Linking Local Cortical Demyelination to Language Impairment in MS

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Background: Due in part to variability in lesion location within the central nervous system, MS can produce a spectrum of symptoms affecting motor, sensory, visual, and cognitive function. While motor and cognitive dysfunctions in people with MS (pwMS) have been extensively studied, language impairments have received comparatively less attention. These deficits are common in pwMS, with word-finding difficulty being the most frequent language complaint in early disease, yet the mechanism for this impairment is unclear. Cortical lesions are common and can be extensive in MS, and recent evidence suggests that cortical lesions may frequently be located in cortical regions implicated in language function.

Objective: To identify whether cortical lesions in regions known to be important for language are associated with language deficits in pwMS.

Methods: 23 pwMS within one year of diagnosis underwent 7T brain MRI and cognitive testing, including a validated task of lexical retrieval speed/word finding (Antonyms: participants rapidly state the antonym for multiple stimulus words; scores adjusted for reading speed assessed with control task). All included participants reported English as their first language. Cortical lesions were identified manually on T1 and T2* weighted images ($0.5mm^3$ resolution). 7T T1 weighted images were segmented into cortical parcels (FreeSurfer) according to the Human Connectome Project brain atlas, and for each participant, cortical lesions were mapped to individual parcels. Group comparisons were used to identify associations between lesion presence and language impairment. Cortical parcels of interest were chosen based on previously described subnetworks of regions active during semantic, syntactical, and speech processing.

Results: The analyzed cohort included 17 women and 6 men, mean time since diagnosis 0.9 ± 0.4 years, mean age 35 ± 9 years. Cortical lesions were identified in 19/23 (83%) of pwMS. 16/23 (70%) had cortical lesions in cortical regions implicated in language function. Presence of cortical lesions in language regions was associated with slower lexical retrieval speed/word-finding (Antonyms mean time 22.0 ± 2.8 vs. 31.4 ± 11.1 seconds, $p = 0.046$). Presence of cortical lesions in language regions was not associated with worse performance on other cognitive or language tasks, and neither total cortical lesion volume nor total white matter lesion volume were significantly associated with performance on any language task.

Conclusions: In early MS, cortical lesions in language regions may account in part for expressive language deficits (i.e., word-finding difficulty).