Spinal Cord Atrophy and Diffusion Tensor Imaging in MOGAD, AQP4-Ab NMOSD & MS

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Short title: Spinal Cord MRI in MOGAD, NMOSD & MS
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Introduction:
Spinal cord involvement is an important feature of aquaporin-4(AQP4) antibody(Ab)-positive neuromyelitis optica spectrum disorder(NMOSD), myelin-oligodendrocyte glycoprotein-Ab disease(MOGAD) and multiple sclerosis(MS). In this study we compare quantitative imaging findings in the spinal cord.

Methods:
Adults with spinal cord involvement and relapsing-remitting(RR) MS(n = 20), AQP4-Ab NMOSD(n = 20) or MOGAD(n = 20) were recruited at least six months outside of a relapse. An EDSS, pain scoring and c-spine MRI (3DT1, 3DT2, 2D axial T2*, DTI) were done. Twenty healthy volunteers(HV) underwent the same MRI. Lesions were manually segmented using FSL. Cross-sectional area(CSA) was calculated using Spinal Cord Toolbox(SCT). DTI scans were processed using FSL and then SCT. Statistical analysis was performed using R-Studio.

Results:
When comparing the groups, the MOGAD group had no residual lesions, and did not show a significant reduction in either CSA or FA.

The NMOSD group showed the most significantly reduced CSA($p=0.0288$) and reduced FA($p=0.0085$) compared to HV. This was driven by those with cervical cord involvement; those with an unaffected cervical cord had values comparable to HV. NMOSD was also an independent predictor of pain.

The MS group had a significantly reduced FA($p=0.0204$). There was no difference in lesional FA between the NMOSD and MS groups.

Considering the clinical relevance of these metrics, both FA and CSA associated with EDSS score independent of disease type when controlling for age. Additionally, FA in the corticospinal tract associated with EDSS($p=0.02, R^2=0.25$) and FA in the spinothalamic tract with pain($p=<0.01, R^2=0.32$). Overall, CSA was the strongest predictor of EDSS.

Conclusion:
In keeping with their good clinical recovery, those with MOGAD did not show a significant reduction in their CSA or FA. NMOSD had the most significant atrophy and FA reduction, driven

by those who had cervical cord involvement. Both CSA and FA show an association with disability independent of disease.

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