Medical Solutions

For the daily and trade press

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Background information: Latest trends in Ultrasound

Diagnostic ultrasound uses high-frequency sound waves to generate images of soft tissue and organs and is the most commonly used diagnostic imaging test. Ultrasound can be used in almost all areas of the body and offers high diagnostic accuracy in a cost effective examination that can be performed at the patient's bedside. Further, as the examination is well tolerated by the patients and does not use radiation, it is suitable for repeat examinations and specialties such as obstetrics and pediatrics.

Ultrasound technology has been used in medicine for the past 60 years and has established itself as an indispensable tool in medical imaging and diagnosis. In cooperation with physicians and researchers, Siemens continues to work on the future of ultrasound. The newest trends in echocardiography are especially noteworthy:

***syngo* Vector Velocity Imaging Technology (VVI):**

The new *syngo* Vector Velocity Imaging (VVI) technology is unique - a new method that visualizes, measures and displays global and regional myocardial motion and mechanics by extracting vector movement from frame-to-frame differences in two-dimensional images. The myocardial motion is visualized by vectors with the vectors pointing in the direction of the motion and their length indicating the speed of the motion. This assists in the visualization of subtle wall motion abnormalities. By applying a second level of analysis to this Vector data a range of parameters can be calculated and displayed including time motion curves, strain and strain rate as well as segment timing. These can also be displayed in easy to interpret cardiac segment diagrams which give the clinician an

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immediate overview of the patient's status. VVI is angle-independent, which allows the determination of the true velocity of highly complex myocardial motion and mechanics and distinguishes it from the established Tissue-Doppler method. Also, as the images used for VVI are 2D ultrasound images, stored in the DICOM standard, no additional Doppler-acquisition is necessary and studies can be efficiently stored for comparisons to follow-up examinations.

syngo Auto Ejection Fraction Technology (EF):

With the new *syngo* Auto Ejection Fraction technology, automated, rapid and reliable measurements of left ventricular Ejection Fraction (EF) are possible on every patient. A sophisticated computer aided diagnosis tool, based on learning from a database of expert contours, provides a new level of accuracy in cardiac quantification. As the system has "learned" how to trace the endocardium, rather than relying on simple endocardial "edge detection" methods, Auto EF is more robust than previous methods, especially in cases of poor image quality and in anatomy such as papillary muscles. Since no manual tracing is required, workflow speed is accelerated and intra- and inter-operator variation is eliminated. *syngo* Auto EF technology is designed to save time, reduce errors and improve consistency among users.

AcuNav 8F:

The AcuNav Ultrasound catheter introduced a new era in Ultrasound imaging by providing the physician with ultrasound images from directly within the heart during therapeutic interventions, improving the guidance and therefore the outcomes of these procedures. At less than 3 mm in diameter, the new AcuNav 8F has a cross-sectional area that is 33 percent less than the AcuNav 10F catheter. As a result, this technology can be used for even smaller patients and can even be applied in the left ventricle. Despite its small diameter, the 8F catheter provides the same high resolution and image penetration as the 10F version.

Contrast medium and CPS technology:

Ultrasound contrast media consists of micro bubbles in a solution which can be injected intravenously. Micro bubbles are gas bubbles that are 1.5 - 3µm in diameter and are very

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strong reflectors of ultrasound as they are able to demonstrate differences in blood supply and thereby highlight tissue which is diseased.
There is a lot of excitement and expectation in contrast agent imaging in ultrasound, because ultrasound contrast agents are not based on toxic elements (such as iodine in the case of X-Ray contrast) and there is no ionizing radiation required.
Siemens already has an outstanding technology called Contrast Pulse Sequencing (CPS) for contrast agent imaging which uses specific transmitted sequences and processing methods to separate the echoes of the contrast bubbles from those of the tissue and results in a dramatic increase in the sensitivity and accuracy of the method.
Current applications of ultrasound contrast examinations include the detection and characterization of tumors and the assessment of the myocardium (heart wall) in patients at risk of heart disease.
Along with partners in the pharmaceutical industry, Siemens is working on the development of special contrast agents which would be targeted for specific tissues (such as cancer) to enable ultrasound to be used in Molecular Imaging.

Silicon transducer technology:

Conventional ultrasound transducers are constructed from a piezoelectric crystal block which is then “diced” into individual elements. This process is very time consuming, has a high failure rate and has limitations as to the size and weight of the transducers.
Silicon ultrasound transducers are made from silicon wafers, which are based upon integrated circuit fabrication processes, which result in miniature drum heads – seven drums can fit in the cross-sectional area of a human hair. Each drum operates as both an ultrasonic speaker and a microphone to transmit sound waves into the body and to receive the returning echoes, which are then used to form the image.
Silicon ultrasound has many advantages, such as the ability to process signals within the transducer, thus reducing size and weight of transducer and system, the ability to produce very large-area transducers for 3D and 4D imaging, or very small transducers such as for the next generation of catheter transducers.

4D technology

Following its three-dimensional imaging, Siemens has introduced a fourth dimension - the real-time display of 3D motions. Moving ultrasound volumes are made possible by

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combining the 3-Scape software solution with fourSight for real-time imaging. Physicians can evaluate moving images that allow for more extensive diagnoses. The application range includes obstetric and gynecological examinations, vascular structures and abdominal examinations.

Native TEQ (Tissue Equalization):

The requirement for the user to manually compensate variations in gain (image brightness) during an ultrasound examination is time consuming and results in variations in the results between users. NativeTEQ (NTEQ) effectively eliminates this problem as the adjustment of axial and lateral gain is performed automatically during the patient examination. This removes the potential sources of error that can occur through manual adjustment and increases the throughput by shortening the time required to adjust the image.

Looking back:

Mostly experimental in the beginning, medical ultrasound was developed for a number of different medical specialties at the same time. In 1953, the Swedish physician Dr. Inge Edler and the physicist Dr. Carl Hellmuth Hertz discovered that ultrasound waves could be used for cardiac examinations as well. With the help of Siemens in Erlangen, the first echocardiograph system was finally developed.
In the early 60's, Richard Soldner developed the Vidoson. For the first time, this system generated images in real time, enabling the first ever visualization of motion inside the body.

Today, continuously improving technology is the basis for further developments and innovations in ultrasound, which Siemens applies to provide more accurate diagnoses and support for the decisions that need to be met in the course of a physician's work.

Images for this press information are located on the Internet under:
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http://www.siemens.com/med-bilder/SequoiaC512_EncompassIII
http://www.siemens.com/med-bilder/Ultraschall-Bubbles
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Siemens Medical Solutions is one of the world's largest suppliers to the healthcare industry. The company is known for bringing together innovative medical technologies, healthcare information systems, management consulting, and support services, to help customers achieve tangible, sustainable, clinical and financial outcomes. From imaging systems for diagnosis, to therapy equipment for treatment, to molecular medicine to hearing instruments and beyond, Siemens innovations contribute to the health and well-being of people across the globe, while improving operational efficiencies and optimizing workflow in hospitals, clinics, home health agencies, and doctors' offices. Recent acquisitions in the area of in-vitro diagnostics – such as Diagnostic Products Corporation – mark a significant milestone for Siemens as it becomes the first full service diagnostics company. Employing approximately 36,000 people worldwide and operating in more than 130 countries, Siemens Medical Solutions reported sales of 8.23 billion EUR, orders of 9.33 billion EUR and group profit of 1,06 billion EUR for fiscal 2006 (preliminary figures). Further information can be found under: http://www.siemens.com/medical

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