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World Federation for Ultrasound in Medicine and Biology (WFUMB)

The 13th Congress of the World Federation for Ultrasound in Medicine and Biology (WFUMB) is the joint meeting of the 23rd Congress of the European Federation of Societies for Ultrasound in Medicine and Biology (EFSUMB) and the 35th joint meeting of the Austrian (ÖGUM), German (DEGUM) and Swiss (SGUM) Societies for Ultrasound in Medicine. Here, IMAGING Management brings you a round-up of the hot topics and predictions for the future of ultrasound technology.

Subharmonic Imaging (SHI)

Subharmonic imaging (SHI) is a modality where pulses are sent at one frequency while echoes are received at half that frequency. Gas microbubbles are used as vascular contrast agents to improve the imaging quality of diagnostic ultrasound. Due to the large impedance between the gas and the surrounding blood, these agents enhance the acoustic backscattering and produce enhancement of both Doppler flow signals and greyscale echogenicity up to 27 dB.

During his talk, Prof. Goldberg said that SHI is a useful additional method to common HI. The main difference between HI and SHI image quality is that the latter suppresses almost all tissue signals for improved tissue-to-contrast ratios but with a lack of anatomical landmarks, making orientation difficult. SHI is most useful where flow detection is more important than mere anatomy, for example in characterisation of breast lesions or other potential malign masses in the human body. Treatment monitoring is also an area where SHI is used as well as when tissue-echoes dominate, such as in intravascular imaging.

Currently Prof. Goldberg and his team are working on a four-year clinical trial of SHI in BAD women with breast lesions, so the successful completion of this trial is obviously one of their major goals. In this study the efficiency of 3D SHI will be investigated for the first time, which has previously only been done in animal studies.

Breast Ultrasound

Breast ultrasound was a hot topic at this year's congress. Asked about the indications for breast ultrasound, leading expert Prof. Mendelson points out that there are standard guidelines that give a very clear answer: "The main indications, and a more complete list is available in the May, 2011 ACR (American College of Radiology) Guideline for the Performance of the Breast Ultrasound Examination, including confirmation and characterisation of abnormalities observed or suspected on clinical or self-examination, mammography or other modalities such as 'second look' ultrasound for MRI-detected lesions and guidance of percutaneously-performed interventional procedures. Additionally, screening of women with dense fibroglandular tissue and elevated risk of breast cancer (with density itself a risk factor), and extent of disease evaluations, including the axillae in newly diagnosed breast cancer patients, were recently added."

According to Mendelson, breast ultrasound is the modality of choice in characterising, assessing and providing histological diagnoses of masses that require biopsy. Prof. Mendelson spoke about current hot topics in the field of breast ultrasound: "For detection, a very hot topic is how and how often to provide screening. Many versions of automated scanners are in development, and research in this area is active. Important workflow concerns affect utilisation of breast ultrasound, and methods of efficient workstation review of 3D images are in development."

Another hot topic is the specification of ultrasound above and beyond the morphologic characters of a mass, which in general allow many assessments to be made confidently, by elastography and its modalities. In future examinations elastography will probably be an additional support for assigning masses that have been found accidentally in whole breast screenings, helping to reduce the number of false positive biopsies without significant impact on sensitivity.

CEUS vs. MS-CT in Abdominal Traumata

CEUS enables visualisation of the vascular system and internal bleeding, even when contrast agents are only applied in small doses. Contrast agents consist of microbubbles that are not absorbed by the vascular system and can be captured for several minutes by specific ultrasound applications. According to presenter Dr. Schuler who spoke at the congress: "CEUS works without any ionising radiation and with few side effects, and it can also be used in patients suffering from kidney dysfunction, thyroid disease or contrast agent allergy. In comparison to common ultrasound methods, CEUS requires additional software and specific ultrasound transferring devices."

MS-CT devices use x-rays and contrast agents and are standard equipment in the emergency unit of every major hospital. However MS-CT also has certain limitations, according to Dr. Schuler: "MS-CT is very useful to get a quick overview of the musculoskeletal system, lung, abdomen and brain/cranium but it also has the side effect of radiation exposure and is not suitable for patients with kidney dysfunction, thyroid disease, allergies, during pregnancy or in combination with the taking of certain drugs."

Both methods are very effective in imaging organ injuries, in which CEUS is even able to detect minor and active bleeding, while on the other hand the use of MS-CT brings advantages in the examination of the pancreas, spine and retroperitoneal musculature.

Ultrasound of Inflammatory Bowel Disease

Imaging of the abdomen plays a major role in detecting Inflammatory bowel disease (IBD) and in its surveillance. At the moment, the gold standard in diagnosing IBD is still colonoscopy, where morphology and biopsy provide information about the patient's condition. Ultrasound is also a very efficient way to detect IBD and is as accurate in terms of results as MR and CT.

Aside from being accurate in detecting the disease it without any ionizing radiation and has no known side effects, but Dr. Wilson, speaking on this subject, also points out that: "Excess radiation exposure from overuse of CT scans is now a well recognised outcome in this population. Furthermore, while highly valuable, colonoscopy is invasive and no patient will tolerate anything other than occasional repeat examinations, emphasising the need for non-invasive and accurate imaging techniques. Ultrasound has excellent spatial resolution allowing for visualisation of all of the layers of the bowel wall."

The last three decades have seen dramatic improvement in the capabilities of ultrasound equipment. Current hot topics in ultrasound include elastography, performed with direct visualisation, as compared with other types of elastography performed with a surface push. This may play a potential role in the differentiation of a fibrotic from an inflammatory stricture in IBD. Furthermore, the use of volumetric techniques now allows us to scan in 3D and BD and to show volumes of data rather than a simple 2D scan.

Tumour Assessment with CE-EUS

Endoscopic ultrasound (EUS) is an internal examination method that is performed close to the actual organ and allows higher imaging resolution than common ultrasound. Contrast enhanced endographic ultrasound (CE-EUS) is a further development of EUS, which uses special ultrasound contrast agents to make even the microvascular level visible to ultrasound imaging. Imaging at a microvascular level is particularly important in evaluating neoplasia due to the fact

Recent research in the field of contrast enhanced ultrasound concentrates on lymph node diagnosis, especially on optimising punctation indication for precise access to malign areas. Significantly, the development of lymph node-specific contrast agents could enhance the diagnosis of oesophagus, stomach and rectal tumours as in these cases the therapeutic approach is influenced by the level of lymph node infiltration. Development of new ultrasound contrast agents should also enhance imaging quality of lymph node tumours smaller than 3 - 5 mm, which are not sufficiently visible using other common imaging modalities, including PET.

According to Prof. Dietrich intense research is also currently being done on alternative uses of contrast agents: "Using contrast agents as a carrier for various substances will be a big topic in the future. Endosonografie is a perfect instrument to destroy microbubbles in the pancreatic area so that high dose medication is set free directly at the concerned organ.

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