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Neural correlates of fatigue in multiple sclerosis: a diffusion tensor imaging and transcranial magnetic stimulation study

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Fatigue is a common and specific symptom in neurological diseases described as an overwhelming feeling of extreme exhaustion, and it concerns the inability to sustain a force or work rate during exercise, often defined as "objective fatigue". Many patients displaying symptoms of physical and mental fatigue have no profound weakness, persistent or progressive cognitive decline or failure of peripheral neuromuscular function. This particular type of fatigue has been termed neurasthenia, frequently reported by patients suffering from multiple sclerosis (MS). The pathological substrate of behavioral deficit in MS is not entirely understood and may reside both in grey matter involvement and white matter injury, with derangement of white matter tracts architecture [1]. In order to investigate the role of connectivity alterations in the development of fatigue and behavioral impairment in MS patients, we examined 19 MS patients combining neurophysiological paradigm by means of Transcranial Magnetic Stimulation (TMS), cognitive assessment and Magnetic Resonance Imagining (MRI) with Diffusion Tensor Imaging (DTI) based tools. DTI is a noninvasive MRI technique [2] that can be used to probe the structural integrity of white matter through quantitative parameters, such as Fractional Anysotropy (FA). We were able to reconstruct the anterior thalamic projections and the caudate-cortical loop tracts, finding lower FA values in the right hemispheres, which results in weaker connectivity in patients compared with controls. In addition, we analysed the thalamic and basal ganglia volume, showing a significant atrophy of striatum and thalamus in fatigued patients, correlated to the neurodegenerative process of the striatum-thalamus loop.

We assume that fatigue and cognitive impairment could be related to micro-structural impairment of white matter tracts of the cortical-subcortical-cortical loop.

References

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Keywords

Fatigue; TMS; DTI; multiple sclerosis.

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