

Redefining Ultrasound

Pediatric Radiology Department in Jena Relies on Z.ONE from ZONARE

As the only pediatric radiology institution in the German state of Thuringia that employs a qualified personnel and has access to state-of-the-art medical equipment and all of the more advanced examination modalities, the pediatric radiology department of the Institute for Diagnostic and Interventional Radiology at the Friedrich Schiller University Hospital in Jena is recognized to be a national reference center for pediatric imaging. In response to the requirements that apply to radiation protection, one main focus is on procedures that, like ultrasound, are completely free from ionizing radiation.

The department's pediatric radiologists are DEGUM (= German Society of Ultrasound in Medicine) trainers on both pediatrics and radiology. They not only act as internal hospital experts on ultrasound exams in their own department, but also provide assistance to other departments and intensive care units with respect to sonographic consultation services on an increasingly frequent basis. Here, the situation in Jena with respect to space has proven to be a real problem due to the fact that the University Children's Hospital, with its pediatric radiology and ultrasound lab, are located around one kilometer away from the Perinatal Center and around eight kilometers from the Pediatric Surgery Hospital.

This means the institution was in need of an ultrasound system that could be used as a portable unit and yet be able to satisfy the broad spectrum of demands made of pediatric sonography. These range from CNS sonography to sonography of the thorax and abdominal organs to imaging of small lesions in the high resolution range of sub-millimeters (small parts, for example). High contrast imaging as well as high spatial and temporal resolution are of particular importance here. In addition, they also wanted to be able to use the system as a stand-alone unit with a large monitor that has all of the functionalities necessary in order to be able to dock onto the PACS (Picture Archiving and Communication System).

Z.ONE Quite Convincing

Following successful testing of the Z.ONE ultrasound system from ZONARE in Erlangen, Germany, the purchase of this system was made possible through funds that were made available by the *Kinderhilfestiftung Jena e.V.* "This system really convinced us thanks to how well it combines high-performance for meeting the diagnostic demands that apply to pediatric radiology which range from extremely premature infants to adipose patients and adults, but also its very convenient portability," explains Prof. Dr. med. Hans-Joachim Mentzel, head of Pediatric Radiology at the University Hospital of Jena.

Extremely Fast Image Formation

The high image quality that the basic B-mode provides and the enormous speed with which images are formed are both made possible by a technology called Zone Sonography. Echo data is no

longer processed line-by-line, but large zones are acquired instead. The raw data from an entire zone is stored on chips that were developed just recently so that post-processing of the images (Channel Domain Processing) can be performed later on. This means that the performance of the system is no longer dependent on the speed of sound propagation, but rather on the speed of the processor.

Rapid image formation is of particular advantage with premature and newborn infants, but also infants with whom breathing and unrest (crying, shaking) can result in movement artifacts in B-mode images. Speed is also of great advantage with Doppler examinations in which the triplex mode is used, in other words, B-mode, color and spectral Doppler are derived simultaneously.

Because less time is needed to acquire and form the images, satisfactory results can be achieved in the peripheral renal vessels even if the infant has a high breathing rate or happens to be crying. The experts in Jena view the ability to automatically adjust the sound speed to suit a specific child's body (Zone Speed Technology) and to quantitatively express the respective shift in the speed of sound propagation as a Zone Speed Index (ZSI) as the chance to be able to quantify the tissue structures, similar to elastography, while performing ultrasound examinations. The use of this technique is currently being reviewed in muscular sonography and in assessing the course of pediatric thyroid diseases.



University Prof. Dr. med. habil. Hans-Joachim Mentzel,
Head of the Pediatric Radiology Department at the University Hospital of Jena, Germany.

Performance Without Taking Up A Lot Of Space

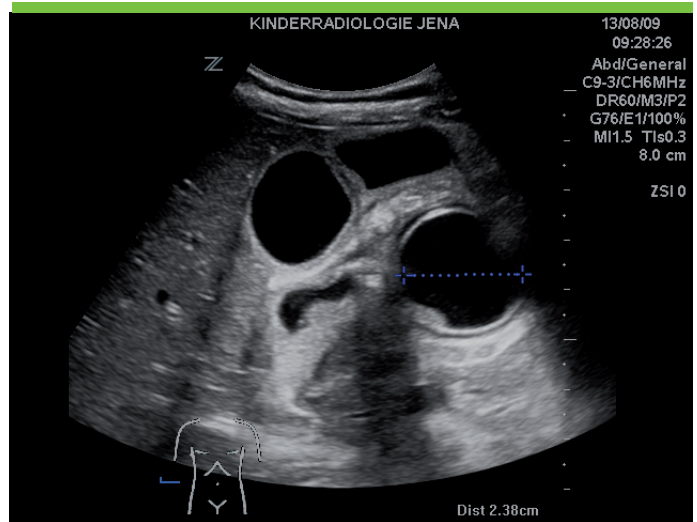
"The extremely high mobility that comes at no cost to the overall image quality is certainly one key advantage that the Z.ONE system offers our pediatric intensive care units and neonatal intensive care wards," Prof. Mentzel explains. The fact that the light base unit or so-called scan engine takes up so little space is of great advantage to intensive care units in which the incubators are lined up right next to each other and the remaining space is taken up by intensive care instruments, parents and relatives, and medical personnel, of course. "Having an extremely small ultrasound system, especially a system like the Z.ONE that requires only a very short time to boot (15 seconds), is of immense advantage, particularly in emergency situations, and allows for a high-quality ultrasound exam to be performed without getting in the way of other medical procedures," Prof. Mentzel adds.

In order to be able to take a much closer look at the extremely small structures in premature infants while they are still lying in an incubator, the scan engine can be connected to the larger monitors in the wards. Once the examinations have been completed, the raw image data that has been stored can be loaded up to the workstation and be optimized as usual, before it is transferred to the PACS. "Due to the high image quality and low susceptibility to artifacts, the images can be viewed in the highest quality on the PACS monitors found all over the hospital. This ability to display the results of ultrasound exams much better increases the overall acceptance of sonography and its results," Prof. Mentzel notes.

New Ultrasound Probes

The transducers available for use with the Z.ONE meet all of the demands of pediatric sonography. "Being able to use the high resolution hockey stick probe (L14-5sp Linear Array) that allows us to image the organs in a newborn with extremely high resolution has proven to be extremely helpful. This transducer is particularly well-suited for assessing the thyroid and testicles, but also the intestines. With a maximum depth of penetration of six centimeters, this is also an excellent transducer for use in examining the abdominal organs in newborn infants.

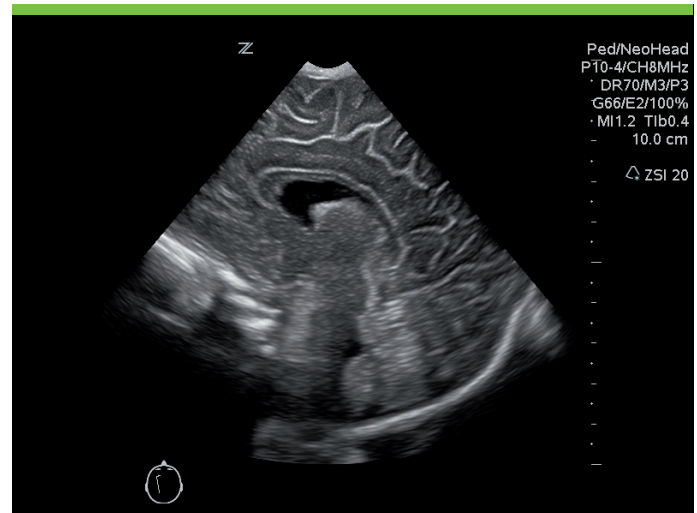
As part of a cooperation that we engaged in, we were also able to test the C9-3 Curved Array transducer that is perfectly suited for examining the abdominal region in newborn and premature infants. Due to its small surface area, it is quite easy to use on smaller bodies and offers a high-resolution B-mode image as a result of its high frequency. Thanks to its broad frequency range, these transducers can also be used to examine older children," Prof. Mentzel concludes.



Cross-sectional sonographic view

5-year-old girl who reported feeling pain in the epigastrium. Pancreatic pseudocyst with a capsule-like wall in the area around the head of the pancreas. Lateral fluid-filled duodenum and gallbladder.

By courtesy of Univ. Prof. Dr. med. habil. Hans-Joachim Mentzel, Pediatric Radiology, University Hospital of Jena, Germany.



Transfontanellar longitudinal section.

Thanks to the high resolution, all of the structures can be easily defined.

By courtesy of ZONARE Medical Systems GmbH, Erlangen, Germany.