Patterns of Regional Gray Matter Atrophy and Cognitive Impairment in Multiple Sclerosis Patients With Different Disease Phenotypes

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Introduction. Impairment of several cognitive domains is frequently encountered in patients with multiple sclerosis (MS). Voxel-based morphometry (VBM) allows identification of gray matter (GM) volume loss at a regional level.

Objective. To investigate whether cognitive impairment in MS patients with different disease phenotypes is associated with an involvement of different GM structures.

Methods. High-resolution T_1-weighted images were acquired from 73 MS patients (22 primary progressive [PP], 22 relapsing-remitting [RR], and 29 secondary progressive [SP] MS) and 39 healthy controls. All MS patients underwent an extensive neuropsychological evaluation, exploring different cognitive domains. Patients with deficits in more than two tests were defined as cognitively impaired (CI). VBM analysis was performed using SPM5 and an ANCOVA model, including age, gender and intracranial volume (ICV) as nuisance variables.

Results. Cognitive impairment was found in 53% of the patients. Compared to cognitive preserved (CP) RRMS, CI RRMS patients had GM volume loss in the deep GM nuclei as well as in several cortical regions in the frontal, parietal and temporal lobes. Compared to CP SPMS, CI SPMS patients had GM volume loss in several regions of the fronto-temporal lobes, bilaterally, the anterior cingulate cortex (ACC), and the hippocampus. Compared to CP PPMS, CI PPMS patients showed GM volume loss in the ACC, right superior temporal gyrus, right inferior frontal gyrus and right cerebellum. In SPMS patients, brain T2 lesion volume was correlated with regional GM volume loss. In SPMS and PPMS patients, regional GM volume loss was correlated with PASAT performance.

Conclusion. Distinct patterns of regional distribution of GM damage are associated with cognitive impairment in MS patients with different clinical phenotypes. Regional GM loss in CI MS patients is only partially correlated with the extent of T2-visible lesions, suggesting that it does not simply reflect secondary degenerative phenomena.

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