Investigating Connections Between Sensorimotor Impairment and Resting-State Functional MRI of the Spinal Cord in Multiple Sclerosis

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In multiple sclerosis (MS), existing diagnostic tools, including clinical magnetic resonance imaging (MRI) and neurological status scales, do not reliably represent disease severity or progression, warranting the investigation of improved imaging and clinical markers of patient function early in disease progression. Therefore, the purpose of this study was to analyze quantitative sensorimotor testing and resting-state functional MRI (fMRI) in the spinal cord, which indicate quantitative measures of neurological disability and the hemodynamic response, respectively. Findings from sensorimotor testing and fMRI were statistically analyzed in minimally-disabled relapsing-remitting MS patients and age- and sex-matched healthy controls. Clinical MRI were visualized and qualitatively interpreted to identify pathologies. There were statistically significant differences between healthy controls and MS patients across measures of strength, sensation, and walking ($p < 0.05$). This study is the first report of statistically significant correlations between sensorimotor impairment and ipsilateral gray matter functional connectivity in the human spinal cord in MS ($p < 0.05$), which illustrate novel connections between neurological disability and gray matter functional networks. Notably, leptomeningeal inflammation in the spinal cord is heretofore unreported in MS literature, highlighting the importance of spinal cord MRI as a distinct form of diagnosis in MS. These findings contribute to the exploratory knowledge of gray matter in MS, particularly in minimal disability, emphasizing both compensatory and disabling damage as related to measures of patient function. These analyses will aid in the identification of novel spinal cord fMRI markers for early MS prognosis and management.

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