Preface


Noam Lazebnik, MD Roee S. Lazebnik, MD, PhD
Guest Editors

Ultrasound imaging is relatively inexpensive, safe, real-time, and readily available in hospitals and clinics throughout the world. For almost forty years, sonography progressed steadily with advances in both clinical application and equipment performance. It is truly an indispensable tool in obstetrics for the diagnosis and management of many diseases, encompassing three generations of women and millions of studies.

At a given time, many new areas of ultrasound imaging are under development and investigation. Of these, volumetric ultrasound (three-dimensional [3D]/four-dimensional [4D] US) generated particularly great interest by the clinical community. Yet, despite decades of exploration, only during the past five years has volume sonography advanced to a practical state for routine diagnostic and interventional applications. Recent advances in computer technology and visualization techniques allow real-time reconstruction, visualization, and manipulation of volume data using inexpensive desktop computers. These continue to enable many physicians to explore the full potential of this modality for a variety of diagnostic and therapeutic applications.

The most clinically mature applications for volume ultrasound technology are within the realm of obstetrics. Often, a volume approach provides information that is not readily available using conventional two-dimensional (2D) imaging. Volume or surface rendering, coupled with multiplanner reformatted displays, allow a comprehensive review of fetal organs and skeleton. The ability to rapidly reorient the active view for optimal visualization of the target anatomy permits rapid identification of normal and abnormal structures. Numerous studies demonstrate the utility of volume ultrasound in obstetrics, often citing advantages compared with conventional 2D ultrasound. These include improved comprehension of fetal anatomy by the parents, allowing more informed decisions for management of the pregnancy; improved maternal/fetal bonding due to intuitive visualization of fetal features; improved identification of fetal anomalies; and greater accuracy in volume measurements to determine the size and extent of anomalies.

In this issue of *Ultrasound Clinics*, Bornstein and colleagues extensively review the technical and clinical aspects of performing a fetal neuroscan. The interested reader is referred to practical advice on imaging-based techniques and investigations, a comprehensive review by Pilu and colleagues, for additional information.[1] In another article, Lazebnik and coauthors discuss the utilization and advantages of 3D ultrasound technology in the evaluation of normal and common congenital spine and vertebral anomalies.

Proper diagnosis of congenital brain anomalies is challenging, even with the use of modern sonographic equipment. A high level of skill and expertise, as well as an understanding of the nature of the abnormality, are of utmost importance. Imaging-based information may drive the choice of prenatal testing (chromosome, DNA, culture). Prenatal diagnosis of neuronal migration disorders, while difficult, is possible using antenatal diagnostic sonography. Dr. Ritsuko Pooh, a leading researcher of sonographic fetal brain imaging, discusses neuronal migration disorders caused by the abnormal migration of neurons in the developing brain and nervous system. These include focal cerebrocortical dysgenesis, heterotopia,

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polymicrogyria, lissencephaly or pachygyria, and schizencephaly.

Intracranial cystic lesions are frequently diagnosed using fetal ultrasound. Although the most prevalent cysts are benign (choroid plexus and arachnoid cysts), the mere suspicion of a brain lesion during fetal life raises serious concerns for the prospective parents regarding the neurodevelopmental outcome of their child. Malinger and colleagues review the diagnostic approach and particularly the differential diagnosis and prognosis of intracranial cystic lesions identified in utero in the context of prenatal counseling.

Although fetal ultrasound is considered the standard of care in the evaluation of fetal anomalies, an understanding of the technology's limitations is important. These limitations include decreased visibility of fetal structures due to maternal body habitus, position of the fetal head, ossification of the fetal skull, and, in some cases, oligohydramnios. Fetal MR imaging is applied by many medical centers in addition to ultrasound in an attempt to further enhance the antenatal diagnostic process. The utilization of fetal brain MR imaging is discussed by Smith and Glenn, and is particularly helpful in the diagnosis of anomalies of sulcation, periventricular nodular heterotopia, callosal agenesis, periventricular white matter injury, cerebellar dysplasia, germinal matrix, and intraventricular hemorrhage during the second and third trimesters. This approach provides additional information for prenatal counseling and delivery planning.

Anomalies of the fetal brain are relatively common and have the potential to result in severe morbidity or mortality. Though much has been published regarding the fetal brain, less has been discussed about the fetal skull. Images of the fetal skull are routinely obtained during ultrasound examination. The frontal, parietal, thin squama of the temporal bones and occipital bones, which together form the calvaria, are visualized. The cartilaginous zones of articulation of these bones—the coronal, sagittal, and lamboid sutures—are visible, as well as the fontanelles (mainly the anterior and the posterior). By combining 2D multiplanner display and 3D-rendered images in the maximum mode, the various bones and sutures of the skull are clearly defined. The article by Sheiner and Abramowicz discusses the sonographic features of the normal and abnormal fetal skull utilizing 2D and 3D ultrasound technologies.

Fetal limb abnormalities are of utmost importance for prenatal diagnosis of fetal disorders and appropriate genetic counseling. Limb abnormalities may be isolated or found in association with other abnormalities. These may result from malformations, deformations, or disruptions, as well as a part of a dysplasia such as skeletal dysplasia. Sonographic image quality depends on many factors, including the patient's body habitus, quality of the ultrasound equipment, and operator skill. The article by Koifman and coworkers reviews a methodical approach to imaging the fetus with prenatally diagnosed limb abnormalities. This process enables the medical team to provide the mother and the family with information regarding the nature of the abnormality, differential diagnosis, prognosis, and management options.

Overall, ultrasound is an established and continually evolving modality for the evaluation of the fetus across many organ systems. As ultrasound technology evolves, so does our understanding of the diagnostic information it provides. We also continue to discover new techniques for image acquisition and methods for data manipulation. Ultimately, these developments lead to increased diagnostic confidence and thus benefit both patients and clinicians.

Noam Lazebnik, MD
Department of Obstetrics and Gynecology
University Hospitals of Cleveland
11100 Euclid Avenue
Cleveland, OH 44060, USA

Roee S. Lazebnik, MD, PhD
Siemens Healthcare
Ultrasound Business Unit
1230 Shore Bird Way
Mountain View, CA 94043, USA

E-mail addresses:
noam.lazebnik@uhhospitals.org (N. Lazebnik)
roee.lazebnik@siemens.com (R.S. Lazebnik)

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