The Role of Diffusion Magnetic Resonance Imaging In Evaluation of Brain Tumors and Their Recurrence

Essay

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Dedication

To My Beloved Mother, because of you I'm here today and just for you I dedicate every success I achieve in my life, Wish you and My Father are proud of me.

Margaret

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Margaret Mansour Aziz

List of Abbreviations

AC	Anterior Commissure
ADC	Apparent diffusion coefficient
AIDS	Acquired immunodeficiency syndrome
CNS	Central nervous system
CPC	Choroid plexus carcinoma
CPP	Choroid plexus papilloma
CSF	Cerebrospinal fluid
CST	Corticospinal tract.
CT	Computed Tomography
DNT	Dysembryoplasticneuroepithelial tumor
DTI	Diffusion tensor imaging
DWI	Diffusion weighted imaging
EP SE	Echoplanar spin echo
EPI	Echoplanar imaging
ET	Enhancing tumor
FA	Fractional anisotropy
FLAIR	Fluid-attenuation inversion recovery
Fps	Frame per second
G	Gradient
GBM	Glioblastomamultiforme
Gy	gray
IHC	Immunohistochemistry
IOFF	Inferior Occipitofrontal Fasciculus
LFB	Luxol fast blue
MB	Multibanded excitation
MD	Mean diffusivity
M-EPI	Multiplexed-EPI
Mm	Millimetre
MRI	Magnetic resonance imaging
N/C ratio	Nuclear to cytoplasmic ratio
NADC	Normalized apparent diffusion coefficient
NET	Non-enhancing tumor
PD	Proton density

PPTID	Primitive neuro ectodermal tumors
PRL	Prolactin
PXA	Pleomorphic xanthoastrocytoma
RF	Radiofrequency
ROI	Region of interest
SE	Spin echo
Sec	Second
SEGA	Subependymal giant cell astrocytoma
SI	Signal intensity
SIR	Selective inversion recovery
SNR	Signal to noise ratio
SOFF	Superior Occipitofrontal Fasciculus
T	Tesla
TE	Echo time
TRN	Treatment related necrosis
TS	Tuberous sclerosis
WHO	World health organisation
WI	Weighted image
WM	White matter

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INTRODUCTION

Primary brain tumors account for 50% of intracranial tumors and secondary brain cancer accounts for the remaining cases. There are two types of brain tumors: primary brain tumors that originate in the brain and metastatic (secondary) brain tumors that originate from cancer cells that have migrated from other parts of the body. A primary brain tumor rarely spreads beyond the central nervous system, and death results from uncontrolled tumor growth within the limited space of the skull. Metastatic brain cancer indicates advanced disease and has a poor prognosis (***Stanley, 2007)***.

Primary brain tumors can be cancerous or non-cancerous. Both types take up space in the brain and may cause serious symptoms and complications. All cancerous brain tumors are life threatening (malignant) because they have an aggressive and invasive nature. A non cancerous primary brain tumor is life threatening when it compromises vital structures. Brain cancer is the leading cause of cancer-related death in patients younger than age 35 (***Stanley, 2007)***.

The diagnosis of brain tumors by magnetic resonance imaging (MRI) is usually based on basic un-enhanced T1- and T2-weighted images and post contrast T1-weighted images. Conventional MRI techniques are not sufficient for the grading and specification of brain tumors. Furthermore, several non-

neoplastic lesions, such as arachnoid cysts, heterotopic gray matter, tubers of tuberous sclerosis, cavernous hemangiomas, aneurysms, granulomas, abscesses, radiation necrosis and acute demyelination with a mass effect can mimic brain tumors on MRI ***(Stephan, 2007).***

In diffusion-weighted imaging (DWI), the image contrast is determined by the random translational (Brownian) motion of water molecules and DWI is most often used for the evaluation of stroke. The quantification of diffusion using DWI, i.e. diffusion imaging, has been attracting growing interest as an easy method to further characterize the nature of brain tumors ***(Stephan, 2007)***.

So Diffusion Imaging appears to have the potential to add important information to pre-surgical planning. While experience is limited, DWI appears to provide useful local information about the structures near the tumor, and this appears to be useful in planning. In future, DWI may provide an improved way to monitor intra-operative surgical procedures as well as their complication. Furthermore, the evaluation of the response of treatment to chemotherapy and to radiation therapy might also be possible. While diffusion imaging has some limitations, its active investigation and further study are clearly warranted ***(Inoue et al., 2005)***.

Diffusion-weighted (DW) MR imaging is a means to characterize and differentiate morphologic feature, including edema, necrosis, and tumor tissue, by measuring differences in apparent diffusion coefficient (ADC). It is hypothesized that DW imaging has the potential to differentiate recurrent or progressive tumor growth from treatment induced damage to brain parenchyma in high-grade gliomas after radiation therapy ***(Patric et al., 2006).***

ADC could provide addition useful information in the diagnosis of patient with brain tumor, such as tumor malignancy, peritumoral infiltration and the type of meningioma ***(Kono et al., 2005).***

Diffusion fiber tractography is the only method giving an indirect, in-vivo view of the nerve fiber trajectory. It can assist in the preoperative check-up for brain tumors (corticospinal bundle) or for medullary compression ***(Escolar, 2006)***.

AIM OF THE WORK

The aim of study is to evaluate the role of Diffusion Magnetic Resonance Imaging in the assessment of brain tumors and their recurrence.