Master Class
Know the Fetus

There is a widespread consensus that ultrasound is the clinical standard for the diagnosis of fetal anomalies, and a constellation of factors will ensure its central role into the foreseeable future.

Most importantly, both ultrasound technology and the expertise to perform and interpret it are now widely available. The technology also remains relatively inexpensive, compared with other modalities; its safety has been well established through both study and long-term experience; and it provides real-time visualization, as opposed to images acquired at a particular point in time. Overall, ultrasound should be the first technology employed in the evaluation of the fetal anomaly. Still, there are well-recognized limitations to sonographic evaluation. The ability to visualize structures—and thus, the accuracy of a diagnosis—is significantly compromised, for instance, in women who are obese. This is far from a trivial concern today, as the rate of obesity in the United States is high and climbing.

Sonographic evaluation also may be limited by fetal position. Even in an average-size woman, for instance, suboptimal fetal positioning can impair proper visualization of structures. Another common limitation is the descent of the fetal head into the maternal pelvis. Transvaginal ultrasound is an alternative approach, but the physics of the transvaginal transducer often prevents us from seeing in as many planes as would normally be desirable.

Ultrasound tends to be optimal during midpregnancy. Beyond this point, calcification of the fetal bone structure intensifies. Cranial ossification, for example, can substantially obscure the visualization of intracranial structures.

Finally, effective ultrasound evaluation requires fluid around the fetus. With oligohydramnios, the quality of the sonographic images is significantly compromised. All told, these limitations are not infrequent or inconsequential. Clinicians commonly encounter situations during the course of their work.

MRI Technique and Safety

Fetal magnetic resonance imaging provides excellent tissue contrast and is not limited by maternal obesity, skull calcification, or fetal position. It can image the fetus in multiple planes and accomplish this with a large field of view.

MRI can therefore play a valuable role when the findings from ultrasound are unclear or incomplete, or when there is potential for other anomalies that cannot be sufficiently visualized with ultrasound. MRI relies on the presence of the high water content of tissues, and on the magnetic qualities of the constituent hydrogen nuclei. When tissue is placed in the strong magnetic field of an MRI machine, the hydrogen nuclei or protons move into particular alignments with the applied magnetic field.

Once the protons are lined up, radio frequency pulses are applied, causing the protons to absorb additional energy and spin on their axes of alignment. When the radio frequency pulses are discontinued, the additional energy that the protons had previously absorbed is released. It is this released energy that is transformed into an image. The quantity of energy released will vary depending on the tissue characteristics, such as the relative water and fat content.

Unlike x-ray and CT scans, MRI does not use ionizing radiation. Numerous studies and reports, including studies of MRI technicians who become pregnant, have documented significant percentages of cases in which fetal MRI is indicated when there is potential for other anomalies that cannot be sufficiently visualized with ultrasound. MRI relies on the presence of the high water content of tissues, and on the magnetic qualities of the constituent hydrogen nuclei. When tissue is placed in the strong magnetic field of an MRI machine, the hydrogen nuclei or protons move into particular alignments with the applied magnetic field.

One of the greatest advantages of fetal MRI is its ability to provide added value and new information that was not heretofore possible using current ultrasound technology.

We have invited Dr. Ray Bahado-Singh, a professor of maternal-fetal medicine at Wayne State University in Detroit and an expert in genetics and prenatal diagnosis, to discuss fetal MRI in detail and to highlight how this new technology may further advance the diagnosis of fetal anomalies.

Dr. Reece, who specializes in maternal-fetal medicine, is vice president for medical affairs at the University of Maryland, as well as the John Z. and Akiko K. Bowers Distinguished Professor and dean of its school of medicine. He is chair of the Association of American Medical Colleges National Colleges of Deans for 2008-2009. He is the medical editor of this column.

Fetal MRI’s Leading Indications, Limitations

Magnetic resonance imaging offers excellent tissue contrast and is not limited by maternal obesity, skull calcification, or fetal position. It can image the fetus in multiple planes and accomplish this with a large field of view.

MRI is indicated when there is potential for significant change in diagnosis or in patient management beyond the initial ultrasound.

Several studies from both the United States and Europe have demonstrated the clear capability of MRI to significantly modify or alter diagnosis, patient counseling, and management.

In one study of 224 fetuses with central nervous system anomalies detected initially by ultrasound, Dr. Deborah Levine of Harvard Medical School and her colleagues showed that fetal MRI led to 49 major changes in diagnosis and 27 clear changes in management, compared with prior ultrasound. Suspected central nervous system anomalies—particularly brain anomalies—are, in fact, the most common indication for fetal MRI. There is some literature to support benefits of fetal MRI for other anatomical defects, but the literature provides the strongest evidence of MRI’s additional benefit for CNS anomalies. Beyond the CNS, the other two main clinical indications for fetal MRI are for evaluation of the fetal neck and chest.

Among the anomalies and conditions best evaluated by fetal MRI are the following:

- **Ventriculomegaly.** Dilatation of the cerebral ventricles is a relatively common finding by prenatal diagnosticians. Although it is usually well visualized with ultrasound, ventriculomegaly may be accompanied by other associated abnormalities that may remain undetected with sonographic evaluation. When ventriculomegaly is isolated with no other accompanying anatomical defects, the long-term prognosis is excellent. If there are associated abnormalities, however, the prognosis is significantly compromised, with much worse neurodevelopmental outcomes.

Fetal MRI can help identify those additional abnormalities. Studies from Europe and in the United States have documented significant percentages of cases in which apparently isolated ventriculomegaly was identified on the ultrasound, but was then found to be associated with additional anomalies on the follow-up MRI.

Even in cases with borderline ventricular dilatation, subtle but significant developmental abnormalities may be identified on more detailed examination by MRI. MRI diagnostics can facilitate better counseling and prognostication regarding outcome, and can aid in the timely development of management strategies.

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Prepregnancy Obesity: Risk Factor for Postpartum Depression

BY DOUG BRUNK

SAN DIEGO — Prepregnancy obesity is an independent risk factor for postpartum depression, a large analysis demonstrates.

Common pregnancy stressors such as divorce or separation or being involved in a physical fight also were found to increase the risk.

“So if a woman comes to pregnancy with a BMI of greater than 35 kg/m² who has psychosocial stressors, she may have a risk of postpartum depression of 40%-60%. Perhaps that population should be targeted, both for research and for clinical purposes,” she said.

After the researchers controlled for demographic, psychological, medical, and obstetrical risk factors, the overall adjusted odds ratio of postpartum depression was 2.87 for obese class II women and 3.94 for obese class III women.

In the PRAMS stressors component of the study, Dr. LaCoursiere and Dr. Varner found that common pregnancy stressors increase the risk of postpartum depression. For example, the adjusted odds ratio for postpartum depression among women who reported partner-associated stressors such as divorce or arguing more than usual was 2.61, while the adjusted odds ratio for those who reported traumatic stressors such as being homeless or being involved in a physical fight was 1.66.

The adjusted odds ratio for those who reported both types of stressors was 8.48.

Fewer than half of the study participants (44%) reported that their clinician asked about their mood during pregnancy, while 54% reported that they were asked about their mood during the postpartum period.

Dr. LaCoursiere acknowledged certain limitations of the study, including the self-reported height and weight data and the fact that while women who were being actively treated for depression were excluded, the questionnaire was not administered antepartum or immediately post partum. Therefore, she said, “this cohort may represent women who were depressed antenatally and continued to have antenatal depression into the postpartum period.”

Dr. LaCoursiere reported that she had no conflicts to disclose.

Obstetrics