Resting-state and structural MRI metrics related to fatigue in MS, MOGAD and AQP4-NMOSD

MRI metrics and fatigue in MS, MOGAD, NMOSD

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ABSTRACT

Background
Fatigue is frequently reported by patients with multiple sclerosis (MS), aquaporin-4 antibody neuromyelitis optica spectrum disorder (AQP4-NMOSD) and Myelin-Oligodendrocyte-Glycoprotein antibody disease (MOGAD). This suggests a common pathophysiological mechanism underlying this symptom.

Aim
To assess linear relationships of resting-state functional connectivity (FC) and structural MRI metrics with Modified Fatigue Impact Scale (MFIS) scores in patients affected by MS, MOGAD and AQP4-NMOSD.

Methods
16 MS, 17 MOGAD and 17AQP4-NMOSD patients attending the Oxford NMO Service underwent MFIS scoring, and a same-day 3T brain MRI consisting of T1 weighted and resting-state functional imaging. Cortical thickness (CT), white matter and subcortical structures volumetrics and FC metrics were derived using Freesurfer and FSL. The linear relationship between the MRI measures and the total (t-), cognitive (c-) and physical (p-) MFIS scoring were assessed in the total cohort and compared across the three disease groups.

Results
Demographics were matched except for older age in AQP4-NMOSD (p=0.0007). Median t-MFIS score was 35.5 (range 3-72) and 42% of patients were classified as clinically fatigued. Across the entire cohort, we observed a significant positive relationship between the t-MFIS score and FC of the fronto-temporal network with left middle temporal gyrus and between the p-MFIS score and FC of the sensory-motor network with right precentral gyrus. A significant negative relationship was found between the t-MFIS score and FC of the left fronto-parietal network with left anterior parietal cortex. The correlation between FC of the frontal/default mode network with left frontal pole cortex and c-MFIS was significantly higher in MOGAD compared to MS and AQP4-NMOSD. MOGAD showed a significant negative correlation between c-MFIS score and normalized brain volume, normalized grey matter volume, average CT. In AQP4-NMOSD, a significant negative relationship between normalized nucleus accumbens volume and p-MFIS score was observed.

Conclusions
While functional alterations related to fatigue appear to be similar across MS, MOGAD and AQP4-NMOSD, we found structural MRI metrics to be mainly associated with fatigue in MOGAD.