

# **Evaluation of Cervical Myelopathy Using Apparent Diffusion Coefficient Measured by Diffusion-Weighted Imaging**

## **Essay**

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وَكَانَ فَضْلُ اللَّهِ  
عَلَيْكَ عَظِيمًا

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*Candidate*

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## **List of Abbreviations**

<b>Abbr.</b>	<b>Full-term</b>
<b>2D</b>	:Two dimensional
<b>3D</b>	:Three dimensional
<b>ADC</b>	: Apparent diffusion coefficient
<b>CC</b>	: Craniocervical
<b>CL</b>	: Capsular ligament
<b>CSF</b>	: Cerebro-spinal fluid
<b>CSM</b>	: Cervical spondylotic myelopathy
<b>CT</b>	: Computed tomography
<b>DWI</b>	: Diffusion weighted imaging
<b>EMG</b>	: Electromyography
<b>EPI</b>	: Echo-planar imaging
<b>FA</b>	: Fractional anisotropy
<b>FOV</b>	: Field of view
<b>FSU</b>	: Functional spinal unit
<b>IEPI</b>	: Interleaved echo-planar imaging
<b>ISL</b>	: Interspinous ligament
<b>ITL</b>	: Intertransverse ligament
<b>JOA</b>	: Japanese Orthopaedic Association
<b>LF</b>	: Ligamentum flavum
<b>LN</b>	: Ligamentum nuchae
<b>LSDI</b>	: Diffusion-weighted line scan imaging
<b>MRI</b>	: Magnetic resonance imaging
<b>OPLL</b>	: Ossified posterior longitudinal ligament
<b>RF</b>	: Radiofrequency
<b>ROI</b>	: Region of interest

<b>SE</b>	: Spin echo
<b>SSL</b>	: Supra spinous ligament
<b>STIR</b>	: Short-time inversion recovery

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## Introduction

Cervical spinal cord compression due to various diseases such as metastases, abscess, or spondylosis is a major cause of motor dysfunction(*Facon et al., 2005*).

Cervical spondylosis is a very common degenerative disease of the spine in the elderly(*Song et al., 2011*).

Cervical spondylosis is evidenced clinically by neck pain, radiculopathy, and/or myelopathy(*Sampathet al., 2000*).

Therapy includes surgical decompression or focal radiation therapy. Clinical outcome is often related to early therapeutic intervention(*Facon et al., 2005*).

Diagnosis is based primarily on clinical manifestations and imaging evidences. The compressed part of the spinal cord shows a specific high signal intensity on T2-weighted MR image(*Vedantam andJonathan,2011*).

T2-weighted imaging alone, however, has low sensitivity for detecting the subtle structural damage of the cord in myelopathy, especially in patients with chronic onset of symptoms(*Horiand Tsutsumi,2014*).

Preliminary data have demonstrated the possibility of assessing the spinal cord with diffusion-weighted imaging, an MR imaging technique that evaluates the translation motion of water molecules in vivo(*Turneret al., 1991*).

Apparent diffusion coefficient (ADC) represents water diffusion magnitude, with high ADC indicating high water mobility and few boundaries to water motion (*Vedantam and Jirjis, 2014*).

ADC measured by DWI of the spinal cord can provide objective and reliable indications of the severity of CSM, by evaluating the relationship between ADC values and other clinical factors. An increased ADC value was reported to relate to internal changes in the early stages of chronic spinal cord compression, with higher sensitivity than T2-high intensity (*Aota et al., 2008*).

## **Aim of the Work**

ADC measured by DWI of the spinal cord detect myelopathic changes before any T2 signal intensity increase could provide a useful way to screen for subclinical myelopathic disorders and to evaluate the severity of myelopathy, ADC values may be one of the diagnostic methods to evaluate CSM. As help in management of myelopathy before permanent damage occurs.

# **Anatomy of the Cervical Spinal Cord**

## **Anatomy of the cervical spinal cord**

Stability of the osteo-ligamentous spinal column is maintained by interdependent systems composed of discrete bony elements (vertebrae) separated by intervertebral discs and articulating joints, which are joined together by passive ligamentous restraints and dynamically controlled muscular activation. A functional spinal unit (FSU) is the basic unit of study of the spine and consists of a superior vertebra, intervertebral disc&inferior vertebra osteoligamentous unit(*Miele et al., 2012*).

### **i. osseous structures**

The typical vertebra consists of a columnar body with a larger transverse than anterior-posterior diameter and serving as the primary support for the spine. The vertebral arch extends from the body, forming a protective enclosure, and consists of a pedicle on either side that unites posteriorly through the two laminae (*Gruener&Biller,2008*).

Three processes arise from the vertebral arch, laterally the transverse and posteriorly the spinous, serving as the attachment site for muscles (Fig. 1). Four separate articular processes, a superior pair extending cranially and an inferior pair extending caudally, serve to direct or limit movement to specific directions by articulating with the vertebra above and below (Fig. 2)(*Gruener & Biller,2008*).