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Emma Van Praagh

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Investigating Connections between Sensorimotor Impairment and Functional MRI of the Spinal Cord in Multiple Sclerosis

In multiple sclerosis (MS), existing diagnostic tools, including clinical magnetic resonance imaging (MRI) and neurological disability scales, do not reliably represent disease severity or progression, warranting the investigation of improved imaging and clinical markers of disability, which are particularly important early in disease progression. Resting-state functional MRI (fMRI) in the spinal cord assesses alterations in gray matter functional networks at rest, which may provide insight into patient function. Therefore, the purpose of this study was to explore the connections between sensorimotor impairment and resting-state spinal cord fMRI findings, which indicate quantitative measures of neurological disability and functional connectivity respectively, as measured longitudinally in MS patients with minimal disability. Findings from sensorimotor testing and fMRI were statistically analyzed. Clinical MRI were visualized and interpreted to qualitatively identify pathologies. Statistically significant correlations between sensorimotor impairment and functional connectivity illustrate emerging connections between neurological disability and gray matter functional networks. This study is the first report of statistically significant correlations between sensorimotor impairment and ipsilateral functional connectivity in the spinal cord in MS. Notably, observations of leptomeningeal inflammation in spinal cord MRI visualization are heretofore undiscussed in MS literature, highlighting the importance of spinal cord MRI as a distinct form of prognosis in MS. These findings contribute to the exploratory knowledge of the functional network in the spinal cord in MS, particularly in minimal disability, emphasizing both compensatory and disabling damage as related to sensorimotor impairment. These analyses will aid in the identification of novel spinal cord fMRI markers for early MS prognosis.