Diffusion Tensor Imaging Reveals Abnormalities Throughout the Neuroaxis in Patients With Cervical Spondylotic Myelopathy

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Introduction

Although cervical spondylotic myelopathy (CSM) is the most common cause of spinal cord dysfunction in adults, a reliable noninvasive biomarker of disease severity and progression is lacking. Diffusion tensor imaging (DTI) measures water diffusion and shows changes in spinal cord microstructure. While studies in spinal cord injury have shown DTI changes distant to the injury, this has not been studied in CSM.

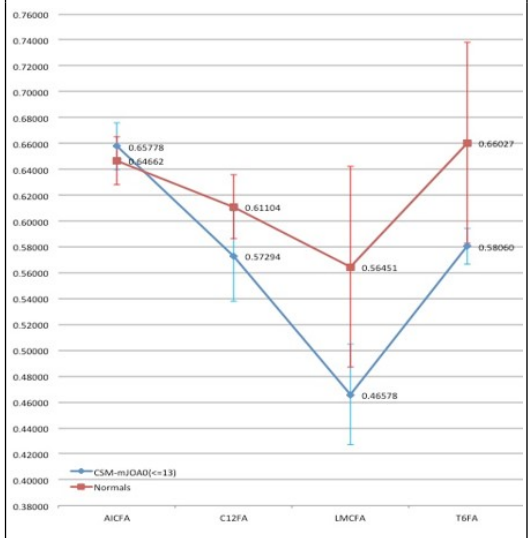
Methods

We performed a prospective cohort study of CSM and normal subjects, excluding patients who could not tolerate a MRI; who had prior cervical surgery; or who had nondegenerative/neuromuscular conditions. DTI was obtained in the internal capsule, C1-2, and T6 in both normal and CSM patients. Additionally, in CSM patients we obtained data at the level of maximum compression, which was compared against the data obtained from C4-7 in normal individuals. Student's t-test and logistic regression were used for analysis.

Results

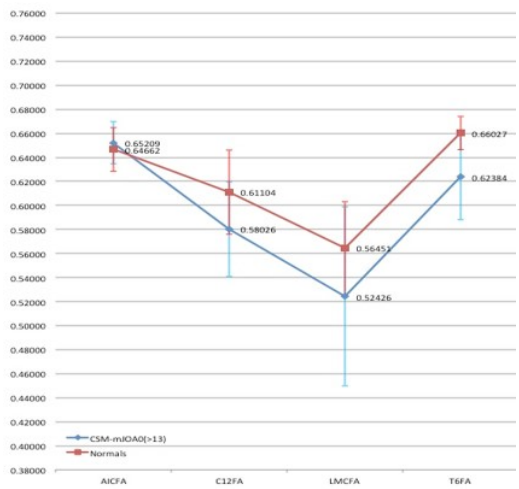
42 subjects were enrolled, of whom 24 had CSM. CSM and normals were similar in age and sex. CSM subjects reported moderate disability (mean mJOA 13). CSM patients were devided in two groups; mJOA < 13 and mJOA > 13. Fractional anisotropy (FA) was significantly lower in CSM subjects at C1-2, level of maximum compression, and T6. The FA reduction was more pronounced for CSM patients with mJOA < 13. After adjusting for age, DTI FA was a significant predictor of CSM versus normal at the level of maximum compression and T6.

Comparison of Average FA in CSM Patients with mJOA < 13 to Normals



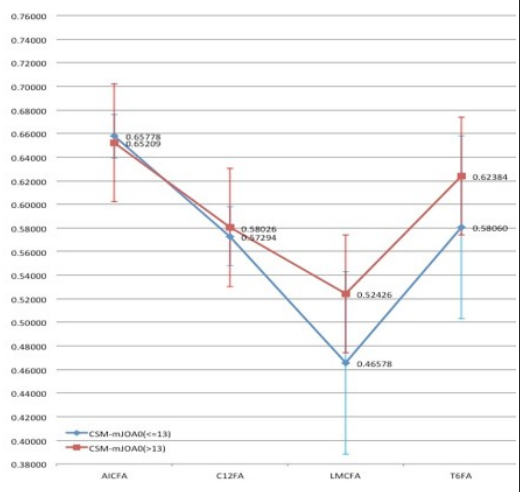
FA is significantly lower at C1-2, LMC, and T6

Comparison of Average FA in CSM Patients with mJOA > 13 to Normals



FA is significantly lower at C1-2, LMC, and T6

Comparison of Average FA in CSM Patients with mJOA < 13 to > 13



FA is significantly lower at LMC and T6

Conclusions

DTI FA is significantly lower in CSM versus normals at the level of maximum compression, C1-2, and T6, suggesting CSM subjects have microstructural changes throughout the cord. DTI has great potential as a noninvasive imaging biomarker that may provide a feasible and efficient way to monitor patients and help in surgical decision making in patients who might have neuroaxis changes but without any obvious clinical change in the exam.

References

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Learning Objectives

By the conclusion of this session, participants should be able to:
1. To understand the nature and role of DTI in spinal cord imaging
2. To pinpoint the areas of microstructural change in CSM, as shown by DTI
3. To understand the importance of DTI as a noninvasive biomarker