

## Individual voxel based analysis of brain magnetization transfer maps evidences high variability of grey matter injury in patients at the first stage of multiple sclerosis

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Background: Grey matter (GM) pathology partly underlies disability in multiple sclerosis. Various MR studies, based on group comparison have demonstrated a common pattern of grey matter (GM) injury in patients since the early stage of multiple sclerosis (MS). However, little is known about the potential variability of this early GM involvement which may determine the high variability of the functional prognosis.

Methods : Eighteen patients presenting with a clinically isolated syndrome suggestive of MS and 24 healthy matched control subjects were included in the study. Patients were imaged with a 1.5-T MR scanner (Magnetom; Siemens, Erlangen, Germany). MR protocol included T<sub>2</sub>- weighted sequences and Magnetization Transfer Ratio imaging (MTR) (transverse proton density-weighted spoiled gradient-echo sequences TR/TE:500ms/4.7ms , 44 contiguous slices, 3-mm thickness, 30° flip angle, 240-mm FOV, 256 x 256 matrix) performed without and with MT saturation (1.5-kHz off-water resonance, 500°). Statistical mapping analyses on MTR data were performed to compare GM MTR of each subject to those of the whole group of controls (two-sample t-test, SPM5). The statistical threshold was chosen as the maximum p value ( $p < 0.005$ , uncorrected  $k=10$ ) enabling to show no significant cluster when comparing any individual control with the whole population of controls. We determined for each patient the volume of GM injury in the whole brain and in the different brain regions.

Results : 83% of patients showed abnormal GM MTR in at least one brain region. The volume of GM abnormalities was highly variable and extends from 0.3 to 125 cm<sup>3</sup>. In the 83% of patients presenting GM injuries, 87% presented abnormalities in the temporal cortex, 80% in the frontal cortex, 80% in the limbic cortex, 73% in the posterior fossa, 53% in the deep GM, 47% in the parietal cortex and 47% in the occipital cortex.

Conclusion: This study demonstrates for the first time the high variability of GM injury present in patients at the early stage of MS. Statistical mapping of MTR data may be a relevant surrogate marker for prognosis of future disability in early MS patients.

