3D atlas of human embryology

New insights in human development

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But the female mind has demonstrated a capacity for all the mental acquirements and achievements of men, and as generations ensue that capacity will be expanded; the average woman will be as well educated as the average man, and then better educated, for the dormant faculties of her brain will be stimulated to an activity that will be all the more intense and powerful because of centuries of repose. Woman will ignore precedent and startle civilization with their progress.”

Nikola Tesla, 1926
Condensation

A novel 3-dimensional perspective of the fetal ventricular system in the first trimester of pregnancy using Crystal Vue image-contrast enhancement and rendering software.

Case Notes

A 32-year-old nulliparous pregnant woman presented for a routine first-trimester obstetric ultrasound scan that demonstrated a viable intrauterine pregnancy with a crown-rump length of 67 mm (13 weeks and 1 day gestation). On 2-dimensional imaging using a WS80 Elite system (Samsung Medison Ltd, Seoul, Republic of Korea), all fetal anatomical structures examined appeared normal within the limitations of the examination and gestation. A 3-dimensional (3D) volume of the fetus was obtained by sagittal and coronal acquisition and examined using Crystal Vue and Realistic Vue software (Samsung-Medison, Korea) (Dall'Asta, Paramasivam, and Lees 2016), which revealed a novel 3D impression of the fetal ventricular system comparable to digitally reconstructed embryological models (de Bakker et al. 2016) (Fig. 1).

Fig. 1. Three-dimensional perspective of the first trimester fetal ventricular system
A: Coronal view with Crystal Vue and Realistic Vue™ software applied
B: Digital reconstruction of the ventricular system of a stage 23 human embryo from the 3D Atlas of Human Embryology (de Bakker et al. 2016)
C: Sagittal view with Crystal Vue and Realistic Vue™ software applied
D: Schematic drawing of the ventricular system as presented in the sagittal plane
The first trimester fetal central nervous system - a novel ultrasonographic perspective

Comment

The fetal central nervous system and in particular ventricular system, is usually difficult to examine in any great detail in the first trimester as it is rapidly changing. Furthermore, visualization of the anatomical complexity of the central nervous system is limited by image resolution (Monteagudo and Timor-Tritsch 2009). The technical challenges of imaging the fetal brain during the first trimester have been evidenced by the difficulty of implementing routine first trimester examination of posterior fossa intracranial translucency as a screening test for open neural tube defects (Chaoui and Nicolaides 2010). A further limitation is that thorough knowledge of both sonoembryology and the use of 3D multiplanar reconstruction and analysis are required to obtain diagnostic 3D images.

Crystal Vue and Realistic Vue™ are an image-contrast enhancement and rendering software particularly effective at enabling perception of depth whilst preserving context and surface information. As demonstrated in this case, they allow visualization of the entire fetal ventricular system in a completely new way and enable imaging of structures not usually seen using standard 2D or 3D methods. The relatively simple use of this software may help to improve our understanding of neurodevelopmental changes in the first trimester. In addition, it may provide insight into pathognomonic markers of ventricular system anomalies and thus enable identification and diagnosis of fetal central nervous system abnormalities well before the second trimester.

References