



volumetric ganglionic eminence assessment in fetal MRI challenges subjective assessment in CNS anomalies

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Objective

Failure of fetal interneuron migration arising from the ganglionic eminence (GE) may lead to various neuropsychiatric and neurodevelopmental disorders. Prenatal detection of anomalies within this transient fetal brain structure may improve the MRI phenotyping of neurodevelopmental diseases. This atlas-based fetal MRI study aimed to quantitatively assess longitudinal development of the GE and altered GE volume in fetuses with previously diagnosed abnormal GE volumes based on subjective assessment only.

Methods

This retrospective study investigated 17 fetuses (20 fetal MRIs, mean gestational age 26.3 weeks, SD 3.3) with subjectively enlarged ganglionic eminence with concurrent structural central nervous system anomalies based on assessment of experienced fetal neuroimaging experts. Three-dimensional volumetry was performed based on super-resolution fetal MRI and compared to age-matched neurotypical controls (94 fetuses, 100 MRIs, mean gestational age 27.2 weeks, SD 3.6).

Results

Among patients with subjectively enlarged GE, only 25% of scans were found to include patients with GE hyperplasia following 3D-volumetry, while 60% showed normal and 15% smaller GE volumes than healthy references. Most fetuses (80%) had increased total brain volume, while only 30% had increased intracranial volume mostly due to ventriculomegaly (75%). Brain parenchyma volume was enlarged in only 20%. No correlation could be found between GE volumes and volumes of ten other substructures of the fetal head.

Conclusion

The study demonstrated the unreliability of expert visual assessment of GE size, despite excellent examination conditions and emphasizes the necessity of three-dimensional volumetry. Specifically in patients with structural CNS anomalies quantitative fetal neuroimaging will serve as an emerging tool for deep phenotyping, which identifies abnormalities within the GE prior to the structural emergence of cortical malformations.

Figures

Top: Postprocessing of super-resolution fetal MRI data and volumetric brain assessment.

Left: Subjectively enlarged GE compared to an available healthy reference collective (Stuempflen M et al. UOG. 2023).

Right: 3D-renderings of a healthy fetus (top) and a fetus with hydrocephalus (bottom) – both fetuses had normal GE volumes.

