Diffusion Tensor Imaging as a Biomarker to Identify Individuals Who Will Benefit from Cervical Decompression at 12 Months

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Introduction

Cervical spondylotic myelopathy (CSM) is a common cause of spinal cord dysfunction. Previous studies have shown diffusion tensor imaging might be a better biomarker compared to T2 signal intensity. There is currently no viable biomarker to identify CSM patients who will improve from surgical decompression. We examined fractional anisotropy (FA) threshold in the cervical spinal cord in a large prospective series of patients as a potential biomarker for clinical improvement following surgical decompression for CSM patients.

Methods

A prospective analysis of 48 patients who had clinical follow up at 12-months after surgery was performed. Preoperative FA was measured at the level of maximum compression (LMC) and cervical 1-2 segment regions. 13 (27%) patients were identified who declined in their modified Japanese Orthopedic Association (mJOA) at 12-month post-operatively compare to pre-operation. Receiver-Operation Characteristic (ROC) Curve was used to determine the threshold for the FA values.

Results

Using ROC curve, we determined that LMC FA (P=0.014) is more accurate compared to FA at C1-2 region (P=0.139) as a biomarker to identify individuals who will benefit from decompression surgery. LMC FA threshold value of 0.528 appeared to separate patients who will decline versus stay stable/improve at 12-months post-operatively. The area under the curve (AUC) was 0.738 with sensitivity of 0.769 and specificity of 0.633 for LMC FA. The AUD was 0.356 with sensitivity of 0.570 and specificity of 0.433 for FA at C1-2 region.

Reciever Operative Characteristic of FA at LMC & C1/2

Area under the curve (AUC) for FA at LMC & C1/2
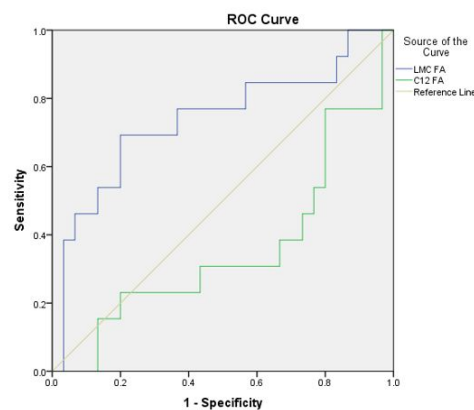
Comparison of AUC LMC FA vs. C12 FA	AUC	Sensitivity	Specificity
LMC FA	0.738	0.769	0.633
C12 FA	0.356	0.57	0.433

LMC FA has higher AUC with greater sensitivity and specificity

Conclusions

In this larger prospective study of CSM patients, FA value at the LMC is a more sensitive/specific test compared to LMC C1-2 region to predict surgical outcomes at 12-month. FA threshold value of 0.528 at LMC may be used a biomarker in conjunction with existing clinical and radiologic assessments as an integral part of diagnosis and prognostication in patients with CSM and might help in the decision regarding surgical intervention.

Learning Objectives

1. To determine the usefulness of fractional anisotropy (FA) as a biomarker for the severity of CSM
2. To explore using objective biomarkers to predict improvement after decompressive surgery.
3. To compare objective vs. subjective methods of monitoring CSM
4. To understand the importance of DTI as a noninvasive biomarker

References

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