

### Medical Solutions

For the daily and trade press  
Erlangen, 2004

#### Background Information: Ultrasound

Medical diagnostic ultrasound systems use high-frequency sound waves to produce images of soft tissues and internal body organs. Frequently, they are the first diagnostic imaging devices physicians buy for their private practice. This is due to a number of advantages: they are easy to operate, are known for their relatively high safety, are affordable and capable of displaying soft tissues.

Ultrasound diagnostics are a non-invasive examination method that operates without ionizing radiation. For this reason, it is frequently implemented not only in gynecology and obstetrics but also in almost all medical specialties. The spectrum of application includes abdominal examinations (liver, kidneys, spleen, gall bladder) and small organs, such as the breasts, testicles and the musculoskeletal system. Ultrasound is also suitable for urology examinations (prostate) as well as cardiovascular and intracardiac applications (applications for diagnosing the heart and the arteries).

The modern, high-performance ultrasound technology enables physicians to detect anatomical details and physiological processes that could not be displayed

with conventional ultrasound technology. The special characteristic of ultrasound is its fine differentiation of tissue structures. It facilitates the difference between healthy and diseased structures.

### **First pioneers**

Sonar is a technique that sends sound waves through water and observes returning echoes to localize and measure submerged objects. This method inspired early ultrasound investigators to explore ways to apply this concept to medical diagnosis.

Siemens began to develop its first ultrasound generator as early as in 1934. This generator was still used for therapeutic purposes. In May 1984, Karl Theodore Dussik and Wolf-D. Keidel reported at the congress "Ultrasound in medical application" in Erlangen about the first diagnostic ultrasound examinations in Europe.

In 1951, Siemens introduced the new ultrasound pulse generator type 1 which was used by many research teams as the basic device.

In 1952, Siemens developed the first echocardiograph world-wide with the two pioneers of echocardiography, namely Inge Edler and Hellmuth Hertz. At the same time, Rokuro Uchida and Toshio Wagai were involved in optimizing their A-Scan device in Japan.

In the following decades the ultrasound pioneers in the US contributed to the development of ultrasound through many innovations and important discoveries. The researchers learned to use ultrasound to confirm carcinoma and to display tumors in the body or in the tissue that had been removed. Forty years ago, on

July 29, 1965, the first ultrasound real-time device in the world, the Viduson by Siemens was implemented at the Women's Clinic of the University Clinic in Muenster. It opened up new perspectives for the physicians, because now they could see both pulsation and motion directly in the ultrasound image.

In Japan, the first Doppler system was used to measure blood flow. The introduction of the Spectra Doppler and later on the Color Doppler, blood flow could be shown in different colors to illustrate the direction of flow and speed.

Also, the first manually guided contact scanner for clinical applications, the second generation of B-mode devices and the prototype of the first manually-guided scanners with an articulated arm - early milestones in 2D ultrasound imaging - were developed in the US.

### **Watching vascular flow**

After its introduction as a medical imaging method in the mid-1960's, ultrasound technology developed rapidly. At the end of the 70's, medicine celebrated its second revolution: ultrasound imaging in real time.

For the first time, physicians were able to see moving life images of the region under examination. In the 80's, spectral Dopplers were introduced followed by Color Doppler sonography. Spectral Doppler is a method used to measure normal and abnormal blood flow in vessels and ventricles and display it in the form of curves.

With Color Doppler sonography, blood flow information is encoded in color. The color-coded Doppler image is then accurately positioned and superimposed on

the conventional black-and-white ultrasound image. This provides the user with the blood flow displayed in the area of examination.

### **Dynamics for the future**

The Doppler sonography measures the speed of blood flow. The blood flow in the vessels is shown “in connection with.” Information is provided about stenoses, occlusions, and normal variations in the vessels and the heart. To improve the analysis of complex anatomical structures, large-area panoramic displays and three-dimensional images can be shown at the computer. For a number of years now, ultrasound technology is offering the user a fourth dimension -the dynamic. Expecting parents and the physician can see the fetus for the first time in action in the uterus. Using a for 3D surface reconstruction or multiplanar reconstruction, cardiologists obtain a amore detailed anatomic display of the heart and clinical pathological processes.

### **Images from inside the heart**

Since the introduction of Acuson AcuNav ultrasound catheters in the year 2000 , physicians are able to generate ultrasound images from inside the heart. The 10-French catheter, which is about as large as spaghetti, as well as the recently introduced 8-French catheter , enable displaying the anatomy and physiology of the vessels and the heart, measuring the blood flow in all parts or the heart and displaying cardiological implants.

Through minimally invasive operations at the heart, the Acuson AcuNav ultrasound catheter acquires useful information and provides ultrasound images of high diagnostic quality. For echocardiographic experts, electrophysiologists and inverional cardiologists, the ultrasound catheter opens up completely new diagnostic and treatment paths for cardiac illnesses.

## **Ultrasound by Med**

Med develops and markets Sonoline and Acuson ultrasound systems. Siemens medical engineering leads in ultrasound systems of the premium class: in hospitals, clinics and private practice, approximately 700 000 diagnostic ultrasound examinations are performed with Sonoline and Acuson ultrasound systems by Med.

**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>