Role of diffusion tensor image in evaluation of multiple sclerosis

Essay

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دور الرنين المغناطيسي باستخدام الإنتشار ممتد الكمية في تقييم التصلب العصبي المتعدد

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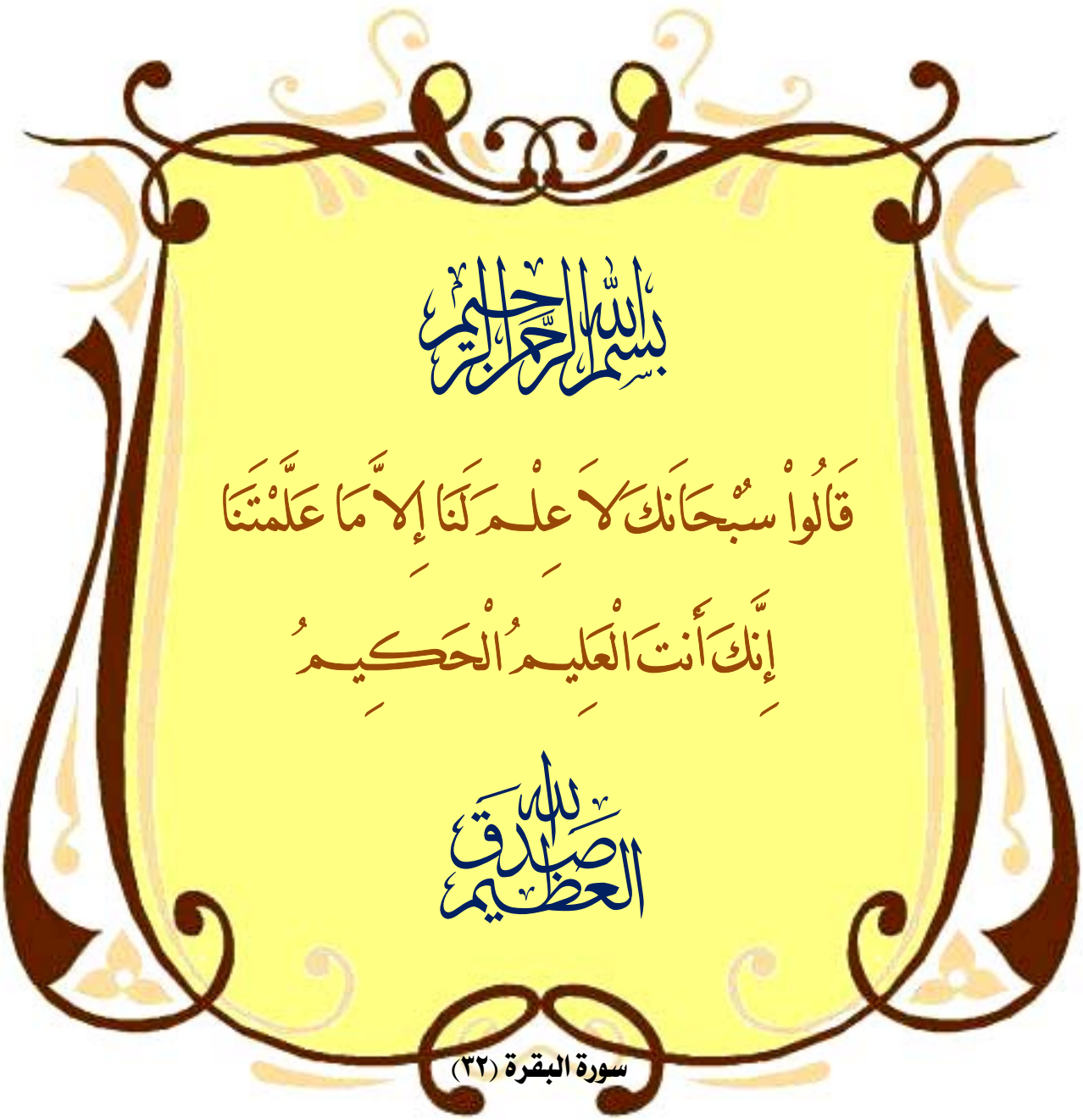
بسم الله الرحمن الرحيم
قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا
إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ
صدق الله العظيم
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Ahmed Noor

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LIST OF ABBREVIATIONS

3-D	Three-dimensional
3 T	Three Tesla
ADC	Apparent diffusion coefficient
AIF	Arterial input function
ASL	Arterial spin labeling
AV	Arteriovenous
AVM	Arteriovenous malformation
BAT	The time of arrival
BBB	Blood brain barrier
CAT	Computed Axial Tomography
CBF	Cerebral blood flow
CBV	Cerebral blood volume
CCSVI	Chronic cerebrospinal venous insufficiency
CDMS	Clinically definite MS
CHESS	Chemical shift selective saturation
CNS	Central nervous system
CSF	Cerebrospinal fluid
CSI	Chemical Shift Imaging
CIS	Clinically isolated syndromes
C-MRI	Conventional magnetic resonance
CNS	Central nervous system
Cr	Creatine
CSF	Cerebrospinal fluid
CST	Cortico-spinal tract
DIS	Dissemination in space
DIT	Dissemination in time
DSC	Dynamic Susceptibility Contrast
DTI	Diffusion tensor imaging
DWI	Diffusion Weighted imaging
EDSS	Expanded Disability Status Scale
EPI	Echo-planar imaging

FA	Fractional anisotropy
FT	Fiber tractography / Fiber tracking
GA	Glatiramer acetate
Gd	Gadolinium
Gln	Glutamine
Glu	Glutamate
GM	Gray matter
GRAPPA	Generalized auto-calibrating partially parallel acquisition
HA	Hunter's angle
HARDI	High angular resolution diffusion imaging
H MRS	Proton Magnetic resonance spectroscopy
MAG	Myelin-associated glycoprotein
MD	Mean diffusivity
MND	Motor neuron disease
MR	Magnetic resonance
MRI	Magnetic resonance imaging
MRS	Magnetic resonance spectroscopy
MRSI	Magnetic resonance spectroscopic imaging
MS	Multiple sclerosis
MTI	Magnetization transfer imaging
MTT	Mean transit time
NAA	N-acetylaspartate
NAAG	N-acetyl aspartyl glutamate
NAGM	Normal-appearing gray matter
NAWM	Normal-appearing white matter
NMO	Neuromyelitisoptica
NMSS	National Multiple Sclerosis Society
NP	Neuropsychological
PRESS	point reserved spectroscopy
ppm	parts per million
PPMS	Primary progressive multiple sclerosis
PRMS	Progressive relapsing multiple sclerosis
PROPEL	Periodically rotated overlapping parallel lines with enhanced

LER	reconstruction
rCBV	Relative cerebral blood volume
RGB	Red, green, and blue
ROI	Region of interest
RRMS	Relapsing remitting multiple sclerosis
SNR	Signal-to-noise ratio
SPMS	Secondary progressive multiple sclerosis
STEAM	Stimulated echo acquisition mode
T1WIs	T1 weighted images
T2WIs	T2 weighted images
TA	Time of arrival
TE	Echo time
TTP	Time to peak
TR	Repetition time
VOI	Volume of interest
WBNAA	whole-brain NAA concentration
WHO	World health organization
WM	White matter

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INTRODUCTION

Multiple sclerosis is widely recognized as the most commonly identified cause of progressive neurologic disability in young adults throughout the developed world ***(Hynson et al., 2001).***

The disorder is clinically suspected when patients experience either acute attacks of neurologic compromise or instead are afflicted by a steadily progressive deterioration in functional capabilities ***(Banwell et al., 2007).***

Multiple sclerosis (MS) pathology is originally defined by the presence of focal white matter lesions, characterized by inflammation, primary demyelination, and reactive glial scaring. More recently, however, it became clear that focal white matter plaques in MS comprise of a broad spectrum of different lesion types, reflecting different stages of activity and different degrees of neurodegeneration or repair ***(Stadelmann and Bruck, 2004)***.

In addition, the MS brain is affected by global changes in the normal-appearing white matter and gray matter. All types of changes in the MS brain and spinal cord occur on the background of inflammation; the type of inflammation, however, differs between different stages and forms of the disease ***(Seewann et al., 2008).***

The study of T2-weighted images on conventional MR imaging is, however, very limited. The main problem is related to

the low specificity, since inflammation, edema, demyelination, gliosis and axonal loss are represented by areas of high signal on this sequence ***(Poser et al., 2006).***

In addition, conventional MR imaging has also shown low ability to detect and quantify the extension and severity of microscopic injuries on the normal-appearing white matter (NAWM) surrounding plaques, particularly in early phases of the disease ***(Minguetti et al., 2001).***

Diffusion tensor (DT) MR imaging is a new technique able to detect and quantify multiple sclerosis (MS)–related tissue damage within and outside T2-visible lesions ***(Menge and Hemmer 2005)***.

Diffusion tensor imaging (DTI) provides unique information about the tissue and cellular microstructure in the human brain ***(Pagani et al., 2005)***.

DT MR imaging has also been shown to be sensitive to the evolution of MS damage over time and to provide in vivo correlates of MS clinical severity and paraclinical markers of long-term disease evolution. Recent developments of DT MR imaging post processing techniques, such as tractography and voxelwise analysis, are likely to improve our understanding of the mechanisms associated with the accumulation of disability in MS ***(Khial and Lesage ,2007).***

AIM OF THE WORK

The aim of this study is to illustrate the role of diffusion tensor imaging (DTI), in the diagnosis and follow up multiple sclerosis.