Clinical Application of Three-dimensional Ultrasound in Fetal Brain Assessment

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Aim. To clarify the usefulness of three-dimensional (3D) ultrasound in the assessment of the fetal head and brain, according to 3D ultrasound surface reconstruction, multiplanar image analysis, three-dimensional angiography, and volume calculation.
Methods. We examined 326 normal fetuses between 10 and 40 weeks of gestation using 3D ultrasound (Voluson, 530D, Medison, Seoul, Korea), mainly with transvaginal 3D transducer. Fetal head structures, such as skull, brain structure, and brain circulation, were presented by surface mode, multiplanar imaging mode, and three-dimensional Doppler mode. After automatic volume acquisition of the fetal head, image analyses were performed off-line, and 3D View software was used for volume imaging of the lateral ventricle and choroid plexus in randomly selected 30 normal fetuses. Seven fetuses with intracranial abnormalities were evaluated by 3D ultrasound functions.
Results. Surface mode of 3D ultrasound objectively depicted *in vivo* development of the cranial bones and formation of the cranial sutures and fontanelles in normal fetuses. Multiplanar image analysis of the brain structure presented a fetal brain in more cutting sections than conventional 2D ultrasound. Transvaginal 3D angiography was successful in 13% of normal fetuses and rotation of 3D circulatory image allowed the analysis of the intracranial vessels. Volume imaging showed the individual intracranial structures, such as the lateral ventricle and choroid plexus. Intracranial abnormalities were longitudinally evaluated by 3D ultrasound and objective images helped in reaching prenatal diagnoses.
Conclusion. Advanced 3D ultrasonography and software for volume analysis can provide additional objective information about the fetal skull formation, brain structure, and brain circulation.

Key words: *blood vessels; brain, ultrasonography; Doppler ultrasonography, color; embryonic structures; fetal ultrasonography; sonography, transvaginal Doppler; ultrasonography, Doppler, transvaginal*

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