3435 - In-vivo 3D Magnetic Resonance Volumetric Analysis of Fetal Cerebellum: From normal to pathology (unilateral cerebellar hypoplasia)

M. Gianonini, M. Schaer, S. Tourbier, Y. Vial, M. Cagneaux, P. Hagmann, R. Meuli, L. Guibaud, M. Bach Cuadra

1 Department of Radiology, University Hospital Center (CHUV) and University of Lausanne (UNIL), Switzerland
2 Medical Image Analysis Laboratory (MIAL), Center for Biomedical Imaging (CIBM), Lausanne, Switzerland
3 University of Geneva, Switzerland, 4 Department of Gynecology and Obstetrics, University Hospital Center (CHUV), Switzerland
5 Hôpital Femme, Mère et Enfant (HFME), Lyon, France

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References
M. Gianonini1,2, M. Schaer3, S. Tourbier1,2, Y. Vial4, M. Cagneaux5, P. Hagmann1, R. Meuli1, L. Guibaud6, M. Bach Cuadra1,2
5 Hôpital Femme, Mère et Enfant (HFME), Lyon, France

Materials and Methods

1. Data
Imaging was performed on 2 healthy fetuses (26 and 28 GA) acquired at Lausanne University Hospital (CHUV) using a HASTE sequence (TE/TR = 180/7000ms) on a 1.5T Siemens Aera with resolution 1.125 × 1.125 × 3.6mm³ and on 8 fetuses (from 29 to 34 GA) from Hôpital Femme Mère et Enfant (HFME), using a SSFSE sequence (TE/TR =180/7000ms) on a 1.5T Philips with resolution 1.09 × 1.09 × 5.6mm³.

2. Image reconstruction
For each fetus, all available low-resolution stacks (at least three different orthogonal acquisitions) were reconstructed into a high-resolution image using the motion compensation and registration approach in [5].

3. Segmentation
Manual delineation of the cerebellum was done using MITK [6], primarily on the axial plane and with review of the coronal and sagittal planes. Volume computation was done as number of voxels by the voxel resolution and the separation into two hemispheres was done by the supervised extraction of the mid sagittal plane for each fetus.

Results

1. We first report the total cerebellar volume of our healthy data set as function of the GA (see here after, in red). We compare our values with those initially published in [1] by Grossman et al. Our findings confirmed data reported in there [2] and in previous studies [1] in which segmentation was based on low-resolution stacks.

2. We concluded, that, despite the differences in acquisition conditions and image resolution, volumetric results between different datasets can be compared and used together to increase statistical power when few dataset are available.

3. We reported a case of unilateral hemispheric hypoplasia, showing a significant decrease of one hemispheric volume using 3D MRI quantitative analysis. This suggests that quantitative volumes extracted from 3D MRI could be used as complementary tool to diagnose and evaluate pathologies of the cerebellum.

Discussion

- We study the cerebellar volume per hemisphere: healthy hemispheric volumes, left and right confounded, are in pink; the patient with cerebellar hypoplasia is depicted in green (healthy right hemisphere) and red (pathological left hemisphere). A polynomial fit on healthy population is estimated (solid blue) with the confidence margins at 0.05 significance level (dashed lines). We can observe that the hypoplasic hemisphere is not included within the confidence interval.

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