

REGIONAL HIPPOCAMPAL INVOLVEMENT IN PAEDIATRIC MULTIPLE SCLEROSIS: A RADIAL MAPPING MR STUDY

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Target Audience. Neurologists and Neuroradiologists.

Purpose. To assess how early hippocampal involvement occurs in multiple sclerosis (MS) and whether damage to this structure contributes to global cognitive impairment as well as to memory deficits, we investigated the patterns of global and regional hippocampal volume (HV) changes in paediatric MS patients, and their correlations with clinical, neuropsychological and MRI metrics.

Methods. From 53 paediatric MS patients and 18 healthy controls (HC), brain dual-echo and 3DT1-weighted images were acquired. Global HV was computed using a manual tracing procedure.¹ Regional HV changes were assessed using a radial mapping analysis.² Patients with abnormal performance in ≥ 2 tests of the Brief Neuropsychological Battery for Children³ were classified as cognitively impaired (CI). Global and regional HV changes were compared between groups and correlated with disease duration, EDSS, BRBC tests scores, T2- and T1-lesion volume (LV), normalized brain (NBV), gray matter (GMV) and white matter volumes (WMV).

Results. Global HV was reduced, bilaterally, in patients versus HC ($p<0.001$), but not significantly correlated with clinical and MRI measures. In patients, radial atrophy affected the cornu Ammonis (CA1), subiculum and dentate gyrus (DG) subfields of both hippocampi, mostly on the right side ($p<0.001$) (Figure 1). Radial hypertrophy of the DG subfield was found in both hippocampi, mostly on the left side (Figure 1). Significant correlations were found between regional HV changes and clinical and MRI metrics (p values ranging from <0.001 to 0.05). Twenty-one (39.6%) patients were defined CI. Global HV did not differ between CI versus CP MS patients. Compared to CP patients, CI ones had areas of radial atrophy of the subiculum and DG subfields of the right hippocampus ($p<0.001$); the opposite comparison showed that, compared to CI patients, CP MS patients had more significant atrophy ($0.001< p<0.01$) of the CA1 and subiculum subfields of the head of both hippocampi (Figure 2). Significant correlations were found between regional HV changes and memory, attention and language abilities (p values ranging from <0.001 to 0.05).

Figure 1.

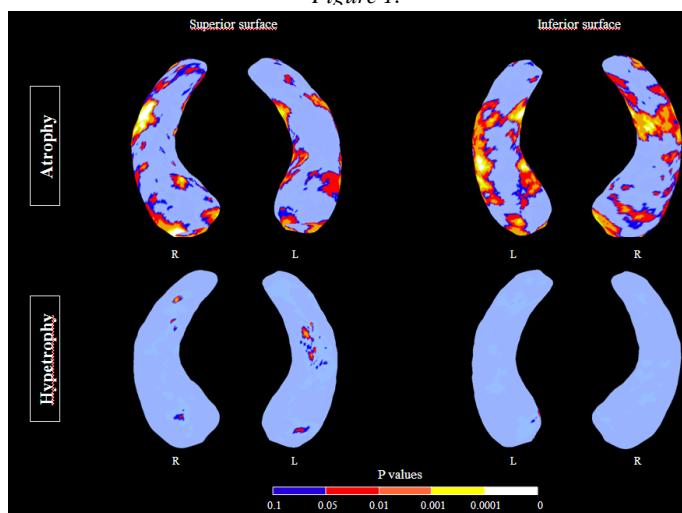


Figure 2.

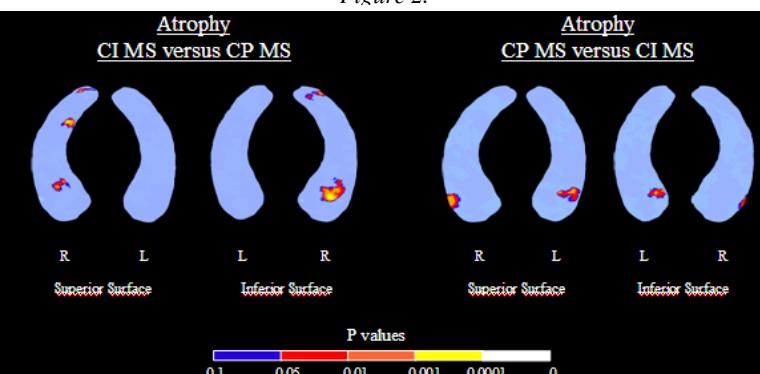


Figure 1. Distribution of regions with significant hippocampal atrophy and hypertrophy in MS patients compared to HC, expressed as colour maps of p values.

Figure 2. Distribution of regions with significant hippocampal atrophy between the two subgroups of paediatric patients with and without cognitive impairment, expressed as colour maps of p values.

Discussion. Hippocampal subregions have a different vulnerability to MS-related damage, possibly reflecting differential susceptibility to inflammatory insults and neurodegenerative processes of the hippocampal subfields. Hippocampal damage contributes to memory deficits and most likely to the global cognitive impairment of young patients affected by MS.

Conclusion. MR-based radial mapping are feasible for the development of reliable markers of disease progression in MS.

References.

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