Specialty area: Advanced Neuroimaging 1 – Brain & Spinal Cord
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Highlights

- Imaging studies consistently show facilitated, less directional diffusion of water in both focal lesions and normal-appearing spinal cord tissue in MS.
- Diffusion can segregate patients with different disability scores but similar lesion volumes.
- More research may determine whether a short-term change in intralesional or perilesional diffusivity can serve as an effective marker of tissue repair.

Title: Spinal Cord DTI: Applications to Multiple Sclerosis
Target audience: Clinicians/clinical researchers interested in the structural basis of sensorimotor disability in MS.
Outcome/Objectives: Attendees should be able to judge whether state-of-the-art diffusion imaging of the spinal cord in MS can provide useful information about the extent of disease, and whether it represents a promising tool for future clinical research in that disease.
Purpose: Conventional clinical approaches to spinal cord MRI suffer from relatively poor sensitivity to both lesional and extralesional tissue damage. Spinal cord volume is a promising measure, as atrophy is associated with disability accumulation, but it represents the end-stage of tissue damage. Diffusion imaging, particularly diffusion-tensor imaging, has been proposed as a noninvasive, quantitative imaging modality to detect early effects of disease that are invisible by other methods.
Methods: Diffusion imaging has been applied to the MS spinal cord since approximately 2000, using a variety of approaches with a range of anatomical coverage. A handful of studies have examined longitudinal changes and correlations with specific spinal cord mediated functional outcomes.
Results: Diffusion measures in the spinal cord are abnormal in MS and typically comprise facilitated diffusion that is more isotropic than normal.[1] The degree of worsening correlates to a moderate degree with clinical disability, so that longstanding MS cases with low and stable disability have less severe abnormalities than longstanding MS cases with high and progressive disability.[2] Moreover, diffusion and other advanced measures help to discriminate cases with similar lesion burden but differing degrees of disability.[3] Longitudinal studies are sparse, but preliminary evidence suggests that diffusion changes over time are more robust in the cord than in the brain. In the few studies that have followed patients with acute cervical cord relapses, baseline diffusion measures predict outcome severity, but improvement of diffusion abnormality in periplaque spinal cord may be a stronger correlate of recovery.[4,5]
Discussion: Spinal cord diffusion imaging is consistently abnormal in MS across a range of imaging platforms. These abnormalities are clinically significant. Changes detectable over a period of months following acute relapse raise the possibility that diffusion imaging may facilitate clinical trials of lesion repair.
Conclusion: Future applications of diffusion imaging of the spinal cord in MS appear to be most promising in the areas of prognostication following an acute relapse and in the setting of clinical trials.
References:

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