Presence of focal and diffuse cervical cord tissue damage in early relapsing-remitting MS: A magnetization transfer study

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Background: Magnetization transfer ratio (MTR) imaging is sensitive to tissue integrity in MS lesions and normal-appearing tissue. Previous studies including patients with well-established MS have shown a significant and disability-related reduction in MTR values in the spinal cord (SC). However, early damage and its predictive utility have yet to be investigated.

Objectives: The main goals of the study were: i) to investigate whether changes in cervical cord tissue quantified using MTR were already present in patients with early relapsing remitting MS (RRMS), and ii) to examine their relationship to EDSS scores at baseline (M0) and one year later (M12).

Methods: Thirty patients with RRMS (disease duration < 18 months) and 11 aged-matched healthy controls were included. Using 3T scanners in 2 centers, $0.7 \times 0.7 \times 3$ mm^3 axial T2*-weighted images and images with/without MT saturation pulse (mt1/mt0) were acquired, spanning from C1 to C7. The SC was automatically segmented on mt0. MTR maps were computed. Cervical SC lesions were manually labeled on T2*-w images and total lesion volume was calculated. T2* images and lesion masks were non-rigidly aligned to the MTR maps. Finally, mean MTR values were computed for each of the vertebral level in the whole SC, normal-appearing SC and lesions.

Results: The median EDSS score at M0 for the 30 patients was 0 (range: 0-2). A total of 54 cervical cord lesions were found in 21 patients. Mean whole SC MTR was significantly lower in patients compared with controls (33.7 pu vs. 34.9 pu, $p = 0.009$). When lesions were excluded, mean normal-appearing SC MTR remained significantly lower in patients compared with controls (33.8 pu vs. 34.9 pu, $p = 0.013$). Lesions exhibited varying reductions in MTR values compared with the surrounding normal-appearing SC (median = -4.1 pu; IQ = [-6.1,-1.8]). Only subtle and nonsignificant correlations were found between the mean whole SC MTR value and T2 lesion load ($R = -0.25$, $p = 0.18$), and between the mean whole SC MTR value and EDSS scores at M0 ($R = -0.18$, $p = 0.32$) and M12 ($R = -0.28$, $p = 0.19$).

Conclusion: MTR values for normal-appearing SC and lesions in patients with early RRMS already have a distinctive and variable pattern. No relationship with clinical status can be highlighted at this stage of the disease, owing to the low level of disability. Longitudinal analyses on an extended sample size are ongoing to evaluate the long-term prognostic utility of these values.