

Ultrasound

By Tom Schaffner

More than just
pretty pictures

Recently, a woman entered the offices of the Fetal Diagnostic Center in Pasadena, Calif., requesting a 4-D ultrasound after she saw a television ad for the technology. When Gregory R. DeVore, MD, who specializes in maternal fetal medicine at the center, performed a comprehensive study that included a 3-D/4-D of the heart, he discovered a complex heart defect, which was not revealed on previous traditional ultrasounds.

"Had she not come in for the facial pictures," DeVore says, "she would have never had the chance for the heart problem to be identified. She came in for one reason, but because we were comprehensive, we found a major complex heart malformation."

This mother's experience isn't an isolated incident. 4-D ultrasound, considered a novelty by patients, holds real value for caregivers.

Before 4-D ultrasound, physicians had to wait a few minutes before a 3-D image could be reconstructed. "With 4-D, because volumes of data are created simultaneously, the image appears in real time," says DeVore.

"The 4-D gives you rapid 3-D volume sets that are helpful to examine the external anatomy of the fetus — the hands, the face, the back, the spine," he says. "It gives [physicians] a quicker way of assessing the 3-D data sets."

4-D ultrasound is 3-D in real time that displays the entire volume of the baby, allowing physicians and sonographers to analyze fetal motion and perform exams previously unavailable. 4-D allows physicians to visualize internal anatomy in real time. In addition, images are a golden hue, which provides a sharper image than the traditional black and white or gray scale.

For fetal examination, each of the dimensions adds a component that you can't have with the others independently, says DeVore. For instance, 2-D imaging looks at anatomy; color Doppler images blood flow through the heart's chambers. 3-D looks at a third plane that cannot be reconstructed by moving the 2-D transducer and two planes perpendicular, he says.

DeVore cites the fetal profile as a good example of using 3-D instead of a

traditional ultrasound. In the second trimester of pregnancy, the fetal head lies in the pelvis in a way that the anatomy can be measured, but the fetal face usually lies on the side of the uterus and can't be reached with a probe.

"We can't come in from the side of the mother because the stomach is pretty flat. By using the 3-D/4-D combination, in that third plane we can reconstruct a profile of the face in [a few] seconds," DeVore says. "We now have the opportunity to visually profile the fetus, looking for conditions such as a recessed chin and other birth defects."

The ability to image previously unreachable areas is helping the new technology catch on.

"With 4-D, there is no question that it is a spectacular technology, especially in some of the now faster frame rates that are becoming available," says Lawrence D. Platt, MD, director, Center for Fetal Medicine and Women's Ultrasound in Los Angeles.

Platt says that 4-D allows physicians to also monitor articulation in babies, check for cleft palates and potentially observe babies with spina bifida.

OTHER BENEFITS

In addition to reassuring parents of their baby's health, 4-D offers some other benefits. DeVore says that the quality of patient care in his practice has increased as a result of 4-D. "It helps us be as thorough as we can be and enables us to enhance the care we

give to our patients. For efficiency purposes, it enables us to decrease our examination time and add components to the exam to make our evaluation more thorough."

Although 4-D is used mostly for fetal images, the Jobst Vascular Center at Toledo Hospital in Ohio focuses more on the technology's use in vascular imaging. "The visualization of parts that cannot be seen in 2-D, such as plaques in the arteries and abdominal aneurysms, are better viewed in 3-D," says Khalil F. Dajani, PhD. "For follow-up treatment, we need to take a closer look at the volume of the aneurysm over time."

MISCONCEPTIONS

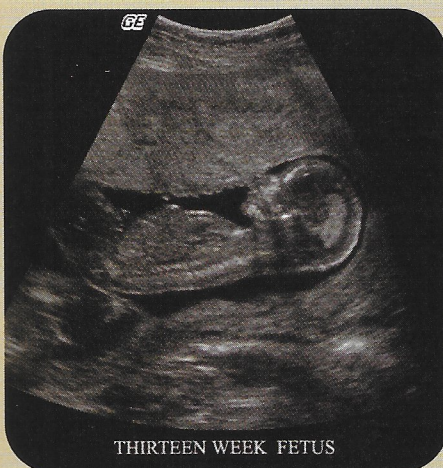
But not everyone is ready to accept 4-D technology without question. At this point, both 3-D technology and its 4-D offspring have not been sanctioned by the American Institute of Ultrasound in Medicine (AIUM). Since 1999, the AIUM has maintained that 2-D gray scale sonography is the primary method of medically indicated anatomic imaging with ultrasound, and that 3-D sonography should not be considered more than a developing technology. For now, 3-D's role is restricted to an adjunct of, but not a replacement for, 2D ultrasound. However, the organization will periodically re-evaluate 3-D's diagnostic value.

"People have a misconception that 4-D ultrasound and 3-D ultrasound replace traditional ultrasound. They don't," says DeVore. He says that 3-D/4-D add to 2-D, allowing physicians to focus on things that could not have been seen as clearly before.

DeVore says that at his facility, the patient gets a comprehensive ultrasound package, which includes 2-D, 3-D, 4-D, color Doppler and post-Doppler. A patient can't request only a 4-D, he says. Each component to the ultrasound package complements the others. "You have to do everything," DeVore says, referring to ultrasound process. "This makes you a more thorough diagnostician."

"Unequivocally, ultrasound for your entertainment has no place in the industry," says Platt. "Patients who come to us have to be referred by a physician. We'll do a complete exam that encompasses 2-D and sometimes 3-D as well."

Images courtesy of GE Medical Systems



From 2-D ...



... to 4-D

Other Applications for 4-D Ultrasound

Beyond pretty baby pictures, 4-D ultrasound systems can be used to research the following:

- Determining fetal age
- Analyzing fetal development
- Evaluating multiple and/or high-risk pregnancies
- Detecting fetal abnormalities
- Detecting structural problems with the uterus
- Detecting placental abnormalities
- Detecting abnormal bleeding
- Determining ectopic pregnancy and other abnormalities of pregnancy
- Detecting ovarian tumor/fibroids
- Locating the placenta

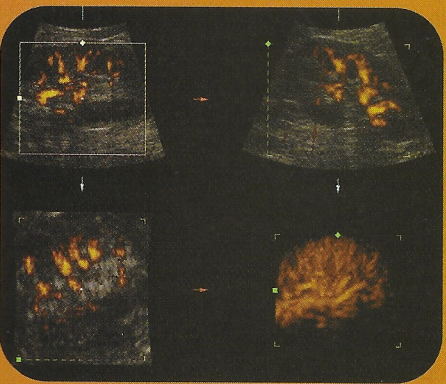
— GE Medical Systems



Abdomen



Transfontanel 3-D Angio



Abdomen images

A NEW FRONTIER

Hee-Joo Cheon, MD, partner with the CareNet Medical Group in Schenectady, N.Y., says that although she loves the technology and advantages that 4-D can offer, she still primarily uses 2-D. “4-D is still in its infancy. It’s still experimental.”

4-D technology has improved upon the traditional ultrasound, says Cheon, but there’s still so much to learn from it. “The capacity that it has is quite tremendous, but with any new technology, there’s a learning curve.”

The technology has limitations, says Cheon. She can’t provide 4-D to all of her patients because the timing of the appointment may not warrant it. She says that the best time to image the facial features of the fetus with 3-D/4-D is between 28 and 30 weeks, to allow for the fetus to develop. However, the best time to do a 2-D is between 18 and 20 weeks, at which point it might not be indicated to perform another ultrasound.

Cheon also notes that although she receives a fair amount of patient requests for 4-D ultrasounds, reimbursement problems have prevented many from getting

the images. Scheduling is another factor. Her office just doesn’t have enough time to fit as many 4-D exams into the schedule.

“Still, the best thing for standard of care is a 2-D image at 18 to 20 weeks,” Cheon adds. “And you can still see the most with that at this point.”

LOOKING AHEAD

4-D is opening a whole new vista for studying the fetus. “3-D/4-D has certainly opened an opportunity for patients to understand what we’re seeing in a much better degree,” says Platt. “If there is a malformation, 4-D allows us to really communicate to the patient what we see in a much greater way than we have in the past. Once you have that 4-D information, you have a whole data set that you can share with consultants, pediatric urologists and surgeons.”

— Tom Schaffner is the editor of RT Image. Comments on this article are encouraged and can be directed to tschaffner@valleyforgepress.com.

