Applications of Magnetic resonance diffusion tractography in intra-axial brain tumors

Essay
Submitted for fulfillment of Master Degree in Radiology.

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2010

بسم الله الرحمن الرحيم

DEDICATED TO MY HUSBAND
AND MY DAUGHTER

Acknowledgements

In the name of Allah, the Most Gracious, the Most Merciful. All the praises and thanks to ALLAH for making this work possible.

I am deeply and forever indebted to ***Professor Dr., Adel Belal.*** I sincerely appreciate his endless guidance and encouragement. It has been a privilege to be taught and guided by such a supportive and patient supervisor. His truly instinctive knowledge had inspired and enriched my work and research.

My sincere thanks to***, Dr. Omnia Mokhtar*** for her continuous guidance and support.

My heartfelt thanks and gratitude to ***Professor Dr., Moharam Badawey;*** *head of Radiology department (NCI);* I appreciate from all my heart his support.

My thanks and my love to all my professors and colleagues in the Radiology department (NCI) for their support. I would like to express my deepest sense of gratitude especially to my colleague ***Aida Ali****,* who helped me a lot during my work.

Last but not least; I would like to thank my family for their endless love and support

Thanks

ABSTRACT

The goal of surgical treatment is to remove as much tumor tissue as possible, while in the same time preserving the integrity of eloquent cortical areas and/or white matter tracts, and thus avoid postoperative neurological deficits. However, tumor infiltration of eloquent cortical areas and/or white matter tracts may preclude safe gross total resection

KEY WORDS

Applications

Magnetic

tractography

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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
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
DTI	Diffusion Tensor Imaging
DTI-FT	DTI Fiber Tracking
DTT	Diffusion Tensor Tractography
DW	Diffusion Weighted
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

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The goal of surgical treatment is to remove as much tumor tissue as possible, while in the same time preserving the integrity of functionally eloquent gray and white matter structures, and thus avoids postoperative neurologic deficits. However, tumor infiltration of eloquent cortical areas and/or white matter tracts may preclude safe gross total resection. Consequently, knowledge of the relationship between tumor and eloquent cortical and white matter regions might be 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).**

The primary motor cortex and the motor fibers constitute one of the most important eloquent regions of the brain; they are connected to the lower motor neurons and control muscular movement. Thus, being able to determine whether a surgically treatable brain lesion (such as a tumor) is located near the motor system would be of major clinical importance. The primary motor cortex is relatively easily identified on CT and magnetic resonance (MR) imaging using well-established neuroradiologic methods **(Yousry et al., 1997).**

On the other hand, 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