ROLE OF MAGNETIC RESONANCE DIFFUSION TRACTOGRAPHY IN INTRA-AXIAL BRAIN TUMORS

Essay

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By

Ali Ahmed Abd El Mohsen Attia
M.B., B.CH
Ain Shams University

Supervised by

Prof. Dr.\Mounir Sobhy Guirguis
Professor of Radiodiagnosis
Faculty of medicine – Ain Shams University

Dr.\Waleed Mohammed Abd El Hamid Hetta
Lecturer of Radiodiagnosis
Faculty of medicine – Ain Shams University

Faculty of Medicine
Ain Shams University

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بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

قَالُوا سُبْحَانكَ لاَ عِلِمَ لَنَا إِلاّ مَا
عَلّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ

صدق الله العظيم

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Dedication

I would like to dedicate this Essay to my Wife *and my* Son*; to them I will never find adequate words to express my gratitude.*

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List of abbreviations

1H-MRSI	Proton MR spectroscopic imaging
3D	3-Dimensional
ADC	Apparent Diffusion Coefficient
ALIC	Anterior Limb Of The Internal Capsule
BOLD	Blood Oxygen Level Dependent
C	caudate nucleus
CC	Corpus Callosum
cg	Cingulum
Cho	choline
CNS	Central Nervous System
CPC	Choroid Plexus Carcinoma
CPP	Choroid Plexus Papilloma
CPT	Choroid Plexus Tumors
CSF	Cerebrospinal Fluid
cst	Corticospinal Tract
CT	Computerized Tomography
DT	Diffusion Tensor
DNET	dysembryoplastic neuroepithelial tumour
DTI	Diffusion Tensor Imaging
DTI-FT	DTI Fiber Tracking
DTT	Diffusion Tensor Tractography
DW	Diffusion Weighted
DWI / PWI	diffusion/perfusion weighted image
e ADC	enhanced Apparent Diffusion Coefficient
EPI	Echo Planar Imaging
FA	Fractional Anisotropy
FACT	Fibre Assignment by Continuous Tracking
fMRI	Functional MR Imaging

fx	Fornix
IC	Internal Capsule
icp	Inferior Cerebellar Peduncle
ifo	Inferior Fronto-Occipital Fasciculus
ilf	Inferior Longitudinal Fasciculus
iMRI	Intraoperative MR Imaging
LGN	Lateral Geniculate Nucleus
mcp	Middle Cerebellar Peduncle
ml	Medial Lemniscus
MR	Magnetic Resonance
MRI	Magnetic Resonance Imaging
MRS	MR spectroscopy imaging
MS	Multiple Sclerosis
NAA	N-acetylaspartate OR Optic Radiation
PLIC	Posterior Limb of the Internal Capsule
PMAs	Primary Motor Areas
PROPELLER	Periodically Rotated Overlapping Parallel Lines with Enhanced Reconstruction
ROI	Regions of Interest
RT	Radiotherapy
scp	Superior Cerebellar Peduncle
sfo	Superior Frontooccipital Fasciculus
slf	Superior Longitudinal Fasciculus
SNR	Signal-To-Noise Ratio
SRT	Stereotactic Radiotherapy
st	Stria Terminalis
T2WI T2	Weighted Image
unc	Uncinate Fasciculus
WHO	World Health Organization
WM	White Matter
WMT	White Matter Tractography

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Introduction

Magnetic resonance tractography (MRT) is a valuable, noninvasive imaging tool for studying human brain anatomy and, as MRT methods and technologies advance, has the potential to yield new and illuminating information on brain activity and connectivity. ***(Saad and Heidi, 2011)***.

MRI diffusion tensor tractography, allows visualization of white matter tracts in vivo and to study white matter integrity. Virtual dissection of the living human brain can be used to visualize white matter bundles with relationship to intra axial brain tumors ***(Aoki et al, 2007)***.

The goal of surgical treatment is to remove as much tumor tissue as possible, while in the same time preserving the integrity of functionally gray and white matter structures, and thus avoids postoperative neurologic deficits. However, tumor infiltration of cortical areas and/or white matter tracts may preclude safe gross total resection. Consequently, knowledge of the relationship between tumor and cortical and white matter regions is helpful for preoperatively determining the extent to which a brain tumor can be surgically removed, and also for guiding the actual surgical procedure ***(Talos et al., 2007)***.

Identifying the location of the motor pathways has been much more challenging. Extensive white matter infiltration by primary brain tumors is a common occurrence ***(Talos et al., 2007)***. Moreover, resecting brain tumors involves the risk of damaging the descending motor pathway. Diffusion tensor (DT)-imaged fiber tracking is a noninvasive magnetic resonance (MR) technique that help to visualize the white matter fibers such as corticospinal (pyramidal) tract, optic radiation and arcuate fasciculus with relationship to brain tumors and can delineate the subcortical course of the motor pathway ***(Berman et al., 2007)***.

Postoperatively, DTI is used to assess surgical outcome. White matter tractography (WMT) alteration patterns including deviation, deformation, infiltration, and apparent tract interruption are examined postoperatively. ***(Lazer et al., 2006)***.