motion mode ultrasonography, and were also noted by the computed tomography and the bright mode ultrasonography with cine images.
Conclusions: The two cases illustrate that the meteor shower sign on the motion mode ultrasonography can depict flowing air bubbles in the portal vein and is useful in clinical applications.

OPT12-014

The Role of Us in Masses in the Groin. Report of a Case and Review of the Literature

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Objectives: Ectopic decidual reaction has been described in various intraperitoneal locations. We present a case of unusual ectopic decidual reaction in the groin mimicking inguinal lymphoma on ultrasound in a pregnant woman. The role of US in masses in the groin will furthermore be presented.
Methods: Case report and literature review.
Results: A pregnant woman presented with a lump in the groin. US of the groin showed a 2.5-cm hypoechoic, well-demarcated, homogeneous mass located subcutaneously. The mass was vascular on color Doppler examination; thus, a non-vascular mass (i.e. a cyst or a hematoma) could be excluded. The finding was interpreted as a pathologic lymph node (reactive or malignant). US-guided 1.2 mm (18 gauge) Tru-Cut biopsies were taken from the mass under local anesthetic. Histologic examination revealed decidualized tissue consisting of diffusely arranged polyhedral cells with abundant eosinophilic cytoplasm and round inconspicuous nuclei, some with nucleoli. The findings were characteristic for ectopic decidua. Three-month post-delivery US scan showed that the mass had shrunk to 1.3 cm. It was not palpable anymore. The patient was managed conservatively, and no further follow-up was required.
Conclusions: US has a great role in diagnosing masses in the groin. The use of Color Doppler and US contrast will be discussed together with the use of US-guided biopsy and puncture/drainage.

OPT12-015

Sonographic-Guided Percutaneous Transhepatic Biliary Drainage aia Peripheral Access: Evaluation of Safety and Technical Efficacy

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Objectives: Biliary drainage is an important technique for decompression in biliary obstruction, regardless of what causes of obstruction. Percutaneous transhepatic biliary drainage is the first choice for the interventional radiological procedure for treatment of obstructive jaundice. The purpose of this study was to evaluate the safety and efficacy of percutaneous transhepatic biliary drainage via peripheral access under sonographic guidance for treatment of obstructive jaundice.

Methods: We retrospectively reviewed 61 percutaneous transhepatic biliary drainage procedures in 58 patients with obstructive jaundice over a 2 year period. All patients underwent percutaneous transhepatic biliary drainage under sonographic guidance. The efficacy of this technique was defined as inserted drainage tube enabling adequate bile drainage and decreased the value of bilirubin.

Results: Fifty seven patients (98.3%) had successful percutaneous transhepatic biliary drainage under sonographic guidance via peripheral access. Percutaneous transhepatic biliary drainage procedure was successfully achieved in 45 (97.8%) procedures via right lobe liver approach and 15 (100%) procedures via left lobe liver approach. The mean number of puncture per patient was 3.50 (range, 1–10). The value of total bilirubin of all patients was decreased within three days after procedure. There were four minor complications (6.6%, 4/61) without further treatment.

Conclusions: Percutaneous transhepatic biliary drainage via peripheral access under sonographic guidance is a safe and effective treatment of patients with obstructive jaundice.

OPT12-016

Full-Automatic Image Fusion of Real-Time Ultrasound and MR/CT Images for Radiofrequency Ablation of Hepatic Malignancies

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Objectives: To compare the registration error, time required for the image fusion and clinical outcomes of manual and full-automatic image fusion of ultrasound (US) and MR/CT images for radiofrequency ablation (RFA) of HCC and colorecatl cancer liver metastasis (CRLM).

Methods: 67 patients with HCC or CRLM were prospectively enrolled. Patients are randomly assigned to a) manual fusion group, or b) automatic fusion group. Two interventional radiologists performed RFA for HCCs or CRLM with manual or full-automatic image fusion of real-time US and MR/CT. Time for image registration (sec), number of point locks, registration error (mm) and technical success rate were compared between the manual group and the automatic group.

Results: 32 HCCs and one CRLM were treated using the manual image fusion and 34 HCCs were treated using the automatic image fusion. Mean sizes of HCCs were 1.60 cm for the manual fusion and 1.63 cm for the automatic fusion ($p=0.903$). Averages of time for image registration, number of point locks and the registration error were 149 sec, 3.6 and 6.0 mm for the manual group, and 147 sec, 3.4 and 5.6 mm for the automatic group, respectively, and there were no significant difference. Technical success rate was 97.0% (32/33) for the manual group and 97.1% (33/34) for the automatic group and there was no significant difference between each other. ($p=1.000$).

Conclusions: The technical performance of the full-automatic fusion technique is comparable to that of manual fusion technique.

OPT12-017

Risk Factors of Liver Dysfunction Induced by Microwave Ablation in Patients with Hepatocellular Carcinoma

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Objectives: To investigate the risk factors of the aggravation of liver function induced by microwave ablation (MWA) of patients with hepatocellular carcinoma (HCC).

Methods: We retrospectively reviewed the liver function of 498 patients with HCC undergoing MWA treatment. The dynamic changes of liver enzymes and Child-Pugh scores were observed. The potential risk factors, including the relative position between the tumor and portal vein (PV), tumor numbers, ablation volumes, Child-Pugh classifications, platelet, APRI and MELD scores, were analyzed. Based on the relative position between the tumor and PV, the tumors of the patients were divided into four groups, (1) far away from PV; (2) close to the third branch of PV ($<$ 5mm); (3) close to the second branch of PV ($<$ 5mm); (4) close to the first branch of PV ($<$ 5mm).

Results: Complete response was achieved in 409 (98.08%) of 417 patients with tumors far away from the PV and in 89 (95.70%) of 93 patients with tumors close to a branch of the PV. Large fluctuations in the levels of ALB, ALT, AST and TBIL were observed three days after treatment, while the concentrations of ALP and γ-GGT were relative stable. 13.86% (69/498) patients suffered from liver function damage, that is, having an increase of Child-Pugh score by two three days after MWA. The incidences of liver dysfunction of the patients with tumors close to PV, more than three tumors, ablation volumes lager than or equal to 22.5 cm3, Child-Pugh classification B, APRI $>$ 1.6, MELD $>$ 30 or PLT $<$ 110 $\times$ 109/L were 53.85%, 46.15%, 20.60%, 24.24%, 31.53%, 22.55% or 18.92%, respectively, much higher than those of patients without above characteristics.

Conclusions: MWA can cause a transient deterioration of liver function. Patients with tumors close to PV, large numbers of tumors or large ablation volumes may present a great fluctuation of liver enzymes and an aggravation of liver dysfunction. In addition, poor liver reserve function is a risk factor of liver function damage but not the elevations of liver enzymes after MWA.

OPT12-018

Contrast-Enhanced Ultrasound Guided Biopsy of Undetermined Abdominal Lesions: A Multidisciplinary Decision Making Approach

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Objectives: To investigate the value of contrast-enhanced ultrasound (CEUS) guided biopsy of undetermined abdominal lesions in multidisciplinary treatment (MDT) decision making approach.

Methods: Between Jan 2012 and Dec 2015, 60 consecutive patients (male 37, female 23, mean age, 51.3 years $\pm$ 14.6) who presented with undetermined abdominal lesions were included. CEUS was performed with injection of 2.4ml SonoVue® (Bracco, Italy). Core needle (16 Gauge) percutaneous biopsies were performed under real-time CEUS guidance in all lesions. The displayment of internal necrotic or active areas, major vessels inner or surrounding lesions were recorded and compared with conventional ultrasound (US) guidance group (n = 75). All CEUS findings and clinical data were evaluated in MDT.

Results: Comparing to the conventional US guidance, CEUS enabled the delimitation of more (88.3 % vs 41.3 %) and larger (14.1 $\pm$ 10.7 mm

vs 32.3 ± 18.5 mm) non-enhanced necrotic areas during different phases of CEUS. More inner (20.0 % vs 6.7 %) and surrounding (18.3 % vs 2.7 %) major vessels were visualized and avoided during biopsies. CEUS-guided biopsy increased the diagnostic accuracy from 93.3 % to 98.3 %, with correct diagnosis in 57 of 60 lesions (95.0 %). The therapeutic plan was influenced by CEUS guided biopsies findings in the majority of patients (98.3 %).

Conclusions: Percutaneous CEUS guided biopsy is an efficient, minimally invasive, accurate and safe method in the diagnosis of undetermined abdominal lesions. The combination of CEUS guided biopsy and MDT decision making approach is useful in the diagnostic work-up and therapeutic management.

OPT12-019

Utility and Safety of Repeat Us-Guided Core Needle Biopsy of Focal Liver Masses

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Objectives: To evaluate the accuracy and safety of repeat ultrasonographically- guided core needle biopsy (CNB) for hepatic focal lesions and to assess the predicting factors of success of repeated CNB.

Methods: For five years, 3085 CNBs were performed for focal hepatic lesions using an automated biopsy gun with an 18-G needle. Seventy-eight patients underwent repeat CNB due to pathologically inconclusive or unexpected results. Twelve patients were excluded due to unavailable additional tissue or follow -up imaging by radiofrequency ablation (n = 5), repeat CNB more than three months after the first CNB (n = 5), and insufficient follow-up time (n = 2). Sixty-six patients were finally enrolled after applying the exclusion criteria. We retrospectively evaluated tumor necrosis, tumor size, the number of passes, lesion site, depth, tumor conspicuity, and complications. Continuous data and the total scores of the grading system were analyzed using the t-test and categorical data, and each category was analyzed using Fisher's exact test.

Results: The repeat CNB rate was 2.5% (78/3085). The diagnostic accuracy of the repeated biopsies was 83.3% (55/66). Size, depth, necrosis, lesion site, and number of passes, didn't have a statistically significant difference. Tumor conspicuity was a significant factor for predicting successful repeat biopsy ($p<0.001$). The cumulative complications rate was 10.6% (7/66) with only minor complications.

Conclusions: Repeat CNB is anthe accurate and safe procedure for obtaining the histologic diagnosis of hepatic focal lesions when if the initial biopsy fails . High tumor conspicuity showed a significant correlation with successful repeat CNB.

OPT12-020

Selective Regional Feeding Vessel Occlusion: A New Alternative for Percutaneous Ablation of Hepatocellular Carcinoma Adjacent to Gastrointestinal Tract when Artificial Ascites Failed

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Objectives: Conventional percutaneous radiofrequency ablation for peripheral hepatocellular carcinoma (HCC) has a high risk of injuring adjacent gastrointestinal tract. The aim of this study was to evaluate the efficacy and safety of selectively regional feeding vessel occlusion as a new alternative for treating HCC adjacent to gastrointestinal tract when artificial ascites failed.

Methods: From June 2014 to January 2016, 9 patients with 9 hypervascular target HCCs (mean, 3.0±0.7cm) were included in this study. The target tumors were located at the hepatic marginal angle (segment 2/3/6) and adjacent to gastrointestinal tract. Structure of feeding vessels were identified with multimodal ultrasound technologies including color doppler ultrasound, 2-dimensional and 4-dimensional contrast-enhanced ultrasound. A unipolar Cool-tip electrode was used to selectively occlude the feeding vessel of a subsegmental and tumor-burden region. Initial complete response (ICR), local tumor progression (LTP), intrahepatic distant recurrence (IDR) and complications were observed.

Results: Successful occlusions were achieved in 7/9 (77.8%) of the tumors. ICR was achieved in 7/7 (100%) of the tumors in 1-month evaluation. After a mean follow-up period of 12.4±8.5 months, LTP was observed in 1/7 (14.3%) of the tumors after a delay of 4.7 months. IDR was observed in 5/7 (71.4%) of the tumors after a mean delay of 8.0±5.7 months. Minor complication occurred in 2/7 (28.6%) of the patients. No major complication occurred.

Conclusions: Selective regional feeding vessel occlusion assisted by multimodal ultrasound has the potential to serve as an effective and safe alternative to treat HCC adjacent to gastrointestinal tract when artificial ascites failed.

Poster Session

PPT12-001

Abdominal Tuberculosis with Splenomegaly and Hemolytic Anemia

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Objectives: To describe ultrasound finding of abdomen tuberculosis with splenomegaly and hemolytic anemia.

Methods: This descriptive study was conducted at a private clinic in Bandung, Indonesia. A female, 36y, pale, weak, headache since a month and (Hb 3,3– 5,9 g%), Leucocyte 2200-3500, Thrombocyte 96.000-102.000, Lympocytosis 42 and Basal Erythrocyte Sedimentation was very high 136). Hemoglobin couldn't be increased although blood transfusion was given several time. Direct and indirect Coomb test were strong positive, Total bilirubin was 5,6 – 6,64 mg%, and Indirect bilirubin was 5,25- 4,8 mg% according to hemolytic anemia. She had history of recurrent colic abdomen and mild fever since several months. Physical examination were anemia, icteric, moderate spleen enlargement; and doughy abdomen as well as 'dam board phenomenon' according to peritoneal tuberculosis. Abdominal ultrasound using ALOKA SSD was performed on June 2, 2013.

Results: Ultrasound examination showed spleen enlargement. Hypo-peristaltic, irregular thickening heterogenic hypo-echoic of the small bowel wall, loss differentiation of the wall layers, irregular margin in addition to several round nodular structures (patchy hyper-echoic non-shadowing with an irregular rim of lower echodensity) within the wall and narrowing of the lumen were examined on the dullness pain area. No ascites. During treatment of methyl prednisolone and anti tuberculosis drug for 9 months she only need once blood transfusion, Blood counts were raised gradually. After treatment: all complaints disappear, spleen and blood count normal.

Conclusions: Ultrasound very usefully to know the whole disease progression and proper treatment as in this peritoneal tuberculosis with splenomegaly and hemolytic anemia.

PPT12-002

Abdominal Ultrasound Evaluation for a 3-Year-Old Man with Iron Deficiency Anemia and Abdominal Pain

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Objectives: Abdominal pain is a common complaint in the GI clinic. For pediatric patients, ultrasound is a useful tool for screening and evaluation the etiology and prevent unnecessory exposure to radiation.
Methods: A 3-year-old boy presented to the hematology clinic due to anemia (Hb 4.4g/dL) and intermittent abdominal pain. An evaluation with abdominal ultrasound was performed.
Results: Abdominal ultrasound revealed target sign over left upper abdomen and intussusception was diagnosed. Repeated trial of air reduction of the intussusception failed. A leading point was suspected from the ultrasound and colonoscopy was performed. A 3cm polypoid was identified in the splenic flexure and resected. The pathology revealed juvenile polyp.
Conclusions: Although rare, a leading point should be considered in pediatric intussusception. Abdominal ultrasound examination provides valuable information for this patient.

PPT12-003

An Epidemiological Investigation of Nonalcoholic Fatty Pancreas Disease and the Relationship to Metabolic Syndrome

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Objectives: To investigate the mobidity of nonalcoholic fatty pancreas disease(NAFPD) in different years old of people and the relationship between NAFPD and metabolic syndrome.
Methods: 10988.8Livers and pancreas of 1396 participants for health check up were examined by ultrasound. The appearance rates of nonalcoholic fatty liver disease(NAFLD) and NAFPF were calculated and compared. The relationships among NAFPD and years, genders, heights, weights, body mass indexes(BMI), cholesterols, triglycerides, high density lipoproteins, low density lipoproteins and glucoses were analyzed.
Results: The appearance rates of NAFLD and NAFPD were 39.8% and 47.1% ($P<0.05$) respectively and increased with aging process. NAFPD was related to age, BMI, cholesterols, triglycerides, high density lipoproteins, low density lipoproteins and glucoses significantly but not related to gender.
Conclusions: NAFPD is associated with age and metabolic syndrome. The mobidity of NAFPD is so high that attention is necessary.

PPT12-004

An Unusual Cause of Acute Pancreatitis: Pancreatic Arteriovenous Malformation

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Objectives: Acute pancreatitis is a common GI emergency. Common etiology includes alcohol, gallbladder stones or hyperlipidemia.
Methods: A 50-year-old man admitted to the emergency department because of abdominal pain. An evaluation with laboratory examination and ultrasound was performed.
Results: Transcutaneous ultrasound revealed ill-defined hypoechoic cystic nodules in pancreatic head with hypervascular content which was confirmed by Color Doppler .Patient also received endoscopic ultrasound (EUS) study which demonstrate similar finding with a 40mm multiloculated cystic lesion with abundant blood flow in pancreatic head. Meanwhile on axial contrast-enhanced dynamic abdominal computed tomography (CT) scan showed an entangled cluster vascular structures lesion with focal hyperenhancement located in pancreatic head, followed with early filling of portal vein.
Conclusions: Abdominal ultrasound is a useful tool for evaluation the etiology of acute pancreatitis. Although rare, clinician should aware of pancreatic arteriovenous malformation as differential diagnosis during ultrasound examination.

PPT12-005

B-Mode Ultrasound Features of a Distinct Entity: Decrum Disease (Lipomatosis Dolorosa)

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Objectives: Lipomatosis dolorosa, also known as Dercum disease, is characterized by generalized obesity and pronounced, progressive, and chronic pain in the adipose tissue of the proximal extremities, trunk, pelvic area, and buttocks; the face and hands are usually spared. It was first described in 1892 by the American neurologist Francis Xavier Dercum at Jefferson Medical College in Philadelphia, Pennsylvania. In this report, we present the sonographic appearance of lesions of a case with Dercum disease.
Methods: Case report and literature review.
Results: A 57 year old woman presented with myalgia was found to have multiple painful lumps at back-lumbar region. Ultrasound examination revealed multiple subcutaneous hyperechoic masses with lobulated margins at paravertebral, lumbar area. The lesion with largest size was measured as 43×13 mm in axial plane, while the others were mostly smaller than 1 cm in diameter. Lesions were with relatively higher echogenity when compared with other commonly encountered solitary lipomas. Additionally, pain at the location of these lipoid lesions, which increases with minimal compression, was also indicated by patient. In the light of these findings, diagnosis of Decrum disease was made.
Conclusions: Adiposis dolorosa, also known as Dercum disease, is characterized by generalized obesity and pronounced, disabling, and chronic pain in the adipose tissue of the proximal extremities, trunk, pelvic area, and buttocks; the face and hands are usually spared. There are a number of associated symptoms, including multiple lipomas, generalized weakness, fatigue, sleep disturbances, constipation, and psychiatric abnormalities. This case illustrates that, the existence of multiple painful lipomas with a relatively higher sonographic echogenity especially in a female patient can the diagnosis of Decrum disease.

PPT12-006

Cellular Angiofibroma of the Scrotum

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Objectives: To review ultrasonographic findings of cellular angiofibroma in the scrotum and inguinal area with CT and pathologic findings.
Methods: Case report and literature review.
Results: A 53 - year - old man without underlying disease visited for the chief complaint of right scrotal and inguinal mass. The pre-operative ultrasonography and CT findings were reviewed with pathologic correlation.
Conclusions: This case reviewed clinical feature and scrotal ultrasound finding with radiologic and pathologic correlation.

PPT12-007

Clinical Usefulness of Transabdominal Us for the Focal Pancreatic Lesion

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Objectives: The aim of this study was to evaluate the clinical usefulness of TAUS in the evaluation of cystic and solid lesions of the pancreas.
Methods: TAUS is the most prevalent and convenient test for the evaluation of abdominal diseases. However, despite the development of ultrasound equipment, there are many limitations to the evaluation of pancreatic disease through ultrasound. Therefore, in this exhibition, we compare the pros and cons of ultrasonography for pancreatic lesions with CT, MRI and EUS. I would like to present the future direction of TAUS.
Results: TAUS helps differentiate between solid lesions (PDAC, SPN, NET, metastasis, lymphoma, and intrapancreatic accessory spleen) and cystic lesions (IPMN, SCN, MCN, solid mass with cystic change, pseudocyst, and retention cyst) in the pancreas, especially body area.TAUS is also useful as an alternative method to follow up the cystic lesions of the pancreas suspected to be benign.
Conclusions: TAUS is a competitive test for the cost and convenience of pancreatic lesion differentiation and follow-up compared with CT, MRI or EUS.

PPT12-008

Diagnostic Accuracy of Usg Guided Fine Needle Aspiration Cytology - A Study of 500 Cases from A Cancer Referral Centre in North India

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Objectives: To find out the diagnostic accuracy in USG guided aspiration . To find out the spectrum of lesions in USG guided cytology and demographic data of the cases.
Methods: A total of 500 cases(between March, 2016- March, 2017) referred to our team for the diagnostic work up of clinically suspicious primary or secondary lesions. These lesions needed to be done under the image guidance due to their deep organ location or close proximity to vital structures. All lesions which yielded sufficient material for satisfactory reporting were included in this study. The inconclusive cases were not included in the analysis.
Results: In our study out of 30 out of 500 cases showed only blood and were inadequate for a any conclusive opinion, so overall diagnostic yield was 94 %. We found that 62 (12.4%) cases were benign, 380 (76%) cases were malignant and in 128 (25.6 %) cases, a descriptive report was given. Regional distribution of lesions were head and neck lesions 125 (25%), hepatobiliary 130 (26%) , intraabdominal and pelvic lesions 150 (30%), chest and mediastinal lesions 55 (11%) and miscellaneous 40 (8%). Of malignant cases 38% were secondaries and 4 % were recurrent lesions.
Conclusions: USG guided fine needle aspiration cytology is very useful and rapid technique in making timely diagnosis in cancer patients with overall good diagnostic yield. The procedure was helpful in avoiding delay may be caused due to biopsy.

PPT12-009

Extrapulmonary Tuberculosis in Adult (Ultrasound Finding)

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Objectives: To describe ultrasound of extrapulmonary tuberculosis in adult.
Methods: This descriptive study conducted at very low economy rural boundary islands: Saumlaki, Tanimbar, Moluccas (January, 20-23. 2009), St Elisabeth Hospital, Flores, (February 2012-August 2013) and Stela Maris-Lukas Hilisimetano Hospitals South Nias–North Sumatera (April- July 2015). Data were abstracted from medical records of adult disseminated tuberculosis. Patients were diagnosed by one certified ultrasound internal medicine specialist. Patients had never previously received specialist service nor ultrasound.
Results: N=1929 adult, > 15-78y (Saumlaki 329, Flores 1299, South Nias 301). All(100%) were Peritoneal (dry type) showed hypo-peristaltic, thickening heterogenic hypo-echoic small bowel wall, irregular margin, several round nodular and lumen narrowing. Kidney: irregular form; lost differentiation of capsule, cortex, pyramids, sinus were at Saumlaki 239(73%), Flores 869(67%) and South Nias 211(70%). Chronic cystitis at Saumlaki 91(28%), Flores 740(57%) and South Nias 193(64%). At Saumlaki: heterogeneous hyperechoic of pancreas 20(6%), Paraaortal lymph-nodes enlargement 16(4,7%). At Flores: testis abnormality 11(0,8%), prostat 1(0,08%), neck lymph node enlargement, pleural effusion 3(0,2%). At South Nias: heterogeneous hyperechoic of pancreas 26(8,6%), peritoneal tuberculosis wet type 1 (0,3%), pleural effusion 6(2%), neck lymph node enlargement 6(2%), Musculoskeletal 1 (0,3%).
Conclusions: Peritoneal dry type and small bowel tuberculosis was the most extrapulmonary tuberculosis, followed by urinary tract, pancreas, pleural effusion, lymph node and musculoskeletal.

PPT12-010

Extrapulmonary Tuberculosis in Children (Ultrasound Finding)

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Objectives: To describe ultrasound of extrapulmonary tuberculosis in children.
Methods: This descriptive study conducted at very low economy and low hygiene sanitation environment at rural boundary islands: Saumlaki Health Centre, Tanimbar, Moluccas (January, 20-23. 2009 and March - May 2010), St Elisabeth Hospital, Flores, Nusa Tenggara Timur (February 2012 - August 2013) and Stela Maris, Lukas Hilisimetano Hospitals and Fanayama Primary Health Centret, Onohondro Village at South Nias–North Sumatera province (April- July 2015). Data were abstracted from medical records of children disseminated tuberculosis. Patients were diagnosed by one certified ultrasound internal medicine specialist using the only one black and white portable ultrasound available. Patients had never previously received medical specialist service nor ultrasound examination.
Results: N=724 children , 0,5-15y (Saumlaki 392, Flores 184 and South Nias 148). All (100%) were Peritoneal (dry type) with recurrent colic abdomen pain, diarrhea/obstipation, distention, doughy & dam-board phenomena as well as constitutional symptom and undernourished. Small bowel ultrasound showed a/hypo- peristaltic, irregular thickening heterogenic hypo-echoic, irregular margin of the wall, loss differentiation of the wall layers, with several oval/ round nodular structures those suggestive granuloma. 100% Lymph

node enlargement both neck and paraaortal. Kidney ultrasound images according to the kidney during childhood growth. Normal pancreas and urinary bladder. At South Nias: Musculoskeletal manifestation were 2 (1,4%).

Conclusions: Peritoneal dry type and small bowel tuberculosis and lymph node enlargement were the most extrapulmonary tuberculosis, followed by musculoskeletal.

PPT12-011

Focal Gallbladder Compression Sign during Abdominal Sonography: What Does This Mean?

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Objectives: Several conditions show mass effects on the outline of the gallbladder wall with an internal protrusion onto the gallbladder lumen. Sometimes, this mass effect may be a sole sign detecting the lesion during abdominal sonography. The purposes of this exhibit are to demonstrate several conditions causing the focal gallbladder compression sign during abdominal sonography and to discuss its clinical significances.

Methods: We retrospectively reviewed the abdominal sonographic results. We selected the patients who showed the focal gallbladder compression sign in abdominal sonography. The medical records and other imaging findings of selected patients were also reviewed.

Results: In this exhibit, we demonstrated intrahepatic isoechoic conditions that show focal gallbladder compression, including the normal hepatic lobule, nodular regeneration of a cirrhotic liver, hepatocellular carcinoma, hemangioma, and metastases. We also demonstrated extrahepatic conditions, including prominent pericholecystic fat and adjacent bowel. In addition, we found a gallbladder adenomyomatosis mimicking the lesion causing focal gallbladder compression. Most of the conditions were correlated with CT imaging findings. The clinical significance of focal gallbladder compression was also discussed.

Conclusions: Although a focal gallbladder compression sign is the nonspecific finding, it may be a useful sign for detecting a small isoechoic mass in segment 4 and segment 5 of the liver.

PPT12-012

Fusobacterium Nucleatum and Actinomyces Co-Infection of Liver Mimicking Liver Malignancy: A Rare Case Report of Radiological, Sonographic and Pathology Evaluation

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Objectives: Hepatic pseudotumor is a rare presentation of actinomycosis infection and easily mistaken as a malignancy tumor clinically. Herein, we introduced a typical case in this section.

Methods: Herein, we reported a 56-year-old woman presented with a hepatic mass for one year. There was no family history of hepatic cancer. On physical examination, no fever, body weight loss no lymph node enlargement was found. Ultrasound examination revealed an ill-defined hypoechoic mass over in the S5 of liver. The portal venous system and bile duct was not obstructed. There is no regional lymphadenopathy found. Under the impression of liver tumor, liver segmentectomy was performed. Pathological exam including histology and histochemical studies was also done.

Results: The excised specimen showed an ill demarcated tumor composed of centrally suppurate debris surrounded by granulomatous inflamed tissues composed of mainly epithelioid histiocytes and occasional multinucleated giant cells. There was no atypical bile ductal proliferation or carcinoma. Immunohistochemically, no occult carcinoma cells were fund by cytokeratin immunostain. The PAS stain showed some Actinomyces-like bacilli and the acid fast stain revealed no pathogen. However, the culture revealed Fusobacterium nucleatum. Therefore, a diagnosis of possible coinfection of Fusobacterium nucleatum and Actinomyces was rendered.

Conclusions: Primary actomyocosis is a rare infective disease involving liver and characterized with ill circumscribed borders and heterogeneous hypoechogenicity contributed to a mass forming lesion mimicking a malignancy in either image study or pathologic differential diagnoses. Without the aid of pathology study, it is hard to make a correct diagnosis among these mimickers.

PPT12-013

Gastric Lipoma: A Rare Cause of Upper Gi Bleeding with Abdominal Ultrasound Evaluation

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Objectives: Common causes of upper GI bleeding includes , peptic ulcer diseases, variceal bleeding, or GI malignancy. Lipoma is a rare cause of benign GI neoplasm and seldom causes symptom.

Methods: A 66-year-old man presented to the hospital due to tarry stool passage. Upper endoscopy revealed a 4cm mass over the gastric antrum. Further investigation with ultrasound and abdominal CT was performed.

Results: The abdominal ultrasound revealed a well-defined hyperechoic mass over gastric antrum and a lipoma is diagnosed. The abdominal CT scan confirmed the fat-containing gastric tumor. Because of symptomatic bleeding from the tumor, the patient received endoscopic resection of the tumor and pathology revealed lipoma.

Conclusions: Although rare, lipoma can cause upper GI bleeding. Abdominal ultrasound is useful to distinguish this rare tumor with other mesenchymal GI tumors such as GIST, leiomyoma.

PPT12-014

Hepatic Arterial Infusion of Chemotherapy for Hepatocellular Carcinoma: The Extremely Rare Case of more than 10 Years Survival after Treatment

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Objectives: The prognosis remains poor in those with advanced HCC with vascular invasions, such as tumor thrombosis of the first branch or trunk of the portal vein or inferior vena cava. Portal vein tumor thrombosis (PVTT) can cause liver dysfunction and portal hypertension.

Methods: Case report and literature review.

Results: A 54 years old male was a victim of chronic hepatitis B. Liver cirrhosis was diagnosed more than a decade ago. The right and left portal vein branch thrombus and the infiltrative liver tumor were noted during abdominal echo follow up. Infiltrative liver tumor with bilateral portal vein branch invasion was confirmed from abdominal Computed Tomography. Echo guide aspiration was performed through the portal vein thrombus and hepatocellular carcinoma was diagnosed. Hepatocellular carcinoma (HCC) with T3bN0M0 stage IIIb was confirmed. Transarterial Chemoembolization (TACE) was performed one time and further PORT-A implanted was arranged. Port-A catheter was inserted into the proximal hepatic artery and the Gastro-Duodenal artery was also thrombosed to prevent the damage of chemotherapy via the right inguinal area. Chemotherapy with 5-FU, Epirubicin, and Mitomycin-C was arranged via the port-A catheter. Four months chemotherapy was performed smoothly. The tumors over bilateral hepatic lobe were shrinkage and necrosis. No obvious residual HCC was noted from both CT and abdominal sonography since post-HAIC till now.

Conclusions: We know the median overall survival was 7.5months for HCC with HAIC, the more than 10 years survival time after HAIC like this patient was rare. HAIC as the second line therapy for HCC after sorafenib treatment failure may be considered clinically.

PPT12-015

Interobserver Concordance of Transabdominal Sonography and Colonoscopy in Ulcerative Colitis

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Objectives: The purpose of this study was to assess the interobserver concordance rate (ICR) of ulcerative colitis (UC) disease activity between multiple centers.
Methods: From June 2013 to August 2016, 57 patients underwent transabdominal sonography (US) and colonoscopy (CS) at five facilities, where operators assessed UC severity using our original US grading system and CS Matts' classification. The colon and rectum were investigated. ICR and systemic error were analyzed by weighted kappa statistics and Bland-Altman analysis, respectively.
Results: The US and CS ICR (95% CI) of the maximum grade of each patient was 0.82 (0.73-0.91) and 0.70 (0.53-0.88), in the cecum 0.54 (0.37-0.70) and 0.71 (0.50-0.92), ascending colon 0.74 (0.57-0.92) and 0.73 (0.60-0.86), right-sided transverse colon 0.72 (0.58-0.85) and 0.69 (0.53-0.84), left-sided transverse colon 0.75 (0.61-0.89) and 0.79 (0.65-0.93), descending colon 0.78 (0.68-0.90) and 0.68 (0.54-0.83), sigmoid colon 0.77 (0.66-0.90) and 0.76 (0.64-0.88), rectum 0.54 (0.34-0.74) and 0.43 (0.15-0.72), and all segments of the colon 0.75 (0.70-0.80) and 0.72 (0.66-0.79), respectively. The US ICR was moderate in the cecum and rectum, the CS ICR was moderate in the rectum only, and both were substantial in the other segments. There was a fixed bias in the cecum on US, and in the max grade, sigmoid colon, rectum, and all the segments of the colon on CS. The grading at the central facility tended to be higher.
Conclusions: The ICRs of US and CS were both good to excellent in UC patients.

PPT12-016

Interpretation Us Elastography in Chronic Hepatitis B with or without Anti-HBV Therapy

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Objectives: Inflammation has significant impacts on liver fibrosis measurement by ultrasound elastography. The interpretation requires further optimization in patients with or without therapy.
Methods: We prospectively enrolled a consecutive series of patients with chronic hepatitis B who received liver histology analysis. Acoustic radiation force impulse (ARFI) was performed with standardized two-location measurements and carried out by one well-trained technician.
Results: One hundred and forty-six patients who underwent liver needle biopsy (50.9%) or tumour resection (49.1%) were enrolled. Thirty-four patients (23.3%) had been receiving anti-hepatitis B therapy of various duration at the time of enrolment. The AUROC for the diagnosis of Metavir F4 by mean ARFI was 0.820 in the non-treatment group and 0.796 in the treatment group. The cut-off value for cirrhosis was 1.523 m/sec with a sensitivity of 0.708 and a specificity of 0.830 in the non-treatment group, while it was 1.420 m/sec with a sensitivity of 0.786 and a specificity of 0.750 in the treatment group. The ARFI tended to be higher than the Metavir grading in patients with a treatment duration of $\leq$ 6 months, equal from 12 to 26 months and lower after $\geq$ 26 months.
Conclusions: We concluded that ARFI is a reliable tool for measurement of liver fibrosis in chronic hepatitis B patients with alanine aminotransferase (ALT) $<$ 5x upper limit of normal. For those patients with active inflammation, the optimal timing for ARFI analysis will be during the second year of nucleos(t)ide analogue therapy. The ARFI measurement after the second year tends to be lower than histology grading.

PPT12-017

Isolated Hepatic Tuberculosis Presented as a Hepatic Pseudotumor

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Objectives: Mycobacterium tuberculosis (TB) remains a major global health problem with a worldwide distribution and a vast spectrum of clinical manifestations. Hepatic TB is an extrapulmonary manifestation of TB. Tubercle bacilli can reach the liver via hematogenous dissemination, generally from the lungs, or by local spread from the gastrointestinal tract.1 Hepatic TB constitutes less than one percent of all TB cases. Isolated hepatic TB without involvement of other organs is extremely rare. Establishing a diagnosis of hepatic TB is not easy, especially when there is no evidence of extrahepatic TB. We report a case of isolated hepatic TB presenting as a hepatic pseudotumor in an immunocompetent host.
Methods: Case report and literature review.
Results: A 59-year-old woman presented with a history of hypertension, reflux esophagitis, and peptic ulcer disease, all with regular medical follow-up. She developed intermittent night fever and body weight loss of 5 kg in 4 months. T Abdominal ultrasound revealed ill-defined, mixed echoic liver tumors located around the hilum. Abdominal CT showed ill-defined hypodense lesions around the hilum and enlarged left axillary lymph nodes. Tumor markers including alpha-fetoprotein, carcinoembryonic antigen, and cancer antigen 19-9 were all within normal range. An ultrasound-guided liver biopsy was performed, and histopathology disclosed caseating granulomatous inflammation. Thus an anti-TB regimen was started on July 31, and follow-up abdominal CT after 3 months showed complete resolution of the liver tumors.
Conclusions: Liver malignancy was high in Asia-Pacific area. This case demonstrates the difficulty of diagnosing this condition despite thorough investigations. A liver biopsy is still essential, and along with

histopathological and bacteriological studies is still the best diagnostic method for liver tumors of unknown etiology.

PPT12-018

Lipomatosis of Kidney Mimicking Hydronephrosis or Urothelial Carcinoma of Renal Pelvis on Sonography

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Objectives: To differentiated hypoechoic pattern of lipomatoisis of kidney from mild hydronephrosis and urothelial carcinoma of renal pelvis on sonography.
Methods: From January 2008 through August 2016, one hundred and six consecutive patients with lipomatosis of kidney underwent sonography study by residents of radiology at ER Department The initial impression was hydronephrosis or urothelial carcinoma of renal pelvis. All patients had CT can study two months before or after and previous sonography study.
Results: All cases were proven no hydronephrosis or mass of renal pelvis but lipomatosis only by CT scan in recent two months before or after. As compared with previous sonography no more than one year, the findings were no significant change. Almost simulated sonographic findings were noted in contralatera kidney in all cases.
Conclusions: Recognizing the characteristics on sonography and comparing with contralatera kidney are important to prevent miss interpretation of lipomatosis of kidney.

PPT12-019

Long-Term Nucleos(T) Ides Analogues Improve Liver and Spleen Size

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Objectives: Antiviral nucleos(t)ides analogues (NUCs) therapy is effective to achieve viral suppression and their long-term use lead to histological improvement and regression of liver fibrosis. We retrospectively evaluate the usefulness of ultrasonography to detect alterations in disease severity during NUCs therapy in chronic hepatitis B (CHB) patients.
Methods: A total of 181 CHB patients receiving NUCs treatment were enrolled. The study population was divided into three groups: 72 cirrhotic, 58 non-cirrhotic CHB, and 51 non-replicative hepatitis B virus (HBV) carriers. All patients had blood chemistries and sonography at baseline and during the NUCs treatment period. The changes in liver size, liver edge, spleen size, platelet count, and platelet count/spleen diameter (PC/SD) ratio were compared among the three groups of patients.
Results: There is no difference in age among the three groups ($p<0.05$). CHB Patients with and without cirrhosis have improved clinical features during NUCs therapy with lower AST, ALT, INR, HBV DNA, and spleen size and higher platelet, liver edge, liver size and PC/SD ratio compared with the baseline data ($P< 0.05$). The differences of liver edge, liver size, spleen size, and PC/SD ratio are higher in cirrhosis group than in non-cirrhotic group ($P< 0.001$). A decrease in spleen size exhibited a linear relationship with treatment duration ($R2=0.905$).
Conclusions: Our data show that long-term NUCs therapy can increase liver size, decrease spleen size, increase platelet count and increase PC/SD ratio. Traditional sonography is helpful to monitor changes of liver fibrosis of CHB patients under NUCs therapy.

PPT12-020

Microvascular Ultrasound Imaging for a Case of Small Bowel Hematoma

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Objectives: Microvascular ultrasound imaging is a new ultrasound imaging technique. It can reveal the small vascular pattern without the use of contrast agent.
Methods: A 77-year-old man with atrial fibrillation presented to the emergency department with abdominal pain that had worsened over the course of 1 day. The patient had suffered a similar attack 6 months earlier and was diagnosed with mesenteric ischemia. Laboratory analysis revealed normal liver and renal function. The white blood cell count was well within the normal range, and the patient had mild anemia (hemoglobin, 10.2 g/dL). A bedside abdominal ultrasound was performed.
Results: The abdominal ultrasound revealed small intestinal wall thickening with little ascites . The microvascular ultrasound imaging revealed preserved blood flow of the intestinal wall. The abdominal computed tomography examinations revealed an intact mesenteric vasculature and long segmental small bowel wall thickening up to 2 cm, which was suggestive of intramural hematoma. The patient was admitted, bleeding tendency was corrected, and parenteral nutrition was provided. The abdominal pain improved gradually over the course of 5 days.
Conclusions: In addition to traditional ultrasound, the microvascular ultrasound imaging can help to evaluate the blood flow pattern in a quick and non-invasive way in the emergency setting.

PPT12-021

Pancreas Ultrasound Finding among Abdominal Tuberculosis with Dyspeptic Syndrome

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Objectives: Dyspeptic syndrome is common in patients with abdominal tuberculosis. These complaints are often difficult at the time of taking the multidrugs anti-tuberculosis, especially in intensive phase of the treatment.The objective of this study was to describe pancreas ultrasound finding among abdominal tuberculosis with dyspeptic syndrome.
Methods: This study was conducted at Emma Poeradiredja Hospital Bandung from August,1st 2008 to December, 15th 2011. Pancreas of abdominal tuberculosis patients were examined by a certified ultrasound internal medicine specialist with trans-abdominal ALOKA-Prosound SSD3500.
Results: There were 178 abdominal tuberculosis (including peritoneal and small bolwe tuberculosis and urinary track tuberculosis) patients. 146(82%) with mild dyspeptic syndrome with recurrent epigastric pain, mild nausea, abdominal distension, mild malabsorption without underweight. Ultrasound of pancreas showed heterogenous hyperechoic pancreatic lesion with irregular pancreatic margin, focal/segmental hyperechoic lesion in addition of some irregular oval/round lesions (patchy hyperechoic non-shadowing with an irregular rim of lower echodensity) with normal pancreas size. Otherwise 32(18%) patients with severe dyspeptic syndrome with chronic recurrent bouts epigastric pain radiating to the back, anorexia, nausea, vomiting, chronic diarrhoea with obviously malabsorption and underweight; these patients had diffuse hyperechoic lesion with or without calcification and decreased of pancreas size.
Conclusions: Severity of pancreatic ultrasound finding were corresponding with severity of dyspeptic syndrome among abdominal tuberculosis.

PPT12-022

Plexiform Fibromyxoma of Stomach: A Rare Case Report of the Sonographic and Pathological Evaluation

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Objectives: Plexifrom fibromyxoma is a rare entity and recently adopted by the 2010 WHO tumor classification of digestive system so that most clinician is not familiar with this tumor. Herein, we introduced a typical case in this section.

Methods: A 59-year-old female patient suffered from long term acid regurgitation. Endoscopic ultrasound examination was done and showed a 2 cm well-defined submucosal tumor lesion at the gastric antrum. A gastrointestinal stromal tumor (GIST) was highly suspected clinically. Then tumor excision was performed. Pathological exam including histology and immunohistochemical studies was also done.

Results: Microscopically, there was a submucosal tumor composed of plexiform and multinodular architectures with myxoid and fibrocollagenous stroma. Bland spindle tumor cells with myofibroblastic immunoprofiles were noted. The tumor cells showed SMA(+), CD117(-), CD34(-), S-100 protein(-), ALK(-), DOG1(-), HMB45(-), EMA(-), beta-catenin(no nuclear staining), CD56(-) and desmin(+, focal) by immunohistochemical studies. The post-operative course was uneventful after 20 months follow-up.

Conclusions: Plexiform fibromyxoma is a rare distinct benign tumor mainly in the stomach and is easily mistaken as other mesenchymal tumors of gastrointestinal tract, especially GIST, in clinical practice. Distinct histopathology and immunoprofiles are helpful in making a correct diagnosis. In addition, by molecular examination, KIT and PDGFRA mutational analyses also show wild-type sequences which are quite unique and different from the GIST.

PPT12-023

Recurrent Lower Abdominal Pain among the Infertility

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Objectives: To describe the cause of recurrent colic abdominal pain among fertility with ultrasound examination.

Methods: This cross sectional study was conducted at St Elisabeth Hospital in Lela, Flores island, Nusa Tenggara Timur Province from February through September 2012. All infertile spouses with recurrent lower abdominal pain who were examined with trans-abdominal ultrasound using Aloka SSD 1100 with 3,5 MHz convex probe ultrasound by ultrasound certified internal medicine physician. Examination for fluor albus and sperm analyse were also performed.

Results: There were 18 infertile spouses, age of 18-42 years, mean 26,2. 11 (61%) with primary infertility and 7 (39%) with secondary infertility. All patient had tuberculosis dry type peritonitis clinically, and ultrasound showed thickening and irregular margin of small bowel wall, hypo-peristaltic movement were found in all affected dullness lower abdomen area. All women had irregular thickening of urinary bladder mucosa wall; recurrent abnormal fluor albus history and microscopic smear of vaginal secret showed gonococcal infection. Sperm analyse showed decrease of number and motility.

Conclusions: Tuberculosis dry type peritonitis, chronic cystitis and pelvic inflammatory disease were related to the recurrent lower abdominal pain among the infertility patients.

PPT12-024

Role of Emergency Ultrasound in Diagnosis of Hollow Organ Perforation

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Objectives: Perforation of the gastrointestinal tract may be suspected based upon the patient's clinical presentation, or the diagnosis becomes obvious through a report of extraluminal "free" air on diagnostic imaging performed to evaluate abdominal pain or another symptom.

Methods: Case report and literature review.

Results: A 52 years-old male patient without any underlying disease presented with sudden onset epigastric dullness pain. Ultrasound showed hyperechoic density over right subphrenic space above liver dome with suspected hollow organ perforation. Abdominal computed tomography showed hollow organ perforation and operation was arranged.

Conclusions: This case revealed that abdominal ultrasound can be used to aid in the diagnosis of hollow organ perforation. Ultrasound has also been studied and shows some excellent potential for identifying pneumoperitoneum.

PPT12-025

Role of Emergency Ultrasound in the Diagnosis of Liver Abscess

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Objectives: Liver abscess is an uncommon disease that is easy to ignore at emergency room. The diagnosis is usually made by Computer Tomography (CT) scan, but CT scan was not always easy to arrange due to patient's renal dysfunction or availability of medical facilities. We present a case of liver abscess with unspecific symptoms which diagnosed by emergency ultrasound.

Methods: Case report and literature review.

Results: A 81 year old woman with history of type II diabetes mellitus presented with fever, chest pain and poor appetite for few days. Emergency ultrasound showed some air density inside left lobe of liver with some air above liver margin. Clinically highly suspected liver abscess and proved by noncontrast CT scan. Finally the patient is consult for radiologist for percutaneous drainage and discharge uneventfully.

Conclusions: This case illustrates that emergency ultrasound can be used to search for unspecific fever source, like liver abscess. Emergency ultrasound is portable, repeatable , non-radioactive and everyday use in emergency Department.

PPT12-026

Small Bowel Ultrasound among Undernourished Children

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Objectives: Children who are already undernourished can suffer from protein-energy malnutrition when rapid growth, infection, or disease. Abdominal discomfort, anorexia, weight loss, low-grade fever, night sweats, pale; chronic recurrent cough and diarrhea were been complained. The aim of this study was to describe small bowel ultrasound finding among the undernourished children.

Methods: This study was conducted at Saumlaki Community Health Centre at Tanimbar, a remote boundary island in the West of South-East

Moluccas (East Part of Indonesia) from April-May 2010. One experienced and ultrasound certified physician conducted clinical examinations to assess undernourished and small bowels ultrasound examinations of all children. Ultrasound examinations were conducted using Fukuda SAN-FS906 or Prince DP 3300 black and white portable ultrasound equipment.

Results: N=236 (age 1–7 years) undernourished children including, 141(59,75%) boys and 95(40,25%) girls were also suffering of disseminated tuberculosis (lung, painless cervical lymph node enlargement and tuberculosis dry type peritonitis). The abdominal discomfort were associated with recurrent colic abdominal pain history. Physical examination showed tenderness, doughy and dam-board phenomena of dry type peritonitis tuberculosis. Hypo peristaltic movement, loss differentiation of the wall layers; irregular margin of the small bowel wall; and irregular oval/round lesions (patchy echogenic non-shadowing with an irregular rim of lower echo density) within the affected small bowel wall.

Conclusions: There was small bowel characteristic on affected dullness area of abdominal tuberculosis among all the undernourished children.

PPT12-027

Small Bowel Ultrasound Findings of Recurrent Colic Abdominal Pain due to Peritonitis Tuberculosis among the Children

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Objectives: To know small bowel wall ultrasound findings of recurrent abdominal colic pain due to peritonitis tuberculosis among the children.

Methods: This study was conducted at Maternity Emma Poeradiredja Women Hospital Bandung from January,1st 2005 to April30th 2009 The children with disseminated tuberculosis (lung, cervical lymphadenopathy and tuberculous dry type peritonitis) diagnosed based on clinically, laboratory, thorax photo, PPD test and ultrasound. The recurrent colic abdominal pain and tenderness were associated with the doughy abdomen and dullness percussion area of dam-board phenomena of tuberculous peritonitis. Small bowel wall thickness examined with transabdominal ALOKA Prosound SSD3500 on the tympanic area and dullness area according of dam-board phenomena.

Results: 82 children of 2,5–13years, mean 6,2 years, 44(53,66) boys, 38(46,34%) girls. The mean of small bowel wall thickness on the tympanic area was 0, 16 cm otherwise on dullnes area was 0,42 cm (2,62 times than tympanic area). Hypoperistaltic movement, loss differentiation of the wall layers, irregular margin of the small bowel wall, and irregular oval/round lesions (patchy echogenic nonshadowing with an irregular rim of lower echodensity) within the affected area.

Conclusions: Small bowel wall thickening with some characteristic were found on affected dullness area of peritonitis tuberculosis among the children.

PPT12-028

Sonographic Approach in Patients with Right Upper Quadrant Pain: What the Radiologist Needs to Know

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Objectives: Abdominal sonography has been used as the primary diagnostic tool to evaluate right upper quadrant (RUQ) pain. The objective of this exhibit is to review sonographic findings for gallbladder to improve the diagnostic values in various diseases in the patients with RUQ pain. Furthermore, we demonstrate the sonographic findings in patients with RUQ pain caused by diseases other than gallbladder regions.

Methods: We retrospectively reviewed the abdominal sonographic results and selected patients who had various diseases that can cause RUQ pain. The medical records and other imaging findings of the diseases were also reviewed.

Results: In this exhibit, we discussed appropriate sonographic scan techniques in patients with RUQ pain and demonstrated visualization, wall thickening, polypoid lesions, and distension of gallbladder as well as pericholecystic fluid, posterior acoustic shadowing, and the presence of Murphy sign. We also demonstrated sonographic findings of various diseases including acute cholecystitis, chronic cholecystitis, several complications of acute and chronic cholecystitis, gallbladder cancer, choledocholithiasis, acute hepatitis, hepatic abscess, rupture of hepatic mass, Fitz-Hugh-Curtis syndrome, and colon diverticulitis. Some of the diseases were also demonstrated with both sonography and other imaging modalities such as CT, MR or fluoroscopy. In addition, we discussed the systematic approach using sonography for differential diagnosis of the patients with RUQ pain.

Conclusions: Radiologists need to be familiar with a systematic sonographic approach for gallbladder and sonographic features of a variety of diseases that can cause RUQ pain to improve the diagnostic values.

PPT12-029

Sonographic Findings of Malignant Appendix Tumors in 7 Cases

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Objectives: To report sonographic findings of the malignant appendiceal tumors of 7 cases.

Methods: Of a total of 9585 registered appendix specimens that were collected during simple appendectomy, cecectomy, ileocecectomy, and right hemicolectomy, we identified 19 patients with malignant appendiceal tumors. Of these malignant appendiceal tumors, we reviewed 7 cases of malignant appendiceal tumors which had preoperative ultrasound.

Results: Seven cases of malignant appendiceal tumors include mucinous cystadenocarcinoma (n = 2), colonic type adenocarcinoma (n = 4), and signet-ring cell carcinoma (n = 1). The 2 mucinous cystadenocarcinomas had markedly enlarged inner luminal diameters (mean, 23 mm; range, 15–31 mm) and thick, irregular walls (mean wall thickness, 5.5 mm; range, 5–6 mm). In contrast, the 5 non-mucinous carcinomas (4 adenocarcinomas and 1 signet-ring cell carcinoma) had relatively small inner luminal diameters (mean ± standard deviation [SD], 6.6 ± 4.5 mm; range, 2–15 mm) and prominent wall thickening (mean wall thickness ± SD, 6.2 ± 2.3 mm; range, 3–10 mm). Of the 5 non-mucinous tumors, only 1 had a discernible mass, 3 had thick irregular walls, 2 had loss of the wall layer pattern and 4 had submucosal hypoechogenicity.

Conclusions: Although the sonographic findings of the malignant appendiceal tumors were non-specific, some of the sonographic features seen in these 7 cases may help radiologists consider the possibility of underlying malignant appendiceal tumors.

PPT12-030

Superb Micro-Vascular Imaging, A Novel Ultrasound Technique In Focal Liver Lesions Evaluation

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Objectives: The purpose of this study is to describe the characteristic of SMI and compare the clinical value of SMI to contrast-enhanced ultrasound/CT/MRI in evaluating focal liver lesions.

Methods: Twenty-four patients with 31 focal liver lesions were involved in our study, the lesions consisted of hepatocellular carcinoma (n=5), Diffuse large B lymphoma (n=1), adenoma (n=1), metastatic lesions (n=5), focal nodular hyperplasia (n=2), hemangioma (n=17). Nine lesions were pathologically diagnosed and 22 lesions were radiologically confirmed. The mean value of the largest diameter of the lesions was 3.9cm (1.1cm ~ 8.5cm). All patients had been done SMI examination for the liver lesions, and at least had been done one of the listed imaging technology (contrast enhanced ultrasound, enhanced CT or enhanced MRI). The patients were divided into subgroups based on the characteristic of SMI results and compared the clinical value of SMI in diagnoses of focal liver lesions to the above three imaging technology.

Results: The SMI manifestations of hemangiomas were described as three subgroups: diffuse dot-like type (n=6); strip rim type (n=8); nodular rim type (n=3), the largest diameters of the three groups were obviously different (P=0.0, <0.05) and these findings were corresponding to the enhanced ultrasound/CT/MRI. The hepatocellular carcinoma were described as two subgroup: diffuse honeycomb type (n=2); strip trunk with tiny branches (n=3). Four of the metastatic lesions were from breast cancer in one patient, the SMI manifestation was like the second type of hemangioma with strip rim; the other metastatic lesion was from pancreatic cancer had the same SMI type of lymphoma with thick rim type. All of the FNH was described as spoke-wheel type, the adenoma was described as diffuse honeycomb type.

Conclusions: SMI technology made the evaluation of micro-vascular of focal liver lesions possible without any enhanced agents. The SMI type were obviously different from different lesions, which could provide additional diagnostic information. While some lesions had the same type, this result was need further research with large sample size.

PPT12-031

The Place of Ultrasound Examination in Diagnosis of Abdominal Liquid Collections

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Objectives: The detection of liquid collections remains a challenge for the traumateam, especially when there is multiple trauma. We present our experience in thediagnosis, follow-up and planning therapy of free and encapsulated abdominal liquidcollections by performing ultrasound examination.

Methods: 143 emergency trauma patients /116 male and 27 female/ were examined usingultrasound for a period of 3 years. The right and left oblique and polypositioning viewwas used for US examination to identify free and bounded liquid collections in theabdominal cavity. The examination was performed immediately after the initial clinicalsurvey with patients supine. Positive findings of liquid collections on US were comparedwith those provided by CT, punctures under US control or surgery. US machine suppliedwith 3.5 and 7 MHz linear and convex transducers , CT device-GE 3000i, needles andcatheters were used.

Results: One hundred and fifteeen /80.41%/ of all 143 US examined trauma patients hadfree and encapsulated liquid collections, confirmed by CT scan, surgery or clinivalcourse. In 59 /51.30%/ patients we performed fine needle puncture under US control.There were 95 true-positives, 14 true-negatives, 2 false-positives and fore false-negativeresults. Overall this demonstrated that ultrasonography had a sensitivity of 95.95%,specificity of 87.50% and accuracy of 94.78%. The PPV is 97.93% and the NPV –77.77%.

Conclusions: Our experience and literature reports support the opinion that USexamination should be used as a primary method for diagnosis and follow-up ofabdominal liquid collections in emergency patients.

PPT12-032

The Utilization of Upper Abdominal Ultrasonography in Taiwan

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Objectives: There is currently a lack of published data on utilization of upper abdominal ultrasonography in Taiwan. In order to get information on this topic, we analyzed data obtained from National Health Insurance that covered almost whole population of Taiwan.

Methods: We conducted a nationwide population-based retrospective study about the use of upper abdominal ultrasonography in Taiwan. The data were retrieved from the Taiwan Longitudinal Health Insurance Database 2005.

Results: Among 15,037,146 individuals applied for health reimbursement in 2005, a total of 65,535 patients were examined by upper abdominal ultrasonography. Males was 53.1%. Mean age of the patients was 50.5 ± 17.3 years (range: 0 to 107 years). Most of the upper abdominal ultrasonography were done in young adults (73.1%), followed by greater than or equal to 65 years 23%, and younger than 20 years: 3.9%,. Except for screening purposes, the most frequent reasons for requesting upper abdominal ultrasonography (expressed as number of patients) were chronic hepatitis (14,657), abdominal pain (2,159), cirrhosis of liver (2,144), hepatoma (1,463), calculus of gallbladder (1,202), calculus of kidney (898), hepatitis (743), disorder of urethra and urinary tract (606), urinary tract infection (565), and chronic kidney disease (533).

Conclusions: This report offers information of utilization of upper abdominal ultrasonography in Taiwan. The information may be applied for economic analysis.

PPT12-033

Trans-Abdominal Ultrasonography of Pancreas is Superior to Liver for Detection of Ectopic Fat Deposit Resulted from Metabolic Syndrome

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Objectives: Non-alcoholic fatty pancreas disease (NAFPD) is frequently found through trans-abdominal ultrasound examination. The incidence of NAFPD varied from 16% to 69.7% in different country. The aim of our study was to investigate the occurrence rate of NAFPD in a south China province of Fujian and the relations to non-alcoholic fatty liver disease(NAFLD) and metabolic parameters.

Methods: A total of 256 subjects were recruited. Each was assessed by abdominal sonography to diagnose NAFLD and NAFPD. The ages, genders, heights, weights and detection of peripheral blood biochemical indexes (cholesterol, triglycerides, high-density lipoprotein cholesterol, low density lipoprotein cholesterol and glucose) were recorded. The relationships among metabolic parameters and NAFPD or NAFLD were evaluated, and the positive rates of NAFLD and NAFPD in the general population were compared.

Results: The age, BMI, holesterol, triglycerides, high-density lipoprotein cholesterol, low density lipoprotein cholesterol and glucose were significantly associated with NAFPD and NAFLD (P<0.05), while the positive rate of NAFPD was significantly higher than that of NAFLD.

Conclusions: NAFPD and NAFLD can reflect the body metabolism, while NAFPD has a higher sensitivity.

PPT12-034

Ultrasonographic Atlas of Splenic Lesions

Kyeong Ah Kim, Gayoung Choi, Jung Woo Kim, Yang Shin Park, Jong Mee Lee, Jae Woong Choi, Chang Hee Lee, Cheol Min Park

Department of Radiology, Korea University Guro Hospital, South Korea

Objectives: This poster presentation presents a comprehensive overview of ultrasonography of splenic lesions. Certain ultrasonic features are also discussed with pathologic correlation.
Methods: We review the ultrasonic characteristics of a wide range of splenic abnormalities, illustrating them with images obtained in our institution from 2005 to 2016.
Results: We describe the ultrasonic features of various splenic lesions: 1. Anomalies and anatomic variants (wandering or ectopic spleen, accessory spleen) 2. Nonneoplastic diseases (splenomegaly, Gamna-Gandy Bodies, infarction, cystic lesions, peliosis) 3. Infection and inflammatory diseases (pyogenic abscess, fungal abscess, tuberculosis, sarcoidosis) 4. Benign neoplasms (hemangioma, lymphangioma, hamartoma, sclerosing angiomatoid nodular transformation, inflammatory pseudotumor) 5. Malignant neoplasms (lymphoma, angiosarcoma, metastatic tumors), based on gray-scale and color Doppler sonography.
Conclusions: Ultrasound is a widely available, noninvasive, and useful modality of diagnosing splenic lesions. A combination of ultrasonic characteristics and clinical data may provide an accurate diagnosis. If the US appearance alone is not enough, US may also be used to guide biopsy of suspicious lesions.

PPT12-035

Ultrasonography of Perinephric Fluid: Differential Diagnosis and Image Interpretation

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[1]Department of Medical Imaging, Chung Shan Medical University Hospital, Taiwan, [2]Department of Medical Imaging and Radiological Sciences, Chung Shan Medical University, [3]Department of Medical Imaging, School of Medicine, Chung Shan Medical University

Objectives: Perinephric fluid is a critical finding of ultrasonography in daily clinical practice. The condition includes a broad spectrum of diseases and the fluid may arise from the kidney or adjacent retroperitoneal structures. We present a case series of patients with perinephric fluid collection with ultrasound images. The brief history, physical examination and image interpretation are addressed as well as the images of subsequent other modalities.
Methods: Case series and literature review.
Results: Cases of pyelonephritis with abscess, obstructive uropathy with perirenal urine leakage, renal laceration with hematoma, pseudoaneurysm and perirenal lymphangiomatosis were reviewed. In most cases, the distinguishing ultrasound characteristics about the fluid shape, internal echogenicity, or the Doppler signal serve as clues to the astute sonographer to search more carefully for an underlying disease.
Conclusions: Perinephric fluid includes a broad spectrum of diseases and ultrasonography plays an important role of management at the point of care.

PPT12-036

Ultrasound Finding of Unusual Duodenal Tumor: Brunner's Gland Harmatoma

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Objectives: Abdominal ultrasound is usually applied for screen for hepatobiliary lesion. Duodenum is usually to visualize with ultrasound. In this report, we report the ultrasound finding of unusual duodenal tumor.
Methods: A 52-year-old male visited our hospital because of dull postprandial upper abdominal pain and intermittent tarry stool passage for one month. He had no weight loss during the period. He has medical history of hypertension. An upper endoscopy revealed a duodenal tumor and abdominal CT disclosed a 2.6cm well-defined tumor rising from the duodenal bulb. Abdominal ultrasound was performed.
Results: Abdominal ultrasound revealed a duodenal tumor with some cystic lesions within of the tumor. A differential diagnosis of this case from ultrasound findings of duodenal cyst containing tumor includes heterotopic pancreas, cystic degeneration of solid tumors (i.e. gastrointestinal stromal tumors, neurogenic tumors), and Brunner's gland harmatoma, which correlated with the the dilatation of the glandular acini or ducts of the Brunner's gland. The patient finally received laparoscopic resection of the tumor and pathology revealed Brunner's gland harmatoma.
Conclusions: An abdominal ultrasound can be useful for evaluation of duodenal tumor. A finding of cystic lesion within the tumor should remind the clinician the diagnosis of Brunner's gland harmatoma.

PPT12-037

Ultrasound of Peritoneal (Dry Type) and Small Bowel Tuberculosis among HIV-AIDS

Maria Goretti Ametembun
Department of Internal Medicine, Cicendo Eye Hospital, Bandung, Indonesia

Objectives: To describe ultrasound of peritonitis tuberculosis (dry type) and small bowel tuberculosis among HIV-AIDs.
Methods: This cross sectional study was conducted at a small private clinic in Emma Poeradiredja Hospital Bandung, Indonesia from July 1, 2011- December 31, 2011. Data were collected from all HIV patients by one certified ultrasound internal medicine specialist using ALOKA SD1100.
Results: N=8 (23-44y, mean 28), all male HIV patients. 1 (13%) had hepatitis B and C and 1 (13%) had hepatitis B. 5 patients (63%) had history of drug abuse. One (13%) patient has had ARV for 2 years, 2 (25%) were newly diagnosed with HIV, while the rest (63%) patients have had intermittent ARV. CD4 range (45-223, mean 127), positive tuberculin skin test (> 5 mm) but negative sputum smear. All were peritonitis tuberculosis (dry type) and small bowel tuberculosis. Normal peristaltic and small bowel wall thickness (2.1-3.9 mm, mean 3.8 mm) were examined on the tympanic area. Hypo peristaltic, thickening heterogenic hypoechoic wall (6.9-24.6 mm, mean 18.4 mm, 4.84 x than on tympanic area), loss differentiation of the wall layers, irregular margin in addition to several round nodular structure within the thickened small bowel wall were examined on the dullness affected area.
Conclusions: Peritoneal tuberculosis (dry type) and small bowel tuberculosis has some characteristics in HIV AIDs.

PPT12-038

Value of Us in Patients with Equivocal CT Findings of Acute Appendicitis: Comparison with CT Reassessment

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Objectives: To compare diagnostic values of ultrasound (US) and CT reassessment in patients with equivocal CT findings of acute appendicitis, including those with coexistent inflammatory lesion.

Methods: Patients with equivocal CT findings of acute appendicitis (n=115), who underwent US, were included. Two abdominal radiologists reviewed CT scans independently. They analyzed four CT findings (appendiceal wall enhancement, appendiceal wall thickening, intraluminal air in appendix, and coexistent inflammation) and make a diagnosis of acute appendicitis. Patients were categorized into positive and negative appendicitis based on previous US reports. The diagnostic performance, interobserver agreement in CT findings interpretation, and appendicitis likelihood were calculated.
Results: The area under the receiver operator characteristic curve (AUC, 0.960), sensitivity (100%), and specificity (92.1%) of US was higher than those of CT reassessment (reviewer 1: 0.697, 51.9% and 87.5%; reviewer 2: 0.759, 66.7% and 85.2%, respectively). In the coexistent inflammation group, the AUC (0.990), sensitivity (100%), and specificity (98.0%) of US were higher than those of CT reassessment (reviewer 1: 0.607, 27.3% and 94.1%, reviewer 2: 0.561, 14.3% and 98.0%%, respectively). Interobserver agreement in the CT diagnosis of appendicitis was moderate (κ=0.44).
Conclusions: In patients with equivocal CT findings of acute appendicitis, US shows better diagnostic performance compared to CT reassessment, and helps differentiate between acute appendicitis and periappendicitis.

PPT12-039

Very Important Ultrasound Role in Diagnose & Treatment Follow-Up Peritoneal and Small Bowel Tuberculosis

Maria Goretti Ametembun
Department of Internal Medicine, Cicendo Eye Hospital, Bandung, Indonesia

Objectives: To describe ultrasound's very important role in diagnosis and treatment follow up of peritoneal and small bowel tuberculosis.
Methods: This retrospective study was conducted at St Elisabeth Hospital, Flores, during February 2012 - August 2013 using ALOKA SD1100 by one very skill certified ultrasound internal medicine specialist. Data were abstracted from medical records of all completed treated of peritoneal and small bowel tuberculosis.
Results: N 546 (14-85 y, x 36,5y), 312 (57%) female, 234(43%) male. Diagnose: All with recurrent colic abdomen pain, diarrhea/obstipation, distention, doughy & dam-board phenomena according to dry type peritoneal tuberculosis, constitutional symptoms, cough and X-ray suggestive lung tuberculosis. Small bowel ultrasound on dullness pain area were: a/hypo- peristaltic, irregular thickening heterogenic hypo-echoic, irregular margin of the wall, loss differentiation of the wall layers, with several oval/round nodular structures those suggestive granuloma process) within the wall and narrowing of the lumen. Follow up during treatment: all the symptoms & signs, dullness area, wall thickening, lumen narrowing were disappeared gradually. After the treatment: no abdominal pain/tenderness/doughy abdomen/dullness area/ constitutional sign &symptoms anymore. Only 292 (53%) then carried ultrasound at the end of treatment (because of economic reason) showed intestine wall thickening were decreased and normal peristaltic were seemed on the affected area, but the wall margin were still irregular.
Conclusions: Ultrasound was very useful and important for more thorough diagnosis & follow-up the treatment of peritoneal and small bowel tuberculosis.

PPT12-040

Ultrasound of Peritoneal and Small Bowel Tuberculosis among Mental Illness Patients

Maria Goretti Ametembun
Department of Internal Medicine, Cicendo Eye Hospital, Bandung, Indonesia

Objectives: To describe ultrasound of peritonitis (dry type) and small bowel tuberculosis among mental illness patients.
Methods: This cross sectional study was conducted at Mental Hospital of West Java Province from August-December 2011. We obtained written informed consent from the subjects, the person responsible for the individual, and the medical committee of hospital. Data were collected by one certified ultrasound internal medicine specialist using (1) questionnaire: both constitutional symptoms and symptoms related to the specific organ affected; (2) physical examination, doughy abdomen, "Dam-board' phenomenon" (3) abdominal ultrasound using ALOKA SD1100.
Results: Within the total 275 patients in the hospital, 162(59%)(14-62y, mean 28,5y) patients with peritonitis (dry type) and small bowel tuberculosis, including 68 (42%) female and 94 (58%) male. The breakdown of psychiatric disorder diagnosis were : 68(41,97%) hebephrenic schizophrenia, 11(6,79%) residual schizophrenia, 61(37,65%) paranoid schizophrenia, 11(6,79%) severe depression and psychotic alteration, 9(5,55%)bipolar disorder, 1(0,62%) postpartum depression, and 1(0,62%) mental retardation. Ultrasound findings were: hypoperistaltic, thickening heterogenic hypoechoic of the small bowel wall (6,2-22,6 mm, mean 12,44 mm, 6,2 x than on tympanic area), loss differentiation of the wall layers, irregular margin in addition to several round nodular structure (patchy hyper echoic non-shadowing with an irregular rim of lower echodensity) within the wall and narrowing the lumen on the dullness area.
Conclusions: Peritoneal tuberculosis (dry type) and small bowel tuberculosis had some ultrasound characteristic were frequent among mental illness.

OPT12-041

Ultrasound-Guided Percutaneous Core Needle Biopsy of Splenic Lesions

Yong Moon Shin, Sang Ik Park, Hyung Jin Won, Pyo Nyun Kim, Moon Gyu Lee, So Yeon Kim
Department of Radiology, Asan Medical Center, University of Ulsan, South Korea

Objectives: To evaluate the safety and efficacy of ultrasound-guided percutaneous core needle biopsy of splenic lesions.
Methods: This retrospective study included 30 patients who underwent percutaneous core needle biopsy of their splenic lesions using 18-gauge or 20-gauge needles between January 2001 and July 2016 in a single tertiary care center. The characteristics of the splenic lesions were determined by reviewing the ultrasound and computed tomography examinations. Acquisition rate and diagnostic accuracy were calculated, using pathologic results of the splenectomy specimen, clinical course and/or imaging follow-up as a reference standard. Electronic medical records, laboratory findings and computed tomography images were reviewed to identify post-procedure complications. Seventy-three pieces of specimens were obtained in the 30 patients and splenectomy was performed in 2 patients.
Results: Twenty-nine of the 30 patients had focal splenic lesions, while the other patient had homogeneous splenomegaly. Acquisition rate and diagnostic accuracy were 80.0 % (24/30) and 76.7 % (23/30), respectively. Perisplenic hemorrhage without hemodynamic instability developed in one patient.
Conclusions: Ultrasound-guided percutaneous core needle biopsy of splenic lesions is a safe method in achieving a tissue diagnosis. It can be considered as an alternative to splenectomy in patients with a high risk of splenectomy-related complications.

T13. Otolaryngology & Head Neck

Pre-Congress Workshop/Symposium

T13-13-IN01

Sonographic Anatomy of the Head & Neck, How & Why

W. K. Tang, E. Dai, A. T. Ahuja
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Sonographic examination of the neck consists of a series of sweeps, predominantly with the transducer held transversely. The examination may be altered depending on the patient's clinical presentation.

A complete examination includes evaluation of both sides of the neck beginning in the submental region, through the submandibular, parotid regions, along the carotid & internal jugular veins (including vagus nerve), down to medial head of clavicle & then transversely across the supraclavicular fossa & then the posterior triangle (including brachial plexus). The examination is finally completed by evaluating thyroid, trachea, esophagus, paratracheal areas & the tracheo-esophageal grooves. This comprehensive examination requires knowledge of sonographic anatomy, meticulous attention to detail, a high resolution transducer & ensures no obvious abnormalities are missed.

Familiarization of anatomy of the neck is essential because lesions in the head & neck are site specific. Their embryologic origin & location are the first clue towards it's diagnosis/narrow differential diagnosis (eg, dermoid/epidermoid, thyroglossal duct cysts, branchial apparatus abnormalities, vagus & brachial plexus schwannomas & carotid body paraganglioma). To their anatomical location, the addition of sonographic/imaging appearances often provides an accurate final diagnosis & obviates the need for pre-treatment biopsy in many cases.

This presentation will discuss the sonographic technique, anatomy of the neck & the identifying abnormalities predominantly based on their anatomical location.

T13-13-IN02

Neck lesions- FNA / Core Biopsy -Tips and Tricks

Dr. Asif Momin, MD
Prince Aly Khan Hospital, India

With the expanded use of ultrasound guidance in neck lesions the demand for obtaining adequate, representative samples both in FNAC and core biopsies has become pivotal in diagnosis and management of various overlapping pathologies. There is specific need for obtaining samples for detection of primary neoplasm, metastatic spread, bacteriological studies in infected lesions and many confusing cases of post treatment neck. Specific tricks regarding aspiration of complex nodules with both cystic and solid components like thyroid lesions. Avoidance of many neurovascular structures during core biopsies by choosing correct needle path and notch sizes, correct patient position, small footprint probes, using colour as contrast and sometimes saline dissection are important.

Patient safety, adequate anaesthesia and careful slide preparation using correct transport media are valuable points for successful outcome. Specific techniques to obtain adequate samples from orbital lesions, salivary glands neck nodes oesophageal lesions, superior mediastinal lesions extending in suprasternal region as well as routine thyroid/ parathyroid and nodal masses need to be planned. Specific cases like laryngeal lesions, prevertebral regions and tonsillar lesions need special attention.

Rare complications and ways to avoid them should be kept in mind while using aseptic technique under universal precautions.

T13-13-IN03

Ultrasound Based Korean Thyroid Imaging Reporting and Data System (K-TIRADS)

Byungjoo Lee
Department of Otorhinolaryngology-Head and Neck Surgery, Pusan National University, Korea

Recently, thyroid nodules increased a lot in the world. This increase maybe is due to an increase in the frequency of ultrasonography in asymptomatic patients, although there are some debates. The rate of malignancy of thyroid nodule detected ultrasonography is reported to be 8-12%. These rate is similar with the malignant rate of thyroid nodules found by palpation.

Ultrasonography is very important basic tools for thyroid nodules. There are several roles of ultrasound in the evaluation of thyroid nodule. First, ultrasonography can easily detect thyroid nodules in asymptomatic patients. Second, the possibility of cancer of thyroid nodules found by ultrasonography can be assessed. Third, ultrasonography can be used to select thyroid nodules to perform FNA and to help determine the portion of the thyroid nodules to undergo FNA. Assessment of the location and size of thyroid cancer by ultrasonography will help determine the surgical method and extent of surgery in thyroid cancer.

Ultrasonic evaluation of thyroid nodules used various parameters. Ultrasonography can assess the size of the thyroid nodule and helps to predict the malignancy and benignity of the diagnosed thyroid nodule using various sonographic findings, such as, internal content, echogenicity, shape, orientation, margin, calcification, halo sign, spongiform sign, vascularity. The risk stratification system was proposed to the Korean Radiological Society to evaluate the risk of cancer of the thyroid nodules based on internal content and echogenicity. I will present the Korean Thyroid Ultrasound based Thyroid Imaging Reporting and Data System (K-TIRADS).

T13-13-IN04

ARFI Elastography (ARFI Imaging) for Diagnosing Cervical Lymph Node Metastasis from Head and Neck Squamous Cell Carcinoma

Takahiro Fukuhara, MD, PhD
Tottori University Faculty of Medicine

Elastography is the novel tool for assessing a new characteristic of target tissues, i.e., elasticity. This tool has not been applied in the head and neck region.

Conventional elastography using manual compression provides the degree of relative strain with color mapping. As color mapping changes continuously depending on variations in pressure, an examiner subjectively fixes the image, and thus images from conventional elastography are not reproducible.

On the other contrary, elastography using acoustic radiation force impulse (ARFI) evaluates the tissue displacement generated by an acoustic push pulse. It can objectively assess the local elastic characteristics of target tissues using a gray scale image. ARFI elastography produces one image for each acoustic push pulse, and it is expected to exhibit high intra- and inter-examiner reliability. ARFI elastography may be particularly useful in the head and neck, where target tissues are superficial, because acoustic push pulses are less likely to be attenuated.

I will present the utility of ARFI imaging for diagnosing metastasis lymph nodes associated with head and neck squamous cell carcinoma.

T13-15-IN05

Ultrasound of Neck Masses in Pediatrics

Panruethai Trinavarat
Radiology, Chulalongkorn University, Bangkok, Thailand

US plays an important role in the evaluation of palpable neck masses in pediatric patients. The superficially located structures are easily examined

and exquisitely displayed by US using a high-frequency linear array transducer. In most of the cases, US can differentiate cystic from solid lesions. For the cystic lesions, the imaging diagnosis is based on location. The midline or paramedian location of cystic neck masses in pediatrics mostly are thyroglossal duct cyst and dermoid/epidermoid when locating between hyoid bone and thyroid gland, ranula or plunging ranula when locating in sublingual or submandibular spaces, and dermoid/epidermoid again when locating at suprasternal notch. Epiglottic cyst can also be detected in its typical location when there is no intervening air. The laterally-located cystic lesions are branchial cleft cyst, venolymphatic malformation, and phlebectasia of the jugular vein. Lymphatic malformation has its typical location in posterior triangle of the neck. Contents within cystic neck masses in many cases are not echo-free and may appear as pseudo-solid lesions on US. For the solid neck masses in pediatrics, US usually can tell whether it is an enlarged lymph node or not. Like in adult, US may depict the suspicious lymph node for biopsy. The imaging diagnosis of the solid neck masses other than enlarged lymph nodes in many cases are nonspecific and need histological diagnosis. However, there are some typical solid lesions that the diagnosis could be provided, e.g., fibromatosis colli, infantile hemangioma, ectopic thymus, and ectopic thyroid.

Symposium

T13-14-IN01

The Role of Ultrasound in Imaging Obstructive Salivary Gland Diseases

E. Dai, W. K. Tang, A. T. Ahuja
Department of Imaging & Interventional Radiology, The Chinese University of Hong Kong, Hong Kong SAR, China

Advances in minimally invasive treatment have altered the management of obstructive salivary gland diseases. It requires early detection & cause of the obstruction, it's anatomical site, & any associated complications.

The imaging modalities to evaluate these conditions include Xray/orthopantomogram, ultrasound, conventional/digital subtraction sialography, CT/CBCT, MRI.

The superficial location of the major salivary glands render them readily amenable for examination with high resolution ultrasound, particularly the sublingual & submandibular glands. Although the superficial parotid can be evaluated with ultrasound, the deep lobe is obscured by the mandible & cannot be visualized.

In addition to identifying the cause of obstruction, imaging, including ultrasound evaluates associated changes in glandular parenchyma, abscess/mucocele/sialocele, Kuttner tumour formation & glandular atrophy.

This presentation will discuss the role of ultrasound as 1st line investigation amongst the gamut of available imaging modalities, it's advantages & limitations & the appropriate choice of other imaging modalities when ultrasound fails.

T13-14-IN02

Pearls and Pitfalls in Ultrasound of Pediatric Head and Neck

Panruethai Trinavarat
Radiology, Chulalongkorn University, Bangkok, Thailand

US is the first imaging method for several diseases of the head and neck in pediatric patients, including developmental and acquired lesions. To get the most benefit out of US examination, good technique in scanning and good knowledge in interpretation are required. Knowledge of developmental disorders (e.g., thyroglossal duct cyst, branchial cleft or pouch anomalies), unique pediatric normal structures (e.g., thymus, palatine tonsil) and the ones in ectopic location (e.g., thyroid, thymus, parotid), unique pediatric diseases (e.g., hemangioma, fibromatosis colli), awareness of a pseudo-solid or pseudo-cystic lesion and adding techniques to clarify (e.g., adjust settings, turn on color mode, compressing), knowing the artifacts (e.g., mirror image from skull), and getting the most out of clinical information (e.g., patient's age, mass appears only in specific position or situation, sign of inflammation) are very important for scanning and interpretation. Many of the pitfalls are from not following the basic ultrasound scanning instructions. The examples of the basic instructions are selecting the appropriate type and frequency of the transducer, covering the appropriate depth, selecting proper window for scanning, scanning in two orthogonal planes, and comparing the echogenicity.

T13-14-IN03

High Resolution Ultrasound of Paediatric Neck

Prof. P. K. Srivastava, MBBS, MD (Radiology), FICR, FICMU
Professor, Deptt. Of Radiodiagnosis, King George's Medical University, Lucknow

High resolution ultrasound is an excellent modality of evaluation of paediatric neck. The excellent tissue details and anatomical landmarks in the neck like thyroid cartilage, trachea, strep muscles and neck vessels have made assessment of the neck masses a practical proposition. The neck masses are divided into two major groups, 1. Thyroid neck masses 2. Non thyroid neck masses. The non thyroid neck masses include cervical masses, lymph node mass, salivary gland masses, nerve tumors, vascular masses, inflammatory masses, parasitic infestations, congenital masses, benign and malignant neck tumors. High resolution ultrasound is multi planner, non invasive, cost effective imaging modality, which is having advantage of CT scan and MRI, since the spatial resolution of ultrasound is much better than CT and MRI. The biggest advantage is that it is dynamic modality, which does not require any sedation or special preparation for evaluation of neck masses. The excellent tissue characterization of various structures in the neck on ultrasound, clearly differentiate different pathologies. The 3D ultrasound with multi planner imaging increases the diagnostic accuracy. The lecture is only restricted to non thyroidal soft tissue masses of the neck.

T13-14-IN04

Mimics of Neck Lesions in Post Treatment Neck Surveillance

Asif Abalal Momin
Chief of Imaging, Prince Aly Khan Hospital, Mumbai, India

This talk highlights the possible mimics seen in a busy oncology centre during a follow up imaging, especially ultrasound (US) of the neck. Various innocuous findings may be mistaken for recurrent or residual disease causing confusion due to inexperience or an apparent lack of knowledge.

All the findings, which may lead to an erroneous diagnosis, have been divided into the following categories. Thyroid and salivary gland abnormalities, nodal, vascular, neurogenic, cartilaginous, bony and soft tissue abnormalities. These include several conditions which mimic metastatic nodes, extra capsular nodal spread, residual lesions of thyroid bed, parathyroid adenomas and a few specific lesions such as Kutteners tumor of submandibular gland. Post operative or foreign body granulomas may mimic soft tissue recurrences or laryngeal neoplasm. In two cases parasitic pathology was identified causing concern for neoplasm. Calcified, necrotic or non necrotic tuberculous lymph nodes also form an important subset due to its high incidence in some countries. Normal thymic and tonsillar tissue also adds to the confusion.

These various normal and abnormal findings in Head and Neck cancer follow-up need to be understood by radiologists of various levels of expertise in busy imaging departments.

T13-14-IN05

How Does Ultrasound-Guided Core Biopsy Change the Clinical Practice of Diagnosing Head and Neck Diseases

Tsung-Lin Yang, MD, PhD

Department of Otolaryngology, National Taiwan University Hospital and National Taiwan University College of Medicine, Taipei, Taiwan

To make the accurate diagnosis before definite treatments is important for head and neck diseases. However, it may be clinically challenging because of anatomical complexity and disease diversity. Sampling by open biopsy (OB) remains the standard procedure to have the pathological confirmation. However, complicated anatomical structure of head and neck may render surgical intervention difficult. Ultrasound-guided core biopsy (USCB) is a minimally invasive and office-based procedure for tissue sampling, which has been widely applied in many diseases of head and neck. Our work had proven that USCB has superior advantages when used in diagnosing head and neck diseases. When compared with the results obtained from open surgery, no significant difference was noted between these two groups in terms of diagnostic accuracy and the percentage of inadequate specimens. All cases in the USCB group had the sampling procedures completed less than ten minutes, but not in the OB group. No obvious scars were found after USCB. Only patients in the OB groups had scars postoperatively, and may need to receive general anesthesia and hospitalization and Accordingly, USCB is suggested to serve as the first-line sampling tool for head and neck diseases with high diagnostic accuracy, minimal invasiveness, and low medical cost.

T13-14-IN06

Head and Neck Sonography from the Viewpoint of a Surgeon

Cheng-Ping Wang, MD
Department of Otolaryngology, National Taiwan University Hospital, Taipei, Taiwan

The ultrasound is the first-line imaging study for evaluation of the thyroid nodule. Comparing with other imaging studies, the ultrasound is the most sensitive and powerful imaging tool to detect the presence of the thyroid nodule and to distinguish between benign and malignant nodules. Besides, the ultrasound is very useful for follow-up of the thyroid nodule without surgery and those after surgery. The ultrasound is also a very promising imaging tool for other head and neck diseases, including major salivary gland diseases, cervical lymph nodes and other specific diseases.

In terms of surgery, the ultrasound provides surgeons much more anatomical information of the thyroid nodule and other head and neck diseases beside differential diagnosis. Through the ultrasound, surgeons could know the extent of central and lateral lymph node metastasis, the anatomical relationship between the recurrent laryngeal nerve and the tumor, tracheal/thyroid cartilage and esophagus compression or invasion, and intrathoracic extension for thyroid tumors. The most amazing part of the ultrasound for head and neck surgery is that surgeons could know the best approach for head and neck surgery, especially revised surgery, and the potential risks/complications.

In this speech, I will talk about the head and neck ultrasound and will more focus on the benefit of the ultrasound on head and neck surgery from the viewpoint of a surgeon, who is always doing the ultrasound by myself for patients, before and after surgery.

T13-14-IN07

Elastography of Neck Masses

Dr.Chander Lulla
Ria Clinic

Elasticity (hardness) is a mechanical tissue characteristic that prevents tissue displacement under pressure.

It varies in different types of tissue (fat, collagen and so forth) and in the same tissue in different pathologic states (inflammatory, malignant).

During the past few years, sonographic elastography, magnetic resonance elastography and some other techniques have performed digital measurements of tissue hardness. http://www.eusjournal.com/article.asp?issn=2303-9027;year=2014;volume=3;issue=1;spage=58;epage=62;aulast=Okasha - ref1

Two techniques of elastography have evolved
1) Strain elastography (SE)
2) Shear Wave elastography (SWE)

US elastography Strain scoring (patterns) system for Lymph Nodes(LN) and Thyroid masses

Score 1: The entire LN is red or green, i.e., soft.
Score 2: 80% or more of the cross-sectional area of the LN is red or green, i.e., soft.
Score 3: 50% or more and less than 80% is red or green.
Score 4: 50% or more and less than 80% is blue; and
Score 5: 80% or more of the cross-sectional area of the LN is blue i.e., hard.

Shear Wave Elastography SWE provides quantitative elastic information on the basis of the acoustic pulse of a US probe that stimulates tissues, thereby producing a real-time elastogram.

Sonographic elastography in the neck can be primarily used to evaluate pathologies involving Lymph nodes (LN), thyroid nodules and salivary gland nodules http://www.eusjournal.com/article.asp?issn=2303-9027;year=2014;volume=3;issue=1;spage=58;epage=62;aulast=Okasha - ref4. Differentiation between reactive and metastatic lymphadenopathy is vital and one of the differentiating criteria is hardness (elasticity) of the mass.

LYMPH NODES LNs that have sonographic criteria suggestive of benign nature and had elastography score of 1 hence biopsy is not indicated and the diagnoses is based on follow-up with the minimum period of 12 months.

In LNs with score 2, if clinical or sonographic suspicion existed the LN was subjected to histopathological examination, but in case of low suspicion a follow-up policy can be adopted to avoid unnecessary invasive procedures.

All LNs with score 3 and 4 are subjected to histopathological examination either by biopsy or FNAC.

Thyroid Nodules Using strain criteria in a study by Rago differentiating benign nodules from malignant ones was a mean elasticity index of 65 kPa on SWE. The sensitivity and the specificity for malignancy were 51.9% and 97% in the case of gray-scale US and 81.5% and 97.0% in the case of the combination of gray-scale US and SWE.

SWE: Sebag et al.in a study of 146 thyroid nodules form 93 patients, the cut-off point for discriminating benign nodules from malignant ones was a mean elasticity index of 65 kPa on SWE.

The sensitivity and specificity for malignancy were 81.5% and 97.0% in a combination of gray-scale US and SWE, respectively

Conclusion: While elastography is a promising technique in some organs such as the breast and the liver there have been conflicting results of its additional value in predicting thyroid malignancy and Lymp Node charachterisation

To be a good adjunctive diagnostic tool to conventional US, additional elastography should improve the diagnostic performances of conventional US, rationalizing the consequently longer US time and the additional cost of elastographic software that comes with its use.

T13-14-IN08

B-Mode and Color Doppler Ultrasound Evaluation of Neck Lymphadenopathy

Daniel Makes
Department of Radiology, Pelni Hospital; World Federation of Ultrasound in Medicine & Biology- Center of Education (Jakarta WFUMB-COE), Jakarta

Ultrasound examination and evaluation of neck lymph-nodes is an essential part if somebody will make a complete head and neck lesion examination.

Recently, with use of modern high-resolution Ultrasound machine and transducer makes it possible we to depict images with higher diagnostic accuracy.

Usually, B-Mode US can evaluates lymph-node morphology while Color Doppler US evaluates the intranodal vascularization.

In this paper we will discuss about the equipment & settings, scanning technique and the ultrasound criteria for differential diagnosis between benign from malignant lymph-node by means of B-Mode and Color Doppler US.

T13-14-IN09

Sonography of Salivary Glands

Sudheer Gokhale, MD, FICR, FICMU, FAIUM
Sri Aurobindo Medical College & P G Institute, Indore, India

Patients with salivary gland abnormalities present most commonly with painful or painless focal swelling, dryness of mouth or pain on eating certain type of food.

The Sonography of Salivary glands needs to answer certain questions. Is there a focal mass? Is it benign or malignant? Is the lesion single or multiple? What is the location? Are there any Lymph nodes?

US is accepted as the first imaging method for assessment of diseases of major salivary glands. Lesions in the deep lobe of parotid gland or behind the mandible are difficult to see. US needs to be complimented by MRI, and also when the tumors are large or appear to bulge into oral cavity or oropharynx. CT is considered better in assessment of inflammatory diseases of salivary glands.

Acute Inflammation: In acute inflammation, salivary glands are enlarged and are often hypoechoic. The glands may be inhomogeneous; may contain multiple small, oval, hypoechoic areas.

Chronic Sialedenitis: In chronic inflammation, salivary glands are normal sized or smaller, hypoechoic, and inhomogeneous and usually do not have increased blood flow. Multiple small hypoechoic foci on a heterogeneous background.

Sialolithiases: 60-90%Salivary calculi occur in the submandibular gland. Parotid calculi are relatively less commonUS and MR are the main modalities for detection of calculi and assessment of ducts.

Sjogren Syndrome: Bilateral glandular involvement. Parotid & Submandibular glands are commonly involved. Sometimes lacrimal glands are also involved. USG reveals heterogeneous echopattern, multiple round hypoechoic areas, reticulated pattern.

Neoplasms: Salivary gland neoplasms are not common. Most of them occur in Parotid glands (80-90%). Most of them are benign (70-80%). Neoplasm in submandibular gland is rare (10-20%) but almost 50% of them are malignant.

Malignant Lesions: The most common malignant neoplasms occurring in salivary glands are mucoepidermoid carcinoma and adenoid cystic carcinoma.

Less than 30% of focal lesions in the parotid gland are malignant, whereas almost 50% of focal lesions in the submandibular gland are malignant.

Ultrasound characteristics are Irregular shape, Irregular borders, Ill defined margins, and Hypoechoic inhomogeneous structure.

T13-14-IN10

Thyroid and Perithyroidal Anatomy for Non-Surgical Treatment

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Ultrasound (US)-guided non-surgical treatments such as ethanol and radiofrequency ablation have been widely used in the treatment of thyroid nodules and neck tumors. For a safe and effective US-guided procedure, knowledge of neck anatomy, particularly critical structures such as nerves, is essential. However, most previous studies evaluated neck anatomy based on cadavers, computed tomography, or magnetic resonance imaging rather than US. Therefore, US based anatomy during US-guided procedure is necessary for non-surgical management. The aim of this lecture is to review US-based thyroid and perithyroid anatomy, focusing on its clinical significance in the use of prevention techniques for complications during the US-guided procedures. Knowledge of these areas may be helpful for maximizing the efficacy and minimizing the complications of US-guided procedures for the thyroid and other neck lesions.

T13-14-IN11

Utility of Intraoperative Ultrasonography for Head and Neck Surgery

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There are many major nerves and blood vessels in the neck. In addition, the anatomy of the neck is complicated. Hence, head and neck surgery is sometimes difficult to perform and intraoperative ultrasonography may be useful in such cases. Here, we will discuss several applications of intraoperative ultrasonography.

First, facial bone fracture can be detected by ultrasonography using an ordinary linear probe, and fracture reduction can also be evaluated by intraoperative ultrasonography. Second, ultrasonography can be used to predict the diameter of the trachea in infants, which shows a wide variation. In addition, anatomic abnormalities of blood vessels or the trachea can be also detected.

Recently, an extremely small-sized probe –2.5 cm in length and 0.85 cm in width– has been developed (L51K linear probe, Hitachi Healthcare. Co., Japan). This small probe makes it easy to use ultrasonography during transoral surgery, such as that performed for oral, oropharyngeal, hypopharyngeal or parapharyngeal tumors. Furthermore, it can also be used for transoral robotic surgery. It enable precise evaluation of the depth of tumor invasion, and the location of the vessels during surgery.

T13-14-IN12

Can Ultrasound Features Predict the Clinical Aggressiveness of Thyroid Cancer?

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Ultrasonography is very important basic tools for thyroid nodules. There are several roles of ultrasound in the evaluation of thyroid nodule. First, ultrasonography can easily detect thyroid nodules in asymptomatic patients. Second, the possibility of cancer of thyroid nodules found by ultrasonography can be assessed. Third, ultrasonography can be used to select thyroid nodules to perform FNA and to help determine the portion of the thyroid nodules to undergo FNA. Assessment of the location and size of thyroid cancer by ultrasonography will help determine the surgical method and extent of surgery in thyroid cancer.

Ultrasonography can help to predict the malignancy and benignity of the diagnosed thyroid nodule using various sonographic findings, such as, internal content, echogenicity, shape, orientation, margin, calcification, halo sign, spongiform sign, vascularity. Many previous studies have focused on distinguishing between malignant or benign thyroid nodule by ultrasonographic findings. There are few studies for the differences of clinical features according to various ultrasonographic findings of thyroid cancer. A hypothyroid nodule with a thyroid nodule have higher the possibility of malignant nodule than benign. However, papillary thyroid cancer has various internal echogenicity such as isoechoic, hypoechoic nodule, and marked hypoechoic nodule. There are a few studies about the difference of clinical feature according to internal echogenicity, such as, isoechoic, hypoechoic, or marked hypoechoic thyroid carcinoma. Therefore, we would like to evaluate the relationship

between important clinical risk factors (lymph node metastasis and extrathyroidal extension) and internal echogenicity in thyroid carcinoma. In addition, various ultrasonographic findings of thyroid cancer may be associated with histologic findings of thyroid cancer. So, I will present the relationship between several sonographic findings and two histologic findings (fibrosis and tumor growth pattern) of thyroid cancer.

T13-14-IN13

Imaging of Parathyroid Glands

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The management of primary hyperparathyroidism differs from secondary and tertiary hyperparathyroidism in that it is a surgical treatable disease and the current standard of care is minimally invasive parathyroidectomy. Hence there is a demand for accurate preoperative localization of abnormal parathyroid glands by imaging. In this lecture, the key sonographic anatomy and scanning technique for parathyroid glands will be covered with particular reference to their embryological descent in the neck. The typical and not so typical sonographic features of parathyroid adenomas will be discussed with illustrative case examples. Common pitfalls and mimics of parathyroid pathology will also be shown. The choice of imaging modality and flowchart for investigating parathyroid pathology will be explained, with case examples demonstrating ultrasound, MIBI scan and 4DCT correlation. The utility of ultrasound as a first line screening tool for evaluation of parathyroid diseases will be emphasized.

Free Paper

OPT13-001

Simultaneous Recording of Ultrasound and Polysomnography during Natural Sleep in Patients with Obstructive Sleep Apnea

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Objectives: Tongue base deformation may play a critical role in the phenomenon of obstructive sleep apnea, but polysomnography provides limited information regarding the effect of tongue motion during natural sleep. We reported on preliminary results of combining a novel ultrasound system and polysomnography (PSG) for simultaneous recordings during natural sleep in volunteers and patients with obstructive sleep apnea (OSA).

Methods: Ten healthy volunteers and five patients with OSA underwent time-synchronized PSG and submental transcutaneous ultrasound examinations during natural sleep. The wearable ultrasound device detected the air–mucosal interface of the tongue surface and automatically determined the maximum tongue base thickness (TBT) in real time. We compared the recorded ultrasonic TBTs between eupnea and other obstructive respiratory events using analysis of variance (ANOVA).

Results: All participants reported no sensation of heat, no sign of skin allergy, and an average of mild disturbance in natural sleep after the ultrasound recordings. In the individual patients with OSA, we demonstrated a significant difference ($p < 0.001$) between the ultrasonic TBT measured during eupnea and that measured during snoring, hypopnea, and apnea. On average, increased TBTs of 2.5 (4.1%), 6.0 (9.8%), and 7.7 mm (12.5%) are associated with snoring, hypopnea, and apnea, respectively.

Conclusions: Our present data demonstrate that simultaneous examination of ultrasonic TBT and PSG is feasible for prolonged recording during natural sleep. The proposed method also enables the detection of significant differences in ultrasonic TBT between eupnea and obstructive respiratory events evaluated using PSG. This novel technique can be used to generate hypotheses for subsequent investigations of the underlying mechanisms and individualized combined therapy for OSA.

OPT13-002

Is Computer-Aided Quantification of Intranodal Vascularity a Useful Tool for Differentiating Different Causes of Cervical Lymphadenopathy

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Objectives: Advancement of information technology allows accurate and reliable assessment of medical images including ultrasound images. This study investigated the feasibility of using intranodal vascularity index (VI) as evaluated by computer-aided quantification in differentiating the various common causes of cervical lymphadenopathy.

Methods: Power Doppler sonograms of 347 patients with palpable cervical lymph nodes were reviewed (155 metastases, 23 lymphoma, 44 tuberculous lymphadenitis, 125 reactive). Ultrasound images were evaluated and VI of lymph nodes was quantified using our self-developed computer algorithm. The diagnostic performance of using intranodal VI in distinguishing different disease groups was evaluated and compared.

Results: Metastatic and lymphomatous lymph nodes tend to be more vascular than tuberculous and reactive nodes. Intranodal VI had the highest diagnostic accuracy in distinguishing metastatic and tuberculous nodes with a sensitivity of 80%, specificity of 73%, positive predictive value of 91%, negative predictive value of 51% and overall accuracy of 68% when using a cut-off VI of 22%.

Conclusions: Computer-aided quantification allows objective assessment of intranodal vascularity. Intranodal VI is a useful parameter in differentiating metastatic and tuberculous lymph nodes, but has limited value in distinguishing lymphomatous nodes from metastatic and reactive nodes.

OPT13-003

Ultrasonographic Determination of the Location of Parotid Gland Tumor Relative to the Facial Nerve

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Objectives: To assess the value of ultrasonography in the preoperative determination of the location of parotid gland tumors relative to the facial nerve.

Methods: The medical records of 118 patients who underwent preoperative ultrasonography and parotidectomy were reviewed. Stensen's duct which can be identified as echogenic lines on the ultrasonography was used as the criterion to determine the location of parotid gland tumors. The ultrasonographic and operative findings were compared to assess the accuracy of the criterion.

Results: Ultrasonography determined the tumor as superficial to facial nerve in 50 (42.4.0%) patients and as deep to facial nerve in 30 (25.4%) patients, could not determine the location in 38 (32.24%) patients. According to the operative records, the tumors were located superficial to facial nerve in 70 (59.3%) patients, deep to facial nerve in 28 (23.7%) patients, superficial and deep to facial nerve in 4 (3.4%) patients and inferior to the cervical branch of facial nerve in 16 (13.6%) patients. To calculate the accuracy of ultrasonographic criterion, 16 patients with tumor inferior to the cervical branch of facial nerve were excluded and the tumors located both superficial and deep to facial nerve were defined as located deep to facial nerve. The indeterminate tumors on ultrasonography were defined as located superficial to facial nerve. Finally, the ultrasonographic criterion showed 89.2% of accuracy,

78.1% of sensitivity, 94.3% of specificity, 86.2% of positive predictive value, and 90.4% of negative predictive value.

Conclusions: Stensen's duct on ultrasonography can be a useful criterion to determine the location of parotid gland tumor relative to the facial nerve.

OPT13-004

Characteristics of Nodular (N) and Non-Nodular (Non-N) Configuration of Subacute Granulomatous Thyroiditis (SAT)

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Objectives: To assess the characteristics and interval change in N and non-N SAT using follow-up US.

Methods: From January 2008 to December 2014, 85 patients who were clinically suspected of SAT underwent US by a single radiologist. SAT was confirmed on the basis of clinical, US, and pathological findings. In the initial and follow-up US, we investigated the US findings and interval change in N and non-N SAT lesions. The interval change for a SAT lesion was classified: disappeared, decreased, increased, negative fluctuation, positive fluctuation, and no interval change.

Results: Of 85 patients, 64 (75.3%) were confirmed as SAT. In 64 SAT patients, the prevalence of N ($n = 39$) and non-N ($n = 35$) lesions was similar; 10 patients exhibited both N and non-N lesions. There was a significant difference in contour, echogenicity, and shape between N and non-N SAT lesions ($p = 0.010$, $p < 0.0001$, $p = 0.014$), whereas no significant difference in margin and vascularity ($p = 0.090$, $p = 0.302$). Of 64 patients, 41 underwent follow-up US. In both N and non-N lesions, the common interval change included disappeared (43.3%, 55.6%), decreased (26.7%, 22.2%), and negative fluctuation (10%, 16.7%), whereas increased change was found only in 4 N lesions (13.3%). The rate of no interval change was similar in N and non-N lesions (6.7%, 5.6%).

Conclusions: There was no significant difference in the interval change between N and non-N SAT lesions, although there was a significant difference in contour, echogenicity, and shape.

OPT13-005

Parathyroid Carcinoma: Atypical Presentation, Diagnosed on Ultrasound: A Case Report

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Objectives: Parathyroid Carcinoma is a very rare condition and with a very few cases published in literature. It is often suspected and diagnosed clinically in cases of hyperparathyroidism, when there is are very highly elevated serum calcium levels, along with significantly raised serum PTH levels, and the patient is quite symptomatic. We report here a case where the serum calcium levels and PTH, both were not so high, hence the diagnosis was not thought of clinically, but only suggested by ultrasound imaging. The typical ultrasound diagnostic findings of a likely malignant parathyroid mass, prompted the surgeon to go for Hemi thyroidectomy along with, instead of simple parathyroidectomy. Biopsy came as Parathyroid Carcinoma.

Methods: Case Report and literature review.

Results: A 66 year old male, presented with complaints of weight loss, back pain in medical oncology. CECT Spine showed multiple lytic lesions in D10, D12, and L4. Differential Diagnosis of metastasis or multiple myeloma was given. PET –CT showed metabolically active lesions in bones and posterior to left thyroid. Bone marrow biopsy was negative for both myeloma and metastasis. Serum parathormone and serum calcium levels were then suggested. Serum Calcium was 10.8mg/dL. Serum PTH was 947.0 pg/mL & 25– OH Vitamin D 16.3 g/mL. Sestamibi showed left inferior parathyroid adenoma. With an endocrinology diagnosis of primary Hyperparathyroidism and with a left inferior parathyroid adenoma, patient was referred to Head and neck oncosurgery for parathyroidectomy. ULTRASOUND: showed a heterogeneous hypoechoic solid cystic lobulated mass lesion, measuring 38 x21 x29 mm, volume 11.2 cc below the lower pole of left thyroid gland. The margins of the lesion appeared to be in close proximity to the thyroid and adjoining structures. It showed amorphous calcifications and heterogeneous increased vascularity, suggestive of parathyroid mass, likely carcinoma-SURGICAL FINDINGS: Left Thyroid lobectomy with left parathyroidectomy was done. The parathyroid gland (30x30x20 mm) was firm to hard at surgery, and adherent to the thyroid. HISTOPATHOLOGY: Parathyroid tissue showed nuclear polymorphism, with large nucleus and prominent nucleoli. Broad fibrous septa are seen. Mitosis1-2/hpf. Capsular invasion is seen as well as invasion in the surrounding soft tissue and parathyroid tissue. Vascular invasion is seen. On IHC: Ki67:2%

Conclusions: A pre-operative suggestion of parathyroid carcinoma instead of parathyroid adenoma improved patient counselling for a planned hemi thyroidectomy along with left parathyroidectomy and resulted in better management of the patient. A dedicated high resolution Colour Doppler Ultrasound is a valuable tool for localization and characterization of parathyroid nodules in all cases of raised serum PTH and must be utilized in all cases along with other imaging modalities.

OPT13-006

The Usefulness of Intraoperative Transoral Ultrasound Examination for Head and Neck Surgery

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Objectives: Recently, the treatment for early head and neck cancer trends toward a transoral surgery. However, it is difficult to determine the indication for transoral surgery or to evaluate the depth of tumor invasion. Ultrasound (US) examination has some advantages that it can evaluate the tumor in real time and in particular. In this study, we used ultrasonography with small transducer in transoral surgery, and performed intraoral evaluation of tumor thickness.

Methods: The subjects were patients with oropharyngeal or hypopharyngeal cancer who underwent intraoperative transoral US examination at our department form April 2016 to March 2017. We used Hitachi ARIETTA 70 ultrasound system with laparoscopic US transducer L43K (Hitachi Aloka Medical, Ltd. Tokyo, Japan). We aimed to verify assessable thickness of primary site by transoral US examination and if the tumor was resected with negative deep margin. Furthermore we compared the tumor thickness measured by US and pathological tumor thickness.

Results: In total, 10 patients (oropharyngeal cancer: 4, hypopharyngeal cancer: 4, oral cancer: 2) were analyzed, consisting with one patient of Tis, 5 of T1 and 4 of T2. Seven of 10 patients were detectable by US. In unassessable three patients, two cases (Tis and early T1) were too thin to detect by US and one was difficult to evaluate due to the location of the tumor. The minimum thickness of tumor in detectable patients was 2.5 millimeters. In all assessable patients, deep resection margin was negative. The range of tumor thickness measured by US was 2.5 to 18.0 millimeters, and the range of pathological tumor thickness was 1.8 to 9.0 millimeters.

Conclusions: Primary site over 2.5 millimeters thickness was detectable by transoral US examination, and was resectable with negative deep margin. Thus, transoral US examination for head and neck cancer was useful to decide deep resection margin in transoral surgery.

OPT13-007

Comparison of Ultrasonography with CT, MRI and Pet in Cervical Lymph Node Staging of Head and Neck Cancer

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Objectives: The correct preoperative N staging is crucial for the patients with head and neck cancer to determine if the neck dissection is necessary or not. This study aims to compare imaging modalities for staging the neck of patients evaluated by CT/MRI/PET and ultrasonography with the histopathologicl findings of the neck dissection specimens.

Methods: Between April 2015 and March 2017, 150 newly diagnosed head and neck patients received regular pretreatment images with CT/MRI/PET and Ultrasonography in one tertiary medical center were enrolled.

Results: There are 80 patients received the surgical treatment. Neck dissections were performed on 60 patients. In these patients, 26 received computed tomography (CT) examination, 46 have magnetic resonance image (MRI) images and all of them accepted cervical ultrasonography preoperatively. Meanwhile, Positron Emission Tomography (PET) was also done on 23 patients in the preoperative status. There are 55 cases of oral cavity cancer, 9 cases of hypopharyngeal cancers, 4 cases of oropharyngeal cancers, 2 cases of laryngeal cancer, 5 cases of parotid cancer, 3 cases of submandibular gland cancer, 2 cases of sinunasal cancer and one case of sublingual cancer. And one patient got synchronous palate and hypopharyngeal cancer. Understaging of the N stage of nasopharyngeal carcinoma (NPC) by Ultrasonography was noted due to the limitation of evaluating of retropharyngeal space lymph nodes. Based on histopathologyical findings of neck specimens or the N0 neck was confirmed after more than 6 months clinical follow-up, ultrasonography, MRI, CT and PET correctly identified cervical lymph node metastases with a sensitivity of 85.19% (specificity 81.13%), 71.43% (specificity 81.25%), 80% (specificity 100%) and 75% (specificity 80%) respectively. The accuracy of ultrasonography, MRI, CT and PET were 82.5%, 92.3%, 78.26% and 78.26%.

Conclusions: Ultrasonography has the highest sensitivity of preoperative N staging in the image modalities in this study. It also has comparable specificity, positive predictive value (PPV), negative predictive value (NPV) and accuracy with MRI and PET. Since the ultrasound is convenient, has high approachability and is a noninvasive technique in the clinical practice, it should be considered to add in the preoperative survey of head and neck cancers routinely. The ultrasonography has the significant dominance to help head and neck surgeons to realize the disease more comprehensively before the operation and may change the decision making of the surgical plan.

OPT13-008

Utility of Ultrasound Imaging and Sampling in Differentially Diagnosing Tiny Tumors of the Parotid Gland

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Objectives: Most parotid tumors are benign and usually treated by surgery. Tiny intra-parotid lesions, especially for those less than one centimeter, have remained a clinical dilemma for clinical decision making. Ultrasound imaging and sampling are regarded as useful tools for pre-operative diagnoses and evaluation. However, whether the technology could be helpful for solving the clinical challenge has seldom be investigated.

Methods: Total 714 cases with intra-parotid lesions receiving both ultrasound imaging screen and tissue sampling were evaluated in a tertiary referral university hospital. A total of 84 cases that met the inclusion criteria including having lesion sizes less than one centimeter and had received ultrasound-guided fine needle aspiration (USFNA) were recruited for analysis.

Results: Among recruited cases, 72% were diagnosed as having salivary gland origin, whereas 28% had lymphoid origin. Among all evaluated parameters of ultrasound imaging, the most significant factors to differentiate true parotid tumors from intra-parotid lymph nodes were the tumor width, the L/S ratio, and hilum presence. No predicators of ultrasound imaging correlated with the adequacy rate of USFNA. Benign parotid tumors could be confirmed by USFNA. However, parotid cancer was still found by surgical specimens in the cases confirmed with adequate USFNA negative results. USFNA had a low rate of specific diagnosis (48%) and high incidence of mismatch (50%) among those with non-specific impression.

Conclusions: The tiny tumors of parotid gland could be differentiated as true parotid tumors or intra-parotid lymph nodes by ultrasound imaging using the significant parameters. Application of USFNA did not increase the rate of definite diagnoses of tiny parotid lesions.

OPT13-009

Efficacy of Ultrasound-Guided Core Needle Biopsy in Cervical Lymphadenopathy: A Retrospective Study of 6695 Cases

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Objectives: To determine the diagnostic yield of ultrasound-guided core needle biopsy (US-CNB) in cervical lymphadenopathy and identify the factors influencing the diagnostic accuracy of US-CNB.

Methods: We retrospectively reviewed the records of 6603 patients with cervical lymphadenopathy who underwent 6695 US-CNB procedures between 2004 and 2017. All the biopsies were performed under real-time US guidance by 1 to 6 passes with a 16 - 20G needle. The final diagnosis was based on histologic examination of excised specimens, clinical course, or laboratory results.

Results: Adequate specimens were obtained in 92.19% (6172/6695) of cases. Most lymph nodes (67.65%) were malignant (metastatic carcinoma, 4131; lymphoma, 398). The overall accuracy of US-CNB for differentiating benign from malignant lesions was 91.70% (6139/6695). Among biopsies in which adequate material was obtained, the sensitivity, specificity, and accuracy of US-CNB were 99.70%, 100%, and 99.46%, respectively. The success or failure of US-CNB for the diagnosis of lymphadenopathy was significantly correlated with node size, nature (malignant vs. benign), and location as well as penetration depth, but not with needle size ($p = 0.665$), number of core tissues obtained ($p = 0.324$), or history of malignancy ($p = 0.060$). There were no major procedure-related complications.

Conclusions: US-CNB is a safe and effective method of diagnosing cervical lymphadenopathy, and our findings may help optimize the sampling procedure by maximizing its diagnostic accuracy and preserving its minimally invasive nature.

OPT13-010

Evaluation of the Usefulness of Quantitative Shear Wave Elastography for Differentiating Benign and Malignant Salivary Gland Tumors

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Objectives: Elastography is a technique for assessing hardness and includes both qualitative and quantitative approaches. The utility of quantitative shear wave elastography (SWE) for the differential diagnosis of

salivary gland tumors is unclear. Hence, we investigated this by comparing the results of Virtual Touch Quantification (VTQ), a form of quantitative SWE, of different salivary gland tumors.
Methods: Patients with salivary gland tumors who underwent ultrasonography in our department between July 2014 and April 2017 and had a cytological or histological diagnosis were included. The ultrasonic diagnosis device used was the ACUSON S2000 (Siemens Medical Solutions USA, Inc. Malvern, PA, USA). A solid part of the tumor was selected for measurement with VTQ. For VTQ, the shear wave speed was calculated within a 5-mm square ROI; instances where calculation was impossible are indicated with x.xx. Thus, the feasibility of VTQ measurement and the measured value (m/s) of each tumor were compared.
Results: Seventy-one cases were benign tumors (45 Warthin's tumors and 26 pleomorphic adenomas) and 15 cases were malignant tumors. The VTQ measurability ratio and measured value medians were 70.4% and 2.44, respectively, for the benign tumors (82.2% and 2.35 for Warthin's tumor, 50% and 2.76 for pleomorphic adenoma) and 13.3% and 1.58, respectively, for the malignant tumors.
Conclusions: VTQ successfully measured most cases of Warthin's tumors, but failed to measure malignant tumors and pleomorphic adenomas. Because of this low rate, the utility of the measured values could not be determined. However, when a measurement was possible, this had the potential to aid in the prediction of benign tumors, especially Warthin's tumor, which can be followed-up with observation.

OPT13-011

Ultrasound Dye-Assisted Surgery (USDAS) for Regional Recurrence in Head and Neck Cancer: A Case Report

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Objectives: The incidence of regional recurrence in oral squamous cell carcinoma(SCC) after the neck dissection is 32.7%. Regional failure after definite neck treatment not only relates to poor prognosis but also leads to higher complication rate in the salvage neck dissection since the diseased structure is often surrounded by scar tissue and hard to be identified. The adequate and safe neck surgery is crucial for head and neck surgeons. Ultrasound dye-assisted surgery(USDAS) offers a simplified way to localize lesions clearly during the operation.
Methods: Case report and literature review.
Results: We report a 53-year-old male who suffered from the left tongue border ulcer for 2 months. Transoral wide excision was performed for pT1, moderately differentiated SCC with negative p16 staining. 3 months later, the left level I neck mass was palpated. Sono-guided fine needle aspiration was done, and cytology revealed SCC. Bilateral neck dissection of the left level I-IV and the right level I-II was accomplished. Pathology reported ypN2b disease over the left level I and III with remarkable extracapsular spread(ECS) of the former one. However, the adjuvant concurrent chemoradiotherapy(CCRT) was incompletely conducted due to the progressive submental mass 5 weeks later. The sonography delineated one 1.33cm hypoechoic lesion with irregular boundary, incomplete halo and central necrosis over the midline of level IA. Fine needle aspiration was done, and cytology report confirmed SCC. For the adequately and completely wide excision of the malignancy, USDAS was done. Methyl blue in 1ml syringe was injected in the assistance with ultrasound-guided technique into the left periphery, right periphery, upper margin, lower margin and most importantly, the base of the tumor. Wide excision of the submental tumor was consequently executed. Final pathology indicated metastastic squamous cell carcinoma of dermis and subcutis sized 1.2cm. The closest surgical margin was 0.5cm from the peripheral margin.
Conclusions: In our case, considering the infiltrative character of dermal pathology ensnared by postoperative fibrosis, USDAS was utilized to mark the surgical boundaries. Final pathology proved adequate margins, and there was no complication. This procedure offers precise localization with avoidance in unnecessary destruction and reduces operative time significantly. Based on the anatomic complexity in head and neck region, the USDAS can be extendedly used in the future. More studies investigating exact decreasing rate of complication and standard procedures regarding injection volume and washing-out time of dye should be achieved.

Poster Session

PPT13-001

Assessment of Carotid Artery Intima-Media Thickness in Patients with Obstructive Sleep Apnea

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Objectives: This study compares the carotid intima-media thickness (CIMT) in different severity levels of obstructive sleep apnea (OSA) patients, and assesses the role of OSA for carotid artery vasculopathy with controlling of multiple co-morbidities.
Methods: This is a prospective case-control study. We recruited 36 volunteers without the complaints of sleep disorder breathing, 27 patients with mild-moderate sleep apnea and 39 patients with severe sleep apnea. The CIMT was measured using a Toshiba Aplio 500 ultrasound system (Otawara, Japan) with a 5-14 MHz L probe.
Results: Bilateral and mean CIMT increased in the order of control, mild-moderate OSA, and severe OSA ($p<0.01$ in ANOVA test). Post hoc tests show that the severe OSA group had significantly higher mean CIMT than the control and mild-moderate OSA groups ($p<0.01$); however, the control and mild-moderate OSA groups had no significant difference in mean CIMT ($p=0.91$). Multiple linear regression could not prove that OSA itself was an independent factors for increased CIMT (Mild-moderate OSA β: 0, [-0.12, 0.13]; Severe OSA β: 0.08, [-0.06, 0.22], both $p>0.05$) after adjusting for age, hypertension and body mass index.
Conclusions: Automated measurement of the CIMT could be a useful tool for cardiovascular disease risk assessment in patients with OSA. Severity of OSA may be an intermediate factor between multiple comorbidities and carotid atherosclerotic change.

PPT13-002

Intra-Operative Ultrasound Guided Trans-Oral Robotic Surgery (TORS) for Recurrent Oropharyngeal Cancers

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Objectives: Trans-oral robotic surgery (TORS) is a relatively recent modality used in the management of head and neck cancers. The greater manoeuvrability of the robotic arms, combined with superior vision allows en bloc resection of selected cancers without the need for trans-mandibular access. The advantages of TORS are reduced operative time, quicker recovery and less functional deficit. While the efficacy of TORS has been well described in the previously untreated oropharyngeal cancer, there is very little data in the literature on using TORS for recurrent cancers. As with all tumour resections, negative margins are key to successful surgical treatment. During TORS, the surgeon depends on the visual appearance of the tumour and the interaction between the energy device and the tumour tissue to define margins and ensure complete resection of the tumour. Surgery for recurrent cancers is particularly challenging as the lesion is ill defined and the irradiated cancerous and normal tissue can interact similarly with the cutting instrument.
Methods: Case series.

Results: Intra-operative ultrasound can assist the surgeon in locating tumour margins, depth and local anatomy, thus guiding the surgical resection. This is performed either manually with an intra-cavity probe or remotely using a dedicated mini-transducer held by one of the robotic limbs with the image incorporated into the surgeon's console.
Conclusions: This presentation will illustrate our early experience and the utility of intra-operative ultrasound during TORS in recurrent cancers in three cases; two cases of defining tumour and a case of locating tumour proximity to retropharyngeal internal carotid arteries guiding the surgical approach utilised.

PPT13-003

Traumatic Pseudoaneurysm of the Superficial Temporal Artery Occurring in the Frontal Region: Case Report and Review of Literature

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Objectives: To recognize that traumatic pseudoaneurysm of the superficial temporal artery can occur in the frontal region following blunt trauma.To review the pathophysiology of pseudoaneurysm formation and imaging diagnosis.
Methods: Case report and literature review.
Results: A 87 year old man was admitted after a fall to the head. Initial computerized tomography (CT) scan of the brain was normal save for the presence of a left frontotemporal hematoma. Follow up magnetic resonance imaging (MRI) of the brain 2 weeks later reveals bilateral subdural hematoma formation and a focal enlarging mixed signal fluid collection in the left frontal region which was not initally recognized as a pseudoaneurysm. An ultrasound scan was then ordered as the patient developed a focal painless pulsatile mass in the left frontal region which shows turbulent flow within the focal swelling giving a yin-yang sign on colour Doppler consistent with a pseudoaneurysm.The feeding vessel was traced to the frontal branch of the left superficial temporal artery.
Conclusions: This case illustrates that pseudoaneurysm of the superficial temporal artery should be kept in the list of differential diagnoses for a post-traumatic pulsatile soft tissue mass in the frontal region.

T14. Interventional, Perioperative, Anesthesiologic Ultrasound

Symposium

T14-15-IN01

Bi-Planar Ultrasound Imaging and Its Role for Central Neuraxial Blocks

Dr. Manoj K. Karmakar, MD, FRCA, DA (UK), FHKCA, FHKAM
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Ultrasound imaging of the spine has emerged as a useful tool to overcome many of the shortcomings of the traditional landmark based technique for central neuraxial block (CNB), such as spinal and epidural injection, and has been used with great success. Ultrasound is most frequently used as a pre-procedural tool but can also be used to guide the epidural or spinal needle in real-time during CNBs. Advantages of the pre-procedural scan include being able to accurately locate the midline, identify a given lumbar interspace, predict the depth to the epidural or intrathecal space, detect any vertebral rotational defects e.g. in scoliosis, and identify patients with a potentially difficult CNB. Cumulative evidence suggests that in expert hands the use of ultrasound for CNBs reduces the number of puncture attempts, improve the success rate of epidural access on the first attempt, reduces the need to puncture multiple levels, and improves patient comfort during the procedure. However when one performs real-time ultrasound guided CNB one has to rely on a single-plane of imaging, i.e. the paramedian sagittal oblique plane, and this can make needle visualization and guidance challenging for the operator. Being able to visualize the needle tip in multiple planes during CNB is desirable and may make USG CNB technically simpler and thus more popular. Today multiplanar 3D ultrasound imaging is available but is not practical for CNB because the integrated mechanical transducers are bulky and they produce slow screen refresh rates. In this presentation the speaker will present experience from his ongoing research on real-time biplanar ultrasound imaging, i.e. the simultaneous use of the sagittal and transverse plane imaging, for needle guidance during CNB using a matrix 3D 4D transducer. Pros and cons of the matrix transducer and its role for CNB will also be discussed.

T14-15-IN02

Diagnostic and Interventional Ultrasound for Head and Neck Pain

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In this recent 10 years, anesthesiologists have been enthusiastic about using ultrasound (US) guidance to localize nerves in the field of regional anesthesia (USRA), because it affords real-time visualization of needle, nerve, and surrounding vasculature. Improvements in transducer technology and imaging processing within the recent years have increased interest in US-guided procedures, including not only regional anesthesia but also interventional pain management (USPM). Multiple radiologic modalities, including MRI, CT, fluoroscopy and Sonography have been used to guide needle placement for interventional pain management. However, these modalities may be limited alone by their individualized weaknesses.

Pain that occurs in the neck and back of the head is a common set of symptoms. The cervical spine is a complex structure made up of seven cervical vertebrae, disc, facet joints (FJ), ligaments, muscles and sensitive nerves. Since the muscles of the cervical spine attach to the skull, problems in the neck can cause headaches in the back of the head. Here we concentrate on the US-guided interventions for head and neck pain originated from the cervical spine. The detail the procedures include: cervical medial branch block, facet joint, selective nerve root, third occipital nerve and great occipital nerve. Moreover, this presentation will contrast the pros and cons between the guidance of fluoroscopy and sonography.

The multiple modalities guidance such as the combination of ultrasound and fluoroscopic guidance might be the faultless imaging guided tools for the head and neck interventional pain management.

T14-15-IN03

Pecs Block and Serratus Plane Blocks. How to Explain Fascial Compartments

Rafael Blanco
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The use of ultrasound has allowed in the recent years anesthesiologist to target specific planes through which local anesthetic can neutralized pain transmission during and after thoracic surgical procedures of multiple kinds.

Breast cancer is an extremely common situation in which wide humoral excisions axillary clearances and breast reconstructions can be counted into the millions eery year world wide.

Like one century ago medical bodies denied help to pregnant women during labour breast cancer procedures are considered by many surgeons as "no that painful". One should wonder why they need an anesthesiologists is this is the case… The reality is that women suffer this traumatic situation with the 'add on" of being ignored.

More experience anesthesiologists used to provide these patients with two central techniques: epidurals and paravertebrales blocks but

both can have devastating complications that leaves these options to centers with a broad experience and high number of operations. Not even 10% of the anesthesiologist use this approach.

The PECS block and serrates plane blocks were described by myself as a simple, quick and effective solution to the pack of postoperative pain management for thoracic procedures of any kind, for chronic pain managements and even for pain management following thoracic trauma.

Ultrasound has allows to provide multiple variation of the same thing but is it really something else or we are just trying to put our grain of sand in the mountain.

In this lecture new will provide evidence and logical thinking about what is a fascial plane block, the different mechanism by which they can work, not only via macroscopic anatomy and how relevant it is to implement these techniques in our daily basis. Eighty percent of the surgery is perform as ambulatory surgery therefore a simple safe technique has a space as a workable solution to pain management.

The Pecs block and serrates plane blocks have revolutionised the way we approach acute pain in the XXI century and it came here to stay.

T14-15-IN04

Adventure on VATS Block

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For selected surgical procedures, the use of peripheral regional anesthetic blocks may avoid general anesthesia and increase efficiency of the surgical pathway. However, evidence on peripheral truncal anesthetic blocks is scarce. Despite non-intubated video-assisted thoracoscopic surgery (VATS) has been reported under local anesthesia in detail with safety, feasibility and favorable results, suboptimal anesthetic status still occurs with moderate pain during surgery. Furthermore, to reduce associated trauma and related chronic pain and paresthesia, a more recent development is the introduction of single (uni) port or incision VATS which has the advantage of involving only one intercostal space for access to thoracic surgery. For uniportal VATS, we would like to investigate the feasibility of ultrasound-guided peripheral truncal anesthetic block combining serratus plane block and intercostal plane block to improve the quality of local anesthesia. Meanwhile, serial plasma ropivacaine concentrations are also measured following VATS block injection to test if the plasma level of ropivacaine reaches its toxic range at this setting.

In this presentation the speaker will present the details of VATS block and experience from his ongoing research on this technique. Practical tips for VATS block will also be disclosed.

T14-15-IN05

Parasternal Intercostal Nerve Block

Yasuyuki Shibata, MD, PhD
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The intercostal nerves reside in the neurovascular space between the parietal pleura and the internal intercostal membrane/muscle. This intercostal neurovascular space is visualized as a thick space on the posterior chest wall and near the sternum. In the intercostal neurovascular space near the sternum, the anterior cutaneous and the collateral branch of the intercostal nerve from T1 to T6 are located and innervate the sternum and the skin around the sternum. Therefore, parasternai intercostal nerve block, a technique of injecting local anesthetic into the intercostal neurovascular space near the sternum is indicated for midline sternotomy and sternal fracture.

As for ultrasound guided technique, the internal mammary artery and the transverse thoracic muscle are a good landmark to detect the intercostal neurovascular space near the sternum. Here, I would like to share the technique of parasternal intercostal nerve block.

T14-15-IN06

Usefulness of Shamrock View for Deep Nerve Blocks

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Ultrasound guided nerve blocks have extremely developed in last one decade. However, Deep nerve blocks using ultrasound assist, especially the lumbar paravertebral region, have had disadvantage about the quality of the image and the artifact caused by bony structures compare with superficial nerve blocks.

Recently, a novel approach to lumbar paravertebral region, Shamrock view reported by Sauter et.al., has attracted rising attention. There are several advantages in performing lumbar plexus block and quadratic lumbermen block for perioperative pain management, and lumbar root block and transforaminal epidural block for Interventional pain therapy.

"Shamrock" was named from the ultrasound image of three muscle, psoas major muscles, quadratus lumborum muscle, and erector spine muscle, around lumbar transverse process as like three-leafs clover. This scan is superior to the standard posterior scan in the point that acoustic shadow of transverse process does NOT interfere the image of psoas major muscle. The needle visibility is also extremely better because of perpendicular reflection to the needle.

Furthermore, structures in the lumbar spinal canal, dura and subarachnoid space, were also visible through the intervertebral foramen using Shamrock view. This provides a lot of information when we perform the lumbar paravertebral block and interventional procedures.

We will present Tips of these techniques in our clinical practice.

T14-15-IN07

Track the Tiny Strings: Live Scanning of Small Truncal Nerves including Phrenic nerve, Dorsal Scapular Nerve, Suprascapular Nerve, Ilioinguinal & Iliohypogastric Nerve

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Tracking small peripheral nerves by high resolution ultrasound is an essential technique for US-guided pain management to achieve not only symptom relief but also avoid procedure related complications. In this life-scan section, we will be demonstrating nerve tracking technique of phrenic nerve, dorsal scapular nerve (interscapular pain), suprascapular nerve (refractory shoulder pain) and ilioinguinal & iliohypogastric nerve (refractory groin pain).

Free Paper

OPT14-001

Transition from Deep Regional Blocks toward Deep Nerve Hydrodissection in the Upper Body and Torso. Method Description and Results from a Retrospective Chart Review of the Analgesic Effect of 5% Dextrose in Water (D5W) as the Primary Hydrodissection

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Objectives: Although low-level studies demonstrate effectiveness of nerve hydrodissection, there are no high level studies to date.4 Prior to high-level study performance, procedural methods must be described that are reproducibly performed, reliable in effect, and safe. The objectives of this article are to

illustrate reproducible methods of hydrodissection for upper torso deep nervous structures including the stellate ganglion, brachial plexus, cervical nerve roots and paravertebral spaces, and to gather preliminary data related to an analgesic effect and efficacy of D5W without lidocaine as the primary injectate in hydrodissection for those conditions.

Methods: A formal letter of exemption allowing retrospective chart review was obtained from the International Cellular Medicine Society Institutional Review Board. (ICMS-IRB). Consecutive charts were reviewed for patients who received hydrodissection of stellate ganglion, brachial plexus, cervical nerve roots, or paravertebral spaces as a treatment method for neuropathic pain, using D5W exclusively, with lidocaine used for skin blebs only. Chart selection continued until data from 100 treatments was available for analysis. Methods of hydrodissection utilized on patients in this consecutive patient data collection were illustrated with use of anatomical diagrams, ultrasound images and videos. The primary measure for a potential intraprocedural analgesia effect of D5W hydrodissection was the mean difference between pre-treatment pain and immediate (5 minute) post-treatment pain in points as measured on a 0-10 Numerical Rating Scale (NRS). The patients were followed-up at two-month post-treatment to inquire about further need for treatment and to obtain a final 0-10 NRS pain level to monitor for treatment efficacy. Data were analyzed using PASW 18 (Predictive Analytics 180 Software 18.0.0, IBM). Descriptive statistics (mean ± standard deviation) were reported at baseline and at each session for NRS. Cumulative improvement in patient's pain levels over time was determined by calculating the mean difference between pre-treatment patient pain measured at time 0 and post-treatment pain measured 2 months after the last clinic visit. The percentage of cases achieving more than 50% and more than 75% improvement in pain was calculated.

Results: A retrospective chart review was performed of treatment results from 100 hydrodissection treatments in 26 consecutive cases (25 patients; one receiving treatment bilaterally) 51±14.7 years of age, with neuropathic pain duration of 16±12.2 months and initial numerical rating scale for pain (NRS 0-10) of 8.3±1.3 points. The mean percentage of analgesia during each treatment session was 88.1±9.8% with injection of D5W without anesthetic. NRS pain levels changed from 8.3±1.3 pre-treatment to 1.9±0.9 two months after the last treatment for a point change improvement of 6.4±1.7 points. Patients received 3.8±2.6 treatments over 9.7±7.8 months from 1st treatment to 2-month-post-treatment follow-up. Pain improvement exceeded 50% in all cases and 75% in half (13/26). An analgesic effect of D5W injection is confirmed by this study and a cumulative pain reduction is suggested.

Conclusions: This article has illustrated potentially-reproducible methods of hydrodissection for stellate ganglion, brachial plexus, cervical nerve roots and paravertebral spaces, provides data supporting a consistent analgesic effect of D5W and suggests a potentially sustainable clinical benefit in patients with chronic upper back/thorax pain of neuropathic origin. The mechanism of analgesia may relate to an indirect (allosteric) effect on the TRPV1 cation channel, hyperpolarization of normoglycemic C fibers, correction of local neural hypoglycemia, or undiscovered, likely multiple, mechanisms. The well-developed chronic constriction injury model, which results in neuropathic pain and neural swelling, is the primary rationale behind hydrodissection of nerves to release the nerve from suspected local neural compression, particularly for those nerves with fascicular nerve swelling or an increase in overall neural volume. The frequency of neural edema and the long-term efficacy of nerve hydrodissection in neuropathic pain, in contrast to anesthetic low volume nerve block, are important foci of future research in neuropathic pain conditions.

OPT14-002

Platelet-Rich Plasma Versus 5% Dextrose for Mild-to-Moderate Carpal Tunnel Syndrome

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Objectives: Although current conservative treatments are helpful for most patients with mild-to-moderate carpal tunnel syndrome (CTS), the cochrane review and large population-based study only concluded their short-term or limited efficacy. Hence, it is critical to develop a novel approach for mild-to-moderate CTS. In 2017, we have demonstrated that ultrasound-guided perineural injection with PRP or D5W is an effective and worthwhile intervention for patients with mid-to-moderate CTS. However, the comparsion of perineural PRP and D5W injection has not been investigated in a single study.

Methods: This is a prospective, randomized, double-blind, head-to head comparative study. Forty-three patients with bilateral CTS were randomized into PRP and D5W groups. PRP group received one-dose 3cc PRP injection and one-dose 3cc D5W injection to another wrist of the same patient as D5W group. The primary outcome is visual analog scale (VAS) and secondary outcomes include Boston Carpal Tunnel Syndrome Questionnaire (BCTQ), cross-sectional area (CSA) of the median nerve, electrophysiological study of the median nerve, and finger pinch strength. The evaluation was performed pretreatment as well as on the 1st, 3th, and 6th after the injection.

Results: A total of 43 patients (43 wrists in each group) completed the study. The PRP group had a significantly noticeable reduction of VAS score, BCTQ and CSA of median nerve than the D5W group ($P<0.05$). Moreover the improved trend between two groups seem more significant in moderate CTS.

Conclusions: This study shows PRP is more effective than D5W for patients with mild-to moderate CTS.

OPT14-003

Fusion of Real-Time Us with Ct Images to Guide Selective Lumbosacral Nerve Root Interventional Therapy

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Objectives: To investigate the safety and efficacy of fusion of real-time US with CT images guidance selective lumbosacral nerve root interventional therapy.

Methods: The main purpose of this study was to compare the total puncture time and X-ray fluoroscopy times between two ways to guide nerve root therapy. The study was approved by institutional review board, and written informed consent was obtained from each patient. 60 patients with unilateral lumbar 4, lumbar 5 and sacral 1 radiculopathy were included(mean age, 63.4 years; range, 47-79 years). The patients were divided into two groups of 30 cases and received single-US guidance or US-CT fusion imaging guidance target nerve root puncture respectively. X-ray fluoroscopy was used to adjust the location of the puncture needle and the total puncture time and X-ray fluoroscopy times were both recorded. After X-ray fluoroscopy and electrical stimulation confirming the needle tip around the target nerve root, the pain physician continued the same follow-up treatment for two groups, including the drug injection and pulsed radiofrequency ablation treatment, and the VAS (visual analogue scale) score of 60 patients before and after treatment were recorded overall.

Results: All 60 patients were completed puncture and following drug injection and pulsed radiofrequency ablation treatment successfully. Puncture needle reaching the target position verified by X-ray fluoroscopy and induced the corresponding innervation of the sensory and motor response, no obvious complications.In single-US group, the total time of puncture was 9-21 min, the mean (16.9 ± 2.6) min, and the number of X-ray fluoroscopy were 4-8 times, mean (6.0 ± 1.0) times. In fusion Imaging group, the total time of puncture was 13-18min, the mean (15.7 ± 1.3) min; fusion imaging time was 4-8min, mean (6.2 ± 1.0) min; registration error was 2.8-5mm, average (4.0 ± 0.59) mm; the distance between the needle tip last showed by ultrasound and the target was 1.2-2.2cm, average (1.60 ± 0.23) cm; and the number of X-ray fluoroscopy were 3-5 times, mean (3.9 ± 0.8) times. The total time of puncture and the number of X-ray fluoroscopy of the fusion Imaging

group were less than that of the single-US group, and the difference was statistically significant ($p<0.05$). The VAS score of both two groups before and after treatment has a significant difference ($p<0.001$), but there was no significant difference between the two groups.

Conclusions: Compared with the single-US group, the fusion imaging group can reduce the total time of puncture and the number of X-ray fluoroscopy. The VAS score of both two groups after treatment were significantly lower than those before treatment, confirming the feasibility and effectiveness of fusion imaging technique in the selective lumbosacral nerve root interventional therapy.

OPT14-004

Ultrasound-Guided Dextrose Injection Treatment for Refractory Chronic Musculoskeletal Pain: A Retrospective Case Series

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Objectives: Management of refractory musculoskeletal pain is challenging for clinicians with numerous available treatment options including physiotherapy, physical modalities, pharmacologic and needling interventions but lack of evidence based consensus. Dextrose injection (Prolotherapy) emerged as a promising, cost-effective treatment for chronic musculoskeletal pain of various etiologies, supported by positive outcomes in many clinical studies and systemic reviews. This retrospective case series aims to evaluate the efficacy of ultrasound-guided dextrose trigger point injections for various musculoskeletal pain syndrome refractory to other alternative treatments.

Methods: We searched for ultrasound guided injection procedures performed from August 2015 to April 2016 in our reporting database and Picture archiving and communication system (PACS), treated with ultrasound-guided injection of 15% dextrose for chronic musculoskeletal symptoms that persisted for more than one month. We reviewed basic profiles of patients, the initial presentation with specified site and duration, physical findings, diagnostic ultrasound findings, severity of symptoms as documented by visual analogue scale (VAS), immediate response after treatment, response reported by patient on follow-up visit one month after treatment. If the patient was not present to the clinic for follow-up, we interviewed the patient by telephone and the treatment response reported by patient or caregiver was also documented. We excluded patients who did not receive post-treatment re-evaluation at clinic or by telephone interview.

Results: 45 consecutive patients received ultrasound-guided 15% dextrose injections. The mean age of treated subjects was 56.6. All the treated patients returned to our clinic for follow-up or repeated treatment. 8 of 45 subjects (24.4%) reported complete resolved symptoms at treated site. 36 of 45 (80.0%) subjects reported greater than 50% improvement of their symptoms. The mean pre-treatment and post-treatment visual analogue scale (VAS) score is 7.0 and 2.44 ($p < 0.001$), indicating overall 65.0% reduction in symptom severity. There were no significant reported immediate adverse reactions or complications following the intervention.

Conclusions: Ultrasound guided 15% dextrose injection for treating localized musculoskeletal pain syndromes refractory to other alternative treatments showed remarkable responses, significantly reducing symptom intensities in the majority of treated subjects in one month after single injection. Our experience is consistent with available scientific evidence that dextrose injection is a safe, inexpensive, and efficient treatment.

Poster Session

PPT14-001

Application of Contrast-Enhanced Ultrasound in the Evaluation of Prognosis of Acute Kidney Injury in Critically Ill Patients

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Objectives: Evaluation of renal function in critically ill patients by contrast-enhanced ultrasonography, and to determine the relationship between contrast-enhanced ultrasound and renal function in patients with acute kidney injury.

Methods: 60 patients with acute renal injury (AKI) in Tianjin Third Central Hospital from January, 2015 to December ,2016 were selected as A group, at the same time, 30 healthy volunteers were selected as B group. Laboratory examinations such as renal function, cystatin C and other indicators were measured and the creatinine clearance rate was calculated in 24h. Real time contrast-enhanced ultrasound was performed on all the patients with Philips iU22 ultrasound diagnostic apparatus. The ultrasound contrast agent was SonoVue. The software(Q-lab) calculates the intensity of the echo signal of the contrast agent in the region of interest and generates the time intensity curve(TIC). Quantitative parameters of contrast-enhanced ultrasound were obtained: Peak intensity (PI), time to peak time (TTP), area under the curve (AUC), time of arrival (AT), slope of the rising curve(A). According to the results of A group and B group compared with contrast-enhanced ultrasound, were divided into negative and positive. All patients in the A group received comprehensive therapy including continuous hemofiltration. According to whether the patients need renal replacement therapy, renal function and urine volume recovery, the A group patients were divided into the treatment group, the improvement group and the ineffective group. Pearson chi square test was used to analyze the relationship between the results of CEUS and the prognosis of the treatment group.

Results: 1.Of the 60 selected cases, there were 26 cases in the treatment group(43.3%), the improvement group of 19 cases(31.7%), the invalid group of 15 cases, (25%). There was no significant difference in creatinine clearance rate and cystatin between the cured group, the improvement group and the ineffective group ($P<0.05$). 2. In the cured group, CEUS was positive in 7 cases and negative in 19 cases. In the improved group, CEUS was positive in 8 cases and negative in 11 cases, and in the negative group, CEUS was positive in 13 cases and negative in the 2 cases.3. The results of CEUS were significantly correlated with renal prognosis ($X2=13.516$ $P=0.001$).

Conclusions: The results of this study show that there is a significant correlation between CEUS and renal prognosis of patients with AKI. This application can be used as a new method to evaluate the prognosis of renal function in patients with AKI, and to guide the early intervention treatment of AKI patients.

PPT14-002

Application of Pulsed Wave Tissue Doppler Image (TDI) in Iatrogenic Right Coronary Ostial Stenosis and Acute Right Heart Failure during Aortic Valve Replacement: A Case Report and Literature Review

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Objectives: Iatrogenic coronary ostial stenosis (ICOS) is a rare but potential fatal complication of valve surgery, with estimated instance of 0.3% to 5%. Here, we present a case of RCA ostium stenosis and consequent right heart failure, which is diagnose by TEE intraoperatively.

Methods: A 69-year-old woman, with severe aortic stenosis, was admitted to hospital for elective aortic valve replacement. The resting ECG showed normal sinus rhythm. Preoperative coronary angiography revealed patent LM and insignificant narrowing of LAD, LCx, and RCA. The systolic function of both ventricles were adequate, without noticeable asynergy or hypokinesia. During operation, the aortic valve was approached via mini-sternotomy and aortotomy. A 21-mm porcine bioprosthesis (St. Jude Medical EpicTM) was implanted after aortic valve excised. After discontinuing the cardiopulmonary bypass (CPB),

new-onset AV block and ST elevation in lead II occurred. TEE disclosed prominent RA and RV dilation with poor contractility. Pulsed wave (PW) TDI peak systolic velocity (PSV) of RV free wall significantly decreased down to 1.14 cm/sec, compared with 6.43 cm/sec measured preoperatively. However, LV regional wall motions were not impaired. The prosthesis was well positioned with appropriate motion. We found that calcified sinus and aortic wall around the RCA ostium remained, with inflow untraceable in proximal RCA. Under impression of right coronary ostial stenosis and consequent right heart failure, CPB was restarted to perform coronary artery bypass for RCA. After the procedure, RV regained systolic function with PSV improved up to 5.20 cm/sec. ECG showed gradually recovery from ST elevation to T wave inversion in lead II. CPB was discontinued uneventfully. The patient was extubated smoothly on day 1 after the operation and transferred to the ordinary ward right away with favorable hemodynamics and functional status.

Results: Mechanisms of ICOS have been postulated in previous reports, including traumatic insults on the coronary vessels by insertion of coronary cannulae, calcium emboli mobilized during the initial aorotomy, intimal thickening, turbulent blood flow around the prosthetic valves and consequent fibrous proliferation, immunological reaction to the graft, and genetic predisposition. Coronary angiography with revascularization for diagnosis and treatment has been shown with favorable immediate and long-term clinical outcomes. However, it is not be feasible to perform coronary angiography during operation. Thus, TEE can serve as a prompt and approachable diagnostic tool in this setting. We presented this case to highlight intraoperative application of pulsed wave TDI for diagnosing ICOS. Peak systolic velocities (PSV) changes in the basal segment of the free RV wall might serve as a valid indicator for infarction area, leading to prompt revascularization and favorable prognosis.

Conclusions: We suggest that routine recording myocardial velocities preoperatively, especially for patients with prominently calcified aortic valves and at risk of iatrogenic coronary ostial stenosis during aortic valve surgery.

PPT14-003

Audit of Ultrasound-Guided Diffuse Renal Biopsies in Newcastle (NUTH) Radiology 2014-16: Complications and Adequacy Rates

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Objectives: Renal biopsy is the gold standard in diagnosis and management of many renal diseases, both in native and transplant kidneys. Adequate tissue diagnosis is central to the management of these patients. A major complication of renal biopsy is haemorrhage, which is uncommon but can be severe, requiring immediate intervention. In NUTH the nephrology team perform the majority of renal biopsies. Radiology provides support for those patients who have additional co-morbidities, and as such are likely to be higher risk. This audit looks at the complication rate and adequacy of biopsies performed in Radiology over three years, and whether these are comparable to the standards set out by the American Society of Nephrology1.

Methods: A retrospective review of 61 ultrasound guided diffuse renal biopsies in native and transplant kidneys was performed from 2014–2016 in the NUTH Radiology Department Early complications requiring imaging and/or intervention were assessed, and biopsy adequacy rates were collated.

Results: There were 7 confirmed cases of post biopsy haemorrhage (11.5%). Of these, 3 patients had frank haematuria, 1 of whom required intervention and 1 required blood transfusion. In all biopsies that lead to complications, the native kidney was being sampled with a 16 gauge needle. 4 biopsies were considered inadequate (6.5%). Of the inadequate yields, 3 of the 4 were from transplant kidneys, and each was performed using an 18 gauge needle.

Conclusions: These findings suggest that patients requiring biopsy with support from Radiology may be at higher risk of complication. The consent process should be altered to reflect this as a result.

PPT14-004

Biliary Decompression by Percutaneous Us-Controlled Cholangiostomy in Mechanical Jaundice of Tumor Origin

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Objectives: To assess the results of biliary decompression by US-controlled percutaneous cholangiostomy for a long period of time.

Methods: From 1997 to 2016 year 918 US-controlled percutaneous cholangiostomies for the patients with mechanical jaundice were performed. In 307 (32.8%) patients the mechanical jaundice was of tumor origin (these patients are further accepted as 100%). For US-control of cholangiostomy different generations of scanners (equipped with a convex transducer 3.5-5.0 MHz) were used (AI-5200, Logic 3, HDI 5000, Aplio 500). Self-locking "pig's tail" drains 6-8 Fr were utilized.

Results: In 72 (23.4%) patients percutaneous cholangiostomies were made as preoperative preparation, in other 235 (76.6%) – as a palliative surgery. The drainage was achieved in 242 cases (78.8%) using left hepatic duct, and in 19 (6.2%) – right hepatic duct. Amongst 98 (31.9%) patients with Klatskin's disease in 46 (15.0%) the drainages of both right and left hepatic ducts were necessary. These manipulations were performed in one session in 28 (9.1%) or sequentially with an interval of 2-3 days in 18 (5.9%) patients. In all cases the adequate drainage was achieved. 3 patients died due to septic shock within 1-4 days after cholangiostomy. In 2 (0.6%) patients laparotomy was required because of leakage of bile. The pain which required medical correction was noted in 71 (23.1%) patients.

Conclusions: Long period observations have demonstrated that US-controlled percutaneous cholangiostomy is a highly effective way of biliary decompression in mechanical jaundice of tumor origin.

PPT14-005

Clinical Application of Ultrasound-Guided, Continuous Infra-Clavicular Brachial Plexus Blockade in Burn Patients on Full Thickness Skin Graft Surgery

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Objectives: Recently, the clinical application of ultrasound guidance for regional nerve block is bombing up. In this study, we examined the efficacy of ultrasound guided insertion of catheter over the infra-clavicular region of brachial plexus.

Methods: This was a review of burn cases that underwent FTSG reconstruction in our institution. Burn patients were offered patient controlled analgesia (PCA) using either intravenous opioid or infra-clavicular plexus nerve blockade for postoperative pain management in an attempt to maintain a numerical rating scale less than 4. At 72 hours postoperative, total morphine consumption and FTSG condition were evaluated.

Results: A total of 12 patients underwent hand/forearm FTSG surgery. Of the 12 patients, six patients who used intravenous PCA required 80-120mg of morphine while the other six patients used continuous nerve block PCA required less than 15mg of morphine during the first 3 days. Also, intravenous PCA group had higher incidence of hematoma over FTSG than the continuous nerve block group despite insignificant FTSG surface area in both groups.

Conclusions: In this analysis, we have observed the use of continuous infra-clavicular nerve block reduces postoperative morphine consumption in severe burn patients undergoing FTSG reconstruction.

PPT14-006

Combination of Microbubbles and Diagnostic Ultrasound at a High Mechanical Index for the Synergistic Microwave Ablation of Tumours

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Objectives: To determine whether combining microbubbles (MBs) with diagnostic ultrasound (US) at a high mechanical index (MI) could enhance the microwave (MW) ablation of tumours.

Methods: Five therapeutic MW adjuvant protocols were studied: MW, MW + US, MW + US + MB, MW + US + NS (saline), and MW + MB. In 30 normal rabbit livers, the synergistic effects were evaluated via temperature, necrosis volume and histology. In 90 VX2 rabbit hepatic tumours, residual cells in the peripheral ablated tumours were examined via immunohistochemical assay and tumour growth. Additional 40 VX2 hepatic tumours were evaluated for ablation safety via blood assay and weight and for survival to 105 days. Results were compared using analysis of variance.

Results: Compared with the other protocols, the ablation volumes in normal rabbit livers were significantly larger using the MW + US + MB protocol ($P < .001$). The histological examination was consistent with more efficient ablation in that protocol. In detecting residual cells, the apoptotic index was higher, the proliferating index was lower ($P < .05$), tumour growth was significantly smaller ($P < .001$), and the rabbits of the MW + US + MB T-Group survived longer ($P < .05$) than those of, the other groups. Additionally, no damage to the liver function or blood cells was found in any of the protocols after ablation ($P < .05$).

Conclusions: MBs in combination with diagnostic US at a high MI showed potential synergy in the MW ablation of tumours in rabbits.

PPT14-007

Complex Liver Tumor: Does It Work when Endoscopic Ultrasonography and ND: Yag Laser Ablation Join Hands?

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Objectives: Endoscopic ultrasound (EUS) have been available in interventional therapy, which often previously needed surgical approaches to achieve. The study aimed to evaluate the effectiveness and safety of EUS-guided Nd:YAG laser ablation in unresectable tumors of the caudate lobe and left liver.

Methods: We discussed four cases of the caudate lobe and left liver tumors underwent laser ablation with EUS guidance (age: 54-70 years, 4 males). EUS-guided LA was performed under conscious sedation. The nidus was ablated by a Nd:YAG laser fiber (300 μm in diameter) with a wavelength of 1064nm, each of which has an output power of 5W for 1500-1800J (Echolaser X4, ESAOTE, Italy). Hematological examinations included: carcinoembryonic antigen (CEA) levels, AFP levels, carbohydrate antigen 19-9 (CA19-9) levels, and carbohydrate antigen 12-5 (CA12-5) levels.

Results: The total energy of EUS-guided Nd:YAG laser ablation in each patient ranged from 1800J to 11950J under 5w power, and these tumors were successfully completed in four patients, who had favourable prognosis with no complications in two-month follow-up.

Conclusions: Based on our early observations, this suggested that EUS-guided LA might be technically feasible in selected patients with left liver tumors. However, the safety of this technique need to be further confirmed in the future.

PPT14-008

Efficacy of Ultrasound-Guided Pulsed Radiofrequency for Recalcitrant Metatarsalgia: A Case Report

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Objectives: Metatarsalgia is characterized by pain in the forefoot, which is associated with increased stress over the metatarsal head region. A few cases have demonstrated relapse or poor response to treatment.Pulsed radiofrequency (PRF) can provide pain relief in patients with diverse chronic conditions without causing neural injury. Here, we describe a successful case of long-term pain relief achieved by using ultrasound-guided PRF targeting in the posterior tibial nerve (PTN) at the ankle of a 67-year-old woman with recalcitrant metatarsalgia.

Methods: We used the musculoskeletal ultrasonography and placed the linear probe to medial malleolus and then inserted the radiofrequency probe in-plane near the left PTN. After the stimulation test including sensory and motor, PRF lesioning was performed for 120 seconds with 2 Hz, 30 ms pulse width at 42°C at the two sites (superior and inferior to PTN). The procedure was repeated at the right PTN.

Results: Ten minutes after ultrasound-guided PRF was applied at the PTN, the patient reported decreased pain (from 8 to 3 on a visual analogue scale (VAS)) and did not exhibit any particular side effects. Three months after PRF application, the patient's VAS score remained more than 50% below the baseline, and she did not need additional conservative treatment during the follow-up period.

Conclusions: To the best of our knowledge, we present the first case report using ultrasound-guided PRF at the PTN for treatment of recalcitrant metatarsalgia. We hypothesize that ultrasound-guided PRF at the PTN may be a potentially novel approach for treating recalcitrant metatarsalgia.

PPT14-009

Intra-Articular Injection of Triptolide for Treatment of RAT Collagen Induced Arthritis

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Objectives: Rheumatoid Arthritis(RA) is a systemic autoimmune disorder of unknown origin with swelling of multiple joint synovitis. RA is a global distribution disease and one of the primary cause for disability. Nevertheless, there are many RA patients only a single joint involvement serious in clinical practice. It can reduce the side effects caused by systemic administration when direct injection in the joint cavity for local treatment. However, side effects were commonly in traditional local treatment agent of glucocorticoids. This article aims to explore the efficacy and safety of intra-articular injection of triptolide for treatment of rat collagen induced arthritis.

Methods: Forty seven rats were randomly divided into 5 groups: normal group, PBS group, triptolide group, betamethasone group and etanercept group. Type II collagen (CII) and Freund's adjuvant were used to induce the rat arthritis model. PBS, triptolide, betamethasone and etanercept were injected into the affected ankle joints twice a week for 4 weeks. The animals were then scarified and the ankle joints were fixated in 10% formalin. After decalcification, paraffin embedding, slide preparation and HE staining, the tissues were observed. Cellular degeneration, necrocytosis,proliferation, hyperemia, inflammatory cell infiltration, damage of the cartilago articularis and bone, inflammatory cell infiltration of the subcutaneous tissue around the jointwere investigated. According to different extent of lesion on various part of joint, the levels are divided into"1 point (a little or mild)" "2 points (medium or moderate)", "3 points (a lot or severe)","4 points (extremely severe)","0.5 points (very slight lesion)","0 point (no lesion)". The total points should

be accumulated to calculate the average points of each animal in each group. The lower point indicates a lower level of lesion.

Results: In addition to the normal group of synovial membrane has no significant changes, the other groups of synovial cells have varying degrees of congestion and edema, hyperplasia and inflammatory cell infiltration. The rats in the normal group(5 rats) were scored 0.50±0.41, PBS group (10 rats) scored 2.60±0.94, triptolide group (9 rats) scored 1.89±0.97, betamethasone group (10 rats) scored 1.50±0.85 and elephantine group (10 rats) scored 2.35±1.43 respectively. The scores of triptolide group and betamethasone group were significantly lower than that of PBS group. There was no significant difference between the triptolide group and the betamethasone group (P> 0.05). At present, the most commonly used drugs clinical application of intra-articular injection of RA is glucocorticoids. Our results showed that triptolide can be injected into the joint cavity for treatment of RA, while etanercept intra-articular injection has no significant effect.

Conclusions: Triptolide can be used for the treatment of RA and can achieve a better effect(no significant difference compared to the most commonly used hormone drugs(P <0.05)), and it can become an alternative drug when glucocorticoids are not applicable.

PPT14-010

Intraoperative Ultrasound During Video-Assisted Thoracic Surgery for Solitary Pulmonary Nodules

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Objectives: The aim of our study was to evaluate the role of intraoperative echo in the localization of pulmonary nodules during video-assisted thoracic surgery (VATS).

Methods: Patients with pulmonary nodules not touching the visceral pleura on the computed tomography scan, who were scheduled for VATS wedge resection, were enrolled in this study. The lobe of interest was examined by using finger palpation when possible, and by using the intraoperative ultrasound method. 10-MHz linear probe with a flexible angulating tip attached to an ultrasound (US) processor (Aloka Alpha 10) was introduced through one of the VATS ports.

Results: One surgeons performed 153 individual VATS-US procedures during an 24-month period. The mean age of these patients were 54.71 years old and female were predominant (n=98, 64.1%). Of these 153 patients, one hundred and two patient was malignancy and the other 51 patients was benign nodule. The lung nodules were palpable by finger in 133 cases (86.9%), and detected by intraoperative ultrasound method in 125 cases (81.7%). In 20 cases with not palpable by fingers, 5 patient was malignancy and 15 patients was benign. In 28 cases with invisible by intraoperative echo, 15 patient was malignancy and 13 patients was benign.

Conclusions: Intraoperative echo offers a real-time, simple, and effective technique for localization nonsubpleural pulmonary nodules. This technique is completely safe and without any complications. This technique can be considered as the first-instance localization technique during thoracoscopic resection of pulmonary nodules.

PPT14-011

Percutaneous Irreversible Electroporation for Portal Vein Tumor Thrombus: Two-Case Report

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Objectives: To explore the efficacy and feasibility of irreversible electroporation (IRE) in local ablation of portal vein tumor thrombus (PVTT).

Methods: We conducted a retrospective chart review of two PVTT cases that were ablated under the percutaneous ultrasonography (US) guided IRE in our center. MRI was performed to evaluate the efficacy of this technology at 3-month follow-up.

Results: Two PVTT cases were successfully ablated under the US guided IRE. Case 1 suffered from right posterior portal vein (RPPV) tumor thrombus that was 2.3×1.0cm. Four paralleled electrodes were placed vertically to the maximum plane of the target lesion. Magnetic resonance image (MRI) obtained after 3 months showed no significant recurrence in ablated RPPV. Case 2 was a 3.7×1.4-cm PVTT lesion located in the right anterior portal vein. Two paralleled electrodes were inserted along the maximum axis of the target lesion in right-to-left approach. 3-month follow-up MRI showed the ablated lesion within the RAPT was non-enhanced during all the phases. Of these cases, the involved portal vein structures were not damaged.

Conclusions: Here we introduced a feasible method for PVTT local ablation. As a potential alternative to conventional thermal ablation, IRE may effectively reduce the disease burden in the PVTT cases.

PPT14-012

Percutaneous Laser Ablation of Unresectable Metastatic Lesions in Retroperitoneal Regions: A Series of 4 Cases

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Objectives: Metastasis in retroperitoneal lymph nodes is one of the signs of advanced stage or terminal stage of malignancy. We performed a trial to assess the safety and efficacy of ultrasonography (US)-guided local neodymium-doped yttrium aluminum garnet (Nd:YAG) laser ablation for metastatic lymph nodes in the retroperitoneal region.

Methods: We evaluated 4 cases of retroperitoneal metastatic lymph nodes treated using US-guided Nd:YAG laser ablation. At first, a plane-cut optic fiber (300 μm in diameter) along with the sheath of a 21-G needle was advanced with a 10-mm bared fiber into the lesions. Then laser ablation under ultrasonographic guidance was performed by a Nd:YAG laser-beam fiber (EchoLaser X4, ESAOTE, Italy) at a wavelength of 1064 nm. The output power of laser was 5 W and the time was approximately 5-6 minutes. Power and energy were selected based on previous experience. Immediately after laser ablation, the entire area without enhancement under CEUS was defined as success. If still enhanced in the target lesion, it was regarded as residual area. Supplementary energy was applied to destroy an area larger than the lesional volume. The selective number of fibers was based on the size of the lesion. The tumor size and location near organs and vascular structures were evaluated using computed tomography (CT) or magnetic resonance image (MRI) and US every three months. Preoperative and postoperative tumor markers of Carcinoembryonic Antigen (CEA), Alpha Fetoprotein (AFP) and Carbohydrate Antigen 19-9 (CA19-9) levels were measured.

Results: In our study, The total energy was between 2600 J and 3600 J. During laser energy application, ultrasound images showed a hyperechoic area around the fiber tip. It was obtained after a delay about 80-120s. Then the hyperechoic region expanded slowly forward. When the procedure finished, the whole lesion was covered with hyperechoic zone. There were no major complications detected in the patients during the laser ablation. All the pre-admission symptoms like abdominal pain, weakness have relieved. At the 3-month follow-up, all lesions were nearly completely ablated with mild discomfort, including pain and fever.

Conclusions: Percutaneous laser ablation could be a theoretically promising approach for retroperitoneal metastatic lesions. Large-scale studies on laser ablation for metastatic retroperitoneal lymph nodes are necessary to confirm our findings.

PPT14-013

Real-Time Overlapping Fusion Imaging during Radiofrequency Ablation Zone on 3D Ultrasound Images with Automatic Expectation of Posterior Margin

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Objectives: Radiofrequency ablation (RFA) induces gas bubbles in ablation zones, and the ablative margin cannot be assessed accurately on ultrasound (US) during RFA. We evaluated the usefulness of new 3D real-time overlapping US fusion imaging with automatic expectation of posterior margin to visualize the ablative margin of RFA for hepatic tumors by using ex vivo bovine livers.
Methods: A bovine loin cube was inserted as a tumor mimicker in the bovine liver block. RFA was performed with guidance of US and 3D real-time overlapping US fusion imaging. During 3 to 12 minutes, either complete or partial ablations were performed for ten tumor mimickers. After obtaining T1-weighted MR images, we cut the ablated bovine liver blocks along the electrode tract and sliced in the transverse plane perpendicular to the axis of the electrode tracks. Ablation zones in specimens were compared with both MR images and stored motion pictures of 3D US fusion imaging.
Results: Among ten specimens, nine ablation zones were correctly accorded with both 3D US fusion imaging and MR images. The remaining one ablation zone with partial ablation was smaller than 3D US fusion imaging.
Conclusions: New 3D real-time overlapping US fusion imaging could show the ablative zones on during RFA. This US fusion imaging can contribute to precise RFA therapy.

PPT14-014

Success and Complication Rates of Ultrasound-Guided Core Biopsies of Abdominal and Thoracic Lesions at a UK Based Tertiary Referral Centre from 2014-2016

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Objectives: To determine success and complication rates for US-guided core biopsy of focal thoracic and abdominal lesions at our institution.
Methods: Retrospective review of pathology reports for relevant biopsies between 01/01/2014 and 31/12/2016. Biopsies were deemed successful if the sample was diagnostic. Unsuccessful biopsies were divided into N1 (inadequate sample) and N2 (geographical miss). We reviewed all biopsies for radiologically confirmed complications.
Results: Liver:278 biopsies; successful - 246(88.1%), N1=7(2.5%), N2=26(9.4%). Complications - 4(1.4%), including 1 bile leak requiring drainage. Peritoneum: 47 biopsies; successful - 45(95.8%), N1=1(2.1%), N2=1(2.1%).Thorax: 20 biopsies; successful - 19(95%), N1=1(5%). Kidney: 123 biopsies; successful - 110(89.4%), N1=5(4.1%), N2=8(6.5%). Complications - 3(2.4%), including 1 peri-nephric haematoma requiring thrombin injection. Other (eg adrenals, adnexae, lymph nodes): 99 biopsies; successful - 92(92.9%), N1=2(2.0%), N2=5(5.1%). Overall: 567 biopsies; successful - 511(90.1%), N1=16(2.8%), N2=40(7.1%). Complications - 7(1.2%), only two requiring invasive intervention (Clavien-Dindo class III).
Conclusions: US-guided lesional biopsies in our institution have a low complication rate, but the number of N2 (missed) biopsies of hepatic and renal lesions is relatively high. As a tertiary referral centre for both hepatology and urology/nephrology, this may be due to the complex nature of the case load, however, we are currently reviewing procedural factors (eg needle gauge, number of passes, lesion size/depth) and their correlation with success rates, to determine whether this can be improved.

PPT14-015

The Usefulness of "Modified MOSE"

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Objectives: EUS-guided FNA (EUS-FNA) has been used as a safe and less-invasive method for obtaining pathologic specimens from pancreatic/peripancreatic tumors.Although rapid on-site cytologic evaluation(ROSE) provides high efficacy of EUS-FNA, its availability is limited. In 2015,a team from Japan proposed that macroscopic on-site quality evaluation (MOSE) may increase the efficacy of EUS-FNA in the facility where ROSE is not available. Since 2016.3.29,we started to perform "modified MOSE" to every case who underwent EUS-FNA.Our objectives is to evaluate the usefulness of "Modified MOSE" for solid pancreatic/peripancreatic tumors.
Methods: From 2014 to 2016,total 31 patients underwent EUS-FNA in our hospital.After excluding 8 cases of fluid analysis, 23 cases of solid pancreatic/peripancreatic tumor was enrolled in our study. Because "ROSE" is not available in our hospital, MOSE(14/23) was performed since 2016.3.29 with some modification. The key point of "modified MOSE" is the adequate sampling to smear cytology ,and the flexibility to every condition we encountered.For example,even if no macroscopic visible core(MVC) obtained in our sample,we could make a definite diagnosis using this method.
Results: The technique successful rate for EUS-FNA to solid pancreatic/peripancreatic tumor was 95%(22/23),accuracy was 87%(19/22),sensitivity was 86%(13/15),and specificity was 86%(6/7).After the application of "modified MOSE" technique since 2016,the pathologists in our hospital started to report a definite diagnosis based on our FNA samples.For example,-they began to feel comfortable to type the terms "adenocarcinoma" instead of "suspicious for malignancy" ,and thus the subsequent management like chemotherapy or surgery could be applied without hesitating after EUS-FNA.
Conclusions: The "modified MOSE" can provide precise diagnosis with small samples obtained from EUS-FNA, and therefore improve the efficacy of EUS-FNA. Furthermore,the technique could be easily applied in every hospital where standard "ROSE" can't be easily performed.

PPT14-016

Utility of Trans-Operatory Sonography in Neurosurgery for Brain Tumors Excision

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Objectives: To describe the experience in trans-operatory neurosonography for brain tumors (Meningioma and Glial-tumors) treatment in our Hospital. Also, we point out features to look for in trans-surgery neurosonography.
Methods: Revision of files from patients that went to neurosurgery from April 2012 to January 2017 with Meningioma and Glial tumor diagnosis was made. It includes those patient's files with evidence of use of ultrasonography: before, during and after surgery, confirmation of histological tumor's type and follow up for Neuropsychology Department.
Results: From 415 patients: 54 were Meningiomas, sonography before dural opening showed the position of cortical and tumoral vessels, the site of contact between tumor and dura, boundaries and size of tumor. Glial tumors were 120 (High and low grade), sonography before dural opening showed the depth and size of tumor, and vessels (normal and new-formed). In both cases, neurosonography allowed the control of the volume of tumor that were extract and the quantity of residuary. Also it detected bleeding in surgical bed. Neuropsychology assessment were use to record functional state after procedure.
Conclusions: Trans-operatory sonography in brain tumor excision showed: size, presence of vessels and depth of lesion, as well as residuary tumor and sites of bleeding. It increases patient's safety during and after surgery at time it decreases complications and time of in-hospital stay. Also, it provides real-time guide through surgery.

T15. Musculoskeletal Ultrasound

Symposium

T15-14-IN01

Ultrasound in Rheumatology: New Challenges

Walter Grassi
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More than 30 years have passed since ultrasound was first applied to the practice of clinical rheumatology. The few pioneers who invested their effort in this long ignored field should be pleased today that interest in ultrasound imaging is steadily growing and driving a real cultural revolution in the field of Rheumatology. However, despite ultrasound is recognized as having an increasingly important role in early diagnosis and therapy monitoring many challenges need to be addressed regarding standardization, operator dependency, reproducibility and image analysis. To face these challenges high quality ultrasound equipments and perfect scanning technique are essential. As we look to the future, it is easy to predict that volumetric ultrasound, while still having a limited role in rheumatology, will show its undeniable potential to solve both technical and interpretation problems. One of the main advantages of acquiring a volume of echoes, as an alternative to traditional single frame ultrasound, is the possibility of rapid and easy tomographic examination of the area of interest. It seems reasonable to predict that as technical advances continue to improve image quality, ultrasound will be finally recognized as an essential tool in daily rheumatology practice.

T15-14-IN02

Ultrasound Biomarkers in Rheumatology

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A perfect biomarker should be sensitive, specific, highly predictive of the presence and probable course of disease, cheap, and safe to use. Its detection should affect clinical management and consequently improve clinical outcomes at the individual level. Several studies over the past few years have provided a clear evidence that ultrasound images can be regarded as excellent candidates to the role of best biomarkers for a wide range of rheumatic diseases, such as rheumatoid arthritis, psoriatic arthritis, gout, calcium pyrophosphate deposition disease, and osteoarthritis. The identification of highly characteristic minimal lesions in the above mentioned diseases has generated a new diagnostic glossary including terms like loss of sharpness, double contour, loss of clarity, snow storm, shining dots, hot erosions. The potential of ultrasound biomarkers has been extensively studied in rheumatoid arthritis. The different combinations of fluid collection, synovial hypertrophy, intra-articular Doppler signal, bone erosion and cartilage thinning generate a cluster of patterns that play an increasingly important role in patient centred management.

T15-14-IN03

Musculoskeletal Ultrasound in the Treat-to-Target Treatment Strategies in Rheumatoid Arthritis

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Treat-to-target (T2T) strategy, aiming at clinical remission or low disease activity, has greatly improved the prognosis of rheumatoid arthritis (RA) since its institution in clinical practice in 2010. However, with the widespread application of ultrasound, the subclinical synovitis has been observed to be commonly present in RA patients in clinical remission. A systematic literature search and meta-analysis elated revealed an association between Power Doppler positivity and the risk of flare (OR 4.52, 95% CI 2.61-7.84, $P<0.00001$, $I2=21\%$), the risk of progressive bone erosion on patient level (OR 12.80, 95% CI 1.29-126.81, $P=0.03$, $I2=52\%$) and risk of progressive bone erosion on joint level (OR 11.85, 95% CI 5.01-28.03, $P<0.00001$, $I2=0\%$). Furthermore, the treatment strategies targeting ultrasound remission in addition to clinical remission better controlled disease activity of RA patients and reduced flare during follow-up comparted to the treatment with clinical remission as the only target. Deeper clinical remission reflects the better control of subclinical synovitis under the ultrasound and could be an optimized treatment target in RA management.

T15-14-IN04

Ultrasound in Rheumatology for Non-Rheumatologist

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Rheumatologists manage patients with rheumatic diseases, which are of a wide range of musculoskeletal pathologies. Without clarification of the exact location of pathologies and the degree of inflammation, rheumatologists may have an incorrect assessment, leading to inappropriate management. In everyday practice, physical examination is limited by its sensitivity and power of assessment. Musculoskeletal ultrasonography (MSUS) is inexpensive, readily available, and allows side-by-side image comparisons. Thus, during the past 10 years, MSUS has become the "third eye" of the rheumatologist, in that it allows more detailed examination of muscles, bones, and joints, just as the stethoscope provides further details about the respiratory and circulatory systems. This presentation briefly introduce how rheumatologists use MSUS for a wide variety of musculoskeletal diseases, not just to diagnose but also to monitor.

T15-14-IN05

Overview the Development of Muscle Skeletal Ultrasound in Mainland and Its Future

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For a long period of time, the muscle skeletal ultrasound (MSU) has been major serviced in sports medicine in China. As some Chinese rheumatologists realize the value of ultrasound in rheumatism diseases, some doctors try to learn and master this skill. These attempts in the 1990 s, some scholars through practice in patients, some one even comparing with the autopsy results, to improve on the understanding of the pathology of sonographic findings. There were also many doctors going overseas, bring the advanced knowledge of rheumatism MSU back to China.

On the basis of these early work, these pioneers tried to further promote the technology in mainland. These efforts, including through a variety of academic conference to introduce MSU, holding workshops, or taking refresher courses. At the same time, we also invite foreign experts to China, which help us to up-to-date the trend of this technology.

On the basis of these efforts, every year, now more than 10 hospitals add to the queer to do MSU for rheumatism, and more than 100 doctors receive standardized musculoskeletal ultrasound training. There are tens of thousands of rheumatism patients accepted MSU exam every year, and the numbers quickly raising up to 100 thousands level.

From the development of domestic MSU is accelerated developing. More and more centers can provide high quality training of MSU. There are five centers contributing training of MSU persistently. There are also dozens promotions of all kinds of meetings every year. The MSU has been extended from tier one and tier two cities, gradually to tier three

cities, and in some economically developed areas, it has already entered tier four cities. More patients have the opportunity to receive this exam at hometown, which providing great help for early diagnosis of arthritis and the evaluation of accurate clinical outcomes.

Same as international counterparts, the development of MSU will encounter some bottlenecks, such as rheumatism need higher performance of ultrasonic instrument and special setting and technical. The characteristic of ultrasound itself leads to the cost time of physicians in the exploration process, and the ultrasonic probing technique has the potential to optimize the demand and the potential.

In China, there are some policy barriers for rheumatologist physician to do MSU, the related association is putting efforts to improve the situation. While Chinese health care system is also in reforming and severe changes, there will great enhance ultrasound in the diagnosis and treatment of rheumatism.

Clinicians also recognized that the new information technologies have huge helps to MSU. In the near future, greatly change will appears in MSU, not only on the mode of exam but also the efficiency.

In general, the development of MSU in mainland is flourishing, more and more doctors and center are involving this work, and more and more patients are benefiting from it.

T15-14-IN06

MSK USG in Diagnosing Inflammatory Arthritis: Pearls and Pitfalls

Dr Lee Ka Wing Gavin
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Musculoskeletal ultrasound (MSK USG) has become interesting popular among rheumatologists in their clinical practice. Inflammatory arthritis is one of the major scopes of rheumatology and the focus of clinical research in the field of MSK USG. Inflammatory diseases like rheumatoid arthritis (RA), psoriatic arthritis (PsA), spondyloarthritis (SpA) and gouty arthritis are some of common examples. Studies have demonstrated ultrasound is a useful tool to assist the management of patients suspected or diagnosed to have inflammatory arthritis.

MSK USG has shown to be more sensitive in the detection of abnormalities in RA. Detection of synovitis and bone erosion would be important for early diagnosis of RA. Enthesitis on the other hand is a characteristic feature of SpA that may guide clinician for such diagnosis in a patient with undifferentiated early arthritis. Various sonographic features may also distinguish PsA from RA. Furthermore, gouty arthritis also has some characteristic USG findings to differentiate from other crystal arthropathy.

Though ultrasound allows clinicians to see much more than what can be detected in clinical examination, one should be alerted to the possibility of non-specific findings and be avoided of over-interpreting the sonographic findings. Other pitfalls would also be highlighted and discussed.

T15-14-IN07

Ultrasound Is a Better Target Than Clinical Disease Activity Scores in Rheumatoid Arthritis

Ying-Chou Chen
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The assessment of joint inflammation is essential for diagnosing and monitoring response to therapies in patients affected by inflammatory arthropathies like rheumatoid arthritis (RA). For this, the use of musculoskeletal ultrasonography (US) with the power Doppler (PD) method has increased in the past decade. Also, US is known to detect B-mode synovitis and synovial Doppler activity in RA patients treated with either synthetic or biologic disease-modifying anti-rheumatic drugs. The US-detected synovitis has a predictive value in relation to radiographic damage progression and disease flare-up or relapse. Assessment by US ranges from wrist and hand joints to a comprehensive examination of 44 joints.

Ultrasonographic (US) assessment has been shown to be useful in the management of RA and for monitoring the disease course. The application of US is helpful in such evaluations and is a complementary tool for classic methods used to detect RA, such as clinical evaluation and radiography, particularly when the MCP, PIP, and MTP joints are considered.

Evidence has confirmed that GS and PD evaluation demonstrates a correlation between disease activity and degree of inflammation of synovial tissue. Moreover, US can be used for evaluating response to biological drugs. Naredo et al. have found a significant improvement in US parameters in RA patients undergoing therapy with a TNF blocking agent. Thus, US evaluation may be a valid method for monitoring response to biological therapy in RA patients.

Finally, sonographic synovitis predicts erosion better than swollen joint count, C-reactive protein and erythrocyte sedimentation rate, US should be considered a promising treatment target in RA patients.

T15-14-IN08

Salivary Gland Ultrasonography in Comprehensive Assessment of Patients with Sjogren's Syndrome

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Salivary gland ultrasonography (SGUS) has recently been used to help diagnose Sjogren's syndrome (SS) as well as monitor disease severity of SS. SGUS has the advantage of radiation-free, convenience, low cost, and a potential ability to quantify disease severity. For diagnosis, SGUS has been suggested to serve as an alternative or additional item to the ACR classification. SGUS has also been found to be valuable to predict treatment effectiveness in SS patients. The aim of this talk is to review the application of SGUS in comprehensive assessment of patients with SS, provide personal experience on SGUS use in SS patients, and provide future potential research questions.

T15-15-IN01

WFUMB Guidelines and Recommendations for Clinical Use of Ultrasound Elastography: Part 1: Basic Principles and Terminology

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Ultrasound elasticity images are able to reveal the differences in the elastic properties of soft tissues (e.g., elasticity and viscosity) that can be used to clearly visualize normal anatomy and delineate pathologic lesions even when similar ultrasonic echogenicities are observed. The rapid dissemination of ultrasound elastography machines into the market place, the range of apparently different elasticity imaging methods available such as stain imaging and shear wave imaging, and the significant increase in research literature on the physics and medical applications of elastography have created a potentially confusing situation for those who may be considering using elastography. The definite need was therefore strongly advocated by the WFUMB to create the guidelines and recommendations on the clinical use of ultrasound elastography at the WFUMB congress in Vienna in August 2011. At the first consensus meeting held in March 2013 in Washington, DC, elastography experts from around the world have come together to create unified guidelines on the clinical use of this technique. The guidelines which consist of two clinical papers regarding diagnosis of liver and breast diseases, and a basic paper to describe the fundamental physics and the associated terminology underlying these

technologies were completed in 2014. At the basic principles and terminology part, we have included a question and answer section, an extensive appendix, and a glossary of terms. We have also endeavored to ensure that the terminology and descriptions are broadly compatible across the WFUMB, EFSUMB and JSUM sets of guidelines on elastography (Bamber et al. 2013; Cosgrove et al. 2013; Shiina et al, 2013). Now I am convinced that this international cooperative product proclaims the worldwide recognition of the use of elastography to diagnose diseases, and that these sets of guidelines should be a major reference for anyone who is going to start or who is already performing elastography.

T15-15-IN02

Elastography: Applications in Skeletal Muscles

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Real-time sonoelastography is a recently developed ultrasound-based imaging technique that evaluates tissue elasticity in real time. It is based on the principle that the compression of tissue produces a strain (displacement) that is lower in hard tissue and higher in soft tissue. Real-time sonoelastography provides information on tissue elasticity, in addition to the shape and vascularity, which are obtained via B-mode and Doppler ultrasound. Similar to B-mode ultrasound, manual or mechanical compression with the transducer and real-time visualization are now available for real-time sonoelastography in actual clinical practice. Tissue elasticity not only varies among different tissues but also seems to reflect disease-induced alternations in tissue properties. Real-time sonoelastography was recently applied to the normal and pathologic tissues in skeletal muscle disease, and it showed promising results and new potentialities. Therefore, it is expected to be a useful imaging modality for providing novel diagnostic information in skeletal muscle diseases because tissue elasticity is closely related to its pathology. It can also be used as a research tool to provide insight into the biomechanics and pathophysiology of skeletal muscle abnormality.

T15-15-IN03

Elastography: Applications in Peripheral Nerves

Hideaki Miyamoto
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The biomechanical properties of soft tissues reflect to some degree the pathophysiology of musculoskeletal disorders. Conventional gray-scale sonography has been widely used as a first-line approach for musculoskeletal disorders because of the advantage of real-time access. Sonoelastography, which we refer to here as strain elastography (SE), requires manual compression vibration and is a modality for quantitatively measuring the elasticity of soft tissue through conventional gray-scale sonography with estimated Young's modulus or semi-quantitative values as strain ratios. By using the semi-quantitative values of strain ratios, SE has demonstrated promising preliminary results for the diagnosis of masses of the liver, breast, pancreas, prostate, and thyroid, with defined cutoff values. In peripheral nerve disorders, SE could be preferable in clinical practice for detecting the biomechanical changes of tendons, muscles, and ligaments surrounding the nerve, to diagnose and plan preoperational or interventional management. Recently, by using SE, several studies have provided insight into the biomechanical properties and pathophysiological changes associated with entrapment neuropathy as typified by carpal tunnel syndrome. In this presentation, the current knowledge of sonoelastographic techniques and their use for peripheral nerve disorders will be reviewed.

T15-15-IN04

Elastography: Applications in Tendon, Ligament and Fascia

Chueh-Hung Wu, MD
Department of Physical Medicine and Rehabilitation, National Taiwan University Hospital, Taiwan

Sonoelastography is a method that can evaluate the mechanical properties of soft tissue via ultrasound imaging. Compression elastography, also described as static strain elastography, is based on the principle that the compression of tissue produces strain. It has been applied in various diseases, such as Achilles tendinopathy, lateral epicondylopathy, patellar tendinopathy, etc. In our experience, by using such system with quantitative imaging analysis, we found that the plantar fascia softened with age and in patients with unilateral plantar fasciitis. We also found that the plantar fascia was softer in patients with typical clinical manifestations of plantar fasciitis, even if they exhibited no abnormalities on B-mode sonography. A one-year follow-up of plantar fascia stiffness after shock wave therapy for plantar fasciitis showed that the plantar fascia would become softer initially and then regained its stiffness 6 months later. Sonoelastography can be used to complement conventional B-mode US in assessment of musculoskeletal disorders.

Shear-wave elastography, also termed dynamic elastography, is based on the measurement of the ultrasound-pulse-produced shear wave velocity distribution. The shear waves travel faster in harder materials. It has been applied in various diseases, such as Achilles tendinopathy and patellar tendinopathy. In our experience, with such system, we found that the thickened coracohumeral ligament of the patients with clinical findings suggestive of adhesive capsulitis of the shoulder is stiffer in the symptomatic shoulder than in the unaffected shoulder.

In addition to summary of clinical studies, practical considerations when using sonoelastography will be discussed in this talk.

T15-15-IN05

Elastography: Applications in Superficial Soft Tissue Tumors

Dr. Nitin Chaubal, MD, DMRD, FICR, FICMU, FAIUM (USA), FSRU (USA)
Thane Ultrasound Centre, Thane, India; Jaslok Hospital & Research Centre, Mumbai, India

Elastography based on principles of elasticity of tissues has been used for the last few years as a new technique for diagnostic purposes. It is now a well-established technique for diagnosis of liver fibrosis, as well as for lesions of breast. In the last few years, we have also seen applications of elastography in other organs viz. Thyroid, lymph nodes, testes, salivary glands, prostate etc. Elastography is proving to be useful in the musculoskeletal system as well as evaluation of soft tissue lesions.

Whenever there is a degenerative change in tendons or in the ligaments, there is a decrease in the tensile properties of these structures with an associated softness. This principle has been made use of in the diagnosis of subtle tendinosis as well as tendon injuries which are not obvious on conventional grey scale imaging.

Elastography is also potentially useful in the diagnosis and characterization of soft tissue masses typically in the subcutaneous or muscle

plane. Elastography patterns are now well described for conditions like lipoma as well as neurofibroma.

Applications of Elastography in musculoskeletal system will be discussed along with other potential applications in the soft tissue lesions.

At present most of this is done with strain imaging, Shear Wave elastography will open up new vistas, Scope and limitations of this technique will be discussed.

T15-16-IN01

Ultrasound Guided Cervical Spine Interventions for the Treatment of Neck Pain

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Neck pain is pain perceived as arising in a region bounded superiorly by the superior nuchal line, laterally by the lateral margins of the neck, and inferiorly by an imaginary transverse line through the T1 spinous process. The main objective of clinical practice is to determine exactly the source and cause of this pain and then to implement measures to stop it.

For any source of pain, it must be innervated. Because they are innervated, all of the muscles, synovial joints, and intervertebral disks of the neck are potential sources of neck pain, along with the cervical dura mater and the vertebral artery.

Based on the location, neck pain is classified as

- Neck pain with Headaches - Cervicogenic Headaches : Pain perceived in the head but whose source lies in the cervical spine. Possible causative structures are Lateral atlantoaxial joint, C2-3 disk, Zygapophysial joints. Cervicogenic Headache a possible cause for the pain in the forehead, orbit and temporal regions. Convergence between trigeminal and cervical afferents explains referral of pain from cervical sources to the forehead, orbit, and temporal regions of the head. Convergence between other cervical afferents and those of C2 explains referral of pain to the occiput and parietal regions.
- Neck Pain with Limb/ Girdle Pain : Radicular pain is that arising in a limb or the trunk wall, caused either by ectopic activation of nociceptive afferent fibres in a spinal nerve or its roots or by other neuropathic mechanisms, that may be episodic, recurrent, or sudden. If the cervical spine and capsular ligaments are injured, facet joint hypertrophy and degeneration of the cervical discs can occur, causing, narrowing of the neural foramina.
- Neck Pain : Below the C4 spine, facetogenic pain is predominantly in the neck.

The value of ultrasound in these therapeutic interventions is substantial and is slowly and surely replacing conventional methods of using fluoroscopy for these interventions.

Serious, Life Threatening Causes of Neck Pain: The pain physician needs to remember the red flags in patients with neck pain, appropriate management of these conditions is critical and the time taken for the corrective measures is most vital. “There is no role for Ultrasound in these pain conditions”. Sonographers must be aware of this and also keep in mind that overzealous and inappropriate use of ultrasound for these conditions could be unforgiving.

A. Internal Carotid artery dissection : Uncommon. Headache is the commonest presentation in these patients but neck pain is the sole presentation in 6% & 17% of the patients, headache with neck pain.

B. Vertebral Artery Dissection: Neck pain with headache is seen in 50% to 90% of the patients. The headache is not exclusive to occipital area.

C. Dissections of aortic aneurysms: Features of chest pain and cardiovascular distress, along with neck pain in 6% of patients.

D. Fractures and Tumors: Both are accepted causes of neck pain, though not necessarily always.

T15-16-IN02

Role of Stem Cell in Muscle, Ligament & Cartilage Regeneration

Dr. Mohammad Moniruzzaman
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Stem cells are generally defined as undifferentiated cells that are capable of selfrenewal through replication. Among the different types of stem cells, adult mesenchymal stem cells (MSCs) are one of them which is necessary to maintain tissue and organ mass during cellular turnover. Autologous Bonemarrow Aspirate Concentrate (BMAC) is one of the best sources of MSCs. The BMAC stem cell has the ability to differentiate into chondrocytes, fibroblasts, and other musculo-skeletal tissue and among this, chondrogenic transformation capability is more than lipoaspirate stem cell. Tissue regeneration by BMAC-MSCs is excellent. The expertness need from the aseptic processing of BMAC-MSCs to the sonoguided target injection. As this is not pain killer and regeneration took time and for this, appropriate case selection, patient counseling is need. Treating by power of his own cells is definitely a new era of regeneration field in Physiatry & Musculoskeletal Medicine.

T15-16-IN03

Stem Cell: Planning & Implementation

Dr. Mohammad Moniruzzaman
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Current Stem cell treatment is an iceberg of Regenerative Medicine. A successful aspiration & processing of BMAC (Bone Marrow Aspirate Concentrate)-Stem cell can be failed due to faulty planning of case selection, faulty technique of application (without imaging) etc. During planning, clinical correlation with imaging, differentiate from inflammatory to degenerative, exclusion of surgical need are very important. So, careful case selection, patient counseling about regeneration (not quick pain killer), image (ultrasono or C-arm) guided application of target area, expertness of interventionalist, maintaining patient registry is a must for successful & sustainable outcome.

T15-16-IN04

Ultrasound-Guided Intervention Techniques in Treating Patients with Hip Joint Disorders

Sheng Bi
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The most common disorders of Disorders are gluteus medius/minimus bursitis pain and calcific tendinosis of medius/minimus tendon. Gluteus medius/minimus tendon abnormalities may be adjacent bursal distention. Evaluation for gluteus medius/minimus tendon abnormalities can be completed with a high-frequency linear array transducer. Tendinosis will appear as abnormal hypoechogenicity and tendon swelling. Calcium deposition in tendon will be seen as hyperechoic foci. Ultrasound-guided injection of corticosteroids to gluteus medius/minimus bursitis showed effectiveness in some patients with hip joint pain. Ultrasound-guided tenotomy may effective in chronic tendinosis.

Ultrasound-guided lavage and aspiration can be completed when calcific tendinosis.

T15-16-IN05

Ultrasound-Guided Intervention Techniques in Treating Patients with Back Pain

Carl P. C. Chen, MD, PhD
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During the past, expensive and delicate imaging analyses such as computed tomography (CT), and magnetic resonance imaging (MRI) may be needed to confirm the correct diagnosis for musculoskeletal disorders. Presently, musculoskeletal ultrasound can diagnose these problems with high accuracy.

Ultrasound is a radiation-free, easy-to-use imaging tool in diagnosing soft tissue lesions and in performing ultrasound guided injections. The injection needle can be accurately guided to the designated area for aspiration and injection procedures. Our studies have indicated that ultrasound can be applied in performing accurate caudal epidural, piriformis, posterior approach glenohumeral joint, cervical selective nerve root block, facet joint, medial branch block, and sacroiliac joint injections. Under ultrasound guidance, the advancing motion of the needle can be observed as continuous and real-time images.

In the past, fluoroscopic needle guidance was needed to perform injection procedures such as cervical selective nerve root block, and caudal epidural injection. In nowadays, these spinal injections can be performed accurately and safely in an outpatient clinical setting. In patients with cervical radiculopathy, selective ultrasound-guided cervical nerve root injection can be performed accurately. With subsequent facet joint injection and medial branch blocks, neck pain can be alleviated.

Back pain is also a common problem in artists. Sometimes imaging studies reveal normal findings. This is may be caused by myofascial pain syndrome. Patients are presented with tender spots at the trapezious, rhomboids, and para-spinal muscle areas. Ultrasound-guided trigger point injection or prolotherapy can be applied to treat these painful areas as well. In today's talk, ultrasound-guided injection techniques in treating back pain problems will be thoroughly covered.

T15-16-IN06

Ultrasound Guided Procedures of the Shoulder and Other Upper Extremity Procedures

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The use of ultrasonography in interventional musculoskeletal radiology is well established and is used primarily to guide needle placement for injections, aspirations, and biopsies. The chief advantage of ultrasound imaging is its ability to perform real-time, multiplanar imaging without ionizing radiation. It is relatively inexpensive, is widely available, and permits comparison with the asymptomatic side. Conversely, the modality is operator dependent and requires detailed knowledge of the relevant anatomy, often resulting in a long learning curve. As well, physically deep and osseous lesions may not be visualized readily.

Shoulder Ultrasonography (US) is an accurate method to perform diagnostic studies because it evaluates both morphology and function by mean of dynamic evaluations. Actually, US is a great tool to guide interventional procedures around the shoulder. Blind injections may fail in a significant percentage of cases, therefore the use of a low-cost and safe tool such as US improves the success of the interventional procedures. The efficacy of US-guided procedure is confirmed by the improved clinical outcome.

Subacromial–subdeltoid bursitis is the most common finding on ultrasound evaluation for painful shoulder. Therapeutic injections of corticosteroids are helpful to reduce inflammation and pain. Steroid injections around the long head of the biceps brachii tendon are indicated in patients with biceps tendinopathy, reducing pain and humeral tenderness. Injection to rotator interval is one of more easy treatment for adhesive capsulitis. For adhesive capsulitis, hydrodilatation is typically performed using fluoroscopic or ultrasound guidance using anterior and posterior approaches, respectively, ultrasound-guided hydrodilatation via the rotator interval has not been much described. This, presentation, will provide rotator interval approach for adhesive capsulitis as well as glenohumeral hydrodilatation from posterior approach.

Other procedures covers in this presentation is injection to common extensor tendon of elbow, de Quervain's syndrome and trigger finger, as this condition is common in our clinics. Lateral epicondylitis, known as tennis elbow, is generally a self-limiting condition. The diagnosis is usually clinical and requires no imaging; most patients respond to conservative treatment including rest, physical therapy, anti-inflammatory drugs, and steroid injections. However in refractory cases, the clinician could do a procedure to common extensor tendon or peritendon. Procedure guided with ultrasound will help the accuracy of drug placement.

de Quervain's tenosynovitis is a stenosing tenosynovitis of the first dorsal compartment of the wrist, affecting the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendon sheaths. Diagnosis of de Quervain's tenosynovitis is clinical and patients can be treated nonoperatively with rest, splinting, NSAIDS, and intrasheath corticosteroid injections. Nonsurgical management for de Quervain's tenosynovitis routinely involves corticosteroid injections into the first dorsal compartment tendon sheath. Injections are safe, cost-effective, and have a favorable adverse effect profile. With as much as 83% achieving pain relief, corticosteroid injection remains the most common and effective treatment option for patients with de Quervain's tenosynovitis. Treatment failure of injections has been attributed to inaccurate injection technique and anatomic variation in the first dorsal compartment. If the injection does not enter the compartment, or all sub compartments, response to the injection is variable. To ensure proper location of injections we need ultrasound guiding for the injection.

Stenosing tenosynovitis of the fingers and thumb or trigger finger is a common upper extremity problem. The cause of this condition remains uncertain. It causes symptoms, ranging from mild discomfort and stiffness to a painful finger that becomes locked in flexion. The treatment options vary from splintage, steroid injection to surgical release of the pulley. The main stay of conservative treatment is injection of steroid into the tendon sheath. Steroid injections have long been the main stay of conservative treatment of trigger digits. This procedure gives variable results, which is dependent on a number of factors. The injection of the steroid in the right place using ultrasound-guided improves the success rate and also prevents complications associated with the procedure.

T15-17-IN01

Ultrasound-Guided Femoral Nailing: Experiences from the Original

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Closed femoral nailing is considered the treatment of choice for femoral shaft fracture. The technique is conventionally possible only when there is an image intensifier. Thus in developing countries where there is no image intensifier closed femoral nailing is

often not possible. The author has developed an alternative method of closed femoral nailing using ultrasound guidance. The technique is found effective with a high success rate in cases with non-comminuted fractures and underwent surgery within one week. The simple portable ultrasound with frequency of 5 MHz is sufficient. The method can demonstrate soft-tissue interposition at the fracture site before femoral nailing. Transverse scanning helps indicate the proper plane to apply a reduction force. The combination of longitudinal and transverse scanning can provide real-time three dimensional evaluations of the bone fragments at the fracture site. This is helpful for adjusting the direction and magnitude of the reduction force during the reduction procedure. The method is simple, reliable, safe and effective without radiation. The equipment is mostly available in almost all hospital in developing countries.

T15-17-IN02

Adhesive Capsulitis of the Shoulder: Evaluation With US-Arthrography Using a Sonographic Contrast Agent

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Adhesive capsulitis (AC) is a painful and disabling disorder, which caused restricted motion and chronic pain of shoulder. Intracavitary contrast-enhanced ultrasound has recently applied to assess obstructive bile duct diseases, tubal patency, vesicoureteric reflux and so on. The aim of this study was to detect the value of US-arthrography by injecting the contrast agent SonoVue into glenohumeral joint compared with US in diagnosing AC. Utrasound (US) and US-arthrography images of 45 patients with AC were compared with that of 45 control subjects without AC with MRI as a gold standard. Patients with AC had a significantly thickened coracohumeral ligament (CHL, 3.1mm) and inferior capsule (3.5 mm) on US, and a decreased volume of axillary recess (1.14 ml) on US-arthrography compared with the control subjects. Filling defect (91.1%) and synovitis-like abnormality (75.6%) in the joint on US-arthrography were more sensitive than that of rotator interval abnormality (71.1%), thickened CHL more than 3 mm (64.4%), thickened inferior capsule more than 3.5 mm (66.7%) on US respectively for diagnosis of AC. Consequently, US-arthrography was more effective method than US for assessment of AC. Filling defects of joint cavity and synovitis-like abnormality in the joint are characteristic US-arthrography findings for diagnosing AC.

T15-17-IN03

The Effect of Percutaneous Ultrasound-Guided Subacromial Bursography Using Microbubbles in the Assessment of Subacromial Impingement Syndrome: Initial Experience

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Subacromial impingement syndrome (SIS) is a common cause of shoulder pain and disability, especially among athletes and the elderly. Various imaging modalities are routinely used in the evaluation of SIS, including plain radiographs, magnetic resonance imaging (MRI), and sonography, which are often helpful in demonstrating supportive findings for SIS, discovering alternative causes of shoulder pain, and disease staging. Contrast-enhanced ultrasound (CEUS) has been widely used to characterize the vascularity of lesions in organs of interest. More recently, many authors have investigated the intracavitary use of ultrasound contrast agents—for example, in the evaluation of obstructive bile duct diseases, tubal patency, and vesicoureteral reflux—with promising results. In this study, we injected the contrast agent mixture into the subacromial bursa of patients with SIS under sonographic guidance in order to observe the distribution of the mixture. The purpose of this study was to determine the feasibility and the value of percutaneous ultrasound-guided subacromial bursography (PUSB) with CEUS for assessment of rotator cuff tears. Between January 2012 and September 2014, 2-D US and PUSB were prospectively performed in 135 patients with suspected rotator cuff tears from among 2,169 patients with clinically diagnosed SIS. Sixty-three patients who had undergone arthroscopy were included. The PUSB findings were compared with those from 2-D US using the McNemar test, with arthroscopy as a standard. Accuracy in diagnosing FTTs was 81.0 % for 2-D US and 98.4 % for PUSB. 2-D US and PUSB yielded sensitivity of 63.2 % and 94.7 %, respectively, for full-thickness tears, with specificity of 88.6 % and 100.0 %, respectively. In conclusion, PUSB is a safe and feasible procedure, with greater sensitivity and specificity than 2D US in diagnosing FTTs. As such, PUSB improves the value of ultrasound for assessing rotator cuff pathology.

T15-17-IN04

Ultrasound Intervention in Orthopedics-Two Topics in Our Procedures

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First Topic: Ultrasound-Assisted Closed Reduction of Distal Radius Fractures

We assessed the accuracy and ability of ultrasound for monitoring closed reduction for distal radius fractures. Consecutive 43 patients undergoing ultrasound-guided closed reduction of acute, displaced distal radius fractures at our department were enrolled. The control group (n=57) was extracted from patients who underwent a closed reduction for similar fractures under fluoroscopy or without any imaging assistance. To confirm the accuracy of the ultrasonography measurements, displacement distance values were compared with those on radiographic imaging before and after reduction. X-ray parameters for pre and post-reduction, reduction time, total cost, and success rate were compared between the ultrasound-guided and the control groups. There were no significant displacement differences between radiographic and ultrasound measurements. In x-ray parameters for pre and post-reduction, there were no significant differences between the 2 groups. Ultrasound-guided reduction took longer than the other 2 methods. The success rate of the ultrasound and the fluoroscopic groups were similar (95% and 94%, respectively). Our data suggest that ultrasound assistance can aid reduction of distal radius fractures as well as fluoroscopy.

Second Topic: Force Recovery Assessment of Functioning Free Muscle Transfer Using Ultrasonography

We evaluated the usefulness of ultrasonography for measurement of functioning free muscle transfer strength and estimate the capacity and potential of ultrasonography measurement. Twenty-five patients underwent functioning free muscle transfer for brachial plexus injury. The cross-sectional areas (CSAs) of the transferred muscle and the contralateral gracilis (control) were measured using ultrasonography. Force recovery was evaluated by calculating the contraction ratio (CR), which was defined as the value equal to the CSA of the transferred muscle under maximum isometric contraction divided by the CSA value in a complete rest position. The CR of the contralateral gracilis was

calculated in the same manner. The CR of the transferred muscle and the control were compared statistically. We also analyzed the correlation between the CR of the transferred muscle and other measurements of muscle strength. The CR of the transferred muscle (1.30±0.12) was significantly greater than that of the contralateral gracilis (1.22±0.13). Furthermore, the CR of the transferred muscle showed significant correlations with both manual muscle testing and elbow arc of motion.

Ultrasonography measurement of transferred muscle can easily indicate the recovery process of rehabilitation in a quantitative and dynamic manner. This study demonstrated that ultrasonography has the capacity to evaluate force recovery objectively.

T15-17-IN05

Ultrasound-Assisted Percutaneous Release in Carpal Tunnel Syndrome and Trigger Digits: A Over 1000-Case Series

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Carpal tunnel syndrome (CTS) and trigger digit (TD) are two of the most common disorders in hand. Numerous surgical release methods have been reported and minimal invasive procedure is the current trend. We previously developed ultrasound-assisted percutaneous release technique and reported our preliminary results. In this series, there were 473 CTS releases in 385 patients (mean age: 56.6±11.8 years; mean symptom duration: 13.2±13.7 months) and 1167 TD release in 936 patients (mean age: 56.0±12.1 years; mean symptom duration: 11.5±20.6 months) using this technique after a 1-year follow-up. For TD, quick-DASH score, modified functional status scale (mFSS), visual analog scale (VAS), pinch power, grip power, and 3-jaw pinch power all were significantly improved since one month after operation until one year ($p<0.05$, all). The 1-year satisfaction rate was 96.6 % and 99.4 % remission rate. There were 6 locked TD with recurrence and relieved with local injection or open release. For CTS, VAS, Boston Carpal Tunnel Syndrome Questionnaire, grip power, and two-point discrimination were significantly improved since one week after operation until one year ($p<0.05$, all). 1-year satisfaction rate was 96.2%. There was no recurrent except three patients presenting persistent numbness until 6 months after operation. There was no complication including infection or neurovascular injury in CTS group, but one patient with infection that was treated with open surgical debridement in TD group. Therefore, we conclude that ultrasound-assisted percutaneous release of carpal tunnel and TD is a safe and effective procedure. However, it is technically demanding and requires substantial training to be proficient in its use.

T15-17-IN06

The Ultrasound-Guided Radiofrequency Lesioning in Recalcitrant Tennis Elbow and Plantar Fasciitis

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Tennis elbow (TE) and plantar fasciitis (PF) are two of the most common tendinopathy/enthesopathy. Up to date, numeroustreatment choices have been reported for the recalcitrant cases. The minimal invasive procedure is the current trend. Mounting evidence supports the efficacy of radiofrequency thermal lesioning (RTL) for treating recalcitrant TE and PF. It is though that RTL is a procedure that enable denervation of a peripheral nerve ending, hence of resolution of pain associated with the nerve lesion. RTL works by dissipating heat from an active electrode. To minimize damage to the surrounding healthy tissue and obtain a better therapeutic effect, the electrode should be precisely placed into the targeted lesion site. In previous literature a fluoroscope had been reported to confirm the location of the electrode. In our daily practice, we use the ultrasound (US) to monitor the percutaneous RTL when treating recalcitrant TE and PF from the initial cannula insertion until the electrode placement and lesioning. US has several advantages in such procedure: First, real-time and easy confirmation of the location of electrode. Second, evaluating the pre-lesioning and post-lesioning condition of the target tissue to monitor the therapeutic response. We have reported two series with satisfactory result using such US-guided percutaneous technique. We conclude that ultrasound is a useful objective tool for guiding RTL and for monitoring the effectiveness of treatment.

Free Paper

OPT15-001

Sonographic Findings of Cutaneous Panniculitis in Systemic Lupus Erythematosus and/or Antiphospholipid Syndrome: A Case Series

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Objectives: Ultrasound (US) is a useful approach for diagnosing subcutaneous panniculitis of various etiologies. We herein reported 3 cases of lower limb subcutaneous panniculitis associated with systemic lupus erythematosus (SLE) as well as antiphospholipid syndrome (APS), diagnoses assisted by US.
Methods: Case series with literature review.
Results: The first case involves a 31-year-old woman with SLE and APS, presenting with acute patchy swelling and tenderness over right leg. US disclosed increased subcutaneous thickness, echogenicity, and Doppler signals around one dilated artery. Her symptoms improved after colchicine use. The second case involves a 25-year-old woman with APS and suspected SLE, presenting with focal swelling and tenderness over right lower calf. US similarly showed subcutaneous hyperechoic change with increased vascularity, accompanied by one central non-thrombosed vein with thickened wall. Steroid was given with fair response. The third case involves a 46-year-old woman with suspected

SLE and APS, who reported focal tenderness over right lateral foot. US revealed a dilated non-thrombosed vein with surrounding panniculitis. She was successfully treated with anti-inflammatory and immune-modulatory therapies, with symptom resolution.

Conclusions: Vaso-centric inflammation accompanied by panniculitis under US examination can raise the suspicion of vasculitis-mediated panniculitis. The utilization of US among these patients assists in the diagnosis and facilitates appropriate treatment institution.

OPT15-002

Can Ultrasound Differentiate Acute Erosive Arthritis Associated with Osteomyelitis, Rheumatoid Arthritis, or Gouty Arthritis?

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Objectives: The study intended to determine the specific ultrasonographic features of acute arthritis with periarticular bone erosions caused by acute osteomyelitis (OM), rheumatoid arthritis (RA) and gouty arthritis (GA).

Methods: This retrospective single-center study included patients having acute monoarthritis or oligoarthritis, and receiving ultrasound (US) examinations in the acute stage. The US images were rated by 3 rheumatologists blinded to the diagnosis. The median scores of their evaluation of subcutaneous tissue, periosteum, and synovium were compared. Interrater reliability was calculated using Cronbach's alpha.

Results: We studied 33 patients (7 with acute OM associated with arthritis, 18 with RA flares, and 8 with GA attacks). The highest mean grades of subcutaneous edema appeared in patients with acute OM, and grade 2 edema was more frequent than patients with RA and GA ($p=0.003$ and $p=0.026$, respectively; $\alpha=0.869$). The prevalence of subcutaneous power Doppler signal was also higher in patients with acute OM than in RA and GA ($p<0.001$ and $p=0.041$, respectively). Periosteal vascularity presented more frequently in acute OM ($p=0.003$ compared to RA; $p=0.041$ compared to GA), but the interrater reliability was poor ($\alpha=0.518$). The tophaceous material in GA was distinctive from OM and RA ($p=0.010$ and $p<0.001$, respectively), with acceptable interrater reliability ($\alpha=0.774$).

Conclusions: The most discriminative US features in this study were the subcutaneous tissue changes in addition to the periosteal findings. US could contribute to the differential diagnosis of the 3 diseases causing bone erosions and arthritis.

OPT15-003

Power Doppler Ultrasonography-Documented Rheumatoid Arthritis Relapse Is Common in Patients on Biologics Dose Reduction

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Objectives: Biologics dose reduction in clinically remitted rheumatoid arthritis (RA) is a policy of Taiwan National Health Insurance Administration. However, the incidences of clinical and ultrasonographic relapse during biologics dose reduction are unknown.

Methods: Nineteen RA patients who were beginning to reduce biologics dose were enrolled. Power Doppler ultrasonography (PDUS) and clinical assessment were performed on week 0, 12 and 24. Eight joints including bilateral elbow, wrist, MCP2 and MCP3 were scanned with an ultrasound unit (GE LOQIC e equipped with a 12 MHz linear probe, PRF 1.2 kHz). Each joint adopted standard positioning and had one scanning plane. The grading of synovitis adopted OMERACT criteria and presented as gray-scale (GS, included both synovial hypertrophy and effusion) score 0-3 and power Doppler (PD) score 0-3. Total score (0-24) was the sum of the score of individual joint. The definition of relapse was 28-joint disease activity score (DAS28) increment >1.2 for clinical relapse, total GS score increment $\geqq 2$ for GSUS relapse and total PD score increment $\geqq 1$ for PDUS relapse. The protocol of dose reduction was as following: to reduce 1/4 dose for tocilizumab (4 patients), 1/3 dose for golimumab (7 patients) and abatacept (1 patient), and 1/2 dose for adalimumab (5 patients) and tofacitinib (2 patients). The primary endpoint was the clinical, GSUS and PDUS relapse rate at week 24.

Results: The mean age was 57.7 ± 12 years (range 30-80). The male-to-female ratio was 3/16. The mean disease duration was 4.9 ± 3.0 years (range 1.3-10.8). Sixteen patients were seropositive for either rheumatoid factor (RF), anti-cyclic citrullinated peptide (CCP) or both. The baseline data were as following: erythrocyte sedimentation rate 19.5 ± 22.4 mm/hr (range 2-101), C-reactive protein 0.39 ± 0.71 mg/dl (range 0-2.74), DAS28 3.1 ± 1.2 (range 1-6), total GS score 6.8 ± 3.7 (range 3-15) and total PD score 1.8 ± 2.6 (0-8). At week 24, the clinical, GSUS and PDUS relapse rate was 18.8%, 29.4% and 64.7% respectively (PDUS v.s clinical, $p<0.01$). The baseline status including negative RF, negative anti-CCP, disease duration <3.5 years, DAS28 <2.6, GS score <6 and PD score $=0$ did not show a protection from any type of relapse at week 24.

Conclusions: PDUS detected more patients with RA relapse than clinical assessment did. Biologics dose reduction led to substantial subclinical relapse of RA at week 24.

OPT15-004

The Role of Ultrasound in the Diagnosis of Infectious Tenosynovitis of Hand Mimic Rheumatic Diseases: Two Case Reports

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Objectives: The diagnosis of infectious tenosynovitis of hand, if caused by an atypical infection without fever, can be challenging. We reported 2 cases whose diagnosis were made with ultrasound (US) examinations and a US-guided aspiration.

Methods: Two case reports and literature review.

Results: Two afebrile patients with tenosynovitis of hand were reviewed. Case 1An 81-year-old man with diabetes mellitus and old pulmonary tuberculosis presented with swelling of the dorsum of left hand for about 2 weeks. He was referred to a rheumatologist. A magnetic resonance imaging showed extensor tenosynovitis. US revealed marked hypoechoic thickening of the synovium but only a few flow signals. A test for rheumatoid factor was negative. In the follow-up US, trace pus was aspirated. The culture confirmed Mycobacterium tuberculosis infection. Case 2A 68-year-old woman with acute left hand painful swelling, especially at the

fourth metacarpophalangeal joint. Gout was suspected initially, but the response to treatment was poor. Besides, left thumb was reported being pierced by a raw fish bone 2 months ago. A US examination showed extensive extensor and flexor tendon tenosynovitis of the wrist and fingers without signs of crystal deposition. Minimal fluid was found around the flexor digitorum tendons, and was aspirated with US guidance. The culture yielded Mycobacterium gordonae.

Conclusions: Infectious tenosynovitis is a serious condition that can result in severe morbidity if untreated, and surgery is often required to make the diagnosis. The utilization of easily accessible US can facilitate early diagnosis with less-invasive procedures.

OPT15-005

Serum C-Reactive Protein Is Predictive of Synovial Proliferation and Joint Deformities in Patients with Chronic Gouty Arthritis: Correlation between Clinical and Ultrasound Manifestations

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Objectives: We aim to elucidate relation among systemic inflammatory biomarkers, joint effusion and features of musculoskeletal ultrasonography (MSKUS) in patients with acute and chronic gouty arthritis.

Methods: We retrospectively analyzed correlation among uric acid and C reactive protein (CRP) white cell counts of peripheral blood and synovial fluid and MSKUS images of patients with acute or chronic gouty arthritis. Images of 280 patients diagnosed by 2015 American College of Rheumatology/European League Against Rheumatism criteria were reviewed. At least one of joint's manifestations of gouty arthritis was identified in each patient. Differences were analysed by independent t tests or Fisher's Exact Test and P values < 0.05 were considered significant.

Results: Joint's manifestations including accumulated synovial fluid, synovial proliferation, double contour sign (DCS), tophi, tenosynovitis, and Baker's cyst were detected in 75.7%, 45.3%, 42.8%, 23.9%, 20.0%, and 9.2% of patients, respectively. Patients with chronic kidney disease have increased risk of synovial proliferation at joints (p value < 0.05). Patients with synovial proliferation have higher serum CRP level ($p < 0.01$) and were characterised by significantly higher comorbidity with Baker's cyst ($p < 0.05$), DCS ($p < 0.05$), and tenosynovitis ($p < 0.01$). Patients with DCS have significantly lower serum CRP level ($p < 0.01$).

Conclusions: In our study, renal insufficiency is capable of predicting development of synovial proliferation in patients with gouty arthritis. Serum CRP level is related to synovial inflammation and proliferation, which contribute to joints deformities in patients with chronic gouty arthritis. However, there will be lower level of CRP when DCS, as an presentation toward chronic gouty arthritis, was detected.

OPT15-006

Scleredema Adultorum Buschke: Ultrasonographic Findings

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Objectives: To describe ultrasonographic (US) findings in patients with scleredema that is a rare sclerotic disorder characterized by the diffuse, swelling, and non-pitting induration of the skin.

Methods: Institutional review board approval was obtained. Eight patients (7 male and 1 female; mean age, mean age of 51.5 years,) with scleredema underwent US examination. Demographic data, including location of lesion, period of symptoms, diabetes history, level of Hemoglobin (Hb) A1c, and etc. were reviewed. US images were assessed for the thickness of dermis, echogenicity, presence of multiple echogenic spots, posterior shadowing, and vascularity of the lesion.

Results: In all patients, the thickening and erythematous discoloration of the skin were at the posterior neck. Six of the 8 patients had a history of diabetes. Two patients denied the diabetes history. However, all patients show the increased hemoglobin A1c level. The dermis was thickened in all cases. The mean dermal thickness on US was 7.0 ± 1.95 mm, similar to a previous study. US imaging revealed the increased echogenicity, multiple echogenic spots in the dermis, posterior shadowing at the lower dermis, and no vascularity.

Conclusions: When the thickened dermis with strong echogenic spots and posterior shadowing on US imaging are observed at the posterior neck, scleredema should be considered in the differential diagnosis.

OPT15-007

Musculoskeletal Ultrasonography in Detection of Early Juvenile Idiopathic Arthritis

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Objectives: Juvenile idiopathic arthritis (JIA) is a chronic inflammatory disease associated with arthritis of unknown etiology that begins before the age of 16 and persists for longer than 6 weeks. We present a case of Taiwanese girl presented with right-side knee joint pain for weeks. JIA was finally diagnosed. DMARDs medication was prescribed initially and later we added biologics. Musculoskeletal ultrasound was used to follow up the joint condition. We intend to determine the role of musculoskeletal ultrasound (MSUS) in early stage of juvenile idiopathic arthritis.

Methods: Case report and literature review.

Results: A 5-year-old girl with JIA successfully controlled with anti-TNF alpha and oral form Methotrexate. The occurrence of cartilage loss in children with juvenile idiopathic arthritis, an early indicator of joint damage. MSUS detected more synovitis than clinical examination (subclinical synovitis) both at base line and at follow up. MSUS is highly sensitive for early detection of joint involvement in JIA especially in young children. The epiphyses are highly vascularized and the metaphyseal vessels anastomose with epiphyseal vessels throughout the growth plate. Irreversible cartilage destruction may occur before bone changes are radiographically evident.

Conclusions: This case illustrates MSUS is highly sensitive for early detection of joint involvement in Juvenile idiopathic arthritis when compared to physical examination.

OPT15-008

Response of Synovitis in Oa Knee to Platelet-Rich-Plasma and Hyaluronic Acid: An Ultrasonographic Study

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Objectives: To determine whether platelet-rich-plasma (PRP) injection into synovitis in osteoarthritis(OA) knee can achieve improvement in knee function and reduce synovitus.

Methods: Fifty five patients with OA knee having unilateral or bilateral synovitis validated by ultrasound (N=42) were studied. All the patients were randomized to receive PRP (N=32) or Hyaluronic acid(HA)(N=40) injection twice at 2-week intervals; Clinical assessments were performed using a visual analog scale(VAS) and The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC index) before injection at baseline, 4 weeks(first evaluation) and 12 weeks(secondary evaluation). Imaging evaluation based on color Doppler ultrasound(CDUS) and the depth of synovial fluid accumulation ,and the width of synovial hypertrophy was performed simultaneously.

Results: PRP injection improved the VAS score (P = 0.023), and WOMAC index (P = 0.01),considerably more than HA injections did at the first evaluation and second evaluation. The depth of synovial fluid accumulation values at first evaluation (P = 0.005) decreased significantly compared with the HA groups but not in secondary evaluation. The CDUS values and width of synovial hypertrophy revealed no significant different between two groups. After subgroup analysis ,the depth of baseline synovial fluid accumulation had significant correlation with the decreased of synovial fluid accumulation (r=-0.7 , P = 0.023) regardless of HA or PRP injection.

Conclusions: PRP injection improved short-term knee function and pain reduction more than HA injection in OA knee treatment. PRP may have superior effect role in reducing synovial fluid accumulation in a short-term evaluation. The initial severity of synovitis in OA knee may determine the treatment effect of mitigating synovitis.

OPT15-009

Dynamic Musculoskeletal Ultrasound (MSK US) of the Knee Joint, from Simple Supine Dynamic Scans to Kinematic Scans

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Objectives: Knee pain is a common complaint in sports injuries or degeneration. One of the biggest advantages of MSK US over MRI in diagnosing causes of knee pain is that it is possible to do real time dynamic scanning, e.g. in a patient with suspected medial meniscus tear, by doing a varus and valgus stress test, or even a slight flexion and extension of the knee joint and put the probe across the meniscus, a clinician can see whether the meniscus is protruding, moving between the tibia and femur, and whether it has clefts or loose bodies or not. This article will elaborate how we can utilize this special advantage of MSK US to do dynamic scanning of knee joints and further assist clinicians to assess patients in real time especially when the patients are complaining mechanical knee pain, e.g. standing up from sitting, during squatting, during walking up and down stairs and even during walking. These activities are in fact showing the effects of gravity and weight of the persons on the knees.

Methods: This is a descriptive essay of possible applications of MSK US dynamically to mainly assess the medial meniscus, patellar femoral joint and another possible cause of medial knee pain with snapping of the gracilis tendon. The description of each method is followed by a picture showing the probe position and patient setting, a video link is included to show each technique. Videos of possible pathologies were also listed. The techniques included in this article are: Technique1: Supine Varus and Valgus Dynamic Scanning, with the long axis of the transducer crossing the Tibiofemoral joint (TFJ)Technique2: Supine Varus and Valgus Dynamic Scanning, with the long axis of the transducer in-plane with the Medial TFJ lineTechnique3: Supine Flexion and Extension Dynamic Scanning Techniques: with the long-axis of the transducer crossing the Medial TFJ line Technique4: Supine Flexion and Extension Dynamic Scanning, with the long-axis of the transducer in-plane with the TFJ joint lineTechnique5: Standing Flexion and Extension Dynamic Scanning, with the long-axis of the transducer crossing the TFJTechnique6: Standing Flexion and Extension Dynamic Scanning, with the long-axis of the transducer in-plane with the TFJTechnique7: Variation1 of the Standing Flexion and Extension Dynamic Scanning Techniques (standing-up and sitting-down dynamic scanning)Technique8: Variation2 of the Standing Flexion and Extension Dynamic Scanning Techniques (walking-up or down-stairs dynamic scanning)Technique9: Kinematic scan of the medial meniscus with the patient walkingTechnique10: Dynamic scan of the snapping Gracilis.

Conclusions: This article described possible applications of MSK US to dynamically evaluate the causes of knee pain from pathologies in medial meniscus, patellar femoral joint and snapping of the gracilis tendon. Further studies need to validate and standardize these techniques.

OPT15-010

Short-Term Effect of Ultrasound-Guided Low-Molecular-Weight Hyaluronic Acid Injection on Clinical Outcomes and Imaging Changes in Patients with Rheumatoid Arthritis of the Ankle and Foot Joints. A Randomized Controlled Pilot Trial

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Objectives: To determine whether hyaluronic acid (HA) injection into rheumatoid arthritis ankles and feet can achieve improvement in foot function and reduce synovial hyper-vascularization.

Methods: Forty-four patients with RA having unilateral or bilateral painful ankle and foot involvement (N=75) were studied. All the patients were randomized to receive HA (N=40) or lidocaine (LI) (N=35) injection at 2-week intervals; Clinical assessments were performed using a visual analog scale(VAS) and foot function index(FFItotal) including subscales of pain(FFIpain) before injection at baseline, 4 weeks(first evaluation) and 12 weeks(secondary evaluation). Imaging evaluation based on color Doppler ultrasound(CDUS) and synovitis scores was performed simultaneously.

Results: HA injection improved the VAS score (P = 0.009), FFIpain (P = 0.041),and FFItotal (P = 0.032) considerably more than LI injections did at the first evaluation. The CDUS values at first evaluation (P = 0.005) and secondary evaluation (P< 0.001) decreased significantly compared with the base line values. HA injections reduced the CDUS values of more than half of the joints (54%,P = 0.042) while the control group exhibited no change(20%, P = 0.56). However, HA injection did not reduce the CDUS values more than LI injection did. Regarding the evaluation of synovial hypertrophy, no significant difference was observed between or within the groups in the synovitis scores.

Conclusions: HA injection improved short-term foot function and pain reduction. HA injection may have a modest effect in reducing synovial hyper-vascularization. Further large-scale study is warranted to confirm this result.

OPT15-011

Muskuloskeletal Ultrasound Finding in Disseminated Tuberculosis

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Objectives: To describe ultrasound finding of musculoskeletal manifestation in disseminated tuberculosis.

Methods: This descriptive study was conducted as a public–private mix approach at some least health facilities: Fanayama Community Health Centre, Lukas Goverment Hospital, Stella Maris Hospital, under coordination of South Nias Ministry of Health, Teluk Dalam, North Sumatera during May-July 2015. All patients had musculoskeletal sign and symptoms, in addition to disseminated tuberculosis including peritoneal (dry type) small bowel tuberculosis, chronic cough (lung tuberculosis suspected), neck lymph nodes enlargement and mild fever. The only available portable black and white ultrasound with convex probe 3,5 m Hz was performed on musculoskeletal affected area as well as abdominal ultrasound on tympanic and dullness abdominal pain area according to 'dam board phenomenon' of peritoneal dry type – small bowel tuberculosis.
Results: N = 2, (9 and 11 y) boys. Musculoskeletal ultrasound finding were thickening of the muscle and synovial of painful affected area in addition to several ovale/round nodular structures (patchy hyper-echoic non-shadowing with an irregular rim of lower echo-density). Small bowel ultrasound showed hypo-peristaltic, irregular thickening heterogenic hypo-echoic of the small bowel wall in addition to similar several ovale/round nodular structures (patchy hyper-echoic non-shadowing with an irregular rim of lower echo-density); loss differentiation of the wall layers, irregular margin and narrowing of the lumen were examined on the dullness pain area. No X-ray available. Follow-up after anti tuberculosis treatment showed improvement both clinically with ultrasound.
Conclusions: Ultrasound of musculoskeletal manifestation in disseminated tuberculosis cases had some characteristics.

OPT15-012

Effects of Bolus Consistency and Volume on Hyoid Bone Displacement during Swallowing

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Objectives: Timely and adequate laryngeal elevation along with hyoid bone displacement is essential for swallowing under normal physiological conditions. This study primarily aimed to investigate the effects of bolus consistency and volume on hyoid bone displacement during swallowing.
Methods: In this study, a self-designed ultrasonography machine connected to a laptop was used. A water balloon was fixed to the transducer, which provided good contact between the transducer and submental skin. 30 healthy participants were recruited. Each participant swallowed 10 and 20 mL of water and 10 mL of juices of three different consistencies (250, 900, and 2500 centipoise) in the upright posture. The transducer was placed in the midsagittal plane of the submental area. Hyoid bone displacement during swallowing was recorded and analyzed.
Results: The average hyoid bone displacement when the participants swallowed 10 and 20 mL of water was 1.94 and 2.21 cm, respectively ($p < 0.05$). The average hyoid bone displacement when the participants swallowed 10 mL of thin juice (250 centipoise), honey-thick juice (900 centipoise), and pudding-thick juice (2500 centipoise) was 2.07, 2.05, and 2.14 cm, respectively. No significant differences were observed in the paired comparison of hyoid bone displacement among the three bolus consistencies.
Conclusions: The results demonstrated that bolus volume, rather than its consistency, significantly affected hyoid bone displacement during swallowing.

OPT15-013

Predict Triangular Fibrocartilage Complex (TFCC) Tear in Severe Rheumatoid Arthritis by PD Ultrasound

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Objectives: The Triangular Fibrocartilage Complex (TFCC) is the main biomechanical stabilizer of the distal radioulnar joint, TFCC tear frequent occurred in patients with wrist pain. This study aimed to predict tear of the triangular fibrocartilage complex using high-resolution ultrasound in severe rheumatoid arthritis.
Methods: We evaluated severe rheumatoid arthritis who received biological therapy. Ultrasound and magnetic resonance imaging (MRI) were performed before and one year after biological therapy. Those with TFCC were recorded. Logistical regression was used to search for the possible factors to predict TFCC tear.
Results: 54 patients were enrolled. There were 42 females and 12 males. 21(38.9%) developed TFCC tear after follow up one years. The mean age were 55.14 ± 9.54 at TFCC tear group, compared with 56.45 ± 14.04($p=0.596$). The body mass index were 22.81 ± 2.59 kg/m^2 at TFCC tear group, compared with 23.61 ± 2.76 kg/m^2 ($p=0.136$). The tear group had higher power Dopper ultrasound score at dorsal radio-carpal joint (1.90 ± 1.30 vs 1.33 ± 0.99, $p=0.011$), higher DAS28 score (6.36 ± 0.47 vs 5.58 ± 0.65, $p=0.011$) than non tear group. In logistical regression analysis, the higher pretreatment PD score had a significantly higher risk of TFCC tear ($p=0.010$, OR=1.987, 95% CI 1.180-3.344), while high DAS28 also had a significantly higher risk of TFCC tear ($p=0.004$, OR=5.924, 95% CI 1.781-19.706).
Conclusions: These results show higher wrist PD score predict future TFCC tear in severe rheumatoid arthritis. So we recommended using PD score before biological therapy to early monitor of possible future TFCC tear.

OPT15-014

Reliability of 8-Joint Ultrasonography Scores in Follow Up of Biological Therapy in Patients with Rheumatoid Arthritis

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Objectives: The primary objectives were to explore the associations between a comprehensive ultrasonographic (US) assessment of joints, tendons and bursae and previously described reduced joint counts (8-, 7-, 12-, 28) as well as to assess the sensitivity to change of these different US joint combinations during biologicaltreatment.
Methods: 8-joint(bilateral elbow, wrist, MCP II and III) were involved in this study. 49 patients with rheumatoid arthritis (RA) were examined by US (B-mode (BM) and power Doppler (PD)) with use of a semi-quantitative (0 to 3) score of 34 joints, tendons/tendon groups at baseline and 1, 3, 6 and 12 months after initiating treatment with biological therapy. BM and PD scores for the different joint combinations were generated.
Results: The reduced 8-joint scores had high correlation coefficients with the 28-joint score at all examinations (range 0.87 to 0.94 for BM and 0.69 to 0.93 for PD, each $P < 0.001$) and sum BM and PD scores of all the different joint combinations improved significantly during follow-up ($P \leq 0.05$ to 0.001).
Conclusions: The reduced joint combinations were highly associated to the 28-joint score. Furthermore, all the joint combinations presently explored responded well to biological treatment. This indicates that an approach focusing on few joints and tendons gives equivalent information about the inflammatory activity in RA patients as a comprehensive US examination. The optimal combination of joints and tendons for a valid, reliable and feasible US measurement should be further explored to define a US score for follow-up of RA patients on biological treatment.

OPT15-015

Classification of Fracture Non-Unions Using the Non-Union Scoring System, Dynamic Contrast-Enhanced Ultrasound (CEUS) and Magnetic Resonance Imaging (DCE-MRI)

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Objectives: There is no diagnostic standard for fracture non-unions. This study evaluated multiple diagnostic tools such as the non-union scoring system (NUSS), dynamic contrast-enhanced ultrasound (CEUS) and MRI (DCE-MRI) for the classification of non-unions and outcome prediction after revision surgery.
Methods: Between 2014 and 2016 non-union microperfusion was prospectively quantified with CEUS and DCE-MRI before revision surgery and at 6, 12 and 26 weeks follow-up. The results as well as the NUSS were compared to the main outcomes: 1) infection of the non-union; 2) osseous consolidation at 26 weeks after surgery, patients were categorized in early- and late-responders.
Results: 43 patients (46.8±16.8 years, 14 women) were available for preoperative and follow-up assessments. 16 had infected non-unions which were only detected by CEUS with preoperatively increased perfusion (Rise Time: 5.6±3.2s vs. 13.9±16.6s, p=.024; Time To Peak: 13.9±16.6s vs. 18.6±21.1s, p=.011), sensitivity/specificity (ROC): 93.3%/65.2%. Neither C-reactive protein levels nor white blood cell counts distinguished between patients with infected and aseptic non-unions. 14 non-unions consolidated after 26 weeks (early-responders), they had better preoperative NUSS values (35.1±9.4 vs. 44.0±10.8, p=.027) and elevated osseous perfusion in DCE-MRI at 6 and 12 weeks follow-up (initial area under curve: 11.7±9.3 vs. 7.2±6.1, p=.035; 10.6±6.2 vs. 7.3±5.8, p=.029), sensitivity/specificity (ROC): 57.1%/92.3% (ROC).
Conclusions: The preoperative non-union evaluation by the NUSS and CEUS combined with the postoperative DCE-MRI perfusion analysis were most suitable to plan non-union surgery and predict its outcome. The integration of these diagnostic instruments into clinical routine could promote a standardized treatment of non-unions.

OPT15-016

Severity Correlation between Cross-Sectional Area and Electrodiagnostic Parameters in Carpal Tunnel Syndrome

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Objectives: To compare the severity between ultrasound and electrodiagnostic (EDx) criteria and to investigate the correlation between cross-sectional area (CSA) of median nerve at the wrist (CSA) and EDx parameters in patients with carpal tunnel syndrome (CTS).
Methods: Physical examination, nerve conduction study (NCS), and needle EMG were done and 37 wrists were diagnosed with CTS and then maximal CSA was measured by tracing method using ultrasound independently. CSA and EDx parameters were analyzed and classified with each severity groups, and then evaluated the correlation between ultrasound and EDx severity classified with each criteria.
Results: CSA was 14.4±4.2 mm2 in 37 wrists. Fourteen ultrasound mild patients were mild in 10, moderate in 2, and severe in 2 patients by EDx criteria; 14 ultrasound moderate patients were mild in 3, moderate in 8, and severe in 3 by EDx criteria; and 9 ultrasound severe patients were mild in 1, moderate in 5, and severe in 3 by EDx criteria. In multiple regression analysis, CSA showed correlation with SNAP and CMAP amplitude (r=–0.48 and r=–0.44).
Conclusions: Severity between ultrasound and EDx criteria was not well correlated. However, CSA had negative correlation with SNAP and CMAP amplitude. Ultrasound severity criteria should add other findings and parameters.

OPT15-017

Is This Juxtacortical Chondroma or Chondrosarcoma?: A Case Report

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Objectives: Low grade chondrosarcoma shows similar imaging findings compared with chondroma. We report a case of juxtacortical chondrosarcoma, initially misdiagnosed as a juxtacortical chondroma.
Methods: Case report and literature review.
Results: A 15-years old man was hospitalized to treat a painful mass in the right lower leg. Ultrasonography (US) and MRI were performed to identify the location and characterize the mass. Excisional biopsy was done to confirm the diagnosis. 3 months later, he had recurrent symptom. So, US and MRI were performed again. And initial pathologic slides were retrospectively reviewed. In our case, initial US showed well-marginated, hypoechoic mass with internal septation and echogenic dots in the pretibial area. Initial MRI showed well-marginated, hyperintense lesion on T2WI and hypointense on T1WI with heterogeneous enhancement in the pretibial area. Underlying cortex and bone marrow of the tibia was intact. There was not shown any periosteal reaction. Juxtacortical chondroma was confirmed by excisional biopsy. About 3 months later, MRI showed the large recurrent mass with cortical involvement and focal eccentric intramedullary extension at the pretibial operation area. As compared with previous MRI, it was shown similar signal intensity. US revealed the large hypoechoic mass with internal echogenic dots and cortical irregularity of the proximal tibia. Initial pathologic slides were retrospectively reviewed by pathologist. Thus, the final diagnosis was juxtacortical low grade chondrosarcoma.
Conclusions: On this case, radiologist and pathologist initially misdiagnosed as a juxtacortical chondroma. However initial imaging findings were more favorable to juxtacortical chondroma. Therefore, radiologist and pathologist should be careful to distinguish low grade juxtacortical chondrosarcoma from chondroma.

OPT15-018

An Ultrasound Pattern of Chronic Sequelae Following Medial Calf Tennis Leg Injuries

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Objectives: It is not uncommon for patients to present with medial calf tightness some months or even years after a medial calf (tennis leg) injury. A common finding in these patients is a thickened area of tissue between the medial gastrocnemius and soleus muscles which has previously been interpreted as a hypertrophic or tendinopathic plantaris tendon. Recently we have observed that the normal plantaris tendon is present deep to the area of thickened tissue demanding an alternative theory for the etiology of this tissue.
Methods: Dynamic high resolution ultrasound and MRI has been performed on patients with the hypertrophic tissue plane present adjacent to the plantaris tendon and between the medial gastrocnemius and soleus muscles.

Results: Dynamic high resolution ultrasound and MRI has been performed on patients with the hypertrophic tissue plane present adjacent to the plantaris tendon and between the medial gastrocnemius and soleus muscles.
Conclusions: This paper describes a common pattern of chronic granulation change, which may develop following a significant tennis leg injury to the medial calf. Tennis leg injuries represent a spectrum of medial gastrocnemius, Achilles tendon musculotendinous junction tears. Treatment of tennis leg injuries is conservative in nature involving rest, ice, compression and elevation followed by physiotherapy. In most cases this leads to a full recovery, however occasionally the healing process leads to a hypergranulation response resulting in chronic scar tissue development. The hypergranulation has a distinctive sonographic appearance, which may be confused with plantaris tendinopathy. From the clinical perspective the patient presents with a prior tennis leg injury, which has resulted in a chronic tightness or lack of full flexibility in the medial calf.

OPT15-019

Comprehensive Sonographic Protocol for Assessment of Ankle Inversion Injuries

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Objectives: Ankle inversion injuries are very common and well suited to ultrasound evaluation of soft tissue and bony injury. The breadth of information which may be obtained by the ultrasound assessment is broad and has led us to question the need for a dedicated protocol.
Methods: A review of ultrasound , plain x-ray and MRI findings in patients suffering ankle inversion stress was performed to establish the scope of potential injury.
Results: The standard commonly performed ultrasound examination is inadequate and expansion to a more comprehensive protocol results in higher yield from the ultrasound examination.
Conclusions: "Ultrasound is an excellent modality for soft tissue and bony assessment in patients who have suffered ankle inversion stress injury. This paper outlines a comprehensive protocol for thorough investigation of these injuries. It goes beyond the standard investigation of lateral ligaments to include: •Anterior ankle joint •Subtalar joint •Anterior talofibular ligament •Calcaneofibular ligament •Anterior inferior tibio-fibular syndesmosis •Dorsal talo-navicular ligament •Peroneal tendons •Superior peroneal retinaculum •Base of 5th metatarsal •Calcaneo-cuboid ligament (Bifurcate) •Extensor digitorum brevis muscle and origin enthesis •Fibula extensor retinaculum avulsion injury •Tibio-talar deltoid ligament (POMI Lesion) •Flexor retinaculum / deltoid ligament conjoint attachment to medial malleolus. A variety of commonly encountered patterns of injury will be discussed involving injury to these easily examined structures."

OPT15-020

Acute Injuries of the Lumbrical Origins in the Palm of the Hand

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Objectives: Between 2008 and 2016 we encountered multiple patients with acute mid palm pain encountered during rock climbing or other forceful gripping with the hand. Ultrasound demonstrated a characteristic mid palm fluid collection around the "bare area" of the flexor tendons. The exact mechanism of injury resulting in this presentation and appearance remained uncertain until recently.
Methods: A careful review of archived cases was undertaken in an attempt to determine the exact injury leading to these symptoms and ultrasound findings. Time was spent in a cadaver laboratory reviewing the mid palm anatomy and possible causes for injury. Results: The cadaver sessions led us to hypothesise that the lumbricals muscle may have been torn from the flexor digitorum profundus tendon in the mid palm.
Results: The result is clearly establishing that the injury causing this characteristic clinical presentation and ultrasound appearance is in fact an avulsion of the lumbrical muscle from the flexor digitorum profundus tendon in the palm of the hand.
Conclusions: This paper describes for the first time a pattern of pathology well demonstrated on ultrasound. Forceful blue-collar work involving extreme finger flexion loading or rock climbing activities are the common mechanisms leading to this injury. The patients preset with an acute pain in the palm of the hand and immediate loss of finger flexion strength. The ultrasound demonstrates a unique pattern representing an avulsion injury of the proximal lumbrical origins from the flexor digitorum profundus tendon. This gives rise to what we have described as the "theta sign" which corresponds to fluid in the mid palm component of the flexor tendons where there is no synovial sheath present. Dynamic ultrasound and high resolution static MRI images confirm the diagnosis and mechanism of injury.

OPT15-021

The Efficacy of Ultrasound-Guided Perineural Injection with 5% Dextrose for Radial Nerve Palsy: A Case Report

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Objectives: Radial nerve palsy is one of the most common compression neuropathy and therapeutic options vary from conservative to surgical interventions for symptom relief and neurological deficit. Perineural injection therapy (PIT) could be a novel intervention for peripheral entrapment neuropathy. Here, we present the first case with Radial nerve palsy having outstanding improvement after two-sessions ultrasound-guided PIT with 5% dextrose (D5W).
Methods: Case report and literature review.
Results: A 62 year-old female presented dysthesia along the territory of radial nerve and drop wrist which fatherly be diagnosed as Radial nerve palsy after confirmed by electrophysiological study. Initially, the patient received conservative treatments including rehabilitation and medicine without any progress. Total two-sessions ultrasound-guided PIT with D5W in an interval of one month were performed 2 months after symptom onset. The noteworthy improvement of sensory and motor function were observed post-PIT injection.
Conclusions: This case illustrated that ultrasound-guided PIT with D5W was an effective and novel intervention for radial nerve palsy.

Poster Session

PPT15-001

A Novel Simplified Ultrasound Scoring System for Evaluation of Activity in Rheumatoid Arthritis Patients

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Objectives: To find a simplified and effective ultrasound scoring system for evaluation of activity in rheumatoid arthritis(RA) patients.
Methods: Bilateral joints of elbow(Elb), wrist(Wri), metacarpophalangeal(MCP) 1-5, proximal interphalangeal(PIP) 1-5,knee(Kne), ankle(Ank) and metatarsophalangeal(MTP) 1-5 of 141 RA patients were examined by high frequency ultrasound. The appearances of

synovitis, power Doppler(PD) signal, effusion, and bone erosion were scored semi quantitatively(scores 0-3) respectively. Twenty eight joints Disease Activity Scores (DAS28) were calculated. Relationships among DAS 28 and synovitis, PD, effusion, and bone erosion scores were analysed.

Results: The sum scores of all investigated joints of synovitis, PD and effusion were correlated significantly($p < 0.01$) with DAS28 respectively. The sum scores of bone erosion were notcorrelated with DAS28 ($P > 0.05$). The sum scores of synovitis of bilateral Wri 、Elb 、Kne 、 MCP2 、MTP1、PIP3、MTP4 and PIP1 were significantly correlated with DAS28($r=0.484$, $p<0.01$) mostly. The sum scores of PD of bilateral Wri 、MTP1 、Kne 、PIP3 and MCP3 were significantly correlated with DAS28($r=0.371$, $p<0.01$) mostly. The sum scores of effusion of bilateral Kne、MCP3 、MTP4 、MCP4 、MCP5 、MTP5 、PIP4 、PIP5 、MCP1 、PIP3 、MTP3 and Ank were significantly correlated with DAS28($r=0.531$, $p<0.01$) mostly. In combination, the total scores of synovitis plus PD plus effusion of Kne 、Wri 、Elb 、MTP4 、MCP3 、MCP4 、 PIP3 、MTP5 、PIP1 、PIP4 were significantly correlated with DAS28($r=0.584$, $p<0.01$) mostly. The total scores of Kne 、Wri 、Elb 、MTP4 、MCP3were also significantly correlated with DAS28($r=0.559$, $p<0.01$), and the r value was just lower mildly than that of previous 10 joints(0.559 vs 0.584).

Conclusions: The sum scores of synovitis, PD and effusion were all correlated with DAS28, and can reflect disease activity of RA, whereas bone erosion cannot. The total scores of Kne、Wri、 Elb、MTP4、MCP3 joints can simply and effectively evaluate disease activity of RA.

PPT15-002

Carpal Tunnel Syndrome with Bifid Median Nerve: Sonographic and Electrophysiological Findings

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Objectives: Carpal tunnel syndrome (CTS) is an entrapment of the median nerve at the carpal tunnel of the wrist. Many risk factors as rheumatoid arthritis, diabetic, hypothyroidism, pregnancy and body mass index are known to cause CTS. Bifid median nerve is rare, and the correlation with CTS is still controversial.

Methods: We report one 37 year old female with bifid median nerve suffered from CTS and present the sonographic and electrophysiological findings.

Results: The patient's nerve conduction study showed: 1. Prolongation of bilateral median motor distal latency, 5.65 ms (RT) and 6.14 ms (LT). 2. Slow down median sensory NCV at distal segment 36.4m/sec (RT) and 30.2 m/sec (LT). Moderate CTS without axonal degeneration was impressed. The sonographic findings revealed hypo-echoic nerve and marked increased nerve size, cross section area-inlet=31 mm^2>10mm^2, CSA-O=15 mm^2, CSA at pronator tere muscle level=10 mm2 over right median nerve and right wrist to forearm ratio=3>1.4. At left median nerve, bifid median nerve was found in ultrasound findings. Marked increased nerve size, cross section area-inlet=33 mm^2>10mm^2, CSA-O=14 mm2, CSA at pronator tere muscle level=0.06 and 0.03 mm2 of bifid nerve over left median nerve and left wrist to forearm ratio=3.1>1.4.

Conclusions: When patient was diagnosed as CTS by electrophysiological studies, the sonographic exam should be conducted to rule out bifid median nerve to prevent the surgical complications.

PPT15-003

Chronic Knee Pain Distribution of Old Patients in Performing Ultrasound-Guided Intervention

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Objectives: Knee pain is one of the most common chief complaints in older adults. We evaluated the location of the knee pain retrospectively.

Methods: This retrospective study enrolled 200 elderly patients over 65 years who received injections due to knee pain for 7 years. The location of knee tenderness was divided into 7 categories: the central, upper, medial, lateral, lower, and posterior knee, as well as others.

Results: The most common tender points were the medial (pes anserinus, 105), lateral (iliotibial band, 78), upper (quadriceps tendon, 65), other (piriformis muscle, 35), central (knee joint, 9), and posterior (Baker's cyst, 4) aspect of the knee, in order of frequency.

Conclusions: Most knee pain in older adults originated from extra-joint disorders, especially caused by pes anserinus syndrome, iliotibial band syndrome, quadriceps tendinopathy, Baker's cyst, or referred pain from piriformis syndrome, as well. Knee pain originating from intra-articular problems was less than 5%.

PPT15-004

Clinical Outcome and Sonographic Findings on Hemiplegic Shoulder Pain and Rotator Cuff Injuries after Hyaluronic Acid Injection in Subacute Stroke Patients

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Objectives: Hemiplegic shoulder pain (HSP) is one of most complications after stroke. HSP impedes the functional outcome of the affected shoulders. Hyaluronic acid (HA) could provide positive effects for pain relief and joint motion on hemiplegic shoulders. We investigated the benefits of HA injection on HSP and rotator cuff injury in stroke patients.

Methods: A randomized double-blinded controlled trial was conducted in one medical center. Twenty-seven subacute stroke patients were enrolled and divided into 2 groups: the experimental group ($n = 18$), in which the patients received ultrasound-guided subacromial HA injections once per week for three weeks and conventional rehabilitation, whereas the control group ($n = 9$) received 0.9% sodium chloride injections once per week for three weeks and conventional rehabilitation. HSP and shoulder sonography on affected shoulders were assessed before intervention, one week and 2 months after intervention.

Results: The VAS scores of HSP were significantly improved at one week and 2 months after treatment ($p=0.001$, and $p=0.002$) in the experimental group. In the control group, VAS scores at one week and 2 months after intervention were significantly reduced ($p=0.015$ and $p=0.026$). In the experimental group, significant differences were found in reducing the level of hyperemia in the long head of biceps and subscapularis tendons at 2 months after intervention ($p=0.020$ and $p=0.014$).

Conclusions: Subacromial HA injections could provide positive effects on the reduction of shoulder pain and hyperemia at tendons and the effects could be persisted for 2 months after intervention in subacute stroke patients with HSP and tendon injury.

PPT15-005

Effects of Ultrasound-Guided Extracorporeal Shockwave Therapy on the Rehabilitation of Patients with Piriformis Syndrome

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Objectives: We investigated the effects of extracorporeal shockwave therapy (ESWT) on the rehabilitation of Piriformis syndrome under ultrasound guidance.
Methods: Sixty patients with piriformis syndrome were selected and randomly assigned to three groups: A, B and C. Patients in Group A received conventional rehabilitation with 20 minutes of hot packs and underwent 15 minutes of deep electrotherapy and stretching exercise three times per week for 6 weeks. Patients in Group B received the same conventional rehabilitation as those in Group A and ESWT (2000 impulses, 0.27 mJ/mm^2) over piriformis guided by local palpation once weekly for 6 weeks. Patients in group C received the same treatment as in group B and ESWT (2000 impulses, 0.27 mJ/mm^2) over piriformis guided by ultrasonography once weekly. The therapeutic effects were evaluated by changes in visual analog pain scale of buttock and H-reflex prolongation, lower limbs function by times of up and go (TUG), and muscle peak torque of hip joints.
Results: We found a significant reduction in pain in each treated group after treatment and at follow-up. However, patients in Groups B and C showed more improvements in TUG and muscle peak torques. Furthermore, patients in Group C showed better in decease of H-reflex prolongation.
Conclusions: Ultrasound-guided ESWT to the piriformis muscle achieved definite clinical improvement and normalization of electrophysiological test results.

PPT15-006

Evaluation of Sonoelastography in Differentiating Benign and Malignant Soft Tissue Masses

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Objectives: To access the value of strain elastography in differentiating benign and malignant soft tissue masses.
Methods: Soft tissue masses of 100 patients were examined by strain elastography. Elastogram scores(ES) and Strain ratios(SR) were obtained and compared between benign and malignant masses.
Results: Sixteen patients were lost to follow-up. Of remained 84 patients, 22 were malignant and 62 were benign. Significantly higher ESs and SRs were observed in the malignant masses than the benign masses (3.32±0.43 vs. 1.73±0.93, P<0.001; 5.84±3.38 vs. 1.92±2.33, P<0.001), AOC area under ; the curve of ES and SR were 0.884 (p<0.001) and 0.915 (P<0.001) respectively. With an ES ≥3 as the optimal cut-off value, the sensitivity, specificity, positive predictive value and negative predictive value for diagnosing a malignant mass were 100%、71.4%、75.9% and 100% respectively. With a SR value ≥ 2.78 as the optimal cut-off value, the sensitivity, specificity, positive predictive value and negative predictive value for diagnosing a malignant mass were 88.9%, 76.2%, 61.5%, and 94.1%, respectively.
Conclusions: Both SR and ES were significantly different between the malignant and benign soft tissue masses; so strain elastography can be adopted as a high application value to differentiate the malignant and benign soft tissue masses,and it is a new technology which is worth promoting.

PPT15-007

Healing of Achilles Tendon Partial Tear Following Focused Shockwave: A Case Report and Literature Review

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Objectives: Achilles tendinopathy is a common cause of posterior heel pain and can progress to partial tendon tear without adequate treatment. Effects of traditional treatments vary and many recent reports focus on the use of extracorporeal shockwave therapy (ESWT) for the Achilles tendinopathy but not in Achilles tendon partial tear.
Methods: We report an 64-year-old female suffering from severe left heel pain for half a year. All treatment and rehabilitation were less effective, until ESWT was applied. Each course of focused shockwave therapy included 2500 shots with energy flux density from 0.142 mJ/mm^2 to 0.341 mJ/mm^2.
Results: The visual analogue scale decreased from nine to one degree. High-resolution musculoskeletal ultrasonography was performed before and one month after the treatment which revealed healing of the torn region and decreased in inflammation.
Conclusions: ESWT had shown to be an alternative treatment for Achilles tendon partial tear under safety procedure and ultrasound observation.

PPT15-008

Hemodynamic Changes of Posterior Tibial Artery during En Pointe Position in Pre-Professional Dancers

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Objectives: In dancers, forced plantar flexion (en pointe position) is the most common movement of ankles. Whether en pointe position causes hemodynamic changes in the lower limbs remains unknown.
Methods: We used Doppler ultrasound (Hitachi Noblus, Linear probe L64, Probe frequency range 18-5MHz) to measure posterior tibial artery flow at the retromalleolar level. Peak velocity from three positions-neutral position, passive and forced active plantar flexion were recorded in 33 pre-professional dancers and 13 age-similar controls. Range of motion(ROM) of ankle plantar flexion was measured. Oxygen saturation was recorded in neutral position and during 1-minute forced active plantar flexion in 24 dancers and 13 controls.
Results: The ROM were larger in dancers than in controls. Peak velocity of posterior tibial artery significantly increased in passive plantar flexion compared to in the neutral position (p< 0.001) in both groups. During forced active plantar flexion, blood flow was undetectable in 36 legs in dancers group (54.5%) and only 3 legs in control group (11.5%); the mean oxygen saturation decreased to 83.8% in dancers and 90.4% in control group.
Conclusions: Passive plantar flexion and forced active plantar flexion were associated with the change of peak velocity in posterior tibial artery. The oxygen saturation decreased during forced active plantar flexion. Those phenomena are more prominent in pre-professional dancers than the control group having similar age.

PPT15-009

Human Leukocyte Antigen-B In Patients with Psoriasis and Psoriatic Arthritis

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Objectives: Certain Human leukocyte antigen (HLA) is associated with the development of psoriasis and psoriatic arthritis. Asymmetric oligoarthritis is one of the presentation of psoriatic arthritis. We aimed to evaluate the asymmetry of joint involvement with respect to HLA-B by ultrasound.
Methods: Fifty-five patients with psoriatic arthritis (PsA) and psoriasis (PsO) were evaluated on their IPs, PIPs, DIPs, MCPs, wrists,

elbows, shoulders, acromioclavicular joints, sternoclavicular joints, knees, ankles, MTPs. Joint inflammation was assessed by ultrasound and graded 0-3 upon grey scale and power doppler. Human leukocyte antigen B results were reviewed retrospectively.
Results: After excluding joints with symmetric normal presentation upon sonography, we analyzed the asymmetry of joint inflammation with categorical data. Right third DIP and left second MTP were affected more than their fellow ones (McNemar test, p=0.049 and p=0.039 respectively). HLA-B60, HLA-B46, HLA-B58, HLA-B27, HLA-B38, HLA-B39 were most frequently observed. Presence of the above-mentioned HLA-B alleles were distributed between PsA and PsO without significant difference and did not affect the distribution of the involved joints. After converting to continuous variables and considering normal symmetric joints, right third DIP and left second MTP joints remained (Wilcoxon signed-rank test, p=0.041, p<0.001 respectively). Right second DIP was affected more than the left in patients positive for HLA-B60 or B61. Left fourth MCP affected more than the fellow one in positive HLA-B27. Left second PIP in positive HLA-B38 or HLA-B39.
Conclusions: Joint sonography can be useful in different HLA-B alleles in PsA and PsO patients.

PPT15-010

Joint Sonography in Patient with Hematoidin Crystals in a Clinically Suspected Septic Arthritis

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Objectives: Hematoidin is an erythrocyte derived product without containing iron. It is rare to find intracellular and extracellular hematoidin crystals in joint effusion. Sonographic description was never described before. We present a case of monoarthritis in a patient with alcoholic cirrhosis and compare his sonographic findings with CT scan and MRI and pathologic findings.
Methods: Case report and literature review.
Results: This 40 year-old man, Taiwanese aboriginal Atayal, with alcoholic liver cirrhosis and diabetes mellitus presented with left knee swelling of acute onset for 1 week. CT scan at emergency room showed free air within the joint effusion Ultrasound was performed and showed heteroechoic thickening of the synovium with focal hyperemia and hyperechoic lines suggesting free air in the synovium. There was also superficial enhancement of the articular cartilage layer. MRI of the knee showed no nodular proliferation of the synovium with lobulated margins or blooming artefact on gradient echo suggesting pigmented villonodular synovitis. Joint aspiration and synovial fluid analysis revealed the presence of intracellular and extracellular hematoidin which is a yellow, rhomboid plate. Joint bacterial culture was negative. He received joint synovectomy and no micro-organism was identified. Pathology showed focal necrosis with acute and chronic inflammatory cells in the synovium.
Conclusions: Hematoidin is a soluble crystal which is seldom present in the synovial fluid. Previous report also showed that hematoidin is present in patients with staphylococcus aureus septic arthritis preceded by previous repeated previous repeated traumatic injuries. Here we presented the sonographic findings of a joint inflamed by the presence of hematoidin crystals.

PPT15-011

Joint Ultrasound In Patients with Psoriasis and Psoriatic Arthritis

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Objectives: Patients with psoriasis have varied joint involvement. Some patients have symptomatic asymmetric oligoarthritis while some are asymptomatic. To evaluate the joint involvement in patients with psoriasis (PSO) and psoriatic arthritis (PSA), we compared fifty-two joints in patients with PSO and PSA and evaluated the symmetry of joint involvement.
Methods: We enrolled a total of fifty-five patients with 38 PSA and 17 PSO and evaluated their IPs, PIPs, DIPs, MCPs, wrists, elbows, shoulders, acromioclavicular joints, sternoclavicular joints, knees, ankles, MTPs. Joint inflammation was graded from grade 0 to grade 3 on grey scales (GS) and on doppler signals (PD). A score of asymmetry was introduced to compare the right and left side of joint involvement.
Results: Baseline demographics between PSA and PSO were not significantly different except that PSA patients had more tender joints (median value = 2, Mann-Whitney U test, p<0.001) and swollen joints (median value = 1, Mann-Whitney U test, p<0.001). GS score (median value = 29, p<0.001), PD score (median value =1, p=0.049) and composite scores (median value = 35, p<0.001) were higher in PSA. PSA has more upper limb joints involvement (p<0.001). Right-Left asymmetry score was not significantly different among PSA and PSO (p=0.956).
Conclusions: Asymmetric oligoarthritis is one of the pattern of psoriatic arthritis. Ultrasound evaluation of PSA and PSO reveals more joint involvement than clinical examination. Joint asymmetry was not different between PSA and PSO.

PPT15-012

Management of Refractory Sciatic Neuropathic Pain Using Ultrasound-Guided Pulsed Radiofrequency

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Objectives: Nowadays, pulsed radiofrequency (PRF) is being used to control several types of musculoskeletal pain. Herein, we report a successful application of ultrasound (US)-guided PRF for a patient with refractory sciatic neuropathic pain.
Methods: Case report.
Results: We applied US-guided PRF to a 50-year-old man, suffering from refractory neuropathic pain on the left foot following sciatic neuropathy for a period of approximately 6 months. We performed PRF on the level of piriformis muscle because the lesion of the sciatic nerve was presented digitally from the level of piriformis muscle on the magnetic resonance images. Under US guidance, the catheter needle was placed close to the left sciatic nerve, and dysesthesia and tingling sensation were reported to be less than 0.2V. The PRF treatment was administered at 5Hz and 5ms pulsed width for 360 seconds at 45V. After PRF on the left sciatic nerve, pain intensity-based on a numeric rating scale-decreased from 8 to 2. The reduction of pain was sustained for at least 6 months after the PRF procedure.

Conclusions: We concluded that the PRF treatment with guidance with US is a very useful treatment technique for patients with refractory sciatic neuropathy.

PPT15-013

Sonography for Localized Cutaneous Nodular Amyloidosis in a Patient with Systemic Lupus Erythematosus

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Objectives: Localized cutaneous nodular amyloidosis (LCNA) is the rare manifestation of amyloidosis. The association of LCNA with Sjögren's syndrome was made in previous reports, but there were fewer cases regarding LCNA in patients with systemic lupus erythematosus (SLE). Herein we reported a patient with underlying SLE with secondary Sjogren's syndrome who developed localized cutaneous nodular amyloidosis and the cutaneous manifest under ultrasound evaluation.
Methods: Case report and literature review.
Results: A 60-year-old woman presented with a lump lesion over her left leg developed for a week without erythema or pain. Her medical history was remarkable for SLE for 6 years with initial symptoms/signs including general malaise and Raynaud's phenomenon, sclerodactyly, digital vasculitis, serositis with pleural effusion and pericardial effusion, positive ANA 1:160. She was hospitalized due to nephrotic syndrome and renal biopsy showed membranous glomerulonephritis. She was regularly followed and was kept with daily prednisolone 5mg, azathioprine 100mg, plaquenil 200mg without major flares, though dsDNA Ab kept rising. There were no apparent skin lesions over her left leg. Sonography showed hypoechoic nodule with ill-defined margins measuring 19.9 x 20 x 9.8 mm in the subcutaneous tissue with posterior acoustic shadow. Bacterial culture was negative. Serum was negative for monoclonal gammopathy. Pathology revealed light chain amyloidosis. No recurrence was noticed at 6 month follow up.
Conclusions: This case demonstrated the sonographic findings of the localized cutaneous light chain amyloidosis in SLE. Ultrasound can be useful in diagnosis.

PPT15-014

The Role of Ultrasound in the Evaluation of Peripheral Nerves Abnormalities

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Objectives: Abnormalities affecting the peripheral nerves are common in clinical practice. Ultrasound with its high resolution is an excellent modality in imaging of peripheral nerves due to its dynamic capabilities, cost effectiveness and good availability. This didactic exhibit aims to 1. Highlight the usefulness of ultrasound in evaluating peripheral nerves 2. Describe the sonographic appearances of normal and diseased peripheral nerves seen in our institution.
Methods: Ultrasound cases of the peripheral nerves that were performed at our institution between January 2009 and January 2017 were retrospectively reviewed. All studies were performed using Philips IU22 machine with a high frequency linear transducer. Where available, correlation with magnetic resonance imaging (MRI) and histopathology will be presented.
Results: Pictorial review with actual case illustrations will be presented. The abnormalities presented will include trauma, tumors and entrapment neuropathies. After reviewing this exhibit, reviewers should be able to recognize sonographic appearances of normal peripheral nerve as well as identify and describe the sonographic appearances of various common peripheral nerve abnormalities.
Conclusions: Ultrasound with its high resolution and dynamic capabilities is useful in the evaluation of peripheral nerves abnormalities. Knowledge of sonographic appearances of normal and common peripheral nerves abnormalities is essential for accurate diagnosis.

PPT15-015

The Use of Ultrasonography and Nerve Conduction Study to Assess Outcomes and Prognostic Indicators in Carpal Tunnel Syndrome: A Study in Patients Treated with Night Splinting

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Objectives: To investigate the value of ultrasonography (US) and nerve conduction study (NCS) in evaluating outcomes and prognosis for carpal tunnel syndrome (CTS) treated with night splinting.
Methods: Fifty-eight hands with mild to moderate CTS were prospectively enrolled; 42 diseased hands completed the study. Satisfaction rating, symptom severity score (SSS), functional status score (FSS), NCS data, and US data were evaluated as outcome variables before and after 3 and 6 months of night splinting. On an intent-to-treat basis, a binary logistic regression analysis was used to determine prognostic indicators of subjective satisfaction and receiver operating characteristic (ROC) curves were plotted.
Results: After 6 months of splinting, 29 hands had good subjective outcomes and 13 had poor subjective outcomes. SSS, FSS, sensory conduction velocity (SCV) on NCS, and the cross-sectional area of the median nerve at the pisiform bone level (PCSA) on US improved significantly in hands with good satisfaction but not in hands with poor satisfaction. On an intent-to-treat basis, 29 hands were categorized as good or poor subjective outcomes respectively. According to regression model and the ROC curves, SCV and PCSA were independent prognostic indicators, and the optimal cut-off values of SCV and PCSA for good subjective outcome were $\geq$40m/s and $\leq$11.35 mm2 respectively.
Conclusions: US and NCS are appropriate tools for assessing outcome variables and prognostic indicators of night splinting for CTS.

PPT15-016

Ultrasono Guide Mr Arthrography: How Can Do and Success Rate

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Objectives: This study was showing capabiliy and sucess rate of doing us guide MR arthrography without fluoroscopy.
Methods: Between march 2014 and november 2015, a total of 9 consecutive patient for MR arhtrography were prospectively include in this study. This study were performed by single center non randomized and one radiologist. 3 case were shoulder joint, 6 case were hip joint.Shouder 2 cases were performed by classic ant.approach method and another one was doing by post. approach method. All case were perfomed by free hand us guide method. Shoulder joint US guide were performed by 7MHZ linear transducer hip joint us guide were perfomed by 3.5MHZ Curved linea transduce.
Results: There are many limitation factor exist but sucess rate are 100%.
Conclusions: Us guide arthrogrphy are many pros such as avoid harmful radiation and not used fluoroguide contrast media. Cons are no much experenced and contrast delivery into joint space conviction are weak than fluroscopic guide.

T16. Nephro-/Urologic Ultrasound

Symposium

T16-14-IN01

History of Transrectal Ultrasound (TRUS)

Hiroki Watanabe
Watanabe Memorial Choumei Research Laboratory, Honorary Professor, Kyoto Prefectural University of Medicine and Meiji University of Integrative Medicine

The idea of transrectal ultrasound (TRUS) was proposed by Wild and Reid in 1957 in the very early stage of the development of medical ultrasound. Only the contour of the rectal wall could, however, be visualized by the primitive machine at that time. The first clinically useful sonograms of the prostate were obtained by diverting an original endocavitary probe primarily designed for esophageal use in Sendai in 1967, 50 years ago. This was the first section of the prostate in the living body, of which human has never watched until that time, because it was 5 years earlier than the conceptual invention of CT and 10 year earlier than that of MRI. Since then, various improvements of the machine have been achieved and various diagnostic and therapeutic applications for the method have been proposed. The author will mention some interesting stories around the primary trials briefly, then will state the history of the development of the method year by year.

T16-14-IN02

Recent Advances of TRUS for Diagnosis of Prostate Cancer

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The major advances that have greatly improved our understanding of prostatic disease are significant revision of prostatic anatomy, development of serum assays for prostate specific antigen (PSA), and improvements in imaging techniques specifically the development of high-resolution transrectal ultrasound (TRUS) and magnetic resonance imaging (MRI).

The prostate is composed of three major glandular zones (transition, central, and peripheral zones), and one non-glandular region (anterior fibromuscular stroma). The peripheral zone constitutes 70% of prostatic glandular tissue and is located at the posterior, lateral and apical aspects of the gland, and 70∼80% of all prostate cancers originate in the peripheral zone. The classic appearance of prostate cancer on TRUS is a hypoechoic lesion in the peripheral zone. However, only 60% of prostate cancers are hypoechoic and only 20∼30% of all hypoechoic lesions are malignancies. Hypoechoic lesions that may mimic prostate cancer are inflammation, atrophy, infarction and benign hyperplasia. Other TRUS findings such as capsular bulge, asymmety of echogenecity, periprostatic fat irregularity, and loss of normal echo of seminal vesicles may help detect prostate cancers. Prostate cancers in the transition or central zone and diffuse cancers infiltrating entire gland do not appear with classical findings. Color or power Doppler ultrasound (CDUS/PDUS) is a simple technique to demonstrate the vascularity of a lesion. CDUS/PDUS may be helpful in differentiating malignant from benign prostatic lesions by demonstrating hypervascular nature of the lesion and may help to identify appropriate sites for biopsy. Contrast-enhanced US (CEUS) and sonoelastography may add specificity in prostate cancer detection.

Whenever a prostate cancer is suspected, systematic prostatic biopsy is necessary. There are controversies regarding optimal number of biopsy cores, and various schemes are used to increase the rate of cancer detection. Currently most commonly used system is 12-core scheme with standard sextant cores and additional 6 lateral cores. If there is focal lesions at TRUS, additional cores are obtained. In patients with very high PSA density level, we may substitute 6-core biopsy for 12-core scheme without increasing the risk of missing cancer detection. The value of CEUS- or sonoelastography-guided biopsy or MRI-TRUS fusion biopsy is yet to be determined.

T16-14-IN03

Recent Advances of TRUS for Fusion and Intervention

Osamu Ukimura
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Pioneer works in the image-fusion of prostate imaging were reported in the field of radiotherapy including external beam radiation therapy and brachytherapy since 1990s. However, recent attention to image fusion technology for prostate cancer is more toward its value in improving the quality of prostate biopsy for patient care by precisely targeting the image-suspicious area in mapping the 3D localization of biopsy-proven prostate cancer, as well as its value in navigating image-guided intervention. Real-time TRUS has been the gold standard of prostate biopsy guidance, and therapeutic intervention, because of the advantages of its real-time nature, its easy-handling, and also recent advance for image fusion capability with other imaging modality (such as MRI, PET) which has been already acquired. Recent advanced information technology of computer assisted digitalized technology is supporting the further role of TRUS, especially in real-time three-dimensional ultrasound world.

T16-14-IN04

TRUS in the USA and Ultrasound Education

Pat Fulgham
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From its inception, transrectal ultrasound (TRUS) has held the promise of a cost-effective, non-ionizing means of evaluating the prostate. The early pioneers of this technique had to overcome the barriers of probe design and poor axial resolution but they correctly foresaw the potential to diagnose prostate conditions that had previously only been detectable in their advanced stages. As technological innovation has continuously improved image quality, the challenges for educators have been to emphasize the critical importance of technique and to encourage clinicians to perform and interpret their own studies. In this way, TRUS can reach its full potential as a diagnostic and therapeutic tool. By developing and adhering to quality standards for performing common urological ultrasound examinations, urologists are able to perform diagnostic procedures equivalent to those performed by their radiology colleagues.

T16-14-IN05

Water Absorption from Urine by the Urinary Bladder

Hiroki Watanabe
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Overnight measurements of human urinary bladder capacity during sleep were performed using transabdominal realtime 3-D ultrasound in healthy volunteers of various ages. Two types of patterns were observed in the increasing curve of capacity; namely, gradual elevation pattern (GEP) when overnight urine production was less than functional bladder capacity (FBC) and steep-flat pattern (SFP) when it was more than FBC. During SFP, bladder capacity reached levels of the FBC quickly, then maintained steadily at that level till morning without awakening. Intravesical urine vanishment (IVUV) phenomenon occurred occasionally, when the volumes of urine reached FBC. Thus, a considerable amount of water may be absorbed from urine in the bladder during sleep to maintain a good

level of sleep. This is the first report which exhibits water absorption from urine within the human urinary bladder in the fully physiological situation without any invasive techniques. Possible physiological mechanism for bladder absorption will be discussed.

T16-14-IN06

Ultrasound of the Acute Scrotum

Harvey L. Nisenbaum
Department of Medical Imaging, Penn Presbyterian Medical Center, Philadelphia, Pennsylvania

The presentation will discuss ultrasound (US) evaluation of Torsion/ Infarction; Infection; and Trauma in the Acute Scrotum

Testicular Torsion
- incidence in males younger than 25 years approx 1:4000
- more often involves left testicle
- salvage rate:
  - 90% if detorsion within 6 hours of pain
  - 50% if detorsion occurs at 12 hours
  - 10% if detorsion occurs at 24 hours
  - approaching 0% if detorsion is delayed greater than 24 hours

Epididymitis
- 5th most common urologic diagnosis ages 18-50
- approx 600,000 medical visits/yr in USA
- retrograde passage of infected urine from prostatic urethra to epididymis via ejaculatory ducts and vas deferens
- orchitis in 20-40% of cases
- complications of acute epididymitis and epididymo-orchitis include following:
- scrotal abscess and pyocele
- testicular infarction
- chronic epididymitis and orchalgia
- infertility secondary to inflammation or epididymal duct obstruction
- testicular atrophy with resulting hypogonadotropic hypogonadism
- cutaneous fistula

Testicular Trauma
- blunt trauma- majority
- penetrating trauma
- testicular rupture- urologic emergency; more than 80% of ruptured testes can be saved if surgery is performed within 72 hours
- blunt testicular injuries can be managed either medically or surgically, depending on the clinical presentation
- 2 factors allow protection from minor external trauma
- physiologic hydrocele- testis slides freely scrotal sac
- suspended by spermatic cord allows free movement
- US/CDU valuable for diagnosis and staging testicular injuries
- tunica albuginea disruption diagnostic of testicular rupture
- direct visualization of testicular fracture line rare- in approx 17% pts
- other findings- scrotal wall thickening, hematocele, testicular hematoma

Conclusions
- US should be the first imaging modality to evaluate the acute scrotum
- Use highest frequency transducer possible
- Include CDU (Power Doppler as needed; include spectral Doppler especially infection)

T16-14-IN07

Image Fusion of the Kidney

Michel Claudon
Radiologist, University of Lorraine, Nancy, France

Image fusion of kidney is now currently used by increasing teams to facilitate the realization of second-row ultrasound (US) examination in complex cases, when contrast-enhanced ultrasound (CEUS), guided biopsy or interventional procedure is required. Fusion is usually obtained using CT series of images, generally after contrast-injection, but T2 -weighted sequences or post-Gd T1-weighted series are more commonly considered. Fusion can be made using various fusion protocols, which require some training phase. Transfer of significant images from PACS to the Ultrasound equipment is a point of attention. Examples of various pathological cases of complex cystic lesions, tumors, vascular pathologies will be presented to illustrate the interest of the technique.

T16-14-IN08

New Role of Transrectal Ultrasound Guided Prostate Biopsy

Osamu Ukimura
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Recent efforts towards the earlier detection of prostate cancer (PCa) have resulted in the discovery of earlier, smaller-volume, lower-grade PCa that are often described as clinically insignificant, with a 10-yr relative survival rate comparable to the general population. However, there is still underdiagnosis of high-risk PCa. In contrast, overdetection occurs in patients found to have PCa, and the possibly consequent overtreatment is one of the main concerns in prostate oncology. The role of prostate biopsies has changed. Their importance has evolved from pure cancer detection to assisting clinical patient management. Biopsy as a critical part of active surveillance protocols emphasises the necessity of reproducible and standardised staging and grading strategies. The historical likelihood of missing clinically significant cancers because of sampling error during random prostate biopsy. Nowadays, the image-guided targeted biopsy has been essential in prostate biopsy.

T16-14-IN09

Multiparametric Ultrasound Performs as well as Multiparametric MRI for Prostate Cancer on Initial Biopsy

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The current enthusiasm for multiparametric MRI (mpMRI) in the management of prostate disease is based on excellent anatomic detail and the ability to characterize tissue based on water diffusion and blood flow. Systems of mpMRI/ultrasound fusion of images have been developed to attempt to improve the diagnostic accuracy of biopsy for prostate cancer. For the initial biopsy of a patient thought to be at risk for prostate cancer, multiparametric ultrasound (mpUS) performs as well as mpMRI in terms of the positive biopsy rate (66.5%) and clinically significant disease detection (12.7%). Careful selection of patients, meticulous attention to ultrasound technique and biopsies targeted to ultrasound abnormalities (not exclusively changes in echogenicity) are critical to achieving optimal results. Systematic biopsy, without attention to sonographic abnormalities, is not an optimal technique. The results of such biopsies are not valid for comparison to mpMRI-targeted biopsies.

T16-14-IN10

Erectile Dysfunction: Ultrasound Assessment and 1600 Patients Results

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Erectile Dysfunction (ED) is the impossibility to achieve and/ maintain sufficient erection to have satisfactory and fulfilling sex intercourse for both partners. ED affects a high number of men around the World, with significant impact on sexual function and quality of life. The erection is the phenomenon of penile erectile tissue vasodilation, mediated by complex

interactions between the central nervous system, the arterial and venous systems and the axis hypothalamus-pituitary-gonadal. The main source of blood supply of the penis is through the internal pudenda artery, a branch of the internal iliac artery. The pudendal artery becomes the common penile artery, which is divided into three branches - dorsal, bulbourethral and cavernosal. For a proper assessment, we recommend to follow these requirements: space with appropriate privacy, provide a detailed explanation to the patient, obtain informed consent, use of B-mode, Color Doppler and spectral analysis display, intracavernous injection of vasoactive drugs (i.e. Alprostadil), serial arterial velocity measurements, 5-10-15-20-30 min. It is necessary to document the five hemodynamic phases and measure the systolic and diastolic velocities in the cavernosal arteries. The normal peak systolic velocity (PSV) is equal or greater than 30 cm/s and the end diastolic velocity (EDV) is equal or less than 5 cm in the cavernosal arteries. The dorsal vein of penis has vmax less than 5 cm/s. Men with arteriogenic ED demonstrate PSV < 25 cm/s, with 100 % sensitivity and 95 % specificity. Venoocclusive dysfunction shows PSV 25 cm/s or greater with a persistent EDV>5 cm/s, with a sensitivity of 90 % and specificity of 56 %, in the setting of venous leak. Ultrasound is a valid method of assessing for arterial insufficiency and venoocclusive dysfunction.

T16-14-IN11

Doppler in Renovascular Hypertension

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Renovascular Hypertension is a curable cause of systemic hypertension. Therefore, its early detection is considerably important. This disease is the most frequent origin of secondary hypertension in specialized reference centers.

Color Doppler, Power Doppler and CEUS (Contrast-enhanced ultrasound), have made possible a precise study of renal circulation.

In the assessment of the renal artery, it is necessary to measure the flow velocity. Therefore, it is very important to adequately place the volume sample into the vessel, in addition to an accurate adjustment of its angle less than 60°. Nowadays, the assessment of the renal artery has become a feasible procedure in most cases. If we get normal results, there is no need for further explorations. Conversely, if we get adverse results in an experienced vascular laboratory, it is vital to continue directly with an angiography in order to solve alterations using endovascular procedures such as angioplasty, the placement of stents or radiofrequency.

The typical sonographic findings in hypertension caused by stenosis of the renal artery are:

1. - Generally, the affected kidney presents a reduced size. However, there are cases where size is normal.

2.- Increasing of systolic peaks, equal to or greater than 200 cm/s in the stenosis site. With Color Doppler, the phenomenon of aliasing in the stenosis site (and in the immediately distal area) can be clearly observed.

3. - Parvus-tardus pattern in the post-stenotic segment, in severe stenosis cases.

4. - RAR > 3.5; AI < 3.0 m/sec^2 and AT > de 100 ms.

5. - Absence of detectable flow in kidneys smaller than 9 cm. is an indication of a total occlusion.

Free Paper

OPT16-001

Multiparametric Quantitative Ultrasound Imaging to Assess Chronic Kidney Disease

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Objectives: To evaluate the value of multiparametric quantitative ultrasound imaging (QUI) in assessing chronic kidney disease (CKD) using kidney biopsy pathology as the reference standard.

Methods: We prospectively measured multiparametric QUI markers with grayscale, spectral Doppler, and ARFI imaging in 25 patients with CKD prior to their kidney biopsies and in 10 healthy volunteers. Based on all pathology (glomerulosclerosis, IF/TA, arteriosclerosis, edema) scores, 25 CKD patients were classified into mild (no grade 3 and < 2 of grade 2) and moderate to severe (at least 2 of grade 2 or 1 of grade 3) CKD groups. Multiparametric QUI in the study included kidney length, cortical thickness, pixel-intensity, parenchymal shear wave velocity (SWV), intrarenal artery PSV, EDV, and RI. We tested the difference in QUI parameters among mild CKD, moderate to severe CKD, and healthy controls using ANOVA, analyzed correlations of QUI parameters to kidney pathology and to eGFR using the Pearson correlation coefficient, and examined the diagnostic performance of QUI parameters in determining moderate CKD and eGFR <60 using ROC curve analysis.

Results: There were significant differences in cortical thickness, pixel-intensity, PSV, and EDV among the 3 groups (all $p < 0.01$). Among QUI parameters, the top AUROCs of PSV and EDV for determining pathologic moderate CKD were 0.88 and 0.97, and for eGFR <60 were 0.76 and 0.86, respectively. Moderate to good correlations were found for PSV, EDV, and pixel-intensity to pathology score and eGFR.

Conclusions: PSV, EDV, and pixel-intensity are valuable in determining moderate CKD. The value of SWV in assessing CKD needs further investigation.

OPT16-002

Resistivity and Pulsatility Index in Diabetic Nephropathy: A Phoenix Bird?

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Objectives: Resistivity index (RI) and pulsatility index (PI) are important Doppler ultrasound (US) parameters for the evaluation of intrarenal hemodynamics. We compared the results of color Doppler parameters RI and PI in type 2 diabetic nephropathy (DN) with hypertensive (HT) patients with proteinuria and tried to assess the risk for the progression of the disease.

Methods: 141 patients with DN stages 3-4 and 46 hypertensive patients with proteinuria values 300-500mg/24h were examined by color Doppler US in both kidneys and RI and PI were measured in interlobar arteries on three levels for each kidney and a mean was calculated. US examinations were made with the same device and by the same examiner.

Results: Mean RI values were: 0.71 for ND group (SD=0.06 95%CI), 0.66 for HT group (SD 0.06 95%CI); t-test was highly significant

($p<0.05$). Mean PI values were: 1.27 for ND group (SD = 0.33 95%CI), 1.04 for HT group (SD = 0.24), t-test was also highly significant with values under 0.05. Cut-off values for RI in incipient DN were above 0.72. PI values were higher with age in diabetic patients. Pi and RI were highly significant in case of patients with more than 5 years from the onset of diabetes.

Conclusions: RI can be considered a suggestive parameter for the presence of DN. PI alongside RI correlated with the duration of diabetes, age and incipient DN. The Doppler US examination is difficult but objective measurements are still to be developed.

OPT16-003

The Relationship between Kidney Shear Wave Speed Measured Using the Elastpq Technique and Different Biomarkers of Chronic Kidney Disease

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Objectives: The present study aims to find a relationship between kidney shear wave speed (KSWS) measured using Elastography Point Quantification (ElastPQ) and different biomarkers of chronic kidney disease (CKD): a tubular injury marker- kidney injury molecule-1 (KIM-1), a marker of interstitial inflammation- urinary monocyte chemoattractive protein 1 (MCP1), markers of fibrogenesis- connective tissue growth factor (CTGF), and soluble Klotho, that inhibits fibrogenesis, as a pleiotropic effect.

Methods: Our study included 38 patients (mean age 56.5+/-16.12 years; 19 female, 19 male) with diabetic kidney disease. In all patients KSWS was measured using ElastPQ (Philips Affinity) and median values of 5 valid KSWS measurements were calculated and expressed in meters/second (m/s). In all patients we assessed renal function- glomerular filtration rate (eGFR), and using an ELISA method, serum levels of: KIM-1, CTGF, klotho, and urinary levels of MCP1.

Results: We obtained a mean KSWS of 0.98+/-0.40 m/s (right kidney) and 0.90+/-0.37 m/s (left kidney). KSWS was significantly lower in male vs. female subjects (0.77 vs. 1.02 m/s, $p=0.05$), and in patients with eGFR < 60ml/min (0.8 vs. 1.1 m/s, $p=0.05$). KSWS showed also a decrease with age ($r=-0.53$, $p=0.0009$). We found a statistically significant correlation of KSWS with urinary MCP1 ($r=0.34$, $p=0.05$), and with the level of sKlotho ($r=0.56$, $p=0.03$), but no correlation with CTGF and KIM-1.

Conclusions: Our study shows that KSWS is decreased in advanced stages of CKD, and this decreased levels are associated to reduced interstitial infiltration (urinary MCP1) and probably to increased interstitial fibrosis (low soluble Klotho).

OPT16-004

Pitfalls in Kidney Ultrasonography: Rare Diseases

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Objectives: Ultrasonography (US) is well known to improve the quality of the clinical diagnosis due to its rapidity, repeatability and non-invasivity. While the physician is accustomed to frequent diseases, rare conditions may not be recognized. Our aim is to describe US images in rare kidney diseases and discuss some diagnostic implications in the detection of these pathologies.

Methods: We analyzed the morphological US aspects in patients from the Nephrology Department of the Mureş County Clinical Hospital during a period of ten years. We performed a routine abdominal US for all cases. The examination was made with various US devices. The final positive diagnosis was made by clinical or other imaging modalities.

Results: We found 19 patients (0.095% of the total investigations) with specific clinical presentations and suggestive US imaging for rare renal diseases: 6 cases with medullary sponge kidney, 2 with persistence of fetal lobulation, 2 cases with hydatid cyst, 2 HIV associated nephropathies, one post-biopsy arterio-venous fistula, 2 cases with tuberous sclerosis complex, one case with superior renal artery branch stenosis, one rare mixed urothelial and sarcomatous tumor and two rare images in renal tuberculosis. For each case we described the US appearance and discussed the pitfalls that may lead to misdiagnosis.

Conclusions: US is an important investigation in urology and nephrology. Being aware of rare diseases or rare US images is important in order to establish the final positive diagnosis and avoid unnecessary invasive and expensive procedures.

OPT16-005

Urinary Tract Tuberculosis and Its Ultrasound Findings

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Objectives: To describe the urinary tract tuberculosis and its ultrasound findings.

Methods: This cross sectional study was conducted at Emma Poeradiredja Hospital Bandung, from August 21, 2008 to January 28, 2012. All peritoneal dry type tuberculosis patients with history of recurrent flank pain, frequent urination, dysuria, urine positive PCR Mycobacterium tuberculosis, positive tuberculin test, negative urine culture of other microorganism, lymphocytosis, high erythrocyte sedimentation rate were examined with ALOKA-Prosound-SSD3500 by one certified ultrasound internal medicine doctor.

Results: N= 34, 5-77 years, mean 47.4. 23(68%) female and 11(32%) male. The kidneys: size were 7.9-11.8 cm (mean 10.3) length and 3.3-5.9 cm (mean 4.06) width, irregular parenchymal thickness between 1-2.8 cm (mean 1.4). In the affected area: irregular renal surface, poor differentiation of capsule, cortex, and pyramids as well as ill defined of sinus echo pattern, hypoechodensity and hypovascularisation in addition of some irregular oval/round lesions (patchy echogenic non- shadowing with an irregular rim of lower echodensity) with diameter of 0.7-2.1 cm (mean 1.4). There were 3 (10%) pelvicaliectasis, 7 (23%), complex cysts and 3 (10%) nephrolithiasis, The urinary bladder: irregularly focal or diffuse bladder mucosal wall thickening (5.0-11.4 mm) in addition of some irregular oval/round lesions (patchy echogenic non-shadowing with an irregular rim of lower echodensity) within the thickening wall of the bladder. 2 (7%) were pyuria, 2 (7%) urinary retention, 1 (3%) vesicolithiasis. Ureteric jets were normal.

Conclusions: Urinary tract tuberculosis and its ultrasound findings showed various chronic manifestations.

OPT16-006

Urethral Diverticula in Women: Comparison of Ultrasound and Magnetic Resonance Imaging

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Objectives: The objective was to compare the effectiveness of ultrasound and magnetic resonance imaging (MRI) in evaluating and diagnosing the female urethral diverticulum (UD).
Methods: We performed a (cohort) study of 18 women who underwent both ultrasound and magnetic resonance imaging for periurethral cystic lesions preoperatively. All these patients underwent surgical excisions within 1 month after the imaging and 14 women had UDs. Clinical manifestation, images and surgical technique about the UD patients were considered.
Results: Mean patient age was ? years (age range, ?-?years) and the principle presentations were ? (%), ?(%), and ?(%). The number of UDs detected during surgery, ultrasound examination and MRI were 16, 14(%) and 14(%) separately, with 7, 6 and 6 simple UDs and 9, 8 and 8 complex UDs. Complex UDs were suggestive of UD diagnosis on both ultrasound and MRI (% and %). Simple UDs could be effectively differentiated from periurethral cysts with SonoVue on ultrasound (% vs %). The surgical technique was diverticulectomy with three-layer closure and no postoperative complication happened.
Conclusions: Both ultrasound and MRI could effectively diagnose the female UDs, with sensitivity of % and % separately. Complex urethral cystic lesions could be diagnosed as UDs without the need of further examination with % confidence.

OPT16-007

Intraoperative Ultrasound during Robot-Assisted Laparoscopic Partial Nephrectomy (RAPN)

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Objectives: Prolonged warm ischemia time (WIT) results in irreversible trauma to the kidney. Robot-assisted partial nephrectomy (RAPN) has demonstrated shorter WIT compared to conventional laparoscopic partial nephrectomy (LPN). In our hospital, RAPN was introduced in March 2014. We assessed the benefit of intraoperative ultrasound during RAPN.
Methods: RAPN was performed in 54 patients between March 2014 and March 2017. They consisted of 43 males and 11 females. The right kidney was affected in 28 patients, and the left kidney in 26. The mean tumor diameter was 24.5 mm (11-57). The mean R.E.N.A.L. nephrometry score was 6 (4-10). We used the da Vinci Si system. ARIETTA® (Hitachi medical) or ProART® (bk medical) robotic probe was used for intraoperative ultrasound. The TilePro® was selected to observe the images on the robotic console, which allowed simultaneous vision of both the operative field and the ultrasound images.
Results: The median console time was 163 minutes (94-301). The median warm ischemic time was 19 minutes (0-39). Furthermore, selective renal artery clamping was performed in 24 patients and off-clamp in 1 patient. There were no intraoperative complications. In 1 case, intraoperative ultrasound clearly revealed 4mm tumor touched to main tumor. Intraoperative ultrasound was helpful for exact excision for en bloc resection of tumors.
Conclusions: RAPN could be safely introduced. Intraoperative ultrasound allowed accurate excision with sparing of normal parenchyma in RAPN.

OPT16-008

MR/US Image-Fusion Targeted Biopsy for Diagnosis of Clinically Significant Prostate Cancer

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Objectives: Recent reports suggest the multi-parametric magnetic-resonance image (MRI) for prostate have high accuracy to visualize the clinically significant cancer (CSCa). The utility of MR/US image-fusion targeted biopsy (MRUS-TB) has been reported using computer-software assisted elastic image-fusion system (Koelis). The aim of this study is to report our experience of MRUS-TB for diagnosis of prostate cancer.
Methods: A retrospective review of total 262 consecutive patients with age of 69 y.o. (37-88), and PSA of 7.1ng/ml (4.0-19.8), who had pre-biopsy MRI with suspicious lesion for CSCa and underwent combination of systematic biopsy (SBx) (6 cores) and MRUS-TB (2 cores). Positive rate of any cancer, positive rate of CSCa, Gleason score (GS), and maximum cancer core length (MCCL) were compared between SBx versus MRUS-TB. The CSCa was defined as GS6 cancer with MCCL≧5mm or any cancer with GS≧7.
Results: Overall, the positive rate of any cancer per patients was 61% (160/262) in SBx vs. 79% (207/262) in MRUS-TB ($p<0.0001$); and that of CSCa per patients was 46% (120/262) in SBx vs. 70% (181/262) in MRUS-TB ($p<0.0001$). Positive rate of any cancer per core was 21.7% (330/1523) in SBx vs. 68.6% (406/592) in MRUS-TB ($p<0.0001$), and that of CSCa per core was 12.7% (193/1423) in SBx vs. 60.3% (357/592) in MRUS-TB ($p<0.0001$). Distribution of Gleason score (6/7/8/9/10) was 59/71/23/6/1 in SBx vs. 48/105/36/15/2 ($p=0.005$). MCCL was 5mm (0.5-16) in SBx vs. 8mm (1-19mm) in MRUS-TB ($p<0.0001$).
Conclusions: MRUS-TB was associated with higher detection rate of CSCa than SBx.

OPT16-009

Novel Dosimetric Criteria for Salvage Permanent Brachytherapy (LDR) based on 3D-Cancer Mapping Using Trus

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Objectives: Brachytherapy is the first-line treatment for low-risk and selected intermediate-risk prostate tumors. Recently, salvage permanent brachytherapy (SPB) is one of non-surgical treatment option in recurred men after external beam radiation therapy (EBRT). Whole gland salvage brachytherapy has demonstrated acceptable oncological outcomes; however, it can have Grade3-4 genitourinary and gastrointestinal toxicities. We have started SPB in men who recurred after EBRT using 3D-Cancer mapping obtained from MRI-TRUS fusion targeted/systematic biopsy technique (Fusion-B). In this study we introduce the novel dosimetric criteria for SPB based on 3D-cancer mapping under the permissible biological effective dose.
Methods: In 13 patients who develop recurrent prostate tumors after EBRT, we have started performing permanent salvage brachytherapy based on three dimensional cancer mapping data obtained from MRI TRUS fusion biopsy examinations. Parameters in determining dosimetric planning are as follows; Gleason score (GS) in Fusion-B, 2) Number of positive cores in target (1-2 cores) as well as systematic (8 cores) biopsies, 3) Positive core(s) located in targeted alone/ hemi/ bi-

lateral lobes ? Prescribed dose to the target lesion, rV100 and uD90 were planned > 160Gy, 0% and <165Gy respectively.

Results: After a median follow-up period of 33 months, biocemical failure occurred in 2 patients . No Grades 3 and 4 complication developed.

Conclusions: Although focal salvage brachytherapy is not an established technique, in cases of post EBRT recurrent prostate cancer, it might offer a way of reducing the frequency of toxicities while maintaining similar treatment outcomes compared with whole gland therapy.

OPT16-010

Ultrasound Findings of Penile Paraffinoma from Self-Injection of Mineral Oil Material: Clinical Presentation and Histo-Pathological Correlation

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Objectives: Penile augmentation via foreign body injection is a practice prevalent in some cultures in South East Asia. In recent years, we have noticed an increasing trend in patients who presented with self-injection of a mineral oil material that was sold as a traditional topical remedy. Most presenting patients usually present months to years after the initial injection rather than acutely, with symptoms of pain, swelling and rarely ulceration. Ultrasound is usually used for diagnosis and pre-surgical planning. Many patients may not be forthcoming with their history and are evaluated as cases of suspected cellulitis/infection before further imaging reveals the true etiology of their complaint.

Methods: Review of typical sonographic findings, complications, histopathological correlation and current literature.

Results: Typical ultrasound findings of symptomatic patients include marked thickening of subcutaneous tissue in the penile skin. There is usually increased echogenicity although the homogeneity can vary. Discrete globules presenting as palpable nodules are sometimes identified. The material can spread along the subcutaneous tissue plane, resulting in "metastatic" deposits distant from site of injections; in areas such as scrotum, perineum and abdominal wall. Complications such as severe deformity or necrotizing fasciitis have been documented. Resected histological specimens demonstrate the presence of diffuse lipo-granulomatous reaction, which supports the ultrasound observations.

Conclusions: Penile paraffinoma from self-injection of mineral oil substance are not uncommon. Ultrasound has been used for diagnosis and pre-surgical evaluation of presenting patients. The evaluating physician should be familiar with the typical imaging findings.

Poster Session

PPT16-001

Churg-Strauss Syndrome Involving Testis and Epididymis

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Objectives: Churg-Strauss syndrome (CSS), or allergic granulomatous angiitis, is a rare syndrome that affects small- to medium-sized arteries and veins. CSS involves mainly lungs, skin, nerves, and gastrointestinal tract. Here, we report a case of CSS involving testis.

Methods: A 47-year-old male presented with painful left scrotal swelling. Scrotal ultrasonography shows diffuse enlargement of left epididymis with several cysts and prominent left scrotal wall thickening, and increased vascularity in left epididymis and both testicle.

Results: He was treated with antibiotics and analgesics under impression of epididymitis for 4 weeks. Scrotal pain was constant and follow up ultrasonography shows fluid collection in left scrotal sac.

Conclusions: So, left orchiectomy and epididymectomy was perfomed and pathological analysis reveals Churg-Strauss syndrome involving left testis.

PPT16-002

Diagnostic Evaluation of Wunderlich Syndrome in Chronic Kidney Disease by Point-of-Care Ultrasonography

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Objectives: Wunderlich syndrome is a rare condition, which means spontaneous non-traumatic renal hemorrhage confined to the subcapsular or perirenal space. It usually presents as acute flank or abdominal pain. Computed tomography (CT) is currently the best method for diagnosis and further survey of possible etiology. We report a bed-ridden patient with right urothelial carcinoma who had unexpectedly rapid deterioration of renal function after admission. Bedside point-of-care ultrasonography provides excellent diagnostic performance.

Methods: Case report and literature review.

Results: A 84-year-old female who had right urothelial carcinoma complicated with right hydronephrosis status post right double J catheter implantation was admitted due to urinary tract infection. During hospitalization, acute deterioration of renal function in the presence of chronic kidney disease developed. Point-of-care ultrasonography showed a hypoechoic lesion surrounding the cortical surface of right kidney. Further abdominal CT disclosed right perirenal hematoma, consistent with Wunderlich syndrome.

Conclusions: Ultrasound is a non-invasive, convenient and reliable tool for expeditious evaluation of perirenal hematoma/hemorrhage. In terms of CT scan-related contrast-induced nephropathy, this approach provides comparative effectiveness and safety in early diagnosis of Wunderlich syndrome.

PPT16-003

Follow-Up Result of the Atypical Small Acinar Proliferation (ASAP) on Trus-Guided Prostate Biopsy

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Objectives: To report the follow-up result of atypical small acinar proliferation (ASAP) on trans-rectal ultrasonography (TRUS)-guided prostate biopsy.

Methods: We reviewed patients that underwent TRUS-guided prostate biopsy and were diagnosed as ASAP between 2005 and 2015 at a single institution. The patients with ASAP on initial or repeated biopsy were all included. Clinicopathologic features including prostate-specific antigen (PSA), PSA density, presence of cancer, number of involved cores, and Gleason score on pathologic specimen were analyzed.

Results: A total of 64 patients had ASAP on initial or repeated biopsy specimen. 22 (34%) were diagnosed with cancer on the following prostate biopsy, 3 (5%) with high-grade prostatic intraepithelial neoplasia, and 39 (61%) with benign pathology. The mean PSA and PSA density were not statistically higher among patients subsequently diagnosed with prostate cancer (PSA: 6.2 vs 5.5, p=0.65; PSA density 0.17 vs 0.14, P=0.24). Of those diagnosed with subsequent prostate cancer, 17/22 (77%) had Gleason score of 7 or 8.

Conclusions: 34% of patients with ASAP were subsequently diagnosed with prostate cancer on the following biopsy, and 77% of prostate cancer had high-grade disease (Gleason score, 7-8). These findings suggest that following biopsy must be performed of patient with ASAP.

PPT16-004

Lower Pelvicalyceal Transitional Cell Carcinoma of Right Kidney Mimicking a Peripelvic Cyst on Renal Ultrasound

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Objectives: Transitional cell carcinoma of the kidney is an ominous condition, compared with benign renal cysts. The diagnosis is usually made by pathological examination of the specimen. The pelvicalyceal hypoechoic lesion on ultrasound combined with hematuria, flank pain and urine atypical transitional cells should raise the suspicion of possible malignancy. The differentiation between hemorrhagic or infected benign cysts and malignant hypoechoic lesions of the kidney on the renal ultrasound is a diagnostic challenge. We presented a male patient diagnosed with urine cytology, renal ultrasound, enhanced multidetector computerized tomography, ureterocystoscopic biopsy, and then surgical intervention.
Methods: Case report and literature review.
Results: This 73-year-old gentleman presented to Taipei City Hospital, Zhongxiao Branch with right flank soreness and hematuria on August 12, 2016. Urine cytology revealed the presence of atypical transitional cells. The renal ultrasound revealed a hypoechoic lesion at B mode examination and hypovascular lesion at color Doppler examination (Fig 1a and Fig 1b). Enhanced multidetector computerized tomography showed bilateral renal cysts, chronic cystitis, enlargement of prostate gland and 2 filling defects in the lower pelvicalyceal areas (Fig 2a and 2b). The pathological findings of preoperative ureterocystoscopic biopsy showed low differentiated papillary transitional cell carcinoma of the lower pelvicalyceal system of right kidney (Fig 3), which arranged in papillary structure with mild to moderate nuclear atypia and showed no stromal invasion in this specimen.
Conclusions: We highlighted that pelvicalyceal hypoechoic lesions combined with hematuria, flan pain and urine atypical transitional cells should be evaluated further for possible malignancy.

PPT16-005

Retrospective Comparison of Renal Ultrasonographic and Clinical Findings in Patients with Rhabdomyolysis

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Objectives: To retrospectively compare the ultrasonographic and clinical findings between two groups with abnormal and normal ultrasonographic findings of kidneys who clinically diagnosed as rhabdomyolysis.
Methods: A total of 78 patients were divided into two groups: A group with abnormal renal ultrasonographic findings and B group with normal renal ultrasonographic findings. Blood urea nitrogen, creatinine, potassium, prothrombin time, activated partial thromboplastin time (aPTT), creatine kinase, myoglobin in serum and urine, dark urine and microscopic hematuria were assessed, which were checked within 3 days before or after renal ultrasonography. All data were statistically analyzed using student's t-test or Mann-Whitney U test.
Results: The most common cause of the rhabdomyolysis in this study was intense exercise, followed by general weakness, muscle ache, intense shivering from generalized tonic seizure, drug intoxication, burn, and operation or trauma, etc. On renal ultrasonography of group A (n=26; M:F=19:7; mean age, 48.7 years), both kidneys show enlarged size, increased cortical thickness and diffusely decreased cortical echogenicity, suggestive of acute and diffuse renal disease. Group A showed elevated blood urea nitrogen, creatinine, potassium, and prolonged aPTT compared with those in Group B (n=52; M:F=36:16; mean age, 41.6 years), which were statistically significant (p value < 0.01). Other parameters including prothrombin time, creatine kinase, myoglobin in serum and urine, dark urine and microscopic hematuria showed no statistical difference between two groups.
Conclusions: The patients with elevated blood urea nitrogen, creatinine, potassium, and prolonged aPTT showed the renal ultrasonographic findings of acute and diffuse renal disease, but other parameters showed no statistical difference between two groups with rhabdomyolysis.

PPT16-006

Role of Ultrasound in the Diagnosis of Mesh Migration into the Urinary Bladder after Inguinal Hernia Repair: A Rare Case Report

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Objectives: Mesh migration to adjacent organs after inguinal hernia repair is an unusual complication. Here we present a case of male patient with mesh migration into bladder presenting with acute urinary retention one month following right inguinal hernia repair, and the definite diagnosis was made with abdominal ultrasound and cystoscopy.
Methods: Case report and literature review.
Results: A 56-year-old man who underwent right inguinal hernia repair with a mesh one month ago with rare complication of mesh migration into the urinary bladder.Transrectal ultrasound of prostate revealed mild enlarged prostate with weights estimated to be around 24.1 milliliter. Abdominal ultrasound showed a tubular structure of foreign body in urinary bladder. Cystoscopy demonstrated a bulge in the right anterolateral wall with an opening adjacent to it, through which a part of the mesh could be visualized. Partial cystectomy with excision of wall containing the mesh was performed.
Conclusions: This case illustrates that abdominal ultrasound can be used to aid in the diagnosis of mesh migration into the urinary bladder after inguinal hernia repair.Once mesh migration to the urinary bladder has been confirmed, surgical plans should be arranged.

PPT16-007

Sonography in Different Practice Guidelines for Diagnosis of Erectile Dysfunction

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Objectives: To assess the role of sonography in different clinical practice guidelines (CPGs) for diagnosing erectile dysfunction.
Methods: The printed and online materials in CPGs for diagnosis of ED by Taiwan Urological Association (TUA), European Association of Urology (EAU), American Urological Association (AUA), and Japanese Society for Sexual Medicine (JSSM) were reviewed. The focus was on diagnosis aspect.
Results: The latest versions of CPGs for erectile dysfunction of TUA, EAU, AUA, and JSSM were available in 2016, 2017, 2011and 2012, respectively. In TUA, sonography was not suggested or discussed for patients diagnosing ED. In EAU, the color Doppler ultrasound was a recommendation of specific diagnostic imaging study but without detail procedure. In AUA, sonography or other invasive procedure was not suggested but with statement of paradigm shift in the evaluation for ED away from the objective (evidence-based) toward the subjective (historical). In JSSM, color Doppler ultrasound was recommended with detailed normal value of maximal peak systolic velocity (>30 cm/sec) and resistance index (0.8) after prostaglandin E1 injection for vasculogenic ED.

Conclusions: In this limited review, differences exist in different CPGs. Sonography is a noninvasive tool but with limited usefulness based on rating from different CPGs. The study may do some help in revising the official guideline for evaluation of ED in Taiwan.

PPT16-008

Ultrasonic Prostatic Evaluation between Transrectal and Ttransabdominal Routes

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Objectives: To assess and understand the clinical experience of transrectal and transabdominal prostatic ultrasonic evaluation in a metropolitan hospital.
Methods: This is a retrospective chart review study. The patients who visited urological clinic and received transrectal ultrasound or transabdominal prostatic evaluations were enrolled. Different procedural clinicians were anticipated.
Results: A total of 74 patients were enrolled. Those patients were for prostatic biopsy. Mean age of the patients was 70.4 years (ranged 40-89). Range of PSA was from 0.32 ng/ml to higher than 500 ng/ml. The number for concurrent transrectal and transabdominal ultrasonic evaluation was 56. The data of the 56 patients was analyzed retrospectively. In the transrectal route group, range of the prostate volume was from 14.5 to 96 ml and mean volume was 41.0+/-21.8 ml. In the transabdominal route group, the range of prostate volume was from 16.1 to 136 ml and mean volume was 50.6+/-26.8 ml. Statistic analysis showed regression R square 0.54.
Conclusions: In this short term retrospective study, selection bias and variations among performers may contribute to the fair correlation of evaluating prostate with different modality. Further research is needed to clarify the relationship.

PPT16-009

Ultrasonographic Appearance of Tumors of the Testis: Radiologic-Pathologic Correlation

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Objectives: Ultrasound of the scrotum is the primary and comfortable image modality and highly accurate in differentiation between extratesticular and intratesticular, and differentiation between solid and cystic lesions. We analyzed correlation of sonographic and pathologic finding of the various testicular tumors.
Methods: The purpose of this exhibit is to correlate the US imaging features of tumors of the testis with their pathologic findings. Illustrative cases will include seminoma, mature teratoma, immature teratoma, yolk sac tumor, mixed germ cell tumor, leukemia, lymphoma, and Leydig's cell tumor.
Results: Testicular tumors are divided into two categories; germ cell and non-germ cell tumor. Those of germ cell origin make up 90% to 95% of primary testicular tumors and are generally highly malignant. By contrast, non-germ cell tumors are generally benign.
Conclusions: The typical US imaging features along with the corresponding microscopic and gross pathology can be seen here. Seminoma, leukemia, and lymphoma revealed homogeneous hypoechoic mass. Leydig's cell tumor, teratoma, and mixed germ cell tumors contained cystic lesion. Teratoma, yolk sac tumor, and mixed germ cell tumor contained calcifications. Differential diagnoses will be presented as well as the role of US imaging in characterization of these tumors.

PPT16-010

Ultrasound Volume of the Testes in Infertile Men with Azoospermia

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Objectives: The purpose of our study was to assess the usefulness of ultrasound (US)-determined testicular volume in the evaluation of the infertile men with azoospermia.
Methods: Our institutional review board approved this retrospective study and the need for informed consent was waived. A computerized search, dated from October 2003 to June 2010, generated a list of 45 infertile men with azoospermia (mean age, 34 years; age range, 26-44 years) who underwent both scrotal US and testis biopsy. US-determined testicular volumes were compared between infertile men with obstructive azoospermia and those with non-obstructive azoospermia.
Results: Testicular volume for obstructive azoospermia (ranged from 6.4 ml to 26.9 ml, with a median volume of 14.0 ml) was significantly larger than those for non-obstructive azoospermia (ranged from 1.0 ml to 12.8 ml, with a median volume of 6.1 ml) ($P < .001$). Area under the ROC curve for distinguishing non-obstructive azoospermia from obstructive azoospermia using testicular volume was 0.91. A cutoff value of less than or equal to 11.4 ml could distinguish non-obstructive azoospermia from obstructive azoospermia, with a sensitivity of 94.1 % (95% CI; 71.3%-99.9%) and a specificity of 73.3 % (95% CI; 54.1%-87.7%).
Conclusions: US-determined testicular volume can be helpful in the differentiation of obstructive azoospermia from non-obstructive azoospermia.

T17. Neurosonology

Symposium

T17-14-IN01

Color-Coded Doppler Flow Imaging in Evaluation of Diseases of Internal Carotid Artery

Chien Jung Lu, MD
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Color-coded Doppler flow imaging (CDFI) is a convenient technology to evaluate the condition of carotid arteries. During this lecture, I will present the procedure in examining normal carotid arteries, and then I will show the CDFI findings of some common problems of carotid artery, including stenosis of carotid artery, dissection of internal carotid artery and CDFI finding after carotid stenting.

Carotid artery is a target of large-vessel atherosclerosis. CDFI is a technology well suited to evaluate the stenosis caused by atherosclerosis. The severity of carotid stenosis can be shown by Doppler waveform and by B-mode ultrasound image. Direct signs of carotid stenosis consist of area stenosis caused by plaque and increase flow velocity cause by a stenotic lumen. The velocity criteria in grading the stenosis of carotid artery will be reported.

Dissection of internal carotid artery is a less common problem of this artery. It often leads to tapering stenosis or occlusion. The

CDFI can show increased external diameter cause by intramural hematoma and eccentric flow through a small lumen. These are characteristic CDFI findings in the diagnosis of dissection of internal carotid artery. Doppler spectrum often shows slow velocity and high resistant flow pattern.

In patient with symptomatic carotid stenosis, carotid angioplasty with stenting has been an option of treatment for carotid stenosis. Its safety and efficacy of stroke prevention have been approved. Stent does not make artifact in the color-flow image, and therefore CDFI is the most convenient method to evaluate the post-procedure condition of carotid artery. With CDFI examination, stent can be seen, and intra-stent hemodynamic parameter can also be measured.

T17-14-IN02

Vertebral Artery Ultrasound

Wei-Jen Fu
MacKay Memorial Hospital

Stroke is the fourth leading cause of death in Taiwan accounting for approximately 12,000 deaths each year of which a significant percentage may be attributed to ischemic strokes of the posterior circulation.

Duplex ultrasonography of the vertebral artery is commonly performed to evaluate patients with cerebrovascular disease. It is an integral part of extracranial cerebrovascular noninvasive screening and provides diagnostic clues for subclavian or vertebral artery stenosis. Although duplex ultrasonography can detect stenosis greater than 50% with a moderately high sensitivity (80% range) and an excellent negative predictive value (> 95%), methods for quantifying the degree of stenosis such as peak systolic velocity and end-diastolic velocity thresholds are not accepted universally.

T17-14-IN03

Clinical Applications of Transcranial Duplex Sonography

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Transcranial duplex sonography (TCCD) is a non invasive imaging method for workup of intracranial vasculature, cerebral hemodynamic and brain parenchyma. TCCD can be used in different phase of stroke from screening in children with sickle cell disease for primary stroke prevention, acute stroke treatment until planning for secondary stroke prevention. For ischemic stroke, TCCD is usually utilized to assess degree of intracranial stenosis, collateral circulation, and recanalization of occluded artery after thrombolysis. Other clinical applications of TCCD are evaluation of vasospasm in subarachnoid hemorrhage, cerebral venous thrombosis, intracranial aneurysm, arteriovenous malformation, brain tumor, intracerebral hematoma, degenerative disease such as Parkinson disease, and brain death. The use of ultrasound contrast enhanced TCCD can examine cerebral perfusion to evaluate final infarct core and clinical prognosis, and also enhances the ultrasound signals in the patients with inadequate or no temporal bone windows.

TCCD can apply in many patients without definite contraindication and easily for follow up as much as possible. However, TCCD is operator dependent and needs some skill in term of technical training and interpretation of results follow the standard diagnostic criteria to improve the accuracy of diagnosis.

T17-14-IN04

Clinical Application 2-Monitoring

Vijay K. Sharma
Yong Loo Lin School of Medicine, National University of Singapore and National University Health System, Singapore

Diagnostic ultrasonography provides clinically relevant information about cerebral hemodynamic changes in patients with cerebrovascular ischemia. The obtained information is often helpful to the treating physician for establishing or confirming the diagnosis, prognosis as well as in taking appropriate therapeutic decisions. It is associated with a high temporal resolution and can be performed bedside. Information about various alterations of cerebrovascular hemodynamics is essential for optimal management of patients with acute ischemic stroke. Transcranial Doppler (TCD) is noninvasive diagnostic modality that provides real-time physiological information regarding various intracranial hemodynamic alterations in patients with acute ischemic stroke. Extended applications of TCD help in understanding pathophysiological mechanisms of cerebral ischemia.

This talk would discuss the role of TCD in the assessment of vasomotor reactivity, diagnosis of right-to-left shunt as well sonothrombolysis. Furthermore, some other indications like brain-death, vasospasm in subarachnoid hemorrhage and non-invasive assessment of intracranial pressure would also be presented.

T17-15-IN01

Carotid Duplex Ultrasound Studies in Head and Neck Cancer Patients after Radiation Therapy

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Nasopharyngeal cancer is a characteristic disease of Taiwan. Patients usually received radiation therapy following operation. It is well known that radiation therapy is a strong risk factor of carotid stenosis. The dose of radiation, location of radiation, and time interval since the end of radiation therapy may affect the probability of carotid stenosis. Stroke risks may increase after radiation and carotid stenting could be a feasible preventive therapy in severe carotid stenosis. Therefore, surveillance with carotid duplex ultrasound study should be a noninvasive and effective method in this patient group. Here we review the previous studies regarding the use of carotid duplex ultrasound study in patients of head and neck cancer after radiation therapy. We also share our experience in the past years and wish to give predictors of carotid stenosis development.

T17-15-IN02

Clinical Studies of Cerebral Autoregulation in Neurological Diseases

Zhen-Ni Guo
The First Hospital of Jilin University

Cerebral autoregulation (CA) refers to the capability of the brain to maintain relatively constant blood flow within a certain range of arterial blood pressure or cerebral perfusion pressure. In recent years, the application of transcranial Doppler ultrasonography

made it possible to detect rapid characteristics of cerebral autoregulation in response to the dynamic changes in blood pressure, which is known as dynamic cerebral autoregulation. Cerebral autoregulation assessment is an interesting tool in understanding cerebrovascular hemodynamics and now has been widely applied in neurological disorders. For cerebrovascular disease, CA is of clinical significance for it may helpful in predicting prognosis and stroke recurrence, improving blood pressure management and delineating optimal therapeutic strategy. For some other diseases that associated with stroke, such as patent foramen ovale (PFO), obstructive sleep apnea-hypopnea syndrome (OSAHS) and insomnia, which have been confirmed sharing an impaired CA, this may suggest an underlying pathogenic mechanism behind stroke. In this lecture, I will briefly introduce our clinical studies of cerebral autoregulation in various neurological diseases.

T17-15-IN03

A Recently Established Network for Clinical Stroke Trials in Japan

Masatoshi Koga, MD
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Of 15 million people annually suffering from stroke, about 9 million are Asian (a massage from the Asian Pacific Stroke Organization). In Japan, stroke is the leading cause of disability requiring intensive nursing care and the 4th leading cause of death. Although the ranking of stroke article fractions and citation fractions of Japan was reported to be third between 2001 and 2011, Japan played small role in the multinational collaboration in stroke research (Asplund K, et al: Stroke 2012;43:830-837.) In this decade, we conducted several multicenter clinical stroke researches (J-STARS Echo Study, SUMURAI studies, THAWS trial). Also, we are participating international stroke trials and studies (ATACH II, TRIDENT, CADISP-plus, BEL-FMD). From our experiences, we strongly felt shortages of study coordinators and research nurses for staff education, administration of test drugs, data management in researcher driven stroke researches in Japan. To overcome these problems, we recently established Network for Clinical Stroke Trials (NeCST) in Japan (Stroke 2016;47:304-305). We are seeking opportunities for multinational collaborations with the Global Alliance of Independent Stroke Networks (GAINS) involving the NIH StrokeNet and the Canadian Stroke Consortium. Asian multinational researcher networks are also expected because we have specific disease characteristics such as high incidence of intracranial atherosclerosis and intracerebral hemorrhage. I will present our research experiences and NeCST.

T17-15-IN04

Supine-to-Standing Transcranial Doppler

Weihai Xu, MD
Department of Peking Union Medical College Hospital, Chinese Academy of Medical Sciences

Supine-to-standing test(SST), a transcranial Doppler (TCD) based technique, has been recently developed to evaluate cardiovascular dysautonomia. In patients with multiple system atrophy(MSA), a natural human model of baroreflex failure, STS detects blunted cerebral blood flow velocity rebound after standing and/or sustained higher pulsatility index upon standing than supine baseline. This finding can be used to predict the adverse outcomes of neurogenic syncope. It is known cerebral blood flow changes in response to orthostatic challenges in the initial (first 30 s) and early phases (1e2 min upright) after standing are mainly governed by the neural system. This technique of STS can be easily applied in daily out-clinics practice for the evaluation of early neurogenic orthostatic hypotension after active standing.

T17-15-IN05

Sonothrombolysis

Jose C. Navarro
University of Santo Tomas Hospital

It has been shown that the significant reduction in disability after acute ischemic stroke (AIS) depends on early recanalization. Recombinant tissue plasminogen activator given within 3 hours improves disability by 30% in 3 months. However, still there are a great number of stroke patients who remained signifcantly disabled with this acute intervention. Currently, numerous strategies are being tested to increase further the recanalization rate in AIS. Sonothrombolysis or adding microsphere, intra-arterial rTPA and mechanical thrombectomy have been tried to increase the recanalization rate hence significant improvement has been reported. The simultaneous ultrasound delivery while administering rTPA known as *Sonothrombolysis* will be discussed in this lecture. A recently concluded randomized, placebo controlled sonothrombolysis study, the CLOTBUST trial has shown significant recanalization rate as its primary outcome measure. However, long-term disability did not show significant difference against placebo. Another non-significant RCT was carried out utilizing "hands-free" TCD device to deliver ultrasound during thrombolysis. Following these results from several trials; a meta-analysis has shown some signals favoring sonothrombolysis in acute ischemic stroke.

T17-15-IN06

Ultrasound Technique to Detect Internal Jugular Valve Incompetence and Clinical Implications

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The internal jugular (IJ) valves are absent in 6% to 13%, more commonly in the left-sided than the right-sided veins, and typically bicuspid valves (66%), but can be unicuspid (15%), tricuspid (6%), or absent (13%). They are located at an approximately 0.3-0.5 cm above the junction with the brachiocephalic vein, but the position in the neck or chest can vary from being almost directly posterior, to 3 cm inferior and lateral, to the head of the clavicle. The closure of the IJ valve occurs during diastole when the atrium transmits backward pressure from the right atrium into the superior vena cava, then into the IJ vein.

The competency of the IJ valves has been previously tested by IJ venography during Valsalva maneuver or cough, a Doppler sample of the IJ vein flow combined with M-mode ultrasonography of the IJ valve during Valsalva, the color flow imaging (CFI) of the IJ vein. However, IJ venography is invasive, while it is difficult to interpret duplex and CFI data of the IJ vein due to slow and swirling flow in IJ vein. We have introduced the use of air contrast ultrasonography with B-mode imaging during Valsalva, so called the air contrast ultrasound venography (ACUV). The ACUV provides rapid, reliable, practical, and noninvasive, method for detection of absent or incompetent IJ valves. In addition the ACUV is more sensitive to assess IJ valve incompetence due to well visualized of the air contrast bubbles from the IJ venous reflux.

The IJ veins are the principle route of venous drainage of the brain through cerebral vein emptying into the dural venous sinuses, then

into the IJ veins. The IJ valve is the only valve between the heart and the brain, preventing venous reflux into the IJ vein. Uni-or bilateral IJ valve incompetence prevalence ranges from 29% in the young adult population to 33-45% in healthy elderly subjects. However, the IJ valve incompetence with IJ vein reflux has been found more frequently in several neurological diseases such as transient global amnesia, transient monocular blindness, cough headache, primary exertional headache and in some medical conditions such as elevated central venous pressure, congestive heart disease, tricuspid valve regurgitation, primary pulmonary hypertension, chronic obstructive pulmonary disease, prolong positive end-expiratory pressure ventilators and status post IJ vein cannulation, probably resulting from cerebral venous outflow impairment. Thus, the incompetent IJ valves leading to cerebral venous hypertension might play a major role in the mechanism of these neurological disorders.

T17-15-IN07

Right-To-Left Shunt and Migraine

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Right-to-left shunt (RLS) is an abnormal pathway between the venous and arterial circulations, and includes both intracardiac and extracardiac RLSs. Intracardiac RLSs are usually related to patent foramen ovale (PFO). Contrast-enhanced transcranial Doppler ultrasonography (c-TCD) is a clinically applicable and reproducible method of detecting RLSs. Migraine is a common disabling neurovascular disorder. It has a high prevalence, 7.9%-14% in the western population and 9.3% in the Chinese population. The pathogenesis of migraine is not well understood. Available data suggest that PFO is more common in patients with migraine, whereas other studies have reported that the prevalence of RLS is similar in patients with and without migraine. The aim of the present study was to assess the prevalence and extent of RLS using c-TCD in Chinese patients with migraine and compare them to the prevalence and extent of RLS in healthy controls. We then used these data to evaluate the relationship between RLS and migraine. The main finding was that the prevalence of RLS was significantly higher in Chinese migraineurs than it was in healthy controls. Hence, there appears to be a close relationship between RLS and migraine without aura as well as between RLS and migraine with aura. In addition, the proportion of large shunts was significantly larger in migraineurs with and without aura than it was in healthy controls. It suggested that RLS, especially large RLS, is associated with migraine with aura as well as migraine without aura. RLS may be involved in the pathogenesis of migraine. Detection of right-to-left shunt should be considered in patients with migraine.

T17-15-IN08

Progression or Regression of Intracranial or Extracranial Arterial Stenosis: Role of Ultrasound

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Atherosclerosis of intracranial or extracranial artery is a major cause of ischemic stroke, which may be a dynamic lesion with progression or regression. Ultrasound examinations are useful and important tools for the diagnosis of progression or regression of intracranial or extracranial arterial stenosis.

Progression of intracranial stenosis may increase the risk of stroke, therefore adequate diagnosis is important. Transcranial Doppler sonography (TCD) may be useful for this purpose, however, optimal diagnostic criteria have not been defined well. According to our subgroup analysis from the prospective clinical trial, which had evaluated the efficacy of cilostazol combined with aspirin in symptomatic intracranial stenosis, sensitivity of TCD criteria ranged 23-42% for progression and 13-67% for regression, while specificity ranged 83-92% for progression and 91-97% for regression. Among the criteria validated, Δ20cm/s increment or decrement criteria had the highest sensitivity (42% for progression and 67% for regression) and specificity (90% for progression and 96% for regression). With these criteria, we compared long-term TCD changes with MRA in patients with intracranial stenosis. Among 164 patients included (84 males, mean age 64 years, mean follow-up period 35 months), progression was observed in 5.7% among MCA and 5.0% among BA. With diagnosis of progression, more aggressive medical management (BP control, blood glucose and lipid lowering, antiplatelet agents, etc.) is indicated and higher-dose statin may be recommended.

Carotid duplex ultrasound (CDU) has an important role for the screening of asymptomatic carotid stenosis (ACS), detection of vulnerable plaques, or monitoring of progression or regression of arterial stenosis. With qualified examination and optimal diagnostic criteria, the sensitivity and specificity has been reported up to 90% and 94% for the detection of stenosis of 70% or greater. In addition to the degree of stenosis, CDU also reveal the morphology and distribution of the plaques. Natural course of ACS also has been studied with CDU and several factors related to the progression/regression of ACS have been reported. Recent advance of medical treatment diminished the risk of stroke ($<$ 1%/year) compared with carotid revascularization in ACS. Therefore, current issue is to identify "high-risk" patients who will get more benefit from the carotid revascularization. With optimal criteria, CDU may diagnose progression of arterial stenosis, which is an important predictor for future stroke. TCD is also useful for the detection of microembolic signals (MES), which is potently associated with the risk of stroke in ACS.

In summary, adequate ultrasound examination is useful for the diagnosis of intracranial or extracranial arterial stenosis, progression/regression of stenosis, and possibly for the identification of the "high risk" patients, therefore is useful for the adequate clinical decision making.

T17-15-IN09

Cerebral Hemodynamics in Carotid or Intracranial Disease

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A hemodynamically significant stenosis in the carotid artery constitutes an important cause of ischemic stroke. Carotid stenosis, especially when symptomatic, carries a high risk of stroke recurrence despite the best medical therapy. The presentation would include the role of cerebrovascular ultrasonography in the diagnosis of carotid stenosis. Various advanced applications of neurosonology enable the grading of severity, risk-stratification as well as monitoring the natural course of carotid stenosis.

Intracranial stenosis is an important cause of cerebrovascular ischemia, especially among stroke patients of Asian ancestory. Up to 50% of Asian patients with acute ischemic stroke may harbour intracranial atherosclerotic disease. This talk would discuss the role of transcranial Doppler (TCD) in the diagnosis and assessment of the severity of intracranial stenosis. Furthermore, advanced applications of TCD may help in optimizing the best medical therapy as well as identifying patients eligible for various interventional procedures.

T17-15-IN10

Dynamic Cerebral Autoregulation Assessment Using Extracranial Carotid Artery Doppler Ultrasonography and Real Time Analysis System

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Transcranial Doppler ultrasonography of the middle cerebral artery (MCA) is frequently used to assess dynamic cerebral autoregulation (dCA); however, this is difficult in patients with poor temporal bone windows. In the study described here, we investigated the agreement and sensitivity of dCA indices determined from the extracranial internal carotid artery (ICA) and those determined from the MCA. Measurements for 32 stroke patients and 59 controls were analyzed. Measurement of the mean flow correlation index (Mx) and transfer function analysis based on spontaneous blood pressure fluctuation were simultaneously performed for the extracranial ICA and MCA. The mean values of Mx and phase shift did not significantly differ between the ICA and MCA. The intra-class correlation coefficient between the dCA indices of the ICA and MCA was favorable in Mx (0.76) and the phase shift of VLF (0.72). The area under the receiver operating characteristic curve for stroke diagnosis did not differ among the dCA indices. Therefore the dCA assessed from the ICA is as effective as that from the MCA. By using a real time analysis software and ICA assessment, dCA could be easily measured in clinical practices.

T17-15-IN11

Ultrasound Examination of Venous Outflow Impairment and It's Increase of the Intracranial Pressure

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Invasive measurement of ventricular or parenchymal pressure is the gold standard for accurate measurement of intracranial pressure (ICP). But accurate methods to non-invasively estimate ICP in clinical practice are needed.

Venous stasis and occlusion, as the result of the cerebral venous sinus stenosis or cerebral venous sinus thrombosis, may cause venous congestion/hypertension and increase of ICP. The increase of ICP further cause cerebral venous sinus not going backward and the aggravation of cerebral venous sinus stenosis or cerebral venous sinus thrombosis. Thus, the venous stasis and occlusion may explain the high ICP.

Internal jugular vein (IJV) and the vertebral venous (VV) as a significant venous route drain most of the brain venous outflow. Imaging duplex ultrasound is a non-invasive and real-time test that has been clinically used to evaluate the venous outflow impairment by the morphology, flow profiles and hemodynamic change of IJV and VV during phases of respiration.

Therefore, we hypothesized that detecting the venous outflow impairment using the imaging duplex ultrasound might be useful for predicting the increase of ICP.

In this presentation, we reviewed the patients of high intracranial pressure who had duplex ultrasound of the IJV and VV, and analyzed the correlations of venous outflow impairment and the increase of the ICP.

Free Paper

OPT17-001

Right-to-Left Shunt Detected Using Contrast-Enhanced Transcranial Doppler: A Comparison of Provocation Manoeuvres between Cough and a Modified Valsalva Manoeuvre

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Objectives: To compare the two ways of provocation maneuver (cough and modified Valsalva maneuver) in detecting right to left shunt (RLS) by contrast-enhanced transcranial Doppler (c-TCD).

Methods: For each participant, c-TCD was performed for three different ways: (i) at rest state (RS), (ii) at cough and (iii) at modified Valsalva maneuver (m-VM) which blew into a tube connected with a sphygmomanometer at 40 mmHg for 10 s. The severity of RLS were assessed with a five level grade according to the number of microbubbles (MBs): Grade 0=Negative; GradeI=1-10 MBs; GradeII=11-25 MBs; GradeIII>25 MBs, and no curtain; GradeIV=curtain.

Results: The positive rate of were 56.2%, 82.1% and 89.5% for RS, cough and m-VM, respectively ($p<0.001$). The positive rate of RLS detected at VM was higher than at cough by c-TCD ($P=0.017$) and there was a significant difference between cough and VM in terms of the severity of RLS ($p<0.005$).

Conclusions: m-VM is a relatively effective provocation maneuver rather than cough maneuver in RLS detection by c-TCD. The m-VM should be used as an effective provocation maneuver in clinical practice.

OPT17-002

Changes In E-Selectin Levels Predict Carotid Artery Progression After Carotid Artery Stenting

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Objectives: We wish to investigate the inflammatory marker (IM) predictors of carotid artery progression (CAP) after carotid artery stenting (CAS).

Methods: Between 2010 and 2012, 122 patients undergoing cervicocranial revascularization in our hospital were recruited. Patients undergoing revascularizations other than CAS were excluded. Carotid duplex ultrasonography was performed in all patients before and at 1 week, 6 months (6M), 1 year, and 2 years after CAS. Patients were categorized into the progression group (PG) and non-progression group (NPG) based on the presence or absence of CAP, including in-stent restenosis (ISR) and contralateral CAP. IMs levels were recorded in all patients before CAS and were followed up immediately and 6M after CAS. Receiver operating

characteristic and multivariate logistic regression analyses were conducted.

Results: Totally 77 patients were enrolled. The frequency of CAP was 24.7% (ISR: 14.3%; contralateral CAP: 14.3%). Compared with the NPG, the PG had lower E-selectin levels before CAS [PG vs. NPG, 47.90 (42.80, 64.90) vs. 68.25 (52.08, 92.30); p = 0.01] and a nonreduced E-selectin levels at 6M after CAS [PG vs. NPG, 7.65 (−2.45, 25.75) vs. −16.10 (−33.45, 1.65); p = 0.002]. The E-selectin changes between 6M after and before CAS had highest predictive accuracy on CAP (area under the curve = 0.74, p = 0.002). The optimal cut-off level was -2.95 ng/mL and the adjusted odds ratio for CAP was 10.16 (p = 0.001) in multivariate logistic regression analyses.

Conclusions: The E-selectin changes between 6M after and before CAS are independent predictors of CAP.

OPT17-003

Age-Dependent Ultrasonographic Changes after Indirect Revascularization Surgery in Patients with Moyamoya Disease

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Objectives: Pediatric patients with moyamoya disease (MMD) were supposed to have better neovascularization by indirect revascularization than adult patients with MMD, but the evidence was limited. The aim of this study was to assess age-dependent ultrasonographic changes after indirect revascularization in MMD patients.

Methods: We prospectively enrolled MMD patients receiving indirect revascularization and ultrasonographic exams before and after surgery at 1, 3, and 6 months. The sonographic parameters included peak-systolic velocity (PSV), end-diastolic velocity (EDV), flow resistance, and flow volume (FV) in the superficial temporal artery (STA) and external carotid artery (ECA). The values and percentage changes of the sonographic parameter before and after surgery were compared between pediatric and adult patients with MMD.

Results: There were 47 hemispheres in pediatric and 16 hemispheres in adult patients with MMD receiving indirect revascularization. Before surgery, adult patients had higher EDV, lower resistance, and more FV of the STA and ECA compared to pediatric patients (all $p < 0.05$). After surgery, the percentage changes in PSV of the STA at 3 and 6 months, FV of STA at 3 months, as well as PSV and FV of the ECA at 6 months in pediatric patients were all higher than those in adult patients (all $p < 0.05$).

Conclusions: Pediatric MMD patients had larger increase of PSV and FV in the STA and ECA after indirect revascularization than adult MMD patients.

OPT17-004

Utility of Sonography Intraoperative in Neuroendoscopy

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Objectives: To demonstrate the usefulness of transoperative sonography aid to neuroendoscopy in different intracranial pathologies, as a minimal invasive tool for increase the anatomical information and its distortions, when the endoscopy direct visualization it is not enough.The combination of both techniques is relevant because they are carried out in real time and as an only true real-time imaging method intraoperatively.

Methods: From 2006 to 2016, the intraoperative imaging of neuroendoscopy and ultrasound was studied in 54 selected patients, adult and pediatric, in which the endoscopiy alone, was not enough. The sono equipment was 2D Aloka and a rigid-neuroendoscope.

Results: We use both techniques, endoscopy and ultrasound intraoperative in 54 cases to aim the follow pathologies: Lateral ventricle hydrocephalus (5), multiloculated hydrocephalus (11), Intrinsic Third Ventricular Craniopharyngioma (7), colloid cyst (2), porencephalic cyst (1), neurocysticercosis (7), intraventricular tumors (8), astrocytoma cystic (4), others (9). The sonographic view allows changes of structures, to be observed. When used in combination with the endoscopic view, it allows safer neuronavigation of the endoscope in real-time.

Conclusions: For neurosurgeons the main goal of intra-operative imaging remains localization and navigation to lesions and control of complete extirpation without harm the brain tissue.The advantage of the combination of both techniques results in safer imaging than is afforded by endoscopy alone.

OPT17-005

Use of Transurgical Ultrasound in the Management of Spinal Lesions

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Objectives: In this study, we expose our experience in the use of ultrasound as a support tool during the surgical management of spinal lesions.

Methods: Spinal lesions represent a difficult endeavor, due to the lack of real time anatomical information specially for intramedullar patology. Considering the possibility of medullar damage, many technologies have been developed that allow surgical navigation. Nevertheless, some of these represent high cost or are simply unavailable in some hospitals. In this study we describe the utility of transurgical spinal ultrasound in the management of this lesions, in which we present a series of 60 cases where ultrasound navigation allowed, in most cases, an accurate and safe margin of resection.

Results: We report 60 cases of spinal medullar lesions in which we used ultrasound nagivation, 18 cases where ependimoma, 6 astrocytoma, 8 spinal angioma, 5 arteriovenous malformations, 14 neurinoma and 2 lumbar hematomas.

Conclusions: The use of ultrasound, represents a tool of great value and utility, owing to the fact that its source of real time anatomical information, its accessible, reproductible and low cost, easy to use and with no radiation risk.

OPT17-006

Ultrasonograph in Complex Hydrocephalus

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Objectives: Present our experience in the treatment of complex hydrocephalus with the use of ultrasonografic guide.
Methods: We achieve diagnosis of complex hydrocephalus in thirty-one patients by TC and RM images techniques. It was included different etiological entities that conditioned this problem like tumors, arachnoid cyst, neuroinfection were the most common observed in our study. These patients were operated by different approaches: microsurgical and endoscopic approach, alone or in combination. In all of cases, we make a transoperative sonographic exploration, which allow real-time navigation to localize lesions, corroborate resection, identify vascular features of lesions, guide endoscopic exploration and guide ventricular devices. We performed postoperative ultrasonography to prove objectives preoperative. Which are corroborated by image techniques TC or RM.
Results: Thirty-one patients were operated using sonographic guide, twenty-one patients with hydrocephalus diagnosis (67% of total cases), eleven with multiloculate hydrocephalus (35%), ten with hydrocephalus in which there is ventricular system segment isolate (32%). Seven patients with arachnoid cyst (22.5%), three brain tumors (9.6%)
Conclusions: We presented our experience in the treatment of unusual hydrocephalus in which microsurgery and endoscopic combination assisted by transoperative ultrasonography allow the possibility to solve CSF accumulation in complex cases. Transoperative ultrasonography offers value information. It is reproducible, cheap and accessible to most of hospitals, becoming a value tool, mainly in developing countries.

OPT17-007

The Utility of Ultrasound and Angio-Sonography in Management of Intracranial Giant Aneurysm

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Objectives: Present our experience in the treatment of giant aneurysm with guided ultrasound images.
Methods: We reported three cases of intracranial giant aneurysm using transurgical ultrasound images as a proof of ischemic testing to determinate aneurismal occlusions and patency of the normal arterial tree.The surgery of giant aneurysms is a great challenge for the neurosurgeon considering the mass effect and the difficulty in the access of proximal and distal control of the vessel. The trans surgical ultrasonography has proven to be a practical tool that in these cases helped us to determinate intraaneurismal turbulence, complete occlusion and to asses and prevent hemodynamic changes and ischemic events during the procedure. The angiograph is the gold standard however the angio-sonography is simple, accessible, and reliable. We describe three complex cases and demonstrated the practical utility.
Results: In all cases, the use of ultrasound images allowed us to perform navigation in real time, assessing size, structures and flow in aneurysm during the trans and postoperative. In patients with vasospasm it allowed us to identify the early stages, and prevent ischemic events.
Conclusions: We presented our experience in the treatment of unusual giant aneurysms in which microsurgery assisted by transoperative ultrasonography allowed the possibility to identify structures and flow in aneurysm in complex cases. Transoperative ultrasonography offers valuable information. It is reproducible, cheap and accessible in most of hospitals, and is becoming an important tool around the world.

Poster Session

PPT17-001

Association of 10-Year Atherosclerotic Cardiovascular Disease Risk Score with Carotid Atherosclerosis in Middle-Aged Abdominal Obesity Patients with Type 2 Diabetes Mellitus

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Objectives: Type 2 diabetes mellitus (T2DM) and Abdominal obesity (AO) are associated with a high risk of cardiovascular disease (CVD). Carotid intima-media thickness (CIMT) and carotid plaques (CP) increasingly used as a surrogate marker for atherosclerosis. Its use relies on its ability to predict future CVD. The aim of this study was to determine the association between carotid atherosclerosis and 10-year atherosclerotic cardiovascular disease (ASCVD) risk score in middle-aged AO patients with T2DM.
Methods: This was a cross-sectional study with 69 middle-aged (<65 years) AO patients (defined as waist circumference (WC) ≧90 cm for Taiwan men and ≧80 cm for Taiwan women) with T2DM who had no apparent history of CVD were enrolled. We obtained information about medical history and lifestyle, clinical examinations, and biochemical evaluations. CIMT by B-mode ultrasonography was measured. Carotid atherosclerosis was considered present when the maximum CIMT was ≧0.9 mm or when the CP were detected. The 10-year ASCVD risk score was calculated using the 2013 American College of Cardiology/ American Heart Association guidelines (high 10-year risk: ASCVD risk score ≧7.5%).
Results: Of this study subjects, the mean age was 56.3±5.4 years and the mean duration of diabetes was 10.3±5.7 years. The mean ASCVD risk score was 12.8±9.8, and 43 (62.3%) subjects with high 10-year ASCVD risk. We found that carotid atherosclerosis had statistically significantly correlations with the age ($r=0.33$, $p<0.01$), systolic blood pressure (SBP) ($r=0.28$, $p=0.02$), pulse pressure (PP) ($r=0.28$, $p=0.02$), mean arterial pressure (MAP) ($r=0.28$, $p=0.02$), and ASCVD risk score ($r=0.31$, $p=0.01$). The carotid atherosclerosis group was significantly associated with the high 10-year ASCVD risk group (odds ratio (OR): 5.098, 95% confidence interval (95% CI): 1.7-15.288, $p<0.01$). Results of multiple logistic regression showed that only 10-year ASCVD risk score (OR: 1.073, 95% CI: 1.01-1.142, $p=0.02$) was significantly associated with carotid atherosclerosis after adjustment for duration of diabetes, diastolic blood pressure (DBP), and lipid lowering therapy.

Conclusions: The findings of this study suggest that 10-year ASCVD risk score is associated with carotid atherosclerosis in a group of middle-aged abdominal obese diabetes.

PPT17-002

Influence of Pulsed Wave Doppler Angle on Diagnosis of Internal Carotid Artery Stenosis

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Objectives: The jet flow direction at the stenotic lesion is not always parallel to the blood vessel direction.
Methods: A total of 50 vessels with stenosis at the origin of internal carotid artery (ICA) were evaluated with carotid ultrasonography and digital subtraction angiography (DSA). The peak systolic velocity (PSV) was measured by pulsed wave Doppler (PWD). The vessels were divided into 2 groups: group A, angle of PWD was aligned parallel to the blood flow at the stenotic lesion (n=23) and group B, angle was aligned parallel to the blood vessel (n=30). Three vessels were evaluated with both methods applied to group A and B. Simple regression analysis was used to examine the relationship between the PSV and ICA stenosis. The receiver operating characteristic (ROC) curve was used to calculate the optimal cutoff values of the PSV for ICA stenosis (≥ 70%).
Results: In groups A and B, there was a significant correlation between PSV and NASCET stenosis ratio. In diagnosing ICA stenosis (≥ 70%), the area under ROC curve, the sensitivity and specificity of PSV were 0.973, 100% and 85.7% with a cutoff level of 203.5 cm/s and 0.765, 70.0% and 80.0% with a cutoff level 256.9 cm/s, respectively.
Conclusions: Our study suggests the angle-adjustment towards the blood flow at the stenotic lesion site is superior to the angle-adjustment parallel to the blood vessel for PSV measurement.

PPT17-003

Pulse-Doppler Ultrasound of Internal Carotid Artery for Diagnosis of Patent Foramen Ovale

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Objectives: For diagnosing paradoxical cerebral embolism, assessment of right-to-left shunt (RLs) including patent foramen ovale (PFO) is essential. For detecting RLs, transesophageal echocardiography (TEE) and transcranial Doppler are used. But there are patients who can not undergo these examination. We compared carotid ultrasonography (CUS) and transesophageal echography in detecting rate of PFO.
Methods: Fifty-eight consecutive patients with ischemic stroke were evaluated for PFO with TEE and CUS. In TEE assessment, the diagnosis of PFO was made using Valsalva maneuver with contrast agent infection. We classified PFO size in small, middle, large by number of bubbles which appeared in left atrium on TEE. Internal carotid artery was evaluated in CUS assessment. PFO was defined as appearance of high-intensity transient signals (HITs) after release of Valsalva load with contrast agent injection.
Results: PFO was detected in 16 patients. HITs were observed in 25 patients by CUS. For PFO diagnosis CUS had the sensitivity 81.3%, specificity 71.4%, positive predictive value 29.4% and negative predictive value 90.9%. In addition, when exclude cases the PFO size is small and middle, CUS had sensitivity 81.3%, specificity 71.4%, positive predictive value 29.4% and negative predictive value 93.8%.
Conclusions: CUS with valsalva load plus contrast agent injection is beneficial for PFO diagnosis.

PPT17-004

Ultrasonographic Manifestations of Common Carotid Artery in Syphilis

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Objectives: Causes of common carotid artery stenosis and occlusion are atherosclerosis, Takayasu's arteritis, post-irradiation arteriopathy, embolism, syphilis, trauma and homocystinuria. Among them, the incidence of syphilis is rare . Yhis study aimed to present the ultrasonographic findings of common carotid artery in a patient diagnosed as syphilis.
Methods: An 84 year-old male patient presented with dementia and left peroneal nerve palsy. Syphilis was diagnosed by data VDRL= 1:2 and TPHA =1:1280.
Results: After antibiotic treatment, VDRL became negative and TPHA=1:640. Ultrasonographic findings reveal concentric, homogeneous intimal-media thickness along distal, middle and proximal part of common carotid artery.
Conclusions: Echogenicity of IMT material was homogeneous in syphilis patient and also involved concentrically in middle and proximal CCA, quiet differ from patient s with atherosclerosis.

PPT17-005

Usefulness of Acceleration Time for Assessment of Stenosis in the Internal Carotid Artery

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Objectives: To apply the acceleration time (AcT) ratio using carotid artery ultrasonography (CUS) as an additional marker for diagnosing internal carotid artery (ICA) stenosis.
Methods: Among 70 patients with stroke who were evaluated with digital subtraction angiography and CUS, 132 vessels were analyzed after excluding ICA occlusion. AcT (time from initiation of the upstroke to the first maximum peak of the waveform) was measured using the average of 3 heartbeats. The AcT ratio was calculated as AcT of ICA/AcT of the ipsilateral common carotid artery. Simple regression analysis was used to examine the relationship between the AcT ratio and ICA stenosis. The receiver operating characteristic (ROC) curve was used to calculate the optimal cutoff values of the AcT ratio for ICA stenosis.
Results: Using NASCET criteria, 35 vessels had 50% or greater stenosis and 28 vessels had 70% or greater stenosis. There was a significant correlation between AcT ratio and ICA stenosis ratio. In ROC curve analysis, AcT ratio had a sensitivity 94.3% and specificity 97.9% with a cutoff of 1.45 for diagnosis of stenosis ≥ 50%, and had a sensitivity 92% and specificity 96.3% with a cutoff of 1.90 for stenosis ≥ 70%, respectively.
Conclusions: AcT ratio is a beneficial parameter for evaluating ICA stenosis in patients with arterial wall calcification in the ICA.

T18. Pediatric Ultrasound

Symposium

T18-14-IN01

Pediatric Contrast-Enhanced Ultrasound – the EFSUMB Position

Paul Sidhu
King's College London

The use on contrast enhanced ultrasound (CEUS) is well established in adults and has gained an important place in the assessment of focal liver lesions. Many other uses have been described in adults, many of which are 'off-label'. In children, ultrasound represents a safe, child friendly imaging modality which gives important diagnostic information. Nevertheless the need to image further with CT or MR is necessary, subjecting the child to a radiation dose, contrast reactions and morbidity associated with sedation or general anesthesia. An ideal extension for an ultrasound examination would be to incorporate CEUS into the examination, preventing further more invasive and expensive imaging. However, until recently, the use of CEUS in children has been off-label: the FDA approved the use of CEUS for focal liver lesions in the USA in April 2016. Many practitioners have developed the application of CEUS in children over the years, demonstrating the usefulness in many clinical situations. EFSUMB has issued a statement bringing together the clinical experience to date, allowing the interested practitioner to understand the experience with CEUS in children and allow incorporation into daily practice. Written by experts in the field, a comprehensive and detailed overview is presented in the EFSUMB Pediatric CEUS statement.

T18-14-IN02

Clinical Application of Speckle Tracking Echocardiography in Pediatric Heart Diseases

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Conventional assessment of cardiac function in children with congenital and acquired heart disease has relied on two-dimensional and M-mode echocardiographic quantification of ventricular size and ejection fraction and Doppler assessment of haemodynamics. Nonetheless, the need for geometric assumptions, the largely qualitative assessment of regional wall motion abnormalities, and the sensitivity of these conventional parameters to loading conditions are well recognized. These conventional indices of cardiac function are, in essence, indirect indices of myocardial deformation. Deformation of myocardium can be quantified in terms of strain and strain rate. In the past decade, advances in speckle tracking echocardiography have enabled direct evaluation of regional and global myocardial deformation. By the use of two- and three-dimensional speckle tracking echocardiographic techniques, quantification of ventricular global and regional strain and strain rate, twist mechanics, and mechanical dyssynchrony has become feasible by the bedside. Clinical applications in pediatric congenital and acquired heart disease include the quantification of global and regional performance of the systemic left and right ventricles, subpulmonary right ventricle, and functional single ventricles, assessment of ventricular-ventricular interaction, tracking of the impact of cardiac interventions, and detection of subclinical cardiac dysfunction with therapeutic and prognostic implications. In conclusion, the application of speckle tracking echocardiography to assess myocardial deformation in pediatric cardiac patients has shed important new light on myocardial mechanics, which may allow better risk stratification, timely institution of interventions, and prognostication.

T18-14-IN03

The Role of 3-D Echocardiography in Guiding Transcatheter Treatment of Congenital or Structural Heart Disease

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With the advancement of new techniques, real-time three-dimensional echocardiography has been used to guide transcatheter therapy of congenital heart disease as well as structural heart disease. The real-time 3-D echocardiography provides visualization of 3-D anatomy and location of the defect and it's adjacent structures. When using this new technology in guiding transcatheter therapy, the interventionalist can visualize the morphology and size of the defects. This allows the interventionalist to select the appropriate type and size of the device to close the defect and guide the procedure. After device deployment, the 3-D ehcocardiography can be used to evaluate the position of the device, presence of residual shunts, and the status of adjacent structures. Therefore, the mean fluoroscopic time can be reduced. The real-time 3-D echocardiography is useful in providing guidance of transcatheter therapy for congenital heart disease and structural heart disease.

T18-14-IN04

Urgency Echocardiography to Not Cardiologists. Myth or Reality?

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Transthoracic Echocardiography (ETT) is a diagnostic tool that allows ultrasonographic visualization of the heart and large vessels, which has proved useful in evaluating not only cardiac activity but also preload, which is fundamental for the rational administration of fluids And blood products to trauma, emergency and critical care patients and often transcendental for therapeutic decision making in these patients. This methodology was originally the exclusive domain of Cardiologists. The problem is the availability at any time of this specialist in critical areas. This motivated that Emergenciologists, Intensivists, Surgeons and other specialties to the learning and use of the ETT of Urgency since the evidence has shown that it increases the survival of very sick patients. The ideal transducer is the microconvex of 2.5-5 MHz frequency. The images can be obtained by two-dimensional or M-mode. The main indications for this type of assessment are hemodynamically unstable patients and patients with thoracic or multisystemic trauma. The evaluation of the volume or fluids of the patient is achieved by measuring the diameter of the inferior vena cava (IVC). Summarizing 4 parameters are evaluated: volume, contractility, ejection fraction and pericardial effusion. With this simple and rapid evaluation we can decide when a patient in critical conditions can benefit from the administration of fluids, inotropes or vasopressors.

T18-14-IN05

Establishment and Implementation of Neonatal Screening Program for Congenital Heart Disease Based on Echocardiographic Confirmation

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Congenital heart disease (CHD) is one of the leading causes of death for newborn babies and infants. Many patients with CHD died of complications such hypoxia, cardiac dys-function and pneumonia, due to delayed diagnosis and management. Early detection before occurrence of

symptoms is able to save the babies with critical and serious CHD before their situation get worse.

We established a screening program for CHD in early neonatal stage by simply using pulse oximetry in conjunction with cardiac auscultation (namely two indicator scheme), which was based on echocardiographic confirmation. Newborn babies are screened for CHD at 6-72 hours after birth. The work has been translated as policy of Shanghai public health service since April 2016. The program is established at all 86 delivery hospitals in Shanghai. Four children's medical centers have been selected as center for screening, diagnosis and treatment of neonatal CHD to further evaluate those screen positive babies and provide management if necessary. Meanwhile, the center for quality control of neonatal CHD screening has been set up as well to supervise the screening work. The program is running smoothly and hundreds of CHD babies' lives have been saved.

T18-14-IN06

CEUS: Renal Applications

Jeong Yeon Cho
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Unlikely with CECT, CEUS can be applied in patients with renal impairment or allergic reaction. CEUS can be used in cases of renal ischemia, renal infections, renal trauma, for the differentiation of solid renal masses and pseudo-tumors, and for the characterization of complex cystic masses.

Renal pseudo-tumors, such as column of Bertin and dromedary hump, can often be evaluated with conventional ultrasound alone. CEUS can be performed directly after the conventional US and may show similar finding of same enhancement pattern as the normal parenchyma.

The differentiation of Bosniak IIF and III cystic masses are important in management and prognosis. CEUS is a sensitive method to depict internal enhancement and structure within the cystic masses. Several studies have shown high concordance (74∼86%) between CEUS and CECT in the Bosniak classification of complex renal cysts.

CEUS is helpful in detection of small renal masses. Although there remained controversy, several reports suggested usefulness of CEUS in characterization of solid renal tumors. CEUS is also useful in the monitoring of renal lesions treated by percutaneous ablation therapies.

The other renal application of CEUS is evaluation of transplanted kidney. CEUS can easily detect vascular problem of transplanted kidneys including aneurysm and infarction. Several studies reported that CEUS in patients with acute rejection may show delayed parenchymal enhancement compared with patients with acute tubular necrosis.

The potential further renal applications may include evaluation of vascular or traumatic insults and follow-up after anti-angiogenic therapy of renal tumors.

T18-15-IN01

The Role of Doppler Ultrasound in Renal Imaging

Ulrike M. Hamper, MD MBA
Russell H. Morgan Department of Radiology and Radiological Science, Johns Hopkins University, School of Medicine, Baltimore, Maryland, USA

This presentation will discuss the sonographic appearance of the following:

1. Scanning techniques
2. Renal Vascular Problems
3. Renal Trauma
4. Obstructive Uropathy
5. Renal Infections

T18-15-IN02

Isolated Neonatal Ductus Arteriosus Aneurysm

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Neonatal ductus arteriosus aneurysm (DAA) is considered uncommon, but is a potentially fatal abnormality. The incidence of congenital DAA ranged from 0.8% to 8.8% based on neonatal autopsies, fetal ultrasound studies and neonatal echocardiographic screening. Transthoracic 2-dimensional echocardiography is still an important tool for the diagnosis and follow-up of DAA. Three important signs, including the unusual ductal shunt jet, "Triple star sign" and "Rabbit ear sign" are essential images for diagnosis. Preferred images of DAA are typically visualized in the high parasternal short-axis view before the third day of life because about 70% of the patent ductus arteriosus closes after the third day of life in neonates with DAA and DAA regression quickens with or without thrombus formation. Careful manipulation of the transducer and analysis of the images are important when using echocardiography to diagnose DAA, since false images must be excluded by carefully tracing the aneurysm-like images from different angulations and views, including mirror image of the pulmonary artery, normal and short ductal bump, persistent left superior vena cava, dilated atrial appendage and vertical ductus arteriosus.

T18-15-IN03

Pediatric Abdominal Pain in the Emergency Department

Adrian Goudie
Fiona Stanley Hospital & King Edward Hospital for Women

Abdominal pain is a common reason for presentation to the emergency department. Ultrasound is well established as the primary imaging modality for paediatric abdominal pain. By combining clinical information and ultrasound performed in the emergency department, the clinical management of children can be expedited. This talk will discuss the common and some of the less common causes of abdominal pain in children and demonstrate the utility of emergency department ultrasound.

T18-15-IN04

Ultrasound in Pediatric Focal Liver Lesions

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Primary hepatic tumors are a diverse group of epithelial and mesenchymal tumors accounting for 0.5 and 2.0% of all pediatric neoplasms (1, 2). Liver masses in children can be benign, malignant, or indeterminate (3). About one-third of the pediatric primary liver masses are benign. In the literature, the most frequently described benign liver tumors in pediatric age group are: infantile hepatic hemangioendothelioma (IHH) (3), mesenchymal hamartoma (MHL), focal nodular hyperplasia (FNH) (4), nodular regenerative hyperplasia (NRH), and hepatic adenoma (HA) (5, 6). However, the incidence data are derived from surgical studies and data concerning "true incidences" are lacking. So far, no data are available concerning the prevalence of hemangioma or cysts in (screened, asymptomatic) children (2). The diagnosis of pediatric liver tumors is made on the basis of clinical features, serum α-fetoprotein (AFP) level, age of the child, and imaging characteristics. The role of imaging, like in adulthood, is to determine the organ of origin, the character, and the extent of the lesion. Knowledge of pediatric liver diseases and their imaging appearances is essential in order to make an appropriate differential diagnosis (2, 5).

This presentation will discuss benign liver tumors in children with an emphasis on imaging features and future perspectives of contrast enhanced ultrasound in pediatric patients (7).

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T18-15-IN05

Role of Ultrasound in Evaluation of Pediatric Scrotal Lesions

Prof.Surekha Panditi
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High frequency, high resolution linear Ultrasound plays an important role and is the imaging modality of choice in the evaluation of Pediatric scrotal lesions. Diagnosis and management planning of pediatric scrotal lesions are done based on ultrasound features.

Acute scrotal lesions such as epididymitis and testicular torsion are differentiated by using specific ultrasound criteria. It is essential to identify testicular torsion as early as possible in order to salvage the testis. Ultrasound plays an important role in identifying the testicular location in 84% of cases .We share our experience in evaluating scrotal lesions such as Inflammatory, ischemic, traumatic and neoplastic lesions.

T18-15-IN06

Capacity Building in Transcranial Doppler Screening in Sickle Cell Disease Related-Stroke Prevention in Children in Nigeria

Kofo Soyebi
University of Lagos

Transcranial Doppler ultrasonography (TCD) measures blood flow velocities in the large cerebral vessels thus, detecting the risk of stroke by estimating velocity of blood flow in these vessels and characterizing them. This facility is however scarce in Nigeria so also the skill.

This report describes a capacity building program which enabled the ingraining of TCD skill in four scientists making them TCD Sonographers who were then employed in the sole TCD centre in Lagos to render fulltime TCD screening services to children with Sickle Cell Disorder (SCD) for early detection of stroke risk for timely stroke preventing interventions. The methodology and impact are described in this report.

T18-15-IN07

Findings in Transcranial Doppler in Children with Sickle Cell Disease in Nigeria

Kofo Soyebi
University of Lagos

Between March 2011 and September 2013, 2,331 children in Nigeria with SCD aged 2–16 years had TCD studies.

TCD findings were classified as normal (standard risk) in 70.4%, conditional in 19% and abnormal (high risk) in 9.3%.

The majority of children (76.9%) in the high risk category were aged 2–8 years. TCD study was inadequate for risk categorization in 1.3% of the patients.

The TCD protocol and technique, classification of findings are described in this presentation.

T18-15-IN08

Transfontanelle Ultrasonography Versus Computed Tomography in the Evaluation of Intracranial Abnormalities in Preterm and Low Birth Weight Neonates in Lagos, Nigeria

Kofo Soyebi
University of Lagos

Intraventricular hemorrhage (IVH) commonly occurs in preterm neonates. Transfontanelle ultrasonography (TFUSS) is a non-invasive technique for the detection and characterization of IVH in preterm. The aim of this study was to determine the incidence, grades, time of evolution of IVH and correlation of the findings with demographics. Serial Transfontanelle sonography was performed on three hundred preterm neonates admitted into a tertiary hospital. Sonographic findings, relevant antenatal, perinatal, and postnatal information were obtained, with relevant tests of statistical significance.

Twenty of these patients were randomly selected for Computed Tomographic studies to corroborate sonographic findings. The findings are reported.

T18-15-IN09

Shear Wave Elastography in Children

Dagmar Schreiber-Dietrich, Christoph F. Dietrich
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Most recently the update on the 2013 published European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) Guidelines and Recommendations on the clinical use of elastography have been published focusing on the assessment of diffuse liver disease (1, 2).

The first part of the long version of these EFSUMB Guidelines deals with the basic principles of elastography including the reasons why ultrasound can be used to make elastograms. Transient elastography (TE) is explained as shear wave elastometry by measurement of the speed of a shear wave that has been generated using a surface impulse. Point shear wave elastography (pSWE) is explained as shear wave elastometry at a location by measurement of the speed of a shear wave generated using acoustic radiation force. Multidimensional shear-wave elastography (2D-SWE, 3D-SWE) is described as quantitative SWE imaging (and elastometry) by measuring the speed of shear waves generated using acoustic radiation force. Acoustic radiation force impulse (ARFI) imaging is discussed as well (1, 2). Guidance is provided on optimization of scanning technique, image display, image interpretation, reporting of data and some of the known image artefacts.

The second and clinical part provides clinical information about the practical use of elastography equipment and interpretation of results in the assessment of different etiologies of diffuse liver disease including normal values and reliability indices (1-4).

Comparative little is known about pediatric patients. Data regarding the pediatric population with biliary atresia suggest that liver (and spleen) elastography could be a valuable tool to predict outcomes before surgery, and might be used after the Kasai operation to monitor liver disease and portal hypertension [(5)]. Many other indications have been shown of value in daily practice but comparative studies are lacking. Here we present the current knowledge and our own data on the use of elastography in pediatric patients including the use of strain elastography (SE) and strain-rate imaging (quasi-static strain imaging). Future perspectives of this promising method are discussed as well.

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Free Paper

OPT18-001

The Impact of Immediate Postoperative Transesophageal Echocardiography on Congenital Heart Disease Surgery

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Objectives: Residual cardiac anatomical defects or functional impairment after open heart surgeries of congenital heart disease (CHD) may result in difficult postoperative status, even death. Performing transesophageal echocardiography (TEE) at operation room (OR) immediately after CHD surgery can detect most of these residual defects, and direct to appropriate mending interventions before leaving OR.

Methods: This retrospective study enrolled 69 open heart surgeries for CHD patients undertaken in the Children's Hospital of China Medical University, Taichung, Taiwan during the period of Jan. 1, 2015 through Apr. 30, 2017. Philips iE33 echocardiographywith micro and regularomniplane TEE probes were used.TEE examinations by pediatric cardiologists were implemented at the end of surgery, when the heart returned beating and cardiopulmonary bypass wastapering.This study categorized the complexity of open heart surgeries into simple, intermediate and complex types. TEE studies identified residual defects as none, minor, or major defect, and severe myocardial dysfunction. Based on TEE findings, cardiologist made discussions with cardiac surgeon and attributedthe patients to mending interventions of none, non-surgical, surgical intervention, and connection to extracorporeal membranous oxygenation (ECMO).

Results: Thirty-eight of the 69 patients were boys and 31 were girls. Their ages at OR ranged 1-day to 14-year-old, median was 5-month-old. Simple surgeries were 39, including VSD 35, atrioseptectomy 2, PA banding 1 and sub-AO myectomy 1; Intermediate surgeries were 23, including RVOT reconstruction 12, artificial valve replacement 2, TOF repair 2, PAPVR rerooting 2 and others 5; Complex surgeries were 7, including Fontan 3, Norwood 1, aterial switch op. 1, TAPVR rerooting 1, and central shunt with TV plasty 1. Mending interventions for TEE identified residual defects were: none 48, minor defects and no intervention 8, minor defects and non-surgical interventions 2, major defects with mending surgeries 7, and severe myocardial dysfunction requiring ECMO support 3.

Conclusions: Performing TEE at OR by cardiologists immediately after CHD surgeries is crucially important to identify residual defects and functional impairment. The following discussions with cardiac surgeon can direct to the way of mending interventions. The more complex the CHD, the higher probability of residual defects be detected by TEE. TEE at OR is not only an examination but also a means for conversations between surgeon and cardiologist. We can also consider it as a frontline handoff procedure between surgical team and ICU team that held at OR.

OPT18-002

Echocardiographic Assessment during the Procedure of Transcatheter Closure of Patent Ductus Arteriosus in Preterm Babies

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Objectives: A patent ductus arteriosus (PDA) in premature infants is common and is associated with a number of adverse outcomes. Because of recent advances in technology, there are many reports suggest catheter-based PDA closure is feasible among infants <3 kg. Echocardiographic assessment for PDA size, hemodynamics impacts, and device selection are very important. The aim of this study was to describe our experiences of echcocardiographic assessment during the procedure of transcatheter closure of PDA in symptomatic low birth weight premature infants.

Methods: Hospital records of basic demographics clinical information, echocardiographic findings, and catheterization reports of all premature babies body weight less than 3 kilogram who underwent transcatheter PDA closure since October 2014 in our hospital were reviewed and recorded.

Results: Fifteen premature infants (seven boys and eight girls) born at gestational ages ranging between 23 and 35 weeks (median, 29 weeks) were identified. All patients were symptomatic and 12 of them received at least one course of indomethacin therapy. Median age and weight for procedure was 32 days (2-102 days) and 1,500 g (520-2,986 g), respectively. The mean minimal ductal diameter was 3.1 +_ 0.7 mm. The mean ductal length was 8.6 +_ 2.1 mm. PDA type C is the most common (n=8). Device used in this study were amplatzer ductal occlude II additional size (ADO II-AS) (n=11), amplatzer ductal occlude I (ADO I) (n=1), amplatzer vascular plug I (n=1), and vascular plug II (n=2). Successful closure was achieved in all patients with no major procedural complications.

Conclusions: Premature babies have relatively larger and longer PDAs. Echocardiograhic assessment is very crucial for the transcatheter closure. It is currently feasible to undertake transcatheter PDA closure in symptomatic premature babies' weight greater than 520 grams.

OPT18-003

Transesophagography Identifies Guide Wire Impingement on the Tricuspid Valve Chordae Duringtranscatheter Closure of the Perimembranous Ventricular Septal Defect

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Objectives: Percutaneous transcatheter device closure of the perimembranous ventricular septal defect (VSD) in proper case is now an alternative to surgical VSD repair. However, some complications during the transcatheter closure procedure might happen, which includean impingement of the arteriovenous rail (AVr) in the chordae of tricuspid valve (TV) and result in chordae rupture withsevere tricuspid regurgitation. Conventionally, we used fluoroscopic images to help judginga 'safe, straightAVr' from a 'wrong, curvedAVr'.Determined to observe the right from wrong AVr course with transesophagography (TEE) directly, we performed this study.
Methods: This retrospective study enrolled 17 patients of perimembranous VSD that received transcatheter VSD closing procedure in Children's Hospital of China Medical University, Taichung, Taiwan in last 4 years. Philips iE33 Echocardiography with omniplane TEE probes were used. TEE study kept going on throughout the whole procedure. The spatial relationships between guiding wire, AVr, delivery long sheath and the AO valve, VSD, aneurysm tissue and TV were particularly noticed of. TV leaflets restriction or deformity by the guide wire or AVr, with or without tricuspid regurgitation, were considered as signs of chordae impingement and the AVr must be removed and reattempted.
Results: Guide wire impingement on TV chordae occurred in one patient and AVr impingement occurred in 4 patients. Compared to the conventional fluoroscopic guideline of 'wrong, curved AVr line', only 2 of the 4 AVr impingement cases displayed this fluoroscopic curved line. Instead, TEE observed quite a few significant image abnormalities of TV restriction, including 'dome-shape deformity of the septal leaflet at systole', 'ring-shape deformity at diastole', 'seagull deformity of TV at systole', 'hanging bed-deformity of TV at diastole', and 'redundant tissue tag' etc., in addition to the appearance of TV regurgitation.
Conclusions: For ascertain a safe AVr course that was passing rightly through the membranous VSD and the TV commissure, the fluoroscopic imageaddress only roughly 'a straight' from 'a curved' AVr line. TEE appeared to be a superior and useful modality for a detail description of TV impingement by AVr or guide wire.

OPT18-004

Septic Pulmonary Emboli Assosiated with Neck Abscess in a Child

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Objectives: Septic pulmonary embolism in a child caused by soft tissue infection.
Methods: 2 year old child presented to A/E with neck pain and fever.on examination found out to have neck rigidity and a provisional diagnosis of meningitis was made and broad spectrum antibiotics were commenced.CSF was negative and on further examination swelling in the neck region was noted.an ultrasound of the neck showed a complex hypechoic structure with hyperechoic debris and a diagnosis of abscess was made.ultrasound guided drainage of the neck abscess was attempted and was sucessful.pus swab for culture and sensitivity was done.The child was doing well and fever subsided then suddenly developed a cough and fever an xray was ordered which showed multiple peripheral based pulmonary nodules and cavitation.a CT scan of chest was ordered which also showed wedge shaped peripheral pulmonary nodules with cavitation.additional finding of a feeding vessel was seen.
Results: pus swab showed the causative organism to be Staphylococus aureus a diagnosis of pulmonary septic emboli asssociated with deep tissue infection caused by staphylococus aureus was made.the patient was started on flucloxacillin,cough and fever subsided and is on followup in the chest clinic.
Conclusions: pulmonary septic emboli is a diagnosis seldom considered in children.pulmonary septic emboli is an uncommon disorder with an insidiousonset and is difficult to diagnose. Typical radiographic features of septic PE include patchy air space lesions simulating nonspecific bronchopneumonia; multiple round or wedge shapeddensities of varying sizes from located peripherally,feeding vessel sign on chest CT scans. Complication include empyema, bronchopleural fistula, pneumothorax, cavity and abscess formations. While most frequentunderlying cause is a endocarditis, soft tissue infections may also also be a cause. Some reports show soft tissue infection to be the commonest cause of septic emboliPrimary staphylococcal pneumonia is usually unilateral. In our patient, pulmonary features,include bilateral, peripherally located nodules and cavities and are consistent with septic embolisation. The cause of septic PE in our patientwas staphylococcal bacteremia secondary to soft tissue infection. Staphylococci are the most commonly isolated pathogens in patients developing pulmonary septic emboli.Emergent debridement of skin abscess and appropriate antibiotics can be effective treatment of septic pulmonary embolism to prevent complication and even death.

OPT18-005

Arfi-Elastography in Differential Diagnosis of Benign and Malignant Solid Lesions in Children

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Objectives: Acoustic radiation force impulse (ARFI) elastography is widely used for the differential diagnosis of focal superficial tissues, hepatic and renal lesions in adults. Typically, malignancies have increased stiffness, whereas benign lesions are soft. In this study we assessed value of ARFI-elastography in differential diagnosis of benign and malignant solid lesions in children.
Methods: 121 children aged from 1 up to 216 months (45 children with neuroblastoma, 14 –hepatoblastoma, 14 – liver hemangioma, 14 – nephroblastoma, 7 – sarcoma of different localization, 15 – other different benign lesions, 12 – other different malignant lesions) were examined. All children underwent ARFI-elastography of tumors with stiffness value assessment according to 10 shear wave velocity (SWV) measurements in each lesion. Diagnosis was confirmed by biopsy in 50, by postoperative histologic examinations in 58, by multimodal imaging in 13 cases.
Results: There was not any significant difference between the stiffness of the liver hemangioma (2.04 m/s (median), 1.74–2.32 m/s (25th–75th percentiles)) and hepatoblastoma (1.85, 1.60–2.27 m/s) (P = 0.37); ganglioneuroma (1.02, 0.93–1.95 m/s) and neuroblastoma (1.77, 1.18–2.14 m/s) (P = 0.28). There was not any significant difference between benign (1.97, 1.20–2.77 m/s) and malignant (1.72, 1.20–2.06 m/s) lesions (P = 0.23). The SWV cut-off value for differentiation between benign and malignant lesions was equal to 1.93 m/s with sensitivity – 0.696, specificity – 0.586, AUC – 0.588.

Conclusions: Accuracy of ARFI-elastography in differentiation of benign and malignant solid lesions in children is low and this technology can not be recommended for use in clinical practice.

OPT18-006

Segmental Heterogeneity of Liver Fibrosis in a Biliary Atresia Patient after Kasai Surgery: Findings on Ultrasound and Shearwave Elastography

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Objectives: Biliary atresia (BA) is a serious infantile obstructive cholangiopathy, and even those who achieve a completely bile drainage after successful Kasai portoenterostomy (KPE) suffer from progressive fibrosis with their native liver. Apart from conventional indicators such as liver biopsy and serum biomarkers., there is a continued need for developing noninvasive, sensitive and reliable indicators for long-term surveillance of liver fibrosis. We are the first to to describe the sign of segmental heterogeneity of liver fibrosis with the use of grey-scale ultrasound and shear-wave elastography (SWE) in a BA patient after successful KPE, and finally prove it with histopathological assessment. Dynamic observation of this sign may provides a promising indicator of prognosis in the postoperative surveillance of BA.

Methods: Case report and literature review.

Results: A 2-year-old BA patient after a successful KPE was found to present segmental deformation of the liver in grey-scal ultrasound, that is, a hypertrophy of the right anterior segment and a coexisting shrinkage of the right posterior segment. SWE was used to quantitatively evaluate the stiffness of these two different regions and revealed an obvious difference: 10Kpa of the right anterior segment and 70Kpa of right posterior segment. Correspondingly, the liver biopsy proved a mild fibrosis of the right anterior segment staged F1 and a more serious condition staged F4 of the posterior segment.

Conclusions: Liver ultrasound scan combined with SWE measurement might be a promising tool for postoperative surveillance of BA. A larger extent of hypertrophic area with lower SWE measurements may indicate a good prognosis.

OPT18-007

The Value of Clinical and Ultrasound Features for the Diagnosis of Infantile Hepatic Hemangioendothelioma: Comparison with Contrast-Enhanced CT/MRI

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Objectives: To investigate the clinical and ultrasound characteristics of infantile hepatic hemangioendothelioma (IHHE) in differentiating IHHE from other focal liver lesions (FLLs) in children, compared to the diagnostic performance of CECT/MRI.

Methods: A total of 45 children with IHHE were retrospectively reviewed. Another 45 children with FLLs who were randomly selected at the same time served as the control group. The location, number, size and imaging appearance of the tumors were evaluated. Independent factors for predicting IHHE versus FLLs were evaluated. The diagnostic performance of the clinical and ultrasound features were compared with CECT/MRI.

Results: Compared with the FLL group, the IHHE group had a younger age at diagnosis (P=0.008), lower AFP levels (P=0.000), smaller lesion sizes (P=0.000), and a higher proportion with a resistance index (RI) <0.7. Multiple logistic regression analysis showed that age, size, RI and AFP were independent factors for predicting IHHE. ROC analysis showed that the area under the ROC curve of the four combined independent factors was 0.881 (95% CI: 0.744-0.960), while that for CECT/MRI was 0.905 (95% CI: 0.774-0.973), for all the above was 0.929 (95% CI: 0.805-0.985), and there was no statistically significant difference among the three methods (P > 0.05).

Conclusions: CECT/MRI was the effective diagnostic indicator for IHHE. But combining the clinical and ultrasound features, including age at diagnosis, lesion size, RI and AFP could achieve the same diagnostic performance as CECT/MRI.

OPT18-008

Percutaneous Ultrasound-Guided Cholecystocholangiography with Micro-Bubbles to Early Exclude Biliary Atresia and Relieve Cholestasis for Infants with Gallbladder >1.5 cm in Length: A Pilot Study

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Objectives: To evaluate the feasibility of Percutaneous ultrasound-guided cholecystocholangiography (PUSCC) for early exclusion of BA in infants who were clinically suspected of BA and had a gallbladder >1.5cm in length on ultrasound (US).

Methods: The ethics committee approved this study, and written informed parental consent was obtained. From February 2016 to December 2016, 9 infants with conjugated hyperbilirubinemia and gallbladder >1.5cm in length on US were referred to PUSCC. PUSCC was performed by using an US machine with incorporated contrast pulse sequencing, and a linear transducer by injecting diluted contrast agents via an 18- gauge needle. US and PUSCC images were evaluated in consensus by two radiologists. Sonographic criteria for BA were triangular cord sign and gallbladder length to width ratio of >5.2. BA on PUSCC was excluded when there was contrast material visualized in the gallbladder, common hepatic ducts, common bile duct and passage to the duodenum. Non-parametric test and McNemar's exact tests were used.

Results: All the patients underwent a successful PUSCC procedure without related complications. Among them, five were excluded of BA. Their serum direct bilirubin level were substantially declined [91.1(75.6-128.8) umol/L vs. 65.3(60.0-76.5) umol/L), P=0.031] after PUSCC. The other 4 patients were diagnosed as BA. The accuracy of PUSCC [9/9,100 %, (69.2%,100%)] in the diagnosis of BA was higher than that of US [4/9, 44.4 %, (21.2%, 78.8%)] (P=0.5).

Conclusions: PUSCC may be a safe and effective tool to early exclude BA in infants whom US scan is equivocal.

OPT18-009

Two-Dimensional Shear Wave Elastography in Pediatrics: A Focus on Examiner Experience

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Objectives: To evaluate examiner experience in performing a 2D-SWE technique in children.

Methods: We compared the first and the last 50 examinations performed by a single examiner with an experience of more than 50 examinations

using this technique in adults. The two study groups were heterogeneous: each group consisted of 17 normal weight children without history of liver disease, 24 obese children and 9 children with diffuse chronic liver disease. The groups were similar in terms of age, gender and body mass index (age range: 3-17 years, mean age 11.9±3.8 years vs 12.5±3.5 years, p= 0.4; 68% vs 60% boys, p= 0.4; mean BMI 24.4±8.1 kg/m2 vs 23.5±7.1 kg/m2, p= 0.5). We used the 2D-SWE.GE (Logiq E9, GE Healthcare, Chalfont St Giles- UK), with a C1-6-D probe. Reliable measurements were defined as a median of 10 liver stiffness measurements acquired in a homogenous area, avoiding large vessels, with an IQR/median ≤ 30%.

Results: In 5 children we obtained unreliable results (3 children were included in the first study group). We found no differences between the first and last 50 examinations in terms of median (4.3±1.2 kPa vs 4.7±2.3, p= 0.7) and IQR/median (0.68±0.38 vs 0.75±0.61). Medians and IQR/medians remained similar in obese and in children with diffuse chronic liver disease.

Conclusions: A prior experience of 50 examinations using 2D-SWE.GE in adults seems sufficient before performing liver elastography in children.

OPT18-010

Normal Liver Stiffness Values in Children Using a Two-Dimensional Shear Wave Technique

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Objectives: To establish normal LS values in children, using a 2D SWE technique and to evaluate the influence of age, gender and body mass index (BMI) on LS measurements.

Methods: We conducted a prospective study which included 46 children (age range: 2-17 years, mean age 10.8±4.2 years, 48.8% girls, mean BMI 19.2±3.5 kg/m2). We enrolled children without history of liver disease, normal serum transaminase levels and normal abdominal ultrasound. All measurements were taken without sedation, in fasting conditions, in the right liver lobe. We used the 2D-SWE.GE (Logiq E9, GE Healthcare, Chalfont St Giles- UK), with a C1-6-D probe. Reliable measurements were defined as a median of 10 LS measurements acquired in a homogenous area, avoiding large vessels, with an IQR/median ≤ 30%.

Results: We obtained reliable results in all except 2 children (97.7%). The mean normal LS value in children, using 2D SWE.GE was: 4.04±0.95 kPa. LS values increased significantly with age: 2-6 years: 3.3±1.05 kPa, 6-10 years: 4.1±0.89, >10 years: 4.3±0.81 kPa (p= 0.02). In addition, we found a weak/moderate, statistically significant positive linear correlation between age and LS values (r= 0.4, p= 0.02). We found no correlation between BMI and LS values (r= 0.25, p= 0.13). LS values were similar in boys and girls (4.1±0.8 kPa vs 3.9±1.01 kPa, p= 0.3).

Conclusions: Normal LS values in children seem to be influenced by age, but not by gender or BMI.

OPT18-011

A Rare Case of Primary Intestinal Lymphangiectasia in Children: Case Report in Malaysia

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Objectives: Primary intestinal lymphangiectasia (PIL) also known as Waldmann Disease, is a rare disorder of protein losing enteropathy, with unknown etiology. The disease is characterized by malformation of the intestinal lymphatic drainage system, resulting in abnormal gut permeability or lymphatic flow obstruction. We present a case report of a child who was repeatedly admitted for bilateral pedal edema and hypoalbuminemia. Ultrasound of abdomen revealed small bowel wall thickening with ascites. Subsequent biopsy taken from colonoscopy showed intestinal lymphangiectasia. This case highlighted the importance of ultrasound findings, Computed Tomography (CT) features correlation and consideration of PIL in paediatric patients.

Methods: Case report and literature review.

Results: A 3-year old boy, presented with recurrent pedal edema and intermittent diarrhoea. He is underweight with mild abdominal distension. Blood investigation showed persistent hypoalbuminemia and lymphocytopenia. Ultrasound of abdomen revealed small bowel wall thickenings with minimal ascites while CT showed diffuse small bowel wall thickenings without terminal ileum and colon involvement. He underwent colonoscopy and biopsy eventually revealed intestinal lymphangiectasia. Patient responded well with dietary modification.

Conclusions: This case highlighted that ultrasound may be the first modality to detect thickened bowel wall among children. CT further characterizes the extent of disease. With the combination of ultrasound and CT findings, PIL should be considered as one of the differential diagnoses among paediatric patients whom presented with diffuse small bowel wall thickening of unknown cause.

Poster Session

PPT18-001

A Pediatric Case of Sigmoid Colon Malignancy Presented with Krukenberg Tumor

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Objectives: Colorectal cancers are mostly encountered at adults and are rare in pediatric and adolescent age group individuals. In this presentation; it was aimed to demonstrate the radiologic findings of a female pediatric patient with the complaint of abdominal pain, in whom a left ovary mass was incidentally determined and the diagnosis of recto-sigmoid cancer wassubsequently made.

Methods: Case report and literature review.

Results: 15-year old female patient with recently started abdominal pain and abdominal distention was referred to our clinic. No additional grouses that could give rise to thought of malignancy, such as loss in weight, blood in stool or change in defecation habits, were existed. Her previously performed ultrasound examination at a private hospital had documented a right ovarian mass. Mild abdominal distention was noted at physical examination. No suggestive finding was determined in laboratory tests. A left adnexal mass including milimetriccystic components and increased vascularity, with size of 13 × 8 cm and well-demarked margins was determined in repeated B-Mode / Doppler sonography. In pelvic magnetic resonance MR imaging, this mass lesion was with signal intensity properties of hypointense at T1-weigthed, hyperintense at T2-weighted sequences, and with homogenous contrast enhancement afteriv. contrastagent administration. Additionally, a diffuse thickening in the wall of the sigmoid colon segment that came in the view of the pelvic MRI sequences was noted.Finally, the diagnosis of metastatic Krukenberg tumor at right ovary secondary to the sigmoid colonic mass was made depending upon the frozen section specimens following the surgery.

Conclusions: Pediatric colorectal carcinomas are rare entities generally with a poor prognosis. Metastasis of colorectal carcinomas, as in the

unlikely event of occurrence, should be kept in minds in pediatric cases with vascular ovarian masses

PPT18-002

Cranial Ultrasonographic Screen in Healthy Neonates

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Objectives: Cranial ultrasonography is a non-invasive screening technique for early detection of abnormalities.
Methods: We retrospectively reviewed the results of cranial ultrasonographic screen in healthy neonates between October 2011 and August 2014, with gestational age between 35-42 weeks.
Results: There were a total of 6405 neonates received cranial ultrasonographic screen during the period, and most of them (5335 cases, 83.3%) were assigned to the normal group. Among the 1070 neonates with abnormal findings, 166 of them (2.6%) had more than two abnormal findings. The most common minor findings were cysts, including 511 (7.97%) subependymal cysts, 118 (1.84%) frontal horn cysts, 148 (2.31%) choroid plexus cysts, and 15 (0.23%) pineal region cysts. Subependymal cysts and frontal horn cysts mostly resolved at the age between 2 and 3 months old (46.1% and 42.8%, respectively). Other detected minor anomalies were lenticulostriate vasculopathy (201, 3.13%), mild ventricular dilatation (92, 1.43%), increased periventricular echogenicity (62, 0.96%), enlarged cisterna magna (47, 0.73%), asymmetric ventricles (7, 0.10%), and mild brain edema (5, 0.07%).There were 10 (0.15%) major anomalies confirmed by MRI, including cerebral hemorrhage, cerebral infarction, periventricular heterotopia, lipoma in perisplenimu of corpus callosum, vascular malformation, arachnoid cyst, dysgenesis of corpus callosum and agenesis of corpus callosum.
Conclusions: In our study, the incidence of intracranial anomalies found by cranial ultrasonographic screen in healthy neonates is 16.7%. Major anomalies were found in 0.12% neonates. Cranial ultrasonography can be an easily used technique for early screening and serial follow-up. Still, continuous clinical assessment is important in neonates even without abnormal newborn screen.

PPT18-003

Decision Making of Clinical Management by Sonography in a Very Low Birth Weight Infant with Hydrocephalus

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Objectives: Intracranial hemorrhage (ICH) can cause hydrocephalus and is not so rare in very low birth weight (VLBW) infant. Progressive hydrocephalus may need surgical approach. However, it is rather difficult to perform in VLBW infants. Here present a case of facing such situation and demonstrate the decisive role of cranial sonography for choosing the proper clinical management.
Methods: Case report.
Results: The patient was born with 24+1 weeks' gestational age and a birth weight of 609 gm. Grade II ICH was found on the second day after birth. A hematoma posterior to 3rd ventricle with dilated lateral and 3rd ventricles was found on the 10th day. Progressive dilatation of the ventricles was detected by the following sonographies. The resistant index (RI) of anterior cerebral artery (ACA) increased gradually. Transient diastolic reversal flow was found on the 19th day. Fortunately, it disappeared after compressing the anterior fontanelle so ventricular tapping was avoided. The RI of ACA decreased and the hematoma and the dilated ventricles shrinked finally. He had no abnormal neurological finding at corrected age of 4 months.
Conclusions: Hydrocephalus is usually a critical condition but the tolerance of the brain decides the necessity of surgical approach. We constantly monitored the cerebral blood flow condition by cranial sonography and held invasive procedure in this case. Serial sonography is helpful for managing ICH in infants.

PPT18-004

Evaluation of Right Atrial Size in Children

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Objectives: A need to get scientific and clinically reasonable data on standard values of the right atrial (RA) size has appeared with the exclusion of unsubstantiated diagnostic approach.
Methods: A total of 1008 people were examined, boys and girls of all age groups (from 3 weeks up to 15 years), and body weight 3.1-40.9 kg. Evaluation of the RA size was carried out from the apical 4-chamber position from the level of the plane of the tricuspid valve ring to the base of the RA.
Results: The mean values of the RA size for the different weight groups of patients from the examination, as well as the value of the 2 standard deviations ($\pm 2\delta$) are given below. Moreover, all the RA values obtained in the study are within the specified interval of 2 standard deviations. Weight 3.1-4.9 kg – size RA 17.2±6.5 mm; 5.0-6.9 - 19.9±3.4; 7.0-8.9 - 21.5±4.3; 9.0-10.9 - 23.9±3.6; 11.0-12.9 - 24.7±4.0; 13.0-14.9 - 26.5±3.1; 15.0-16.9 - 27.4±5.7; 17.0-18.9 - 27.9±4.6; 19.0-20.9 - 28.7±3.8; 21.0-22.9 - 29.1±4.1; 23.0-24.9 - 31.2±5.7; 25.0-26.9 - 31.7±4.3; 27.0-30.9 - 32.6±4.4; 31.0-35.9 - 33.4±5.2; 36.0-40.9 - 34.8±5.9, respectively.
Conclusions: A close correlation (r=0.87) between the size of the RA and the body weight of the examined children and adolescents, as well as the links between body weight and dimensional parameters of the heart chambers, supposes a comprehensive assessment of the last, with the purpose of the correct interpretation of the data and verification of the diagnosis.

PPT18-005

Imaging Findings of Rapunzel Syndrome Including Sonography

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Objectives: Rapunzel syndrome caused by thichobezoar is an extremely rare intestinal condition in humans resulting from ingesting hair (trichophagia). Trichobezoars (hair ball) are usually located in the stomach, but may extend through the pylorus into the duodenum and small bowel (Rapunzel syndrome). They are almost always associated with trichotillomania and trichophagia or other psychiatric disorders. When not recognized, the trichobezoar continues to grow in size and weight due to the continued ingestion of hair. This increases the risk of severe complications, such as gastric mucosal erosion, ulceration and even perforation of the stomach or the small intestine. In this presentation, it was aimed to make a well-groomed demonstration of the radiologic findings of a giant gastric bezoar that was determined in a young female.
Methods: Case report and literature review.
Results: 15-years-old woman was referred with complaints of anorexia, weight loss and left upper quadrant mass. Physical examination specified a left hypochondriac solid mass bloating the skin upwards. B-Mode Ultrasound imaging of upper abdomen revealed an echogenic mass with acoustic shadow behind at gastric site. CT examination following intravenous contrast administration revealed a heterogeneous

giant mass with lamellar-concentric structural pattern of mixed soft-tissue and air attenuation; determined mass was identified as signal void in T2 and post-contrast T1 weighted and MR images in both axial and coronal planes. The patient underwent surgery with the pre-diagnosis of gastric trichobezoar and the mass was excised via an epigastric approach by delivering from a tight primary gastric incision. The ex-vivo consideration of trichobezoar was revealed as 23 cm-in-size (cranuocaudal) and mainly composed of barba. The drains were drawn at sixth day of the operation following successful per-oral feeding. Patient was discharged without complication at seventh post-operative day.

Conclusions: In conclusion, trichobezoar should be suspected in young females presenting with non-specific abdominal complaints; as a non-invasive modality, ultrasound can be the initial imaging method that can be used in detection of trichobezoars especially with substantial growth.

PPT18-006

Newborn Ultrasound Screen Program for Developmental Dysplasia of the Hip: A Local Women's and Children's Hospital Experience in Taiwan

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Objectives: In Taiwan, national newborn screen with genetic and metabolic diseases has been performed for decades. Moreover, the early hearing detection and Intervention for all babies was arranged since 2012. The incidence of developmental dysplasia of the hip (DDH) was reported as 1.2 per thousand live births but no advanced general technical survey. In this study, we tried to investigate the screen program for DDH.

Methods: The newborns delivered in a local women's and children's hospital during April, 2015 to March, 2017 were enrolled under the free will for self charged hip ultrasound screen. Two pediatricians with Taiwan ultrasound society qualified membership evaluated via Graf method for classification.

Results: Totally 2716 newborns were received DDH ultrasound screening in two years among 6715 live births. 245 cases needed to follow up and 6 babies were soon transferred to pediatric orthopedics and others revealed stable hip in following 338 operations with education to parents about DDH, swaddling care and double layer diaper usage. Forty percent parents would like to pay for this study and the positive screen rate was about nine percent. Only one third transfer cases had partial abnormal hip physical examination, and one eversion foot and one congenital dislocation of the knee were also noted.

Conclusions: Graf type IIc or D cases were transferred for Pavlik harness with near-double incidence rate(2.2‰) compared to prediction. Not only the risk group performed but the incidence might be under estimated. A national screening policy could be recommended for early diagnosis and intervention with further more studies.

PPT18-007

Performed Sternocleidomastoid (SCM) Muscle and Hip Ultrasound in Infantile Muscular Torticollis

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Objectives: Musculoskeletal ultrasound a fully development technique in today but it still not routine used in infant muscular torticollis. Congenital muscular torticollis (CMT) is the common etiology of torticollis in infant, it associated with a contracture of the sternocleidomastoid muscle with a lateral head tilt and chin rotation toward the side opposite to the tilt, most cases are present with a palpable neck mass appearing at 2 to 4 weeks of age. An association between congenital muscular torticollis and developmental dysplasia of the hip (DDH) has been described in the many literatures. SCM Ultrasound examination for congenital muscular torticollis not routine performed in Taiwan although the ultrasound systems were very popular and available in many local clinic.

Methods: case report.

Results: We reported these 2 cases, one is found unilateral torticollis in physical examination, however, SCM ultrasound examination revealed bilateral fibromatosis mass, another case is right torticollis has palpable neck mass with normal bilateral hip maneuver examination but ultrasound examination showed right torticollis with right hip subluxation, the patient has been transferred to pediatric orthopedic and underwent Pavlik harness therapy to reduction the hip subluxation.

Conclusions: Ultrasound examination is one of the most sensitive tools for the diagnosis of CMT and DDH. It is easy to assessment and low misjudgment rate. Bilateral torticollis could be misdiagnosed as unilateral torticollis because of the less severe side was easy to ignored compared with another side. By the way, physical examination of the neonatal hip is challenging, and requires a sensitive hand, and patience, examination. Through the ultrasonography is objective and accurate detect the SCM lesion and silent DDH, it will be leading the physician create an appropriate physiotherapy or treatment for the patient.

PPT18-008

Role of Echocardiographic Diagnosis for an Adolescent with Sudden Cardiac Arrest

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Objectives: Hypertrophic cardiomyopathy is an uncommon myocardial disease which is usually asymptomatic in early childhood. The clinical presentations are cardiac murmur, arrhythmias, syncope, sudden collapse and cardiac death. Echocardiography is one of the best diagnostic tools, and also can pick up the asymptomatic patients as a screening modality.

Methods: Case report.

Results: A 13-year-old boy experienced of sudden collapse and syncope while exercising in school. He was sent to our emergency room immediately. Physical examination revealed lethargy of consciousness and a grade II/VI systolic murmur over left lower sternal border. Chest X-ray showed normal size & contour of heart without significant increase of pulmonary vascular markings(Figure 1). The electrocardiography demonstrated sinus arrhythmia and left ventricular hypertrophy with strain (Figure 2). The Two-dimensional and M-mode echocardiography demonstrated the marked increase in interventricular septal thickness (3.41cm) and posterior left ventricular wall (Figure 3). Continuous-wave Doppler echocardiography demonstrated insignificant obstruction of left ventricular outflow tract (Figure 4). The ejection fraction of left ventricle was 64.93%, mild tricuspid and mitral regurgitation were detected by Doppler echocardiography. After the stabilization of patient's condition, he was discharged and then received open septal myomectomy at another teaching Di. Unfortunately, sudden cardiac arrest attacked again during physical education at school 2 years later. After emergency cardiopulmonary resuscitation and AED defibrillation by the school nurse, he was sent back to our emergency room. The electrocardiography before resuscitation in school demonstrated ventricular fibrillation and Torsade de pointes (Figure 5). The follow-up echocardiography revealed the same findings of hypertrophic cardiomyopathy but less left ventricular outflow obstruction (Figure 6). For prevention of the recurrence of syncope and possible sudden cardiac death, an implantable cardioverter device was implanted and then he was discharged and on beta-blocker in home. The follow-up electrocardiograms & Holter's monitoring showed normal sinus rhythm without ventricular premature depolarization.

Conclusions: Hypertrophic cardiomyopathy is an uncommon but serious myocardial disease in children and adolescent. It is usually presenting with syncope & sudden cardiac arrest during activity, especially during the physical education and exercise which may induce the occurrence of ventricular arrhythmias. Echocardiography is an effective & accurate tool to evaluate the anatomical changes & function of heart. The thickness of septal & ventricular wall and severity of left ventricular outflow tract obstruction can be easily detected by 2-D & Doppler echocardiography. In patients with syncope or sudden onset of collapse, echocardiography is one the first choice to study and it should be the best tool to evaluate and make the diagnosis of hypertrophic cardiomyopathy.

PPT18-009

When is the Optimal Timing for Evaluation of Spine Us for Sacral Dimple in Neonates?: The Earlier Evaluation is Not Always Better than the Later

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Objectives: This study aimed to propose the optimal timing for evaluating spine ultrasonography (US) for sacral dimple in neonates.
Methods: This study included a total of 211 neonates with clinically diagnosed as simple sacral dimple and underwent spinal US, from January 2016 to March 2017. Patients were classified into two groups based on whether delineable subarachnoid CSF space exists (group A) or not (group B). Patient-, mother-related clinical factors include antenatal history and US findings compared between both groups.
Results: Group A included 163 patients (M:F =76: 87) and group B included 48 patients (M:F =22:26). Group A showed significantly older age, older corrective age, larger birth weight and body weight compared with group B (all $p < 0.003$). Mean age of group B noted 12.5 days old with corrective age of 42+2. Mean birth weight of group B noted 3.3 kg with body weight about 4.8 kg on examination day. However, no statistically significant differences were seen between other patient and maternal factors. Delineation of subarachnoid CSF space showed significant relation with detection of cord and cauda equine pulsation, filum thickness, and could affect the confidence of the examination ($p< 0.001$).
Conclusions: Spinal US was known to be difficult when baby grow older, but according to this study earlier evaluation is not always better. We suggest that spinal US might be performed at least after 12.5 days after birth with body weight more than 4.8kg, considering that delineation of subarachnoid CSF space is difficult before this period.

T19. Preclinical Ultrasound

Symposium

T19-14-IN01

In Vivo Ultrasound Imaging and Characterization of Mouse-Embryo Brain Development

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High-frequency ultrasound (HFU, >20 MHz) offers a means of investigating biological tissue at the microscopic level with spatial resolutions better than 100 μm. Novel *in vivo* HFU imaging methods were developed to form three-dimensional (3D) images of the brain of developing mouse embryos. Many genetically-engineered mice display abnormal development of the central nervous system (CNS) at early embryonic ages, and HFU offers great potential for *in vivo* imaging and characterization of normal and abnormal development. A 34-MHz, five-element annular array was excited using chirp-coded excitation. *In utero, in vivo* 3D data sets were acquired from more than 120 embryos over five stages, from embryonic days E10.5 to E14.5, and CNS and head volume renderings were generated using automatic image-processing methods. Mutants expressing CNS deficiencies were also imaged and detected using automatic signal-processing approaches. These HFU methods could prove instrumental in improving the efficiency of preclinical studies in mouse models of a wide range of conditions.

T19-14-IN02

Ultra-sensitive Doppler for Micro-flow imaging

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Microvessel imaging is useful for cancer diagnosis and treatment evaluation, neural functional imaging (through the neurovascular coupling effect), and evaluation of inflammatory diseases. High frame rate ultrasound imaging combined with more advanced tissue clutter filter can greatly improve the sensitivity of Doppler for micro-flow imaging. Examples in healthy human kidney, bowel of patients with Crohn's disease, and activation of animal brain and spinal cord in response to electrical stimulus will be presented. A second technology (with contrast agent), which achieves super-resolution microvessel imaging by tracking the centers of individual microbubbles, can resolve microvessels with size below 50 μm in a freely breathing rabbit with several millimeters of breathing motion. The principles of these imaging technologies will be presented with preliminary *in vivo* results.

T19-14-IN03

A Mouse Model of Neuroblastoma by Using High-Frequency Ultrasonography

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Neuroblastoma is a childhood cancer that originates from the sympathoadrenal lineage of neural crest. Despite modern multimodal therapy, approximately 50% of patients with neuroblastoma still succumb to the disease eventually. Moreover, neuroblastoma with amplification of the *MYCN* oncogene, accounting for ~20% of cases, correlates with an extremely poor prognosis and requires more rapid discovery of new therapy. In 1997, Weiss *et al.* constructed Th-*MYCN*, the first transgenic (Tg) mouse model of neuroblastoma, featured by targeted overexpression of human *MYCN* cDNA in the neural crest by using rat tyrosine hydroxylase (Th) promoter. The Th-*MYCN* model recapitulates most clinical and molecular characteristic of human high-risk neuroblastoma and had been widely used in biologic and therapeutic studies. However, spontaneous occurrence of tumor in Th-*MYCN* mice is usually detected by abdominal palpation, which is less accurate and highly variable among observers. In recent years, we modified the methods of Teitz *et al.* in 2011 and utilized a high-frequency ultrasound system (VEVO 2100; FUJIFILM VisualSonics, Toronto, Canada) with an RMV-706 transducer at 40 MHz to screen the hemizygous Tg mice since age 4–6 weeks. The probability of developing abdominal or thoracic tumors ≥ 2 mm at age 60, 90, and 120 days was 62%, 80%, and 83%, respectively ($n = 53$). Thoracic tumors occurred less frequently than did abdominal tumors but was related to rapid death after tumor detection. We tested the efficacy of JQ1, a BRD4 bromodomain inhibitor which epigenetically blocks *MYCN* transcription, at 50 mg/kg IP QD for 28 days ($n = 6$), showing significant delay of tumor growth ($P < 0.01$) and improved survival (median survival, 18 *vs.*

43 days after treatment, $P = 0.0002$). However, the majority of mice (5/6) had their tumor relapsed after cessation of BRD4 inhibition. By contrast, no treatment response was observed in mice treated with 13-*cis*-retinoic acid (5 mg/kg PO QD for 14 days), a differentiation agent. Next, we treated Tg mice with common cytotoxic chemotherapy regimens, including cyclophosphamide/doxorubicin/vincristine (CDV), cisplatin/etoposide, and topotecan/cyclophosphamide, with/without JQ1. The mice treated with chemotherapy showed more durable remission ($P < 0.01$). On survival analysis, mice treated with CDV showed the longest survival. In conclusion, high-frequency ultrasonography enables early detection and longitudinal evaluation of hemizygous TH-*MYCN* mice and helps to confirm the additive effect between BRD4 inhibition and cytotoxic chemotherapy.

T19-14-IN04

Innovative Photoacoustic Imaging Technology to Support Vascular Health Science

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Photoacoustic imaging provides high optical contrast sensitivity to physiological parameters such as the oxygen saturation of hemoglobin and offers better spatial resolution of ultrasound for deep imaging compared with purely optical imaging by combing the merit of optical and ultrasound imaging technologies. Photoacoustic imaging has been explored for the early diagnosis of cancer based on tumor angiogenesis, and identification of cardiovascular plaques. We have conducted development of photoacoustic mammography system in Kyoto University/Canon joint research project supported by MEXT from 2008. In addition, we are promoting development of 3D-PA technologies to be applicable in wider clinical field and non-medical purposes in ImPACT (Impulsing Paradigm Change through Disructive Technologies) program supported by cabinet office of Japan from 2014. In ImPACT program, biomedical imaging is still the main target and applicable for wider clinical fields including cancer diagnosis, orthopedics, dermatology, plastic surgery, and dementia, as well as health and beauty care. In addition, we aim to foster "Vascular Health Science," a new health science to contribute to the early prediction of diseases and health maintenance by monitoring blood vessel networks and blood state in the human body to enable people to continue working while preserving their health and beauty in the super-aging society.

T19-14-IN05

Evaluating LV Function in Mouse Myocardial Infarction Model by Speckle Tracking Echocardiography

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Mouse models of cardiovascular disease have been used to study the mechanism and various stem cell therapy strategies. Speckle tracking echocardiography (STE) has been shown to provide unique information for the quantitative assessment of global and regional myocardial function. Standard view B-mode images are recorded and measured by continuous frame-by-frame motion analysis of speckles within the myocardium. Deformation parameters including radial, longitudinal and circumferential strain can be used for a serious of myocardial remodeling indicator after infarction. In multimodality noninvasive imaging techniques, including PET, SPECT and STE are employed to monitor serially the beneficial effects of cell therapy on angiogenesis, blood perfusion, and myocardial function, respectively. These experimental data reveal the efficacy of mesenchymal stem cell therapy after MI and elucidate the mechanism cardiac repair.

T19-14-IN06

The Application of Theranostic Microbubble Ultrasound System for the Minimally Invasive Surgery

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Sensorineural hearing loss and balance dysfunction are common symptoms of inner ear disorders. Therapeutic strategies may include medication, surgical intervention, sound amplification, or physical therapy. Methods for local delivery can include intratympanic or intracochlear approaches. Intracochlear drug delivery is achieved via a cochleostomy through the round window membrane (RWM) or directly through the otic capsule, and a variety of devices, including syringe, osmotic pumps, microinjector, and a reciprocating drug delivery system, have been employed. Although intracochlear application can achieve greater bioavailability of drugs entering the inner ear than the intratympanic approach, the former usually requires invasive surgical manipulation to interrupt the inner ear structure, and may increase the risk of deafness. Active intratympanic drug delivery was developed in an attempt to overcome the shortcomings of direct transtympanic injection. Potential utilization for such a topical application of medicine to the inner ear will be further explored in the future in view of its convenience in application, fewer side effects, and minimal invasiveness. Recently, ultrasound (US) combined with a contrast agent, microbubbles (MBs), has been used to target or control drug release to tissues and cells. MBs, which are small gas-filled microspheres that are used as contrast agents in diagnostic ultrasound-based imaging, are now being intensively investigated for ultrasound-mediated gene and drug delivery as cavitation nuclei. In this presentation, the feasibility of US combined with the most suitable particle size MBs to enhance the drug delivery by theranostic MBs-US system in inner ear was firstly demonstrated. The practical application of optimal MBs-US on increasing the RWM permeability for facilitating drug or medication delivery to the inner ear. Biotin–fluorescein isothiocyanate conjugates (biotin–FITC) are as delivery agents, and guinea pig animal models simulate the clinical case. Finally, the efficiency and feasibility of theranostic MBs-US system in clinical purpose will be assessed.

T19-14-IN07

Anti-inflammation as a Novel Therapy for Post-Infarction Heart Failure-The Linkage Between Myocardial Contractility and Biochemical Changes

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Myocardial infarction (MI) is a potentially fatal event and the major cause of heart failure (HF) in adults. Although timely revascularization significantly reduces MI-related mortality, one of the major unmet therapeutic needs is to develop strategy aimed at minimizing post-infarction myocardial inflammation and subsequent HF. Cyclooxygenase-2 (COX-2) is induced in response to ischemia-induced stress and inhibition of COX-2 prevents cardiomyocytes from apoptosis, reduced infarct size, and attenuated cardiac remodeling in animal models of MI. We recently examined novel anti-inflammation modalities in a rat model of acute MI. Treatment with amino acid derivatives significantly reduced the extent of inflammatory cell infiltration and the expressions of inflammation-related genes and preserved myocardial viability post-infarction. These anti-inflammatory effects were associated with a significant reduction in end-systolic diameter and improvement in ejection fraction of left ventricle (LV), as assessed by using echocardiography. The differences remained to be significant at 14th day post-operation. These echocardiographic findings not only demonstrated the association between anti-inflammation and the preservation of LV systolic function post-MI, but also shed light on the prevention of ischemia-related HF.

T20. Therapeutic Ultrasound

Symposium

T20-15-IN01

Sonobactericide - An Adjunct Therapy for Infective Endocarditis: An *In Vitro* Proof-of-Concept

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Infective endocarditis (IE) is associated with high morbidity and mortality rates. The predominant bacteria causing IE is *Staphylococcus aureus* (*S. aureus*), which can bind to existing thrombi on heart valves and generate vegetations (biofilms). In this *in vitro* study, we evaluated sonobactericide as a novel strategy to treat IE, using ultrasound and an ultrasound contrast agent in combination with an antibiotic and a thrombolytic. We developed a model of IE vegetations using human whole-blood clots infected with S. aureus. Histology and live-cell imaging revealed an outer biofilm layer of fibrin-embedded living Staphylococci around a dense erythrocyte core. Infected clots were treated under flow for 30 minutes and degradation was assessed by time-lapse microscopy imaging. Treatments consisted of either continuous plasma flow alone or with different combinations of therapeutics: oxacillin (antibiotic), recombinant tissue plasminogen activator (rt-PA; thrombolytic), intermittent continuous-wave low-frequency ultrasound (120-kHz, 0.44 MPa peak-to-peak pressure), and an ultrasound contrast agent (Definity®). Infected clots exposed to the combination of oxacillin, rt-PA, ultrasound, and Definity achieved 99.3 ± 1.7% clot width loss, which was greater than the other treatment arms. Size measurements of the effluent suggested low emboli risk. These results demonstrate that sonobactericide could be an effective therapeutic strategy for treating IE.

T20-15-IN02

The Immunological Effects of Therapeutic Ultrasound

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Advances in cancer immunotherapy have improved our understanding of the power of the immune system and its optimization to help against the disease. Therapy Ultrasound can both induce necrosis in target tissues by raising the temperature to ablative levels and create cavitation which can result in mechanical disruption of stroma surrounding cancer cells. Both these processes may increase the immunogenicity of tumors, and there is anecdotal clinical evidence to that effect. In a pre-clinical study, pancreatic tumours have been subjected to a number of different to Therapy Ultrasound exposure regimes (ablative, hyperthermic & cavitational) to explore whether there is increased T cell infiltration and immune cell activity in the area of the tumour and improved efficacy of immunotherapy (using anti-CTLA-4 and anti-PD-1 antibodies), and which regime is the most effective. The results will be presented here.

T20-15-IN03

Real-Time Cavitation Control for Enhancing In-Vitro Gene Transfection

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Sonoporation using mid-frequency high-pressure ultrasound is a non-viral approach for in-vitro and in-vivo gene delivery. However, partially due to the unstationary behavior of cavitation microbubble cloud, sonoporation effect is usually unrepeatable, especially in low intensity conditions. This appears as a main drawback for therapeutic applications of ultrasound requiring soft mechanical effects of cavitation microbubbles such as blood-brain barrier opening or gene delivery into cells, particularly when it is required to maintain for a sufficiently long time weakly nonlinear oscillations of microbubbles (stable cavitation). In this work we discuss the recent possibilities of real-time acoustic feedback control of cavitation activity aiming at distinguishing the various cavitation regimes of microbubbles oscillations (stable cavitation) and strong collapses activity (inertial cavitation). By quantifying acoustic cavitation activity through specific acoustic indicator (subharmonic emission and broadband noise) associated to a feedback process on the applied voltage to the transducers, it is shown that ultrasound cavitation can be systematically initiated and maintained at a stable level during the whole pulsed sonication shot. Efficiency of the proposed approach, in terms of transfection rate and reproducibility, is demonstrated in-vitro through the quantification of gene delivery of plasmids within liver (BNL) or adenocarninoma (HT29) cells.

T20-15-IN04

Localized Image-Guided Drug Delivery into the Brain Using Novel Transmit/Receive Ultrasound Phased Arrays

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MRI guided focused ultrasound provides a completely noninvasive method for delivering energy deep in the brain when a large phased array is used to compensate the skull induced distortions of the wave front. This has been successfully exploited for thermal ablation of small volumes of VIM nucleus for the treatment of essential tremor with FDA approval last year. Animal research and recent clinical experience indicate that similar technology could be used to increase the permeability of the blood-brain barrier (BBB) for drug and cell delivery into the brain. These exposures require orders of magnitude with smaller powers than the thermal ablation when the exposure is combined with microbubbles. To effectively deliver agents into clinically relevant volumes, the focal spot needs to be electronically moved and the acoustic emissions from the focal volume used to control the exposure. In this talk our experience with such experimental arrays in animal experiments will be reviewed.

T20-15-IN05

Ultrasonic Neuromodulation: Evidence from Neuron to Animal Model

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Background, Motivation and Objective: Neurostimulation is among the fundamental ways of neuroscience to probe the neural mechanisms from molecular to behavioral levels. The cutting-edge discovery of ultrasound as a non-invasive neurostimulation tool, has made possible for the effective amelioration of multiple functional brain diseases such as Parkinson disease, epilepsy and major depression. In this study, we highlight the up-to-date research on the application of the ultrasonic radiation force in the stimulation of isolated neuron, mice and monkeys with the underlying mechanism and the challenges of ultrasonic neuromodulation discussed.

Statement of Contribution/Methods: A high-frequency neurostimulation chip based on surface acoustic waves (SAWs) was designed and fabricated for the stimulation of isolated neuron. The responses of HEK cells, and neuron under the stimulation of the chip were recorded by the Ca^{2+} imaging and patch clamp. Confocal imaging of fluo-4-AM fluorescence was conducted on the neuron cells with the neurostimulation chip. The whole-cell voltage clamp was used to record the changes in membrane current in response to stimulation with the chip. Portable and wearable systems incorporating high voltage waveform generator (0.5-5MHz) were designed for free-moving small animal studies. In addition, a wearable 256-element 2D dual-curvature focused ultrasound phased-array transducer and MRI compatible ultrasonic neuromodulation system were developed for primate studies. Rhesus monkeys were trained to perform perceptual tasks with and without intermittent ultrasonic stimulation to specific cerebral cortex. In vivo single or multiple neuron electrode recording and eye tracking were conducted during task performance, allowing an evaluation of the direct linkage between physiology and behavior.

Results/Discussion: Time-lapsed series of confocal images were obtained from neuron cells loaded with fluo-4-AM. Ca^{2+} transients were triggered in response to the stimulation by the high-frequency neurostimulation chip indicated by the increase in fluo-4 fluorescence intensity. Alterations in the membrane currents in response to high-frequency neurostimulation were recorded for HEK cells and neuron, respectively. Electromyography and local field potential signals were successfully recorded, demonstrating that the ultrasound neuromodulation can induce neuronal activity and evoke motor behaviors of animals. These results manifested that the interaction between ultrasonic radiation force and the protein of cell membranes may lead to the opening of mechanosensitive ion channels, thus triggering effective neuromodulation at both cellular and behavioral levels.

T20-15-IN06

Ultrasound Noninvasive Gene Delivery for Parkinson's Disease Treatment

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Parkinson's disease (PD) is a potent neurodegenerative disease in which a progressive loss of dopaminergic neurons eventually produces a loss of movement controlling ability and other symptoms. To date, in addition to pharmacological, non-pharmacological, and neurosurgical therapies, gene delivery has emerged as a potential therapeutic modality for PD. Effective targeted gene delivery is complicated in that gene vectors cannot penetrate the blood-brain barrier (BBB), thus clinical tests must rely on invasive intracerebral gene vector injection. Focused ultrasound with the presence of microbubbles has been noticed to be capable of locally and reversibly disrupting blood-brain barrier (BBB) without causing neuronal damage, and has proven its potential to enhance the delivery of therapeutics into CNS. In this study, we aim to preclinically explore the feasibility in using focused ultrasound to deliver gene into the brain, and also demonstrate the feasibility of this approach to restore behavior and neuronal function on PD animal model.

T20-15-IN07

The Impacts of Microbubble-Induced Sonoporation on Cell Membrane Permeability and Cytoskeleton Arrangement

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Microbubble-mediated sonoporation has shown its great potential in facilitating intracellular uptake of gene/drugs and other therapeutic agents. However, the biophysical mechanisms underlying cell-bubble interactions remain unclear. Particularly, the cell cycle-phase-dependent cellular responses to sonoporation have never been reported. Here, efficient synchronizations were performed to arrest HeLa cells in individual cycle phases. Then, atomic force microscopy was adopted to examine the topography and stiffness of synchronized cells. Finally, real-time fluorescence imaging system was designed to simultaneously visualize sonoporation-induced variations in cell membrane permeabilization and cytoskeleton arrangement. The results showed that G1-phase cells had the largest height and elastic modulus, while S-phase cells were the flattest and softest ones. Consequently, S-Phase might become the preferred cycle for sonoporation treatment, due to the greatest enhancement of membrane permeability and the fastest cytoskeleton disassembly. These findings may benefit ongoing efforts pursuing rational utilization of microbubble-mediated sonoporation in cell-cycle-targeted gene/drug delivery for cancer therapy.

T20-15-IN08

High-Resolution Ultrafast Imaging of Microbubble Activity during Sonoporation

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Sonoporation is the combined action of ultrasound and microbubbles on cells and blood vessels which results in changes in the tumor microenvironment that promote drug uptake. Sonoporation may lead to: (a) transient cell membrane permeability alteration; (b) vessel poration increasing permeability and particle extravasation; and (c) interstitial pressure modulation leading to increased particle transport through diffusion. The precise parameters that induce sonoporation are not fully understood. Ultrasound imaging may demonstrate the interaction of ultrasound with microbubbles during the sonoporation process in order to understand the underlying mechanisms. An ultrafast high-resolution imaging approach was developed to study the sonoporation of liver cancer cells (HepG2) in vitro in an Opticell-like cell enclosure. Using plane wave imaging with a 15 MHz linear array on a Verasonics 128 system, frame rates of about 8 kHz were achieved. Unique microbubble movement and destruction patterns including streaming, vortexing, and standing waves were observed in rea-time. Despite the simplicity of the cell enclosure, the complexity of the microbubble patterns during sonication as observed for the first time with ultrafast imaging reveals surprising results and gives guidance on the ultrasound parameters and concentration needed for efficient sonoporation.

T20-15-IN09

Ultrasound Microbubble Contrast Agents Promote Transdermal Drug Delivery

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This report discusses a new development in the use of ultrasound (US) microbubble contrast agents on transdermal drug delivery. In clinical applications, microbubbles serve as imaging agents to enhance the contrast

of ultrasound images via intravenous injection. Different degrees of microbubble oscillation due to distinct acoustic fields can elicit various degrees of cavitation. Inertial cavitation can enhance the permeability in the surrounding tissues, increase vessel wall permeability, and promote drug entry from blood into cytosol or matrix, whereas stable cavitation can slightly increase tissue permeability without causing any harm. At present, most ultrasound contrast agents are designed for injection into blood vessels, nevertheless, microbubbles with different condition parameters are highly correlated with efficiency in transdermal permeation. As for applications in a transdermal drug delivery, we also used microbubbles at a given concentration in combination with ultrasound to widen intercellular spaces, thereby successfully enhancing the in vivo delivery of arbutin across the skin. In order for liquid-phase microbubbles to be conveniently applied to skin surface, our team modified the medium surrounding the microbubbles at the optimum concentration from liquid to gel. Moreover, it is found that under the same ultrasound power density, microbubbles of larger particle sizes can extend the penetration depths of dye at the phantom surface. Recently, US-mediated drug-coated microbubble cavitation for enhancing hair growth, the treatment of inflammatory skin diseases, and wound healing both in vitro and in vivo have been investigated by our group.

Free Paper

OPT20-001

Study of Biological Effects of Standing Wave Focused Ultrasound

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Objectives: This study aimed to explore the differences in biological effects of standing wave focused ultrasound (SWFU) with that of propagating wave focused ultrasound (PWFU).
Methods: To get standing wave focused ultrasound, two identical propagating wave transducers were set coaxial relatively and were driving simultaneously with the resonance frequency of 626.9kHz. The focal length of the transducer is equal to 221mm and the diameter is 270. As for the implementation of the focusing of propagating wave, it was carried out by driving unilateral transducer and sheltered another one with sound absorption material. There is no need to choose driving frequency specially, so driving it with the same frequency as SWFU. The theoretical and experimental sound field results of the two focus methods were compared with each other to explore the differences of sound field. Irradiating the tissue-mimicking phantom with the same focal pressure (18MPa) of the two focus methods, the cavitation signals were collected with passive cavitation detection and the lesion formations were recorded with High-speed camera. Recording and analyzing the sound pressure wave and the spectrum of it to compare the nonlinear degree of the two focus methods.
Results: The results of the acoustic field the theoretical distribution and the experimental scan in the free sound field are in good agreement with each other. The sound field distribution between the two focusing methods was obvious different in the acoustic propagation axis. -6dB width in this axis of PWFU was up to 5.2 times of wave length, however that of SWFU reached 0.42 times of wave length. To reach the same focal pressure of 18MPa, the driving power of SWFU is much lower than PWFU. When irradiating tissue-mimicking phantom with the same acoustic pressure of the two focusing methods, the lesion caused by PWFU is formed faster. With the same irradiating time, the lesion caused by PWFU is larger. The degrees of cavitation of the two focusing modes have no significant differences with each other, but in the degree of nonlinearity, PWFU's was stronger.
Conclusions: The size of focal region caused by SWFU is significantly smaller than that of PWFU, which can achieve more accurate and more controllable treatment. To reach the same focal pressure, the driving power of SWFU is much lower than PWFU, so SWFU can reduce the energy deposition of tissue along the sound propagation path to improve the safety of the treatment. Irradiation tissue-mimicking phantom with the same acoustic pressure, the lesion caused by PWFU is faster and larger, that is mainly because of the nonlinear effect.

OPT20-002

Temporal and Spatial Resolved Observation of Bubble Cavitation Signal by Holographic Image Reconstruction

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Objectives: Control of micro-bubble cavitation is a key technology in improvement of both efficiency and efficacy of ultrasound-assisted DDS. However, the mechanism of bubble cavitation is too complicated to optimize due to the formation of bubble cloud and interaction between the neighboring bubbles. To control the bubble cavitation in ultrasound-assisted DDS, in-situ observation of bubble cavitation mechanism is required. In this study, a novel measurement method of bubble cavitation, which has temporal resolution of sub-micro second and spatial resolution of sub-mm, is proposed.
Methods: High intensity focused US wave (Pumping wave) which causes bubble cavitation and high frequency US pulse (Probing pulse) are irradiated synchronously to the bubble. Bubble radiates secondary US wave by bubble cavitation of the pumping wave. RF signal of probing wave, which contains bubble cavitation signal, is acquired and the bubble cavitation signal source is reconstructed by holographic US wave back-propagation followed by amplitude deconvolution.
Results: Experiments were carried out using Sonazoid microbubbles by changing frequency and sound pressure of the pumping wave, and bubble density. Interesting phenomena of bubble cavitation, which were difficult to observe by conventional methods, were visualized. First was the difference of the harmonic signal irradiation depending on lateral position. The second was a phenomenon like "stimulated US wave irradiation" of bubbles positioned in a lateral direction.
Conclusions: A novel temporal- and spatial-resolved measurement method for bubble cavitation signal is proposed. This in-situ measurement method can observe bubble cavitation dynamics including its temporal development with sub-micro second temporal resolution.

OPT20-003

Prevention of Doxorubicin Induced Cardiomyopathy after Delivery of Modified Acidic Fibroblast Growth Factor by Using Ultrasound-Targeted Microbubble Destruction: A Preliminary Experimental Study

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Objectives: To observe the preventive effects of doxorubicin-induced cardiomyopathy (DOX-CM) rats after delivery of modified acidic fibroblast growth factor (MaFGF) by using ultrasound-targeted microbubble destruction (UTMD).
Methods: The fifty male SD rats were randomly divided into five groups: (1) Control group, (2) DOX-CM group, (3) MaFGF group, (4) UTMD group, (5) MaFGF+UTMD group. (2)-(5) groups rats were intraperitoneally injected with doxorubicin to induce DOX-CM and given the corresponding interventions. Six weeks after intervention, all rats

were underwent conventional echocardiography and velocity vector imaging (VVI) exams. Left ventricular internal dimension-diastole (LVIDd), left ventricular internal dimension-systole (LVIDs), left ventricular ejection fraction (LVEF) and left ventricular fractional shortening (LVFS) were measured using conventional echocardiography. The segmental mean peak systolic radial velocity (Vs), systolic radial strain (Sr), and systolic radial strain rate (SRr) of six walls at the papillary muscle level were measured in left ventricular short-axis view by VVI. At last, myocardial tissues of all rats were stained with Hematoxylin-eosin (HE) to observe the myocardial tissue morphology and with Van Gieson (VG) to calculate the collagen volume fractions (CVF).
Results: Six weeks after intervention, HW/BW, LVIDs and LVIDd of MaFGF+UTMD group were significantly decreased compared with DOX-CM group($P<0.05\sim0.01$), while the LVEF, LVFS, Vs, Sc and Sr was significantly increased ($P<0.05\sim0.01$). Van Gieson stains showed that the collagen volume fractions (CVF) of DOX-CM groups significantly increased comparing with the control group ($P<0.01$), while the CVF of MaFGF+UTMD groups significantly decreased ($P<0.01$) .
Conclusions: Delivery of MaFGF to myocardium in DOX-CM rats by UTMD could retard the formation of myocardial fibrosis and effectively protect the left ventricular function of DOX-CM rats.

OPT20-004

Ultrasound Guided Radiofrequency Ablation of Peritoneal Implantation after Resection of Hepatocellular Carcinoma

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Objectives: To evaluate the efficiency, safety and survival of ultrasound guided radiofrequency in peritoneal implantation after resection of hepatocellular carcinoma.
Methods: Two case had reviewed. The first case is 59 y/o, who recurrence peritoneal nodule 2 cm detected 12 months after resection of primary tumor. RFA was done using expandable needle with partial open and low power 40W for 10 minute. then observe effect and survival. Second case took left segmentectomy for residue lesion that not response to TACE and PEI 12 year after first treatment of HCC. 10 month later, 1 cm peritoneal implantation found. radiofrequency was done using cool-tip 1 cm probe for 6 min.
Results: Both cases showed complete ablated on following CT image. No obvious side effect or complication in both cases except small skin burn scar at puncture site in first case which healed spontaneously. The first case die in brain metastasis 6 years after ablation. He died in liver failure 3 years 11 month later. No peritoneal recurrence and whole following. although liver recurrence present, however, it is smaller than 3 cm and considered not related to his liver failure.
Conclusions: The ultrasound guided radiofrequency is effective and safe for treatment of peritoneal implantation.

OPT20-005

A Multifunctional Theranostic Nanoagent for Dual-Mode Image-Guided Hifu/Chemo- Synergistic Cancer Therapy

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Objectives: To develop the perfluorohexane and the anticancer drug doxorubicin-encapsulated hollow mesoporous Prussian blue nanoparticles (HMPBs-DOX/PFH), and to investigate the capacity of amplifiable ultrasound/ photoacoustics (US/PA) dual-mode imaging and synergistic HIFU/chemo- treatment enhancement.
Methods: HMPBs-DOX/PFH was prepared by utilizing a controlled self-etching reaction and vacuum siphon degassing process. 200μl HMPBs-DOX/PFH was dropped into wells of the agar-gel model well and irradiated by focus ultrasound (FU). Then, the PA imaging was performed by LASER VEVO imaging system. 12 rabbits bearing VX2 breast tumor were intratumorally injected with normal saline and HMPBs-DOX/PFH. US and PA imaging were performed before and after injection of the above agents, and correspondingly, the quantitative analysis of contrast enhanced imaging was measured. 42 rabbits were randomly divided into seven equal groups: Saline, DOX, HMPBs-PFH, HMPBs-DOX/PFH, saline+HIFU, HMPBs-PFH+HIFU, HMPBs-DOX/PFH+HIFU, and the solutions were injected intratumorally. All the HIFU ablation was performed at 120 W for 5 s. After HIFU ablation, the changes of gray-scale value and the tumor volumes of each treatment groups were collected and calculated. Finally, pathology and immunohistochemical examination of PCNA and TUNEL were performed to detect the synergistic efficiency of HIFU and chemotherapy.
Results: HMPBs-DOX/PFH was performed excellent contrast at both B mode and contrast mode after phase transition triggered by FUS irradiation. In vitro PA imaging performance, HMPBs-DOX/PFH could produce strong PA signal. We also surprisingly found that the PA intensity of the HMPBs-DOX/PFH group (16.35 $\pm$ 1.046 a.u.) was higher than that of the HMPBs-DOX group (11.144$\pm$ 2.347 a.u.) after HIFU exposure. This difference was ascribed to the contrast enhancement from the increased temperature and PFH gas generated by the HIFU stimulus. Based upon the results of imaging performance in vitro, PA signal intensity of each tumor after injection (1.218 $\pm$ 0.094 a.u.) was much stronger than the pre-injection value (0.274 $\pm$ 0.101 a.u.). The echo intensity of each tumor increased threefold over the pre-injection value after HIFU irradiation. Depending on the results of smaller tumor size, the lower positive index (PI) of PCNA and the higher apoptasis index (AI), HMPBs-DOX/PFH could generate acoustic cavitation effects and thermal mechanisms that can enable rapid and highly localized thermal ablation, as well as promote the efficiency of site-specific drug release for achieving synergistic HIFU/chemotherapy.
Conclusions: The HMPBs-DOX/PFH could act as a multimodal contrast agent for US and PA imaging, as well as it was a potential synergistic agent for HIFU/chemo- surgery for any residual tumor tissue, inhibiting possible tumor recurrence and minimizing systemic side effects.

OPT20-006

Focused Ultrasound Treatment Promotes Nerve Regeneration in RAT

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Objectives: Ultrasound has been widely used in clinic for the treatment of repairing bone fractures and of healing in various soft tissues. Some reports indicated that ultrasound accelerated peripheral nerve regeneration. However, these studies are focused on pulsed ultrasound stimulation(PUS) and little is known about effect of focused ultrasound stimulation(FUS) treatment. This study is to investigate which FUS improved the nerve regeneration in rat crush model.
Methods: Male Sprague-Dawley rats weighing 150g were underwent right sciatic nerve crush surgery and were randomly divided into 2 groups: injury and treatment groups. 24hr after surgery, FUS were applied at the crush site for 3 weeks. The ultrasound protocol had a spatial average, temporal-averaged intensity of 1.6 W/cm2 operated at 2 MHz for 10 minute per application. Footprint analysis was performed in measurements for print length (from tip of third toe to heel), toe spread (from tip of first toe to tip of fifth toe), and intermediate toe spread (from tip of second toe to tip of fourth toe). Scores for sciatic function index (SFI), tibial function index (TFI), and peroneal function index (PFI) were calculated using the Bain's formulas.

Results: SFI, TFI and PFI values were zero before surgery, indicating that the rats had normal sciatic nerve function. The treatment group's scores for the SFI, TFI, and PFI were significantly decreased compared with injury group. Rats treated with the ultrasound showed a statistically significant acceleration of foot function recovery as against injury group.

Conclusions: FUS could promote the functional recovery of rat sciatic nerve crush injury. Further studies should focus on identification of the mechanisms.

OPT20-007

Focused Shockwave Induced Blood-Brain Barrier Opening

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Objectives: Blood-brain barrier (BBB) is a diffusion barrier, which impedes influx of most compounds, and controls the exchange of substances between the blood and the central nervous system (CNS) to maintain the physiological condition. Nonetheless, the protecting mechanism of BBB also prevents CNS drugs from treating CNS disorders effectively. In this study, a commercial focused shockwave was applied for inducing blood-brain barrier opening to improve the efficiency of drugs delivery.
Methods: A commercial focused shockwave instrument (Piezowave, Richard Wolf GmbH) was combined with a computer controlled bi-axial locator, and four-point laser locator on transducer to process the shock-wave induced blood-brain barrier opening. Evans blue was injected via tail vein as a BBB opening indicator. All Brain samples were collected 3 hr after shocking, and analyzed by H&E stain and TUNEL assay (S7100, Millipore).
Results: Under intensity level 5 (P- -10 Mpa, P+ 17.4 Mpa, 0.182 mJ/mm2) with 5 Hz of shocking, BBB was opened by 100 times of shocks (with above 50 % of success opening rate), and opened with bleeding by 300 times of shocks. With the proposed locating- mechanism, the target treating area could be located precisely, including the depth and the area on brains (SD rat).
Conclusions: The proposed focused shockwave technique to induce blood-brain barrier opening has several advantages: consistent BBB opening rate, good penetration (due to low frequency), lack of thermal effect, and easy-accessibility (based on a commercial device).

Poster Session

PPT20-001

Antitumor Effects of Combining Hemocoagulase with the Blocking Microvascular Action of Microbubbles Enhanced Ultrasound Cavitation on Rabbit Vx2 Liver Tumor

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Objectives: Substantial effort is being directed toward investigating the use of microbubble enhanced ultrasound cavitation (MEUC) to promote penetrate vascular wall and disrupting circulation in liver tumor. In this study we propose and investigate a new method for combining MEUC with hemocoagulase (HC) atrox, which is effectively a vascular targeting to induce embolism effects and combine these with an antiangiogenic treatment strategy.
Methods: Rabbits were implanted VX2 tumor mass to establish a liver tumor model. 7 days after tumor implantation, rabbits presented with single liver tumor were randomly divided into 4 study groups: (1) control group were given injections of saline use micro- pump intravenously. (2) HC only injection. (3) MEUC treatment. (4) MEUC+HC treatment. The MEUC induced an acute reduction of blood flow as confirmed with contrast enhanced ultrasound (CEUS) imaging. QontraXt software quantitative analysis time intensity curve (TIC) of the tumor blood perfusion and microvascular changes. HC was administered was inserted precisely into the tumor under the guidance of real- time ultrasound with a 21-gauge needle. MEUC were conducted at1 MHz frequency probe (with a 400-cycle pulse length and a pulse repetition frequency of 9 Hz) at peak positive pressure of 1 MPa in combination with the commercial microbubble agent SonoVue. MEUC treatments were performed on 10 min on and off periods and HC was administered for 1KU.
Results: Post MEUC+HC treatment at 1 h and 7-day, the parameters of TIC including peak value, RBV and AUC were measured using CEUS were significantly lower than that found in the other treatment groups. The MEUC+HC treatment group showed significant growth inhibition relative to the MEUC-only and HC-only treatment groups. The MEUC+HC treatment group showed significant growth inhibition relative to the MEUC-only ($p < 0.01$) and HC-only treatment groups ($p < 0.01$). No damage was observed in the surrounding normal tissues.
Conclusions: These results indicate the feasibility of a new approach to combining microbubble enhanced ultrasound cavitation with hemocoagulase.

PPT20-002

Application of Ethanol-Enhanced Percutaneous Laser Ablation for of Rabbit Vx2 Liver Tumors

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Objectives: Our goal was to investigate to both the safety and efficacy of method for percutaneous ethanol injection (PEI) and ultrasound-guided percutaneous laser ablation (PLA) to treat rabbit VX2 liver tumors, a method designed to induce and duplicate the effects of embolisms combined with a strategy to inhibit tumor growth.
Methods: Fourteen days after rabbits were implanted with a single liver VX2 tumor, they were randomly divided into 2 study groups: (1) those PLA treatmenttreated with PLA. and (2) those treated with PEI+PLA treatment. An Nd: YAG laser was coupled to a quartz fibreoptic fiberoptic guide (600μm) with a flat tip. The fibre fiberoptic guide and a thermocouple were placed in the lumen of one Chiba needles (21G), which were inserted into the tumor under ultrasound- guidance. The laser was fired for 6 min at 5 W power. Contrast-enhanced ultrasound (CEUS) was performed before treatment and 1- hr, 1-day, 7-days, and 14- days post-after treatment for the analysisto analyze of tumor size, enhancement and degree of necrosis range. We analyzed quantitatively the time intensity curve (TIC) of the tumor blood perfusion and microvascular changes.
Results: The volume of tumor ablated in the PEI+PLA group grow was significantly larger than that in the PLA group on 1- day and on day 14-day ($P<0.01$). We noted a substantially significant reduction of in the flow of blood flow to the tumors treated with PEI+PLA compared to treated with PLA in terms of Peak signal intensity, regional blood volume RBV and area under the curve AUC parameters ($P<0.01$). Examination of treated tumors demonstrated necrosis in the ablated zones and increasing surrounding fibrous bands in both treatment groups. No damage was observed in the surrounding normal tissues.

Conclusions: Our study indicates that ultrasound-guided ethanol injections enhances the efficiency of laser ablation therapy. Therefore, this method is well suited to the treat treatment of tumors that are near vital structures.

PPT20-003

Effects of Subatmospheric Pressure and Dissolved Oxygen Content on Lesions in Ex Vivo Bovine Livers Induced by High Intensity Focused Ultrasound

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Objectives: This study was aim at investigating the effects of subatmospheric pressure and dissolved oxygen content(DOC) on cavitation in tissue.
Methods: This experiment put ex vivo bovine liver tissues which were degassed for 60 minutes into three different DOC degassed water, 1.0 mg/L, 1.5 mg/L and 2.0 mg/L, respectively. 1 MHz US with Isp equal to 11700 W/cm2 was used to exposure the degassed bovine livers under two ambient hydrostatic pressure(Pstat), atmospheric pressure(Pstat=1 bar) and subatmospheric pressure(Pstat=0.1 bar), with exposure time of 2 s, exposure depth of 2 cm. The hyperecho in focus before and after HIFU exposure were monitored by B mode ultrasound. The acoustic cavitaion signal was detected by passive cavitation detector (PCD) during the process of exposure.
Results: The results showed that the broadband noise under atmospheric pressure were all higher than that under subatmospheric pressure when keep DOC the same. Under atmospheric pressure, evident signals of broadband noise were appeared during HIFU exposure under three DOC condition, meanwhile the hyperecho was found in focus after exposing. Moreover, the intensity of broadband noise signal increased with the increase of DOC. Under subatmospheric pressure, cavitation just occurred under DOC of 2.0 mg/L, and only under DOC of 1.0 mg/L did not found hyperehco in focus. Results also demonstrated that lesions induced by HIFU increased with DOC under two Pstat, but the volume of lesions under atmospheric pressure were all larger than that under subatmospheric pressure when keep DOC the same.
Conclusions: 1. The volume of lesion decrease with the decrease of DOC when keep Pstat constant. 2. Subatmospheric pressure would suppress cavitation in biological tissue during HIFU exposure. 3. The homogeneity of lesions in tissue was changed by cavitation.

PPT20-004

Exosomes Are Potential Novel Mediators for Microbubbles Enhanced Ultrasound Cavitation-Induced Anti-Inflammatory Therapies

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Objectives: Ultrasound has anti-inflammatory effect, however, the mechanism of this effect, we still unknown.
Methods: Using experimental database mining and statistical analysis methods we developed the following findings.
Results: 1) Microbubbles can enhance exosome delivery by ultrasound cavitation effect on increasing immunosuppressive cellular permeability; 2) Various anti-inflammatory molecules including microRNAs and anti-inflammatory cytokines and chemokines can mediate the anti-inflammatory effects of immunosuppressive cell-derived exosomes by ultrasound cavitation.
Conclusions: Our results suggest that exosomes are potential novel mediators for Ultrasound-induced anti-inflammatory therapies.

PPT20-005

Hemocoagulase Combined with Microbubble-Enhanced Ultrasound Cavitation for Augmented Ablation in Rabbit Liver Microvasculature

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Objectives: We investigated a new method to block blood perfusion of rabbit liver by combining microbubble-enhanced ultrasound cavitation (MEUS), which can damage vascular structures, with the antiangiogenic effects of hemocoagulase (HC) atrox.
Methods: Rabbits were randomly divided into 4 treatment groups and 1 control group: The treatment groups received MEUC, HC, percutaneous ethanol injection, and MEUC + HC combined, respectively; the control group received saline intravenously via a micropump. The groups were monitored with contrast-enhanced ultrasound (CEUS) at 1 h and at 7 days post treatment. QontraXt software was used for quantitative analysis of blood perfusion in the target area and to determine microvascular changes. Light microscopy, scanning electron microscopy, and transmission electron microscopy were used to evaluate the therapeutic effects.
Results: After administration of MEUC+HC at 1 h and 7 days, the values of the time intensity curve-peak signal intensity, regional blood volume, maximum signal intensity, the mean signal intensity-as measured using CEUS, were significantly lower than those in the other treatment groups. The quantity of hepatic tissue ablated, the microvascular rupture score, and the number of microthrombi were significantly higher in the MEUC+HC group than in the other treatment groups. No damage was observed in the surrounding normal tissue.
Conclusions: The results suggest that the vascular effects induced by MEUC+HC can safely and efficiently block blood perfusion of rabbit liver.

PPT20-006

Safety of Radiofrequency Ablation of Benign Thyroid Nodules and Recurrent Thyroid Cancers: A Systematic Review and Meta-Analysis

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Objectives: We performed a systematic review and meta-analysis to evaluate the safety of radiofrequency ablation (RFA) for the treatment of benign thyroid nodules and recurrent thyroid cancers.
Methods: Ovid-MEDLINE, EMBASE, and Library of Cochrane databases were searched up to July 12, 2016 for studies on the safety of RFA for treating benign thyroid nodules or recurrent thyroid cancers. Pooled proportions of overall and major complications were assessed using random-effects modeling. Heterogeneity among studies was determined using the χ^2 statistic for the pooled estimates and the inconsistency index I2.
Results: A total of 24 eligible studies were included, giving a sample size of 2421 patients and 2786 thyroid nodules. Forty-one major complications and 48 minor complications of RFA were reported, giving a pooled proportion of 2.38% for overall RFA complications [95% confidence interval (CI), 1.42%–3.34%] and 1.35% for major RFA complications (95% CI, 0.89%–1.81%). There were no heterogeneities in either overall or major complications (I2 = 1.24%–21.79%). On subgroup analysis, the overall and major complication rates were significantly

higher for malignant thyroid nodules than for benign thyroid nodules ($p = 0.0011$ and 0.0038, respectively).

Conclusions: RFA was found to be safe for the treatment of benign thyroid nodules and recurrent thyroid cancers.

PPT20-007

Synergistic Effects of Nanodrug, Ultrasound Hyperthermia and Thermal Ablation on Solid Tumors - An Animal Study

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Objectives: Delivery barriers of nanodrug in large tumors due to heterogeneous blood supply, elevated interstitial pressure and long transport distances can degrade the efficacy of cancer treatment. In this study, we proposed a therapeutic strategy to improve the tumor growth inhibition by injecting pegylated liposomal doxorubicin (PLD), and then applying a short time of ultrasound hyperthermia (HT) on the entire solid tumor, and inflicting ultrasound thermal ablation (Ab) in the low-perfused tumor region.

Methods: BALB/c female mice with an average weight of 20 g were adopted and murine breast cancer cells 4T1 were subcutaneously implanted into the flank. A 1.0-MHz planar and a 0.47-MHz focused ultrasound transducers were used respectively for the HT and Ab treatment.

Results: For a PLD dose of 5 mg/kg, the PLD+HT(42°C, 10 min) group caused a significant decrease in the tumor size as compare with the control and the PLD group, but there were no significant differences between the PLD+HT group and the PLD+Ab(56°C, 49 s)+HT group. For a PLD dose of 3 mg/kg, the tumor sizes among the four groups were mutually significant. The level of reduction in tumor was PLD+Ab+HT > PLD+HT > PLD > control.

Conclusions: The combination of anticancer nanodrug and ultrasound thermal treatment could remarkably suppress cancer tumor growth with a minimum compromise of side effects. The strategy of using thermal ablation in locations that are not reached by nanodrug with mild hyperthermia shows a promising potential for the entire tumor treatment.

PPT20-008

Therapeutic Ultrasound-Induced Antitumor Immune Response and Enhanced by Immunostimulant for Tumor Treatment

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Objectives: To evaluate whether antitumor immunity is enhanced systemically by combining pulsed-wave ultrasound hyperthermia (pUSHT) and local injection of an immunostimulant, OK-432.

Methods: BALB/c mice were inoculated CT26-luc-GFP tumors on both flanks as a bilateral tumor model. The treated-side tumor underwent a 10-day treatment with pUSHT and/or subcutaneous injection of OK-432. The untreated-side tumor was regarded as a non-visualized small tumor to assess the degree of anti-tumor immune response. In a rechallenge tumor model, a rechallenge tumor was implanted contralaterally after the treated-side tumor experienced a 5-day treatment and then surgically removed. This model was designed to evaluate the establishment of a long-term active tumor-specific immune memory for preventing tumor recurrence.

Results: The tumor growth rate and growth activity of both tumors (treated- and untreated-side) were significantly inhibited with the OK+pUSHT combination treatment. Systemic anti-tumor effect seemed to be prolonged. The results of IF and H&E staining showed that there was a remarkable increase of NK cell infiltration in the tumor center and an earlier necrosis area for the combination treatment. Survival rates significantly increased for the OK+pUSHT group. In the rechallenge test, the volume of all reimplanted tumors decreased and then disappeared as compared with the control group.

Conclusions: Combining pUSHT with local injection of immunostimulant OK-432 may lead to indirectly activation of systemic antitumor immunity.

T21. Small Part & Vascular Ultrasound

Refresh Course

T21-14-IN01

US-Elastography in Differential Diagnosis of Benign and Malignant Thyroid Nodules

Vito Cantisani, MD, PhD

EFSUMB, Italy

Thyroid nodules are increasingly detected during thyroid evaluations or incidentally during ultrasound examinations for other clinical purposes or screening programs, leading to potential overdiagnosis and overtreatment; thus, the present thyroid nodules' epidemic represents a challenge for the clinical management, since the vast majority of discovered nodules end up being diagnosed as benign. Thyroid Imaging Reporting and Data System (TI-RADS) was proposed to facilitate understanding and communication of US reports among specialists. Furthermore, technology developments including CEUS and US-elastography have opened further prospects of ultrasound leading to the possibility to perform the advocated multiparametric ultrasound.

Assessing stiffness as indicator of malignancy, using either SE (strain quasistatic elastography) or SWE (Shear wave elastography), is recognized as a valid and useful additional tool to gray-scale and color Doppler US in thyroid evaluation. It may be performed with no patient preparationand dedicated equipment that supports elastography is required. Elastography is especially recommended as an additional tool to conventional ultrasound and to guide follow-up of lesions previously diagnosed as benign at FNA biopsy and can be used in combination with conventional US to improve specificity. To date the majority of papers and the meta-analyses present in literature showed US-elastography more accurate than Ultrasound with a few exceptions. However, what was clearly debated and reported is that to achieve reliable SE, adequate training, suitable cut-off values for both strain and SWE, adequate equipment and clinically appropriate examinations are necessary. Expert suggestions are to minimize pre-compression, carotid pulsation artefacts, to check the ROI size and positions, avoid areas with artifacts or with gross calcifications or cystic areas and instruct patients to cooperate properly.

There are still open and debated issues such as which is the most accurate and reproducible elastographic techniques; which is the role of U-elastography for thyroid nodules indeterminate at FNAC; which is the reproducibility of these techniques and how much thyroiditis may influence the US-elastography accuracy in thyroid nodules characterization. Limitations and perspectives will be presented.

T21-14-IN02

Ultrasound Features of Thyroid Follicular Adenoma and Carcinoma

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Objective: To review the ultrasound presentations of thyroid follicular neoplasm, and search for usable ultrasound features to distinguish the follicular carcinoma from follicular adenoma.

Materials and methods: We retrospectively reviewed cases with the diagnosis of thyroid follicular adenoma and follicular carcinoma. 97 patients (29 men and 68 women; median age, 50 years) with follicular adenoma and 28 patients (6 men and 22 women; median age, 47.5 years) with follicular carcinoma were enrolled. Ultrasonographic studies were reviewed by 3 experienced radiologists for interpretation the features of echogenecity, echotexture, cystic change, intranodal vascularity, peripheral vascular ring, halo, and calcifications of these cases. Chi-square and Fisher's exact test, and multiple logistic regression were used for analysis. A p value of less than 0.05 was considered as statistically significant.

Results: Presence of calcification (9 [9.3 %] of follicular adenoma patients vs 9 [32.1 %] of follicular carcinoma patients; $p = 0.005$), absence of halo (6 [6.2 %] of follicular adenoma patients vs 9 [32.1] % of follicular carcinoma patients; $p = 0.001$), and absence of cystic change (61 [62.9 %] of follicular adenoma patients vs 25 [89.9 %] of follicular carcinoma patients; $p = 0.008$) were more frequently associated with follicular carcinoma than with follicular adenoma. No significant difference in the age, gender, location of tumor, volume and size of tumor, intranodal vascularity, peripheral vascular ring, echotexure, and echogenecity of tumor between follicular carcinoma and follicular adenoma.

Conclusion: The ultrasound features of the thyroid follicular adenoma or carcinoma are generally similar, but presence of calcification, absence of halo, and absence of cystic change favor a follicular carcinoma.

T21-14-IN03

Core-Needle Biopsy for Thyroid

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In clinical obstetric ultrasound, the ALARA (As Low as Reasonably Achievable) principle is what should guide the end-user in his/her daily practice. Ultrasound is a form of energy that will cause effects in every tissue it traverses (bioeffects), most likely via two mechanisms: thermal and non-thermal. These effects are not necessarily harmful if certain rules, such as ALARA, are followed. ALARA is based on two very different approaches: some risk/benefit analysis of how much acoustic energy is tolerable to obtain diagnostic information and the precautionary principle which states that benefit must be proven before certain actions are executed. When comparing images obtained at various acoustic output levels, as docu- mented by on-screen thermal (TI) and mechanical (MI) index, it is evident that excellent clinical information may be obtained at very low outputs. Knowledge of clinical end-users continues to be sorely lacking both in the USA ad throughout the world.

T21-14-IN04

Application of Contrast-Enhanced Ultrasonography in the Evaluation of the Invasiveness of Papillary Thyroid Carcinoma

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Objective: To study the enhanced patterns of papillary thyroid carcinoma (PTC) on contrast-enhanced ultrasound(CEUS).To explore the relationship between the characteristics of enhancement and the invasiveness of papillary thyroid carcinoma.

Methods: One hundred and fifty-eightPTCs in 136 patients selected for thyroid surgery underwent conventionalultrasound andcontrast-enhanced ultrasound. The enhanced patterns were analyzed. To explore the risk factors of extrathyroidal extension and cervical lymph node metastasis.

Results: Univariate analysis showed that extrathyroidal extension was associated with PTC nodules size, contour bulging, contact with thyroid capsule observed by CEUS, centripetal enhancement and IMAX≥1. In multivariate analysis, contact with thyroid capsule observed by CEUS, centripetal enhancement and IMAX≥1 had a significant effect on extrathyroidal extension.

An age of <45 years, multinodes, size(>1.1cm), vascularity, IMAX≥1were significantly with lymph node metastasis in patients with PTC.

Conclusion: The preoperative PTC nodes characteristics on contrast enhanced ultrasound with extrathyroidal extension and cervical lymph node metastasis may serve as preoperative supplementary markers for the optimal surgery extent.

Key words: contrast-enhanced ultrasound; Papillary thyroid carcinoma; tumor invasiveness

T21-14-IN05

Ultrasound-Guided Radiofrequency Ablation of Low-Risk Papillary Thyroid Microcarcinoma: a Prospective Study

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Introduction: Low risk papillary thyroid microcarcinoma (PTMC) has a high incidence and a good prognosis. Surgical operation to all PTMC has been questioned as over treatment and active surveillance is recommended as an alternative. However, some patients have heavy mental burden and minimally invasive treatment could be used to eliminate PTMC and reduce the tumor related risk of growth and metastasis. The objective of this study was to evaluate the efficacy and safety of ultrasound (US)-guided radiofrequency ablation (RFA) of low-risk PTMC on a large scale of patients with over 1 year follow-up.

Methods / Case Presentation: 421 patients with 440 low risk PTMC were included in this study. US and contrastenhanced ultrasound (CEUS) examinations were performed before ablation. RFA was performed using the movingshot technique. The ablation area exceeded the tumor edge to prevent marginal residue and recurrence. Patients were followed at 1, 3, 6, and 12 months and every six months thereafter. US and CEUS examinations were used to evaluate the ablation area and cervical lymph nodes.

Results / Discussion: The mean volume reduction ratio (VRR) was 0.58 ± 0.09, 0.79 ± 0.07, 0.87 ± 0.05, 0.94 ± 0.04, and 0.96 ± 0.01 at 1, 3, 6, 12, and 18 months after RFA, respectively. Of all the nodules, 172 (39.1%) resolved in six months, and 415 (94.3%) resolved in 12 months. No residual lesion was detected in ablation area. 82 patients were followed up for more than 3 years and the rest patients were followed up for at least 1 year. During follow up, 4 patients had biopsy proved recurrent PTMC in other parts of thyroid tissue, which had diameter of 2mm-3mm and received a second RFA. 5 patients had suspicious thyroid lesions less than 2mm and continued follow up. 4 patients had biopsy proved cervical lymph node metastasis and received RFA of the lymph nodes. No distant metastasis was detected in these patients. And no major complications were encountered.

Conclusions: RFA can effectively eliminate low risk PTMC with a very small complication rate. Very low recurrent PTMC and cervical lymph nodes were detected, which could be treated by second RFA. RFA may be an alternative strategy for the treatment of low risk PTMC, especially in patients with heavy mental burden.

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Key words: ultrasound, radiofrequency ablation, papillary microcarcinoma.

T21-14-IN06

Thyroid and Perithyrodal Anatomy for Non-Surgical Treatment, Including Radiofrequency Ablation

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Ultrasound (US)-guided non-surgical treatments such as ethanol and radiofrequency ablation have been widely used in the treatment of thyroid nodules and neck tumors. For a safe and effective US-guided procedure, knowledge of neck anatomy, particularly critical structures such as nerves, is essential. However, most previous studies evaluated neck anatomy based on cadavers, computed tomography, or magnetic resonance imaging rather than US. Therefore, US based anatomy during US-guided procedure is necessary for non-surgical management. The aim of this lecture is to review US-based thyroid and perithyroid anatomy, focusing on its clinical significance in the use of prevention techniques for complications during the US-guided procedures. Knowledge of these areas may be helpful for maximizing the efficacy and minimizing the complications of US-guided procedures for the thyroid and other neck lesions.

T21-15-IN01

Adhesive Capsulitis of the Shoulder

Luis Fernando Chavarría Estrada
Imágenes Médicas Dr. Chavarría Estrada Costa Rica

Adhesive capsulitis is the primary cause of loss of movement of the shoulder, other causes being trauma, rotator cuff dysfunction and arthritis. It consists of a restriction in the range of both passive and active movements of the shoulder; Has a prevalence of 2-5% of the population and is more common in diabetic patients (11-20%). Primary adhesive capsulitis is idiopathic, but there are theories involving endocrinological, immunological, inflammatory and biomechanical mechanisms; while the secondary is of known cause, either intrinsic or extrinsic (systemic). Clinically it is characterized by three phases: painful, adhesive and resolutive. Distinguishing adhesive capsulitis and impingement syndrome can clinically be difficult, as symptoms, in addition to the dysfunction of the muscles of the rotator cuff, in conjunction with rupture can lead to adhesive capsulitis, or coexist both entities overlap.

Among the sonographic findings in adhesive capsulitis they are: hypervascularity and loss of echogenicity intervals rotator thickening coracohumeral ligament, sonographic evidence of movement restriction, fluid in the bicipital groove, fluid in the more lateral aspect of the subdeltoid bursa and integrity of the tendons of the rotator cuff muscles.

T21-15-IN02

US of Elbow, Wrist & Hand and Rheumatologic Disease

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With the advances of technology and software, and increased availability of high-resolution probes, ultrasonography (US) is nowadays widely used for clinical grounds and for research purposes in sports, rehabilitation as well as rheumatology. The number of publications addressing these areas of US scanning has grown rapidly in recent years. US is currently improving clinical examination of the elbow, wrist and hand, and, for its convenience nature, it is commonly used as daily practice by many clinicians. There is increasing evidence that US detects inflammatory diseases that is silent to clinical examination. Detection and classification of synovitis and the early detection of bone erosions are important in clinical decision making. Disadvantages compared to MRI, however, include small field of view, poor image presentation, and difficulty in demonstrating cartilage and deep joints in their entirety.

The color Doppler US provides a measure of neovascularization within the lesions. US is also an useful tool as the guidance of therapeutic injections and mini-invasive procedures. We would like to review the current status of US scanning of the elbow, wrist, hand as well as rheumatologic disorders.

T21-15-IN03

Ultrasound-Guided Interventional Procedures in Joint, Nerve, Soft tissue, and Spine

Yusef Sayeed, MD, MPH, MEng., CPH, CMRO, CME, DABPM
Mayo Clinic, Senior Associate Consultant, Mankato, MN

This session is specifically designed for health care providers who are exploring musculoskeletal ultrasound to enhance the evaluation and management of patients with soft tissue injury and complaints. Covering the nerve, joint, spine and soft tissue this course will present a systematic and focused assessment with ultrasound. The session will include video scanning and when and how to intervene. The participant will develop ultrasound pattern recognition of the major tendons, ligaments, nerves, and muscles surrounding various joints. The case discussions will focus on pathologies that are commonly encountered. In addition, the session will cover regenerative medicine topics including platelet rich plasma, stem cell therapy, and the current state of the evidence.

T21-15-IN04

Sonographic Evaluation of Meniscus

Luis Fernando Chavarría Estrada
Imágenes Médicas Dr. Chavarría Estrada Costa Rica

Meniscal pathology is one of the most frequent causes of gonalgia in the patient, with ultrasound and magnetic resonance being

the most used tools for diagnosis. Sonographically, meniscus are hyperechogenic triangular structures whose border does not extend beyond the bony joint edges, which are surrounded by hypoechoic lines corresponding to hyaline cartilage. Echographically, the rupture is evidenced as an anechoic or hypoechoic defect, which causes the structure of the meniscus. The meniscal degeneration is evidenced as protrusion or herniation of the meniscus on the articular line; This may or may not be accompanied by rupture. Meniscal lesions, seen by ultrasound, are classified into four grades, depending on the extent of the lesion. Some secondary findings in meniscopathies are: synovitis with or without the presence of pannus and / or joint bodies, hydrartrosis and meniscal cysts. Meniscal cysts consist of collections of mucinous material, most associated with meniscal rupture and myxoid degeneration, may be intrameniscal or parameniscal; they are more frequently located in the outer region. In relation to the ligaments of the knee, they can be sonographically evaluated for acute or chronic injuries, or rupture of the same. The most frequent injury mechanisms would be hyperflexion, valgus with external rotation and hyperextension. The triad of O'Donoghue, also known as an unhappy or unhappy triad, consists of the rupture of the medial collateral ligament, anterior cruciate ligament and meniscal rupture; Often associated with young men and the performance of sports, particularly football.

T21-15-IN05

Ultrasound Guided Prolotherapy

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Diagnosis and management of chronic musculoskeletal symptoms related to myofascial pain syndrome had been challenging for clinicians decades. Despite advances in understandings of its underlying pathogenesis and efforts to established practical diagnostic criteria widely accepted by clinicians, a widely accepted consensus for the effective management of such chronic condition had not been established yet. Management of refractory chronic musculoskeletal pain with ultrasound guided injection of dextrose demonstrated promising efficacy recently. However, there is inadequate documentation of positive clinical outcomes treating myofascial pain syndrome with dextrose injection. A variety of physical treatments included mechanical pressure, stretching, ultrasound, low-level laser therapy (LLLT), transcutaneous electrical nerve stimulation (TENS) and repetitive magnetic stimulation (rMS), nonsteroidal anti-inflammatory drugs (NSAIDs), muscle relaxants, needle-based interventions were applied, but effect limited. With increasing attention and interests in the clinical application of ultrasound-guided needle injection of bioactive agent as therapeutic alternatives to more invasive treatments for refractory chronic musculoskeletal pain. Dextrose injections, which is most commonly used in Prolotherapy by clinicians for decades, were discussed in the medical literature, including numerous retrospective series and randomized controlled trials. Theoretically dextrose injection leads to local inflammation mimicking the condition of tissue injury and stimulates the proliferation cascade, as observed in experimental animal models. Tissue repair and remodeling follow the transient inflammatory state, which is associated with short-term or long-term relief of patients chronic musculoskeletal symptoms. From our experience, US-guided high concentration dextrose injection for treating localized musculoskeletal pain syndromes refractory to other alternative treatments showed remarkable effectiveness, significantly reducing symptom intensities in the majority of treated subjects. We are going to demonstrate our experience on the treatment of chronic musculoskeletal pain using US guided prolotherapy.

T21-15-IN06

High Resolution Ultrasound of Brachial Plexus

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Brachial plexus is a network of spinal nerves which originates in the back of the neck and extend through the axilla and gives rise to nerves to the upper limb. The brachial plexus is formed by the union of portions of the 5th, 6th, 7th and 8th cervical nerves (C5 to C8) and first thoracic nerve all of which come from the spinal cord. This complex nerve formation innervates the muscles, articulations, tegument of the shoulder girdle and upper limb. It is highly vulnerable to trauma due to its large size, superficial location and position between two highly mobile structures neck and upper extremity.

The diagnosis of brachial plexus injury is done by clinical, radiological, electrophysiological and MRI. High resolution ultrasound is an excellent modality for evaluation of brachial plexus injury. It can very well visualize the cords of brachial plexus, level of the root avulsion and rupture of the cord by detecting disruption of the nerves and inflammatory chronic neuroma formation around the nerves. HRSG advantage is that it is easily available at bedside of the critically ill patient. Cost effectiveness of the investigation and metallic implants. Short focus, broadband linear transducers from 7 to 12Mhz are used for evaluation of brachial plexus in semi lateral position, coronal oblique position. Color Doppler is used to differentiate the brachial plexus in supraclavicular region from the neck vessels.

T21-15-IN07

US-Elastography of Superficial Organs: Update of Current Knowledge

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Reported by Hippocrates, palpation is an ancient diagnostic technique used in several fields and especially for thyroid and breast clinical evaluation. A firm or hard nodule consistency is associated with an increased risk of malignancy. A novel, evolving and fast expanding technology – elastography, based on the premise that pathologic processes such as cancer, alter the tissue stiffness, evaluates the mechanical features of tissue elasticity. By assessing hardness as indicator of malignancy, elastography has recently become an additional tool for superficial organs, such as thyroid, breast and salivary glands, in combination with conventional ultrasound (US) and fine-needle aspiration cytology (FNAC). Therefore, the current status of thyroid, breast and salivary gland neoplasm elastography, with regard to the techniques, applications, performance and limitations, will be discussed. US techniques available for breast lesion evaluation and their use in the diagnosis and their limits will be discussed; qualitative elastography with polichromatic score, semi-quantitative strain ratio measurements and shear wave elasticity and velocity measurements will be analysed. Tips and tricks for better results will be showed. Recent EFSUMB, WFUMB guidelines will be discussed. Clinical typical and atypical cases will be presented enhancing Take-home points.

T21-15-IN08

Evaluation of Cervical Lymph Nodes (Duplex Scan and Color Doppler US)

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Learning Objectives: 1) To become familiar with the normal and abnormal US imaging of cervical lymph nodes

2) To discuss the current literature and best practice recommendations for imaging evaluation (US) and FNA of cervical lymph nodes indications.
3) To present the best imaging criteria to distinguish benign and malignant lymph nodes.

Abstract

The distinction between malignant and non-malignant lymph nodes is a challenge in clinical practice. This is because a large number of patients present with enlarged lymph nodes, whose distinction is unreliable on physical examination. Characterization of lymph nodes is an important clinical issue, because lymph node metastasis is a critical factor in predicting prognosis.

US can provide valuable information in the preoperative work-up of head and neck cancers, since it is able to differentiate lymph nodes from other masses, and in some instances helps to indicate whether a given node is more likely to be normal or abnormal.

The best and more relevant signals of malignancy are: the abnormal hylo (absent, eccentric, or thin), size, heterogeneous echotexture (presence of necrosis and calcifications), hypoechoic echogenicity, altered vascularization on color Doppler (when vessels were mapped in the subcapsular region, with a radial distribution, tortuous, sprinkled, or mixed pattern); on spectral Doppler, the RI higher or equal to 0.77.

T21-15-IN09

Ultrasonography and Ultrasound-Guided Intervention of Salivary Glands

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An accurate diagnoses of salivary gland masse is clinically critical for optimal patients' management. A patient with sialadenitis, benign neoplasm or lymphoid hyperplasia may be treated conservatively. Patients with lymphoma may undergo chemotherapy or radiation therapy after systemic staging, while those with primary malignancy may be treated by surgery.

Ultrasonography (US) has become an optimal diagnostic tool due to its non-invasiveness, non-irradiation, multi-planar capability and high portability.

US-guided fine needle aspiration (USFNA) and US-guided core needle biopsy (USCNB) have also been used to increase the accuracy in diagnosing salivary gland masses.

On sonograms, significant difference can be found between the benign and malignant lesions of parotid gland with respect to the shape. The benign neoplasms and lymphoid hyperplasia are more likely to have homogeneous texture, well-defined margin and round or oval shape; while the malignancies and inflammatory lesions tend to be heterogeneous with indistinct margin and irregular shape.

USFNA is a well-accepted and widely used technique for the preliminary diagnosis of salivary gland masses. It is safe, fast, and well-tolerated. In the literature, on average, it has a high specificity (98%) but lower sensitivity (80%) in differentiating benign from malignant salivary gland masses. According to our reports, USFNA has a sensitivity of 71%, a specificity of 98%, and an accuracy of 94% in differentiating benign from malignant parotid masses. The corresponding figures for the USCNB are 98%, 100% and 98%, respectively. USCNB has positive and negative predictive values of 100% and 96%, respectively, in diagnosing malignancies.

Thus, a positive diagnosis by FNAC is reliable, but the false-negative rate associated with FNAC may be unacceptable. Accurate diagnoses and subtyping of lymphoma cannot be reliably made on the basis of cytology.

A meta-analysis report on five studies with 277 cases published between 2002 and 2009 showed that the sensitivity of USCNB is 0.92 (95% CI, 0.77-0.98) and the specificity is 1.00 (95% CI, 0.76-1.00). It is concluded that USCNB has a high accuracy and a low (1.2%) inadequacy rate for diagnosing salivary gland masses.

In this presentation, the techniques to avoid complications of USCNB will also be discussed.

T21-15-IN10

Cancer Detection in Human Lymph Nodes Using Quantitative Ultrasound

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Quantitative ultrasound (QUS) approaches using high-frequency ultrasound (HFU, >20 MHz) permit characterizing tissue microstructure with fine spatial resolution. In a recent study, 3D imaging and QUS methods were applied to detect metastatic regions of lymph nodes freshly-excised from cancer patients. Accurate determination of lymph-node status is of paramount importance for proper staging and patient management. These QUS methods could reduce the rate of false-negative determinations by guiding the pathologist towards suspicious regions in lymph nodes. 3D radio-frequency data were acquired from more than 400 freshly excised lymph nodes using a spherically focused transducer with a 26-MHz center frequency. QUS analyses based on the backscatter coefficient and envelope statistics were applied to the 3D RF data to obtain QUS estimates throughout each individual lymph node. Classification results suggest that these QUS methods may provide a clinically-important means of identifying small metastatic foci that might not be detected using standard pathology procedures.

T21-15-IN11

Scrotal Ultrasound for Assessment of Pain, Masses and Fertility

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Sonography remains the most effective imaging modality for assessment of scrotal pathology. This paper will explore the applications of ultrasound in a variety of clinical settings. Acute pain, chronic pain, palpable lumps, scrotal swelling, trauma, cryptorchidism and infertility assessment will be explored. A variety of potential pitfalls as well as some interesting normal variants and benign intra-testicular masses are considered. A protocol for extending sonographic assessment of varicoceles beyond the scrotum, particularly in the setting of infertility is presented. Many recent clinical cases are used to demonstrate the sonographic appearances of a comprehensive range of scrotal conditions.

T21-15-IN12

Ultrasound in the Assessment of Temporomandibular Joint Disorder

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Temporomandibular disorders (TMD) affect nearly 10-70% of population. It refer to changes in the temporomandibular joint (TMJ) articular capsule and muscles of mastication. In the past, the diagnosis of such a condition was limited to physical examination and plain radiological examination by means of radiography of the joint with the patient at rest and after opening the mouth, with lateral and panoramic views of the mandible. Up to date, ultrasound (US) is routine used to check the neck pathology. US can be also used to check the TMJ. The author would like to introduce the application of high resolution US in the TMJ assessment. The diagnostic performance of US to determinate TMJ disorder will be also reported.

Free Paper

OPT21-001

Feasibility of Ultrafast Doppler in Postoperative Evaluation of Hepatic Artery in Recipients Following Liver Transplantation

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Objectives: To determine feasibility of UltraFast Doppler in postoperative evaluation of hepatic artery (HA) in recipients following liver transplantation (LT).

Methods: This retrospective study was approved by our institutional review board. Over a 2-month period, 126 patients underwent 283 simultaneous conventional and UltraFast Doppler sessions using an Aixplorer scanner to survey vascular complications after LT. The Doppler indexes of HA (peak systolic velocity [PSV], end diastolic velocity [EDV], resistive index [RI], and systolic acceleration time [SAT]) by retrospective analysis of retrieved wave from UltraFast Doppler clips were compared with those obtained by conventional spectral Doppler. Correlation, performance in diagnosing the pathologic wave, and reproducibility were evaluated.

Results: The PSV, EDV, RI, and SAT of spectral and UltraFast Doppler measurements exhibited excellent correlation ($P < 0.0001$; $R = 0.884$, 0.875, 0.902, and 0.916, respectively). The sensitivity, specificity, positive predictive value, and negative predictive value of UltraFast Doppler for diagnosis of pathologic HA wave were 85% (95% confidence interval, 62.1–96.8%), 98.5% (96.2–99.6%), 81% (58.1–94.6%), and 98.9% (96.7–99.8%), respectively. Both conventional and UltraFast Doppler exhibited good to excellent inter-analysis consistency.

Conclusions: UltraFast Doppler is feasible for the postoperative evaluation of the HA in recipients following LT. Compared with conventional spectral Doppler, UltraFast Doppler values correlated excellently and yielded acceptable pathologic wave diagnostic performance with excellent reproducibility.

OPT21-002

Towards an Automatic Super-Resolution Image Based Method for Current 2-Dimensional Contrast Enhanced Ultrasound

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Objectives: This study aims to create a new automatic super-resolution image based method to be used with current contrast enhanced ultrasound imaging (CEUS) technology without the need for the generation of new imaging modes. The emerging field of super-resolution ultrasound imaging aims to detect and track single microbubbles to provide image data that reveals the detail of the vascular treewith micrometre resolution. Current 2-dimensional (2D) ultrasound provides significant challenges as the point spread function (PSF) and the number of MBs are highly variable not only between different image frames but also throughout a single image. This high variability is related to the orders of magnitude difference in blood volume between the largest (arteries) and the smallest of vessels (capillaries). The original hypothesis of this study was that a super-resolution image based method can provide up to 10-fold resolution gains compared to conventional imaging using video loops that are short in duration and are generated with existing CEUS modes. For this a new super-resolution image based method was developed. The method is based on a morphological based algorithm designed forfluorescence optical microscopy and incorporates both particle detection and trajectory linking and is also capable of handling large particle numbers (Wilson et al. Royal Soc Open Sci 2016; 3: 160225).

Methods: The study was designed to address the original hypothesis using an in vivo animal model. The ovaries from blackface ewes were exteriorised and the corpus luteum (CL) was imaged using CEUS. The CL is ideally suited for perfusion imaging studies as it is a highly angiogenic gland and has the size of a small solid tumour (Sboros et al. Ultrasound Med Biol 2011; 37: 59). Once the CEUS imaging was complete the CL was fixed for histological evaluation in order to identify large vessels and endothelium for comparison with the CEUS image data. An iU-22 Philips scanner with an L9-3 linear array probe (6MHz) was used to generate the CEUS images. Intravenous infusions of Sonovue MB suspensions generated images with high densities of single microbubbles. Video loops (typically 1 minute long) were collected. The image analysis method for generating the super-resolution data utilises 11 different parameters. Firstly, the method detects and localises microbubbles through the use of a particle probability image (PPI) which enhances their signal. The PPI is formed using non-local and statistical mapping of the original greyscale by measuring local contrast and particle size. In the second step microbubbles in consecutive frames are linked in order to generate their trajectories through the vascular bed. The nearest neighbour linking model used has been extended to include the morphology and intensity profiles of the microbubbles. The software is automatic in that after an initial manual training of the parameter set it is able to adapt to the image data.

Results: Several less than 1 minute long (less than 600 frames) video loops of CEUS image data from the CL were processed. The processing of each video loop using the method described above produces a particle/microbubble density and a velocity map. These were compared with the histological evaluation that determines the location of the lectin stained capillaries and the actin stained arteries. The processed images provided a 5 to 10-fold improvement in resolution when compared to conventional ultrasound. Entire arteries with diameters as small as 200μm were visualised with a less than 20% error in their measure diameter, compared to the spatial resolution of conventional ultrasound which is only 400μm in optimal conditions. In addition, small arterioles in the range of 40μm can also be visualised. Importantly, the super-resolution ultrasound ethod handled on average over 40,000 single scatter events per video loop. In individual image frames it was possible to identify up to 300 single microbubbles in the 1.5 mm x 1.5 mm region of interest of the CL.

Conclusions: The new image analysis method enables super-resolution maps of the vascular bed using short duration video loop data captured by conventional 2D CEUS, confirming our original hypothesis. The robust detection and linking of microbubbles enables the automatic handling of large microbubblenumbers in each image, which in turn significantly reduces the required duration of the examination. This method is ready to be tested in patient data.

OPT21-003

Augmented Velocity Index - A New Doppler Index to Reflect Arterial Stiffness

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Objectives: Augmentation index (Aix) of pressure waveform is a surrogate marker of arterial stiffness. Increased arterial stiffness is associated with hypertension, diabetes, dyslipidaemia and target organ damage. We developed a new Doppler index, Augmented Velocity Index [Avi= (velocity at late systole – velocity at early systole)/ (systolic velocity – diastolic velocity)] which simulated Aix of pressure waveform. We aimed to investigate the association of Avi of Doppler waveform with Aix of pressure waveform and cardiovascular risk factors.

Methods: Thirty-two healthy volunteers (20 men, aged 22-60 years) had ultrasound examinations of carotid arteries for measurements of Avi and intima-media thickness (IMT). They had applanation tonometry for the measurement of Aix of carotid pressure waveform. Fasting blood tests were performed for assessments of cardiovascular risk factors.

Results: The Avi of carotid Doppler waveform was significantly correlated with Aix of pressure waveform ($r=0.88$, $p<0.001$), age ($r=0.82$, $p<0.001$), IMT ($r=0.56$, $p=0.001$), systolic BP ($r=0.58$, $p=0.001$), diastolic BP ($r=0.64$, $p<0.001$), total cholesterol ($r=0.5$, $p=0.003$) and LDL ($r=0.4$, $p=0.025$). After adjustments for sex, BMI, age, blood pressure, plasma glucose, LDL, triglycerides and HDL using linear regression analyses, Avi was the only significant independent variable, and explained for 79% variances of Aix of pressure waveform.

Conclusions: The Avi of Doppler waveform was strongly associated with Aix of carotid pressure waveform. This new Doppler index may not only assess arterial stiffness of carotid arteries and its associated cardiovascular risk, but also assess vascular stiffness of visceral arteries which cannot be assessed by traditional measurement devices.

OPT21-004

Diagnosis and Management of Vascular Complications after Renal Transplantation - 15 Years of Experience

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Objectives: To present a single-center, 15-year (2001-2016) experience in ultrasound diagnosis and interventional radiology treatment of vascular complications after renal transplantation.

Methods: A retrospective analysis of 470 adult patients who underwent ultrasound examination(including Duplex Doppler and Spectral Doppler techniques) and, if applicable, interventional radiology treatmentafter renal transplantation was made. Ultrasound examinations were performed immediately after transplantationprocedure, and subsequently, at regular scheduled intervals or in presence of clinical indicators of worsened graftfunction.

Results: Vascular complications were observed in total of 1.7% patients ($n=8$), and comprised: arterial stenosis atthe site of anastomosis in 1.1% ($n=5$), renal vein thrombosis in 0.4% ($n=2$) and formation of arteriovenous fistulaafter graft biopsy in 0.2% ($n=1$) of patients. No cases of aneurysms or pseudoaneurysms were noted. All stenoticpatients ($n=5$) were qualified for endovascular treatment as graft-saving procedure. Drug-eluting balloonangioplasty was performed in 2 patients, uncoated balloon angioplasty in 1 patient, and balloon angioplasty withstent deployment was implemented in the remaining 2 patients. The immediate technical success rates, definedas complete reperfusion of the renal artery, reached 100% ($n=5$).

Conclusions: Vascular complications are rare occurrences in patients after renal transplantation. However, theypose a significant risk of graft malfunction or rejection. As reported in literature, renal artery stenosis proved to bethe most prevalent vascular complication in our Department as well. Endovascular balloon angioplastydemonstrated to be sufficient, highly-effective treatment technique of this pathology. If combined with stentdeployment, it should be reserved for treatment of the most problematic cases, i.e. artery dissection.

OPT21-005

Volumetric Evaluation of Carotid Artery Flow, Imortance of Compensatory Mechanisms

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Objectives: Carotid artery stenosis exceeding 70-80% is an indication for interventional procedure consideration. However two groups of patients – symptomatic and asymptomatic have to be evaluated separately. One of obvious mechanisms of different patient's performance is development of collateral circulation providing blood to affected region - patency of Willis circle vessels, which connects inflow of both carotid and vertebral arteries. It is fully developed in only 34,5% of patients.

Methods: In our work we concentrated on volumetric measurements of cerebral inflow in basic arteries – ICA, ECA & VA assuming that total flow volume in elderly patients does not exceed 800 – 1000 ml (ICA – 250-350 ml, VA-100-120ml / min). To establish range of normal values control group of 80 patients age>65 with no evidence of neurological/ vascular disease were checked. In a group of 100 patients with ICA narrowing >50% global flow in ICA, ECA & VA was estimated using Aloka F75 & ToshibaAplio500.

Results: In cases of major stenosis/obstruction of ICA significant increase of flow in nonstenosed vessels was observed in over 80% of patients, with absent or minimal clinical symptoms, vs. only 27% in group of symptomatic patients with stenosis >70/80%. The results are obscured by the fact, that atheromatic changes are present in different vessels providing blood to brain flow, causing different interactive alterations of brain perfusion.

Conclusions: Changing point of interest from degree of stenosis towards global cerebral inflow estimation can possibly change our indications for vascular invasive procedures by excluding patients with developed collateral circulation. On the other hand patients without sufficient compensatory mechanisms should be considered principal candidates for surgery, even in absence of clinical symptoms.

OPT21-006

B Flow Imaging for Varicocele

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Objectives: Varicocele can be reliably and commonly diagnosed with color Doppler sonography which shows dilation of the vessels of the pampiniform plexus and the blood reflux on valsalva maneuver. The purpose of this study was to determine the effectiveness of B-flow sonography in the diagnosis of varicoceles comparing with color Doppler sonography.

Methods: 33 patients (mean age 29.1 years; age range 16-74years) were enrolled which were diagnosed with a varicocele by scrotal sonographic

assessment with color Doppoler and B-flow sonography. All images were reviewed and graded independently by 2 observers using Sarteschi varicocele classification. In addition, clinical varicocele evaluation was also performed by urologists under varicocele grading system suggested by Dubin and Amelar for the clinical correlation. In statistical analysis, Wilcoxon signed rank test was used for comparing the varicocele grade evaluated by two sonographic methods and physical examination.

Results: Wilcoxon signed rank tests showed no significant difference between B-flow and color Dolppler sonography (P = 0.18), between color Doppler and clinical grading (p= 0.368), and between B-flow and clinical grading (p= 0.064). And, in some cases, B-flow sonographies detected blood reflux on valsalva maneuver were more sensitive than that of color Doppler examination.

Conclusions: Comparing color Doppler sonography, widely used in the diagnosis of varicocele, B-flow sonography showed no significant difference of the diagnostic yield. And sometimes it gives us more superior and sensitive image, avoiding the artifacts like aliasing or perivascular color artifact of color Doppler sonography in the diagnosis of varicocele.

OPT21-007

The Value of Ultrasound in the Diagnosis of Level Ii/ Iii Axillary Lymph Nodes and the Initial Exploration of an Ultrasonic Follow-Up Strategy after Alnd of Breast Cancer Surgery

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Objectives: Level II/III axillary lymph nodes are detected by ultrasound frequently after axillary lymph node dissection, which present as oval small nodes and are difficult to identify metastasis. The aim of this study is to evaluate the diagnostic value of ultrasound in level II/III axillary lymph nodes and to provide a follow-up strategy.

Methods: Cases followed by axillary ultrasound (AUS) including level II/ III axillary lymph nodes were divided into three groups: high suspicion of malignance, low suspicion of malignance and benign. Follow-up records were established including imaging changes of lymph nodes and their final consequences. Related risk factors were also analyzed.

Results: Overall, 425 cases were included, and 82 axillary metastases were found (19.3%). AUS had a positive predictive value (PPV) of 73.4% and a negative predictive value (NPV) of 100%. Size increases (>20%), shape alterations or new suspicious lesions in other regions might suggest lymph node metastasis. In the low suspicion of malignance group, 4.3% cases (13/306) were proven to be malignant during a follow-up shorter than 2 years.

Conclusions: AUS has a good PPV and NPV for level II/ III axillary lymph nodes in the follow-up after surgery. If lymph nodes with a low suspicion of malignance were detected, the strategy of AUS follow-up with every 3-6 months for 2 years was recommended, with annual follow-ups thereafter.

OPT21-008

Evaluation the Venous Pressure of Deep Vein Thrombosis of Early Phase in Lower Extremity by Ultrasonic Imaging

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Objectives: Conventional ultrasound measures the diameter and the velocity of the vein to evaluate early venous tension changes in deep vein thrombosis (DVT) of lower extremity. The accuracy and repeatability of conventional measurement are poor, because diameter measurement of vein are susceptible to not only respiratory and extrusion of edema from soft tissue, but also affected by limit of sampling angle when measuring venous flow rate by the color box. By applying the ratio of common femoral vein and cross-sectional area/cross-sectional perimeter (A/C), DVT early vein tension change was evaluated. The cut-off value method and diagnostic value of the A/C preliminarily was discussed. This study by measuring the value of cross-sectional area, pipe perimeter and their ratio among groups evaluate the value of venous tension change and provide certain reference basis for early clinical intervention.

Methods: Four-hundred and fifty orthopaedic patients (294 male V.S. 156 female) in our hospital were chosen to perform ultrasound examinations from June 2014 to April 2016, including 150 cases as normal control group, 150 cases as the flow reduced group, 150 cases as venous thrombosis group. Their average age was 36.8±11.0 years (8-67). Inclusion criteria includes that patients had no deep vein blood vessel diseases in lower extremity before. Cross-sectional area (A), cross-sectional perimeter value (C), the ratio of the two and the venous flow velocity of common femoral vein were measured and compared among groups. ROC curve was used to explore the diagnostic value of the A/C. The middle segment of the common femoral vein was selectecd as the measurement point where great saphenous vein enters. The standard of decreasing blood flow velocity was Vmean < 15 cm/s. Quantitative data using one-way ANOVA. P < 0.05 was considered to be statistically significant.

Results: For normal control group, the average value of cross-sectional area was 66.13±11.25mm2, the average value of cross-sectional perimeter was 28.84±5.14mm and the average value of A/C was 2.65±0.34. For flow reduced group, the average value of cross-sectional area was 94.82±12.57mm2, the average value of cross-sectional perimeter was 32.49±4.73mm and the average value of A/C was 3.26±0.27. For the venous thrombosis group, the average value of cross-sectional area was 151.63±17.41mm2, the average value of cross-sectional perimeter was 43.62±6.61mm and the average value of A/C was 3.94±0.53. There was significantly differences in the cross-sectional area between the normal control group and flow reduced group and venous thrombosis group (P<0.05). No significant statistical differences was found between flow reduced group and venous thrombosis group. With the development of venous thromboembolism disease gradually increase, A, C, and A/C were found to increase gradually and venous blood flow velocity gradually reduced. The cutoff point value of A/C was 2.91 to evaluate early vein tension change of DVT. The area under ROC curve of ratio of A/C was 0.891, sensitivity was 90.0%, specificity was 77.6%.

Conclusions: A/C quantified the variation in vein tension which was used to be an abstract concept. The value of A/C was more stable than the venous diameter and showed relatively small disturbance when assessing the venous tension. We provide new thinking and reference for early intervention of clinical preventing DVT.

OPT21-009

A New High Pulse-Repetition Frequency Ultrafast Sliding Compound Doppler Imaging: Fully Qualitative and Quantitative Analysis of Blood Flow

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Objectives: Ultrafast compound Doppler imaging (UCDI) can evaluate cardiovascular disease using high frame rates (Bercoff J. et al, 2011). However, the pulse-repetition frequency (PRF) in the UCDI method is limited since it leverages between the number of compounding angles and acquisition time. In this study, we present a new high PRF ultrafast sliding compound Doppler imaging (HSDI) to improve qualitative and quantitative blood flow analysis.

Methods: Unlike the UCDI method, the angle compounding in the HSDI method is consecutively updated so that there is no reduction in frame rates, Doppler PRF and sensitivity. In addition, by updating a new compounding set with a certain time difference (i.e., sliding

window step size, L), the HSDI method allows various PRFs with the same acquisition data to enable a fully qualitative, retrospective flow assessment. Therefore, it can provide advanced flow image analysis as well as full ROI quantification by producing various scaled Doppler at the same time.

Results: In the in vitro and in vivo studies with the various flow conditions (e.g., diseased vessels and diverse velocity flows), the HSDI method showed improved hemodynamics representations (i.e., transient complex flow dynamics and instantaneous flow disturbances from a laminar flow profile) without a loss of either temporal resolution or sensitivity. In addition, the measured root mean squared velocity error (RMSVE) exhibited below 2% for 9 angles with L of 1 to 9 compared to the UCDI method.

Conclusions: Consequentially, the HDI-SAC method is expected to provide more accurate and reliable hemodynamic assessments from qualitative or/and quantitative blood flow measurements.

OPT21-010

Ocular Ultrasound of Uveitis Which is Accompanied by Tuberculosis Together with Ultrasound Restores Sight for the Blind

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Objectives: Tuberculosis affects the eye either with active infection or as a result of immune reaction to the mycobacterium. One form of eye inflammations is uveitis that could be due to tuberculosis as underlying disease. The aim of this study was to describe ultrasound of uveitis which is accompanied by tuberculosis.

Methods: This retrospective study conducted at a private clinic in Bandung from April 2016-March 2017. Data were abstracted from medical records of uveitis which is accompanied by tuberculosis. Uveitis without complication with onset < 3 months of vision loss, were diagnosed by ophtlmologists, then tuberculosis and ultrasound were examined by one certified ultrasound internal medicine specialist. Abdominal ultrasound with convex probe 3,5-5 MHz and posterior ocular ultrasound with linier probe 9 MHz.

Results: N = 8, 18-35y,mean 26y, 7(87,5%) female and 1(12.5%) male. Posterior ocular ultrasound findings were: various vitreus opacities due to inflammatory debris. Abdominal ultrasound on small bowel, liver, kidneys and urinary bladder showed chronic process suggesting tuberculosis with strongly positive tuberculin test and high sedimentation rate. Anti tuberculosis treatment were performed for 9 months with good response. Inflammation of uveitis were resolved within first 1-5 months of the treatment period both clinically and follow- up with ultrasound.

Conclusions: Uveitis which is accompanied by tuberculosis had some characterictic ultrasound findings. Good clinically response of anti tuberculosis together with ultrasound follow-up restored sight for the blind.

OPT21-011

Clinical Advances in Pressure Ulcer Management by Ultasonography: The First Local Report

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Objectives: Wound ultrasonography (USG) is the first clinical application by nurses to enhance the standard of wound treatment in point of care. Unstageable pressure ulcers present as necrotic flaps partially or completely covered onto the wound. Commonly, the definitive treatment are debridement. It ends up frequently dressings; cross infection and unhealed wound. This paper evaluates the wound USG whereas it could effectively and conservatively manage hard-to-healed wound while minimize the unnecessary debridement.

Methods: For patient, who was diagnosed an unstageable pressure ulcer, will be recruited for the wound USG. The examined part will be draped prior scanning. The entire wound; included the circumferential peri-wound areas will be scanned in both transverse and longitudinal axis using the 12 MHz linear probe. All subjects will be examined for different tissue plane integrity in terms of echogenicity, vascularity, fluid collections, and level of treatments.

Results: In convenience sampling, altogether 10 patients (Age: 65-99) with 14 wounds recruited. They are sacrums(7); coccyxes(3) and trochanters(4). They appeared differently in echogenicity in terms of tissue integrity. In results; 6 wounds needed to be debrided; 7 wounds needed USG guided drainage without debridement and 4 wounds could be observed.

Conclusions: In forthcoming day, wound USG maybe the first investigation choice to assess anatomical structures and identify different wound treatment in real time. It can largely minimize the risk of sepsis by wound drainage and eradicate invasive debridement among poor morbidity patients.

OPT21-012

Value of Doppler Ultrasound in the Diagnosis of Dialysis Fistula - Related Vascular Complications

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Objectives: The aim of this study was to assess the value of doppler ultrasound in the diagnosis of vascular complications of arteriovenous (AV) fistulae in dialysis patients.

Methods: 53 patients were referred during 6-month period to the Department of Interventional Radiology and Neuroradiology, Medical University of Lublin for the ultrasound examination of the AV dialysis fistulae. There were distinguished two types of anastomoses within the group of examined patients. 38 subjects presented with end-to-side fistulae, whereas the remaining patients had side-to-side anastomoses. All dialysis fistulae were localized in the distal part of the forearm. Each examination was performed using LOGIQ 7, GE ultrasound scanner with 6-12 MHz linear probe.

Results: 12 cases of vascular complications were diagnosed among the study group including: 3 cephalic vein thromboses, 2 cephalic vein stenoses, 2 radial artery stenoses and 5 cases of the steal syndrome. All the patients diagnosed with either venous or arterial stenosis based on ultrasound examination were further qualified for PTA procedures.

Conclusions: Doppler ultrasound examination is the method of choice in the monitoring and diagnosing vascular complications of dialysis fistulas.

OPT21-013

Checkered Pattern on Color Doppler Sonography in Four Cases of Spontaneous Isolated Dissecting Aneurysm of the Superior Mesenteric Artery

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Objectives: To describe ultrasound findings and evaluating of checkered pattern on color Doppler in diagnosis of spontaneous isolated dissecting aneurysm of the superior mesenteric artery.

Methods: From 2015 – 2016, four cases were collected, male, age 48-60 years (mean age 53), all cases were performed ultrasound scanning first

and after that were confirmed by CT. Diagnosis base on B-Mode, TM-Mode and color Doppler ultrasound. All of them chief complained of mild pain in epigastric region during scanning. There were three cases with acute onset epigastric pain sharply, relieve by management but not in recovery. The first case lasted one month, the second case lasted two months and the third case had acute epigastric pain for 2 days accompanied vomiting, dyspepsia and abdominal distension, melena was in last case.
Results: The dissecting aneurysm happens at proximal part and extending to distal part, bigger than 10 mm in diameter, with intimal flap inside to split into true and false lumen. The flapping of intimal flap is not very clear. Two cases with false lumen contain thrombosis in which there was one case of obstruction due to fully thrombosis. The checkered appearance on color Doppler sonography appeared in three cases. Two cases were endovascular stenting, conservative therapy for one case and last case unknown its final result.
Conclusions: The checkered appearance on color Doppler sonography is typical pattern for dissecting aneurysm of the superior mesenteric artery which can help diagnosis in case of thin intimal flap, not clearly on B-Mode and TM-Mode.

OPT21-014

To Assess the Value Oo Three-Dimensional Power Doppler Angiography (3DPDA) In Quantitatively Evaluating Testicular Blood Flow In Patients with Testicular Torsion

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Objectives: To assess the value of three-dimensional power Doppler angiography (3DPDA)in quantitatively evaluating testicular blood flow in patients with testiculartorsion.
Methods: Bilateral testes of 8 patients with testicular torsion and 14 patients withepididymitis were examined by ultrasound , and 3D-PDA was performed. Data suchas vascularization index (VI), flow index (FI), and vascularization flow index (VFI)of the affected testis were compared with values obtained for the contralateral normaltestis.
Results: The VI, FI, and VFI of the testis with torsion were significantly lowercompared with values obtained for the contralateral normal testis (all $P<0.01$);meanwhile, the VI, FI, and VFI of the testis with epididymitis were significantlyhigher than values for the contralateral normal testis and that with torsion (all $P<0.01$).
Conclusions: 3D-PDA parameters were significantly different between testiculartorsion and epididymitis, and 3D-PDA might be an effective method for thedifferential diagnosis of testicular torsion.

OPT21-015

Relationship between the Abnormal Diastolic Vortex Structure and Impaired Left Ventricle Filling in Patients with Hyperthyroidism

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Objectives: Intraventricular hydrodynamics plays an important role in evaluating cardiac function. Relationship between diastolic vortex structures and left ventricular (LV) filling is still rarely reported. This study aimed to evaluate the evolution of intraventricular fluid dynamics during diastole in hyperthyroidism (HT), and to explore the alteration of hydromechanics characteristics with sensitive indices.
Methods: Forty-three patients diagnosed with HT were divided into two groups according to whether myocardial damage existed: simple hyperthyroid group (HT1, $n = 21$) and thyrotoxic cardiomyopathy (HT2, $n = 22$). Twenty-seven age- and gender-matched healthy volunteers were enrolled as the control group. Offline vector flow mapping (VFM model) was used to analysis the LV diastolic blood flow patterns and fluid dynamics. Hemodynamic parameters like area (A), circulation (C) and intraventricular pressure gradient ($\triangle P$) in different diastolic phase (early, mid, and late) were calculated and analyzed.
Results: HT2, with a lower E/A ratio and left ventricular ejection fraction (LVEF), had larger left ventricular end-diastolic diameter (LVEDD) and left atrium diameter (LAD) compared with the control group and HT1($P<0.05$). Vortex displayed a typical biphasic temporal course during diastole in these three groups. In early diastole, vortices of the controls were smaller and weaker than those of HT1, larger and stronger than those of HT2 ($P < 0.05$ for both). Vortices of these three groups increased in mid-diastole at the same pace and differences remained ($P < 0.05$ for both). Then vortices in HT2 developed so fast that exceeded the control group, but still below HT1 during the end of diastole. The intraventricular pressure gradient during early and mid-diastole ($\triangle P_E$, $\triangle P_M$) were higher in HT1 and lower in HT2 compared with those of the control group ($P<0.05$). However, the intraventricular pressure gradient ($\triangle P_L$) of HT2 increased and was higher than that of the control group in late diastole ($P < 0.05$). Good correlation could be found between C_E and E/A ($P < 0.05$), CM and $\triangle P_M$ ($P < 0.01$), C_L and FT3 ($P < 0.05$).
Conclusions: VFM can reflect the abnormal left ventricular filling by showing the changes of left ventricular diastolic vortex.

OPT21-016

Ultrasonography-Guided Antegrade Common Femoral Artery Puncture: Factors Associated with Puncture Time

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Objectives: We prospectively evaluated the feasibility and safety of sole ultrasonography (US)-guided antegrade common femoral artery (CFA) puncture, and also assessed the factors which may influence the CFA puncture time.
Methods: Forty-four antegrade CFA punctures followed by superficial femoral artery (SFA) accesses were performed under US-guidance alone in 34 consecutive patients (28 male and 6 female; mean age 65 years). The time between injection of local anesthetic and insertion of microsheath into the SFA was measured. CFA diameter, cutis thickness, distance between arterial access and CFA bifurcation, degree of CFA calcification, body mass index (BMI), and history of previous access were recorded.
Results: Technical success was achieved in 43 of 44 procedures (97.7%). The mean time for SFA access was 1.9 ± 0.6 minutes (range, 0.5–2.9). In one failure (41.6 in BMI, 7.8 min in access time) in which SFA cannulation was achieved with the aid of fluoroscopic roadmapping.There was a strong positive correlation between BMI ($r = 0.72$, $P < 0.001$) and access time, and a moderate positive correlation between cutis thickness ($r = 0.53$, $P < 0.001$) and access time. The rest of the variables had no significant correlation with the access time. Complication such as hematoma, pseudoaneurysm, or arteriovenous fistula was not observed.
Conclusions: Antegrade CFA puncture and subsequent SFA access performed solely under US-guidance was feasible and safe. There was a significant positive correlation between BMI, cutis thickness, and antegrade SFA access time.

Poster Session

PPT21-001

Ultrasonographic or CT Findings of Epidermal Cysts in the Trunk: Correlation with Surgical Findings

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Objectives: To evaluate the ultrasonographic (US) or CT findings of surgically proven epidermal cysts in the trunk.
Methods: A total of 63 patients were retrospectively evaluated. US or CT findings of epidermal cysts were compared with surgical findings in regard to location, size, shape, number, echogenicity, posterior sound enhancement, septa, and perilesional infiltration.
Results: All 63 patients (M:F=41:22; US in 36, CT in 27) had only one cyst, and they are located in buttock (n=27), back (n=17), inguinal (n=6), posterior neck (n=5), perineum (n=3), abdominal wall (n=3), presternal (n=1), and axilla (n=1). Of 36 patients with US, there were homogeneously hypoechoic mass (n=11, 30.6%), inhomogeneously hypoechoic mass (n=11, 30.6%), homogeneously hypoechoic mass with internal hypoechoic lines and echogenic spots (n=10, 27.8%) and homogeneously hypoechoic mass with internal echogenic spots (n=4, 11.1%). Posterior sound enhancement was noted in 29 patients (80.6%). Of 27 patients with CT, there were simple cyst (n=20, 74.1%) and abscess-like lesion (n=7, 25.9%). Overlying skin thickening (n=18), contrast enhancement of cystic wall (n=15), perilesional infiltration (n=10), and internal septa (n=8) were demonstrated. Internal contents of cysts were keratinous (n=38, 60.3%) or greasy (n=21, 33.3%) material.
Conclusions: Epidermal cysts showed homogeneous or inhomogeneous hypoechoic mass with posterior sound enhancement on US. In case of ruptured cyst, abscess-like lesion with wall enhancement and perilesional infiltration was noted on CT scan.

PPT21-002

Assessment of Ultrasound 3D Volume Automated Software in the Measurement and Follow-Up Assessment of Aortic Aneurysms Post Endovascular Aortic Repair (EVAR)

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Objectives: It has become standard practice in many sites for post-EVAR aortic aneurysms to have ultrasound surveillance to determine any changes in sac diameter. Ultrasound is subject to error margins in single plane calliper measurements of up to 10%. The aim of this study is to assess the accuracy of using 3D ultrasound and automatic segmentation software with regard to post-EVAR aortas.
Methods: 22 patients on the post-EVAR surveillance program had 3D datasets acquired of their aorta as well as the standard 2D measurements. The 3D datasets were assessed offline and manual measurements made. They were also assessed by an automatic segmentation tool which provided computer generated maximum AP and TC diameter of sac as well as "true" maximum diameter irrespective of which plane this was oriented.
Results: Automated segmentation of the post-EVAR aortic aneurysm sac was achieved in 34.9% of datasets, minor operator input was required in 36.3% and significant operator input required in 28.8%. Offline 3D dataset measurements, both manual and automatic, correlated well with 2D, correlation coefficient of 0.98 and 0.94 respectively.
Conclusions: Automated segmentation of Aortic aneurysms following EVAR is possible with no or minimal operator involvement in the majority of cases. Both 3D manual and automated measurements show good correlation with the 2D measurements.

PPT21-003

Chest Pain with Right Leg Weakness and Numbness: Aortic Dissection

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Objectives: Aortic dissection is a vascular emergency arising from a tear of the aorta intima layer. Up to one-third of patients may present with secondary symptoms caused by occlusion of branch arteries or compression of local structures. Here we present a case of aortic dissection detected by emergent ultrasound. With quick diagnosis and proper management, the patient recovered very well in the 3 months follow-up.
Methods: Case report and literature review.
Results: A 53-year-old female was sent to the emergency department due to sudden onset of chest pain. She also complained nausea, vomiting and right leg numbness and weakness. Emergent ultrasound revealed an intimal flap in the abdominal aorta. Computer tomography verified the diagnosis of type An aortic dissection involved ascending aorta, aortic arch, abdominal aorta and right common iliac artery. The patient received emergent surgery of aortic graft transplantation immediately.
Conclusions: Emergent ultrasound evaluation for aortic dissection can be performed rapidly and non-invasively. The diagnosis of aortic dissection should be established without any delay. Many studies noted a sensitivity of 67%-80% and a specificity of 99-100% for the diagnosis of aortic dissection by ultrasound with the visualized intimal flap. Apply emergent ultrasound to survey the possibility of aortic dissection is very reliable in the emergency Department.

PPT21-004

Clinical Utility of Preoperative Carotid Duplex Ultrasonography Prior to Operation for Peripheral Artery Disease

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Objectives: Carotid duplex ultrasonography (CDUS) is one of useful screening modality for internal carotid artery stenosis (ICAS) associated with vascular disease. We aimed to clinical utility of CDUS for neurological asymptomatic patient prior to operation for peripheral artery disease (PAD).
Methods: This study had institutional review board approval, and informed consent was waived. From January 2011 to December 2015, 231 consecutive patients (69.5±7.74 years, male 202 patients) who had undergone preoperative CDUS (Phlilips IU 22 , Philps Healthcare, Amsterdam, Netherland) for peripheral artery disease were included in this study and two radiologists assessed degree of ICAS by using European Carotid Surgery Trial (ECST) with consensus and severe (> 70%) ICAS or moderate ICAS (50-69%) ICAS with vulnerable plaque were defined as significant ICAS. To find out risk factors of asymptomatic significant ICAS, we analyzed demographics, co-existing medial conditions, lesion of PAD, and ankle brachial index (ABI) with multiple logistic regression model. For statistical analysis, data were tested by multiple logistic regression analysis and Chi-square test.
Results: Among 231 PAD patients, 35 patients had significant ICAS (15.1%). Multi-level lesion revealed significantly higher incidence of significant ICAS than iliac and infrainguinal lesion (22.5% vs. 9.4% vs. 8%: P = 0.016). Age (OR:1.05, 95% CI: 1.00-1.10: P = 0.035), Chronic kidney disease (CKD, OR:6.19, 95% CI: 1.47-26.06: P = 0.013) and cerebral vascular disease (CVD, OR:4.08, 95% CI: 1.09-15.30: P = 0.037) were significant risk factors of significant ICAS in multivariate analysis. Prevalence of significant ICAS according to ABI in PAD was not significant.
Conclusions: CDUS can be a useful non-invasive preoperative screening imaging tool for evaluation of significant ICAS in PAD patients with multi-level lesion, age, CKD, and CVA.

PPT21-005

Comparison of Popliteal Artery between Fracture and Nonfracture Sides by Ultrasound in Patients with Femur Fracture

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Objectives: Reduced physical activity and muscle atrophy is common in patients with femur fracture. The aim of this study is to assess whether immobilization after femur fracture surgery leads to atherosclerotic change in popliteal arteries.
Methods: Thirty one patients who admitted for rehabilitation after surgical treatment of femur fracture (13 men and 18 women; mean age, 77±11 years) were enrolled. We measured intima-media thickness (IMT) of popliteal artery in longitudinal and transverse plane bilaterally using ultrasound. And peak systolic velocity (PSV) was also evaluated by duplex-sono.
Results: Interval between fracture and exam was 67±60 days and 6 patients were taken total hip arthroplasty (including hemi-arthroplasty) and 25 patients were treated by internal pin fixation. Mean IMT of popliteal artery was thicker in the fracture side than in the non-fracture side (1.21±0.90 mm vs 0.93±0.68 mm) significantly (pp>.05). However, PSV was increased significantly (102.2±13.6 cm/s vs 94.6±4.9 cm/s) in patients with 1 month or more duration. Femur fracture and consequential immobilization affected popliteal artery IMT, and it was highly related to progression of atherosclerotic plaque formation.
Conclusions: Femur fracture and consequential immobilization affected popliteal artery IMT, and it was highly related to progression of atherosclerotic plaque formation.

PPT21-006

Sonographic Diagnosis of Takayasu's Arteritis in a Pediatric Girl

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Objectives: To illustrate the ultrasound features of Takayasu's arteritis in a pediatric girl.
Methods: Retrospective review of the ultrasound and magnetic resonance angiography (MRA) images of a 14-year-old girl enjoying good past health and presenting with recurrent syncope within three months was done.
Results: Greyscale ultrasound found diffusely and circumferentially thickened walls with smooth contour and moderately increased echogenicity along bilateral common carotid arteries. Doppler ultrasound found spectral broadening and color aliasing within the lumens of bilateral common carotid arteries. The ultrasound features are highly suggestive of Takayasu's arteritis. Magnetic resonance angiography (MRA) confirmed the ultrasound findings and showed the disease process was confined with the major branches of the aortic arch.
Conclusions: Takayasu's arteritis is a rare vasculitis. The clinical presentation of Takayasu's arteritis can be non-specific, especially in the pediatric patients. Ultrasound examination is useful as the initiation investigation of the carotid arteries. Characteristic long, smooth, circumferential arterial wall thickening of bilateral carotid arteries can suggest the diagnosis of Takayasu's arteritis and should prompt further investigation, especially MRA to delineate the extent of the disease.

PPT21-007

To Evaluate the Clinical Significance of Vertebral Artery Intracranial Stenosis Lesion in Different Parts

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Objectives: To evaluate the correlation between different site of intracranial vertebral artery(VA) stenosis and posterior circulation ischemia (PCI) sympto.
Methods: 319 cases of patients with unilateral VA stenosis of intracranial lesions confirmed by color Doppler flow imaging (CDFI), CT angiography(CTA) and(or) digital subtraction angiography (DSA):according to the relationship between lesion and posterior inferior cerebellar artery (PICA):before PICA 55 cases and after PICA 264 cases; according to whether the symptoms of PCI and magnetic resonance (MRI) results in symptoms of 132 cases and 187 cases without symptoms. CDFI analysis and record hemodynamic parameters and spectrum shape; evaluated the correlation between different site of intracranial VA stenosis and PCI symptoms.
Results: 1.The comparison of the ipsilateral VA and contralateral show that the peak systolic velocity (PSV), end diastolic velocity (EDV) and resistance index(RI), VA diameter (VAD) had significant difference ($p<0.05$); The ipsilateral VA intervertebral segment PSV, EDV and RI was significantly related to position of PICA ($P<0.05$), but not VAD($p>0.05$); 2.when the ipsilateral VA before PICA, intervertebral segment showed "spectrum unimodal" and after PICA showed "highresistance".3.VA intracranial stenosis and the symptoms of PCI are associated with moderately dependent (dependence coefficient =0.404, $p<0.05$).
Conclusions: CDFI is a noninvasive assessment of VA intracranial stenosis, and the symptoms of PCI in ipsilateral VA before PICA was more serious. All of that can provide reliable basis for clinical treatment and prognosis.

PPT21-008

Venous Dysgemia: The Detection of Cerebral Circulation Changes in Children by Doppler Ultrasonography

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Objectives: Assessment of cerebral venous hemodynamics in children and teenagers having cranialgia with updating cause-effect relations of venous dysgemia (discirculation).
Methods: A transcranial Doppler ultrasound examination.
Results: According to the data of Ultra Sonic Testing (in C- and PW-modes) 109 patients (at the age from 2 to 18) it was found that discirculation in the system of vertebral veins is linked with apparent extravasal effects on bloodstream in internal jugular vein (with vessel compression on the side of vasoconstriction registration) (r=+0.67), spasms of posterior cerebral artery (r=+0.63), coiling of internal carotid and vertebral artery (r=+0.20 +0.32). In case of discirculation in the system of internal jugular vein, the changes mentioned are interrelated with extravasal compression on the level of internal jugular vein surrounding soft tissues or compression in the bone canal (r=+0.76), anterior cerebral artery spasms, hyperperfusion of vertebral and posterior cerebral artery ($p<0.05$). Intracranial venous discirculation depends on the straightness of vertebral artery in the bone canal (r=+0.33), discirculation intensity on the level of vertebral vein (Vmax right r=+0.73, $p>0.05$).Vasoconstriction in the vein of Galen is accompanied by ipsilateral hypersthenia of vertebral, internal carotid and middle cerebral artery (reflectory changes), and is also interrelated with flexures, sigmoid coiling of internal carotid artery.The link of "headache syndrome" with accelerated venous blood flow along the veins of Galen turned out to be quite low (r=+0,22).
Conclusions: Main causes of children's vasoconstriction are either congenital pathology of cervical spine (with arcuation and tortuosity of bone canal), or "birth injuries with pseudo-luxation of cervical vertebrae".

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INSTRUCTIONS FOR CONTRIBUTORS

Aims and Scope

Ultrasound in Medicine and Biology is the official journal of the World Federation for Ultrasound in Medicine and Biology. The journal publishes original contributions that demonstrate a novel application of an existing ultrasound technology in clinical diagnostic, interventional and therapeutic applications, new and improved clinical techniques, the physics, engineering and technology of ultrasound in medicine and biology, and the interactions between ultrasound and biological systems, including bioeffects. Papers that simply utilize standard diagnostic ultrasound as a measuring tool will be considered out of scope. Extended critical reviews of subjects of contemporary interest in the field are also published, in addition to occasional editorial articles, clinical and technical notes, book reviews, letters to the editor and a calendar of forthcoming meetings. It is the aim of the journal to meet the information and publication requirements of the clinicians, scientists, engineers and other professionals who constitute the biomedical ultrasound community.

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