

THREE DIMENSIONAL (3D) SONOGRAPHY IN THE EARLY DETECTION OF MORPHOLOGIC AND GENETIC DISORDERS

MILAN KOS¹, ASIM KURJAK¹

UDK: 376.36

¹ Medical School University of Zagreb, Department for Gynecology and Obstetrics, "Sveti Duh" General Hospital, Zagreb, Croatia

Over the past two decades, an ever increasing number of studies has appeared trying to predict fetal health in connection with morphological and functional development. Antenatal sonography is a method of choice in early detection of severe developmental disorders, genetic disease and malformation sequences before fetal viability. It enables us to avoid unnecessary damage and consecutive handicaps primarily related to these disorders.

Three dimensional sonography is the modest ultrasonic technology, offering respectable advantages comparing to the conventional two dimensional (B-mode) technology. Modern 3D systems are capable to generate surface and transparent views depicting the sculpture like reconstruction of fetal surface structures or the X-ray-like images of fetal skeletal anatomy. Main advantages of three dimensional technology in the early antenatal diagnosis include scanning in coronal plane, improved assessment of complex anatomic structures, surface scan-analysis of minor defects, "plastic" transparent imaging of fetal skeleton. With arbitrary sectional display in 3D-ultrasonography, the orientation of tomograms is unlimited, despite the limited probe manipulation or unadequate position of fetal structures. Multiple three dimensional reconstructions of stored images (surface and volume rendering) are the most impressive benefits of three dimensional scanning.

Embryonic developmental disorders related to the chromosomal and genetic disorders are at the top of interest within modern sonography. During the first trimester, three-dimensional "surface and sculpture like imaging" do include excellent morphological recognition and follow-up of physiological midgut herniation process and consecutive abdominal anterior wall visualisation. Following the possibilities of three-dimensional transparent mode imaging, the morphology related to nuchal translucency and cystic hygroma could be recognizable earlier than development of biometrically detectable nuchal thickening.

Besides impressive demonstrating of normal fetal structures, 3D ultrasonography is adding "new window" to the diagnosis of structural defects. Fetal face disorders such as cleft lip, dysplastic ear, facial dysmorphism, anophthalmia and proboscis are easier to depict with 3D surface mode. Facial deformities are one marker of chromosomal abnormalities, and 3D technology may be useful for increasing the selectivity of ultrasound screening and confirming normalcy. Similarly, the 3D surface mode enables sculpture like reconstructions of abdominal defects such as omphalocele or gastroschysis. Using this modality, the size and extension of the defect are precisely demonstrated. Surface rendering in 3D ultrasonography gives a clear display of normal extremities. Clubfoot, reversible or irreversible pathological angulation of the normal anatomical axis and other limb abnormalities are easy to define using 3D orientation. Three dimensional imaging is also helpful in assessing the precise relationship of the wrist, hand and fingers. Transparent mode of 3D ultrasonography allows imaging of internal structures, like the fetal skeleton, depicting its malformation in spatial orientation. Three dimensional sonography provides several advantages in evaluating fetal brain and neural tube defects. The level and the extent of defect can be more accurately determined by using simultaneous display of three orthogonal planes combined with volume rendered image. The spine may be evaluated along a curved line in order to evaluate the vertebral bodies in a transverse or axial plane. And finally, three dimensional neurosonography of neonatal brain represents one of the most practical benefits, enabling us detailed and repeated analysis of neonatal central nervous system.

Key words: Fetus, three-dimensional sonography, disorders