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

Essay

Submitted for partial fulfillment of Master degree
in Radiodiagnosis

By

Nehad Said OMAR
M.B.B.Ch.
Faculty of Medicine – Ain Shams University

Supervised by

Prof.Dr. Hanan Mahmoud Arafa
Professor of Radio-diagnosis
Faculty of Medicine – Ain Shams University

Prof.Dr.Gamal Mohammed Neiazy
Professor of Radiodiagnosis
Faculty of Medicine – Ain Shams University

Faculty of Medicine
Ain Shams University
2016


بسم الله الرحمن الرحيم
وأنزل الله
عليك الكتاب
والحكمة
وعَلَّمَكَ مَا لَمْ
تَكُن تَعْلَمُ
وكَانَ فَضْلُ اللَّهِ
عَلَيْكَ عَظِيماً
صدق الله العظيم
سورة النساء الآية
(113)

Acknowledgments

First and foremost, I feel always indebted to ***Allah,*** *the Most Beneficent and Most Merciful.*

I am so grateful and most appreciative to the effort of **Prof. Dr. Hanan Mahmoud Arafa,** *Professor of Radio-diagnosis, Faculty of Medicine, Ain Shams University, for his kind assistance and continuous beneficial advice.*

I wish to express my thanks to **Prof.Dr. Gamal Mohamed Neiazy,** *Professor of Radio-diagnosis, Faculty of Medicine, Ain Shams University, No words can express what I owe him for his continuous advice and support.*

Finally I am deeply thankful to my dear ***husband****, family&lovely* ***daughters****, for their kind support and love which allowed the completion of this study.*

Candidate

Nehad Said Omar

Contents

List of Abbreviations

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

SE : Spin echo
SSL : Supra spinous ligament
STIR : Short-time inversion recovery

List of Tables

List of Figures

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 imagingalone, 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 indicatinghigh 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 managmentof 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, inter-vertebral 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).***