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Fetal brain development in congenital diaphragmatic hernia

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Objective

It is reported that many infants with CDH have evidence of brain injury on postnatal brain magnetic resonance imaging (MRI). It is not known whether this injury already occurs in utero. The objective of this study is to assess prenatal brain morphometry and cortical development in CDH using fetal MRI.

Methods

We retrospectively reviewed all fetuses with CDH followed between 2014 and 2021. Those who had brain MRI were included in the study. Foetuses who underwent prenatal MRI for disorders other than CDH, and had the brain included, served as controls. All fetuses were imaged using a 1.5T MRI scanner. The two groups were compared for the following variables: brain morphometry (fronto-occipital diameter, cerebral biparietal diameter, bone biparietal diameter, transverse cerebellar diameter, and anteroposterior and craniocaudal cerebellar vermis dimensions) and cortical fissure (CF) depths (parietooccipital, lateral and cingulate fissures) and insular depth. CF were measured and corrected by biparietal diameter (BPD), obtaining a ratio (CF/BPD) for each fissure measurement to perform the statistical analysis. Fetuses with known syndromes were excluded from the study.

Results

A total of 53 fetuses with isolated CDH and 49 controls were included in the study. Median GA at MRI was 32 wks both in CDH patients (range 24-36 wks) and controls (26-37 wks). Overall survival in CDH patients was 75%. We found no significant difference in terms of transverse cerebellar diameter, anteroposterior and cranio-caudal vermis length, parieto-occipital and lateral fissure depth. On the other hand, cingulate fissure was significantly deeper in CDH foetuses compared to controls (respectively 0.06 vs 0.04; $p<0.0001$). Insular thickness too (here reported as insular depth) was significantly reduced in CDH foetuses compared to controls (respectively 0.27 vs 0.28; $p<0.05$).

Conclusion

In this study we investigated brain development in CDH foetuses with a quantitative method and found some significant differences in brain morphometric parameters as compared to foetuses without CDH, in particular in insular thickness and cingulate fissure depth. These findings may be clinically important as both areas play an important role in the limbic system. However, further larger prospective studies are needed to confirm our findings and to analyse their clinical significance in the long term.