بسم الله الرحمن الرحيم

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بقسم التوثيق الإلكتروني بمركز الشبكات وتكنولوجيا المعلومات دون أدنى مسئولية عن محتوى هذه الرسالة.

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Prediction of Aphasia Outcome Using Diffusion Tensor Tractography in Patients with Acute Ischemic Stroke

Thesis

Submitted for Partial Fulfillment of Master Degree in Neurology and Psychiatry

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قالوا

سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم

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Mostafa Khalf Ramadan

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List of Abbreviations

Abbreviation	Full term
3D	*Three dimensions*
ADC	*Apparent diffusion coefficient*
AF	*Arcuate fasicuclus*
AOS	*Apraxia of speech*
CBC	*Complete blood count*
CT	*Computed tomography*
DTI	*Diffusion tensor imaging*
DTT	*Diffusion tensor tractograbhy*
DWI	*Diffusion-weighted imaging*
ESR	*Erythrocyte sedimentation rate*
FA	*Fractional anisotropy*
FLAIR	*Fluid-attenuated inversion revovery*
HBA1C	*Hemoglobin A1C*
HQoL	*Health-related quality of life*
INR	*International normalized ratio*
MCA	*Middle cerebral artery*
MR	*Magnetic resonance*
MRA	*Magnetic resonance angiography*
NCCT	*Noncontrast CT*
PET	*Positron emission technology*
SF	*Sylvian Fissure*
SPECT	*Single-photon emission CT*
TIA	*Transient ischemic attack*
WHO	*World Health Organiztion*

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INTRODUCTION

Stroke is a leading cause of major adult disability, and aphasia is one of the most common consequences of stroke. It has been reported that 21%–38% of patients with stroke have aphasia in the acute stage ***(Engelter et al., 2006).***

Recovery from aphasia occurs mainly during the first 3 months after stroke; finally, 10%–18% of patients with stroke have aphasia in the chronic stage. Therefore, it is important to predict the prognosis of aphasia at an early stage in patients with stroke because it could provide useful information for planning specific rehabilitation strategies and for estimating the duration of rehabilitation ***(Berthier, 2005)***.

Previously, many studies have attempted to predict the outcome of stroke-related aphasia by using brain computed tomography (CT), conventional brain magnetic resonance (MR) imaging, and functional neuroimaging ***(Marchina et al., 2011)***. However, these neuroimaging modalities are limited in that they cannot reconstruct and estimate neural tracts. In contrast, diffusion tensor tractograbhy (DTT), a 3 dimention visualized version of diffusion tensor imaging (DTI), allows 3D visualization of the architecture and integrity of neural tracts at the subcortical level ***(Assaf and Pasternak, 2008)***.

Diffusion tensor tractography (DTT) for the neural tract has been used for prediction of outcome for the corresponding function. For example, many studies have demonstrated the predictive value of DTT of the corticospinal tract for evaluating the motor outcome in patients with stroke ***(Jang et al., 2012)***. However, little is known about the usefulness of DTT for the arcuate fasicuclus (AF), which is the important neural tract for language, connecting Wernicke and Broca areas, in predicting the aphasia outcome in patients with stroke, though few studies have demonstrated the clinical usefulness of DTT for AF ***(Breier et al., 2008).***

Aim of the Work

To asses the Arcuate Fasiculus in patients with aphasia and its impact on predicting the outcome (clinical radiological correlation).

Chapter 1

ANATOMICAL OVERVIEW

In order to study the language which is one of the most important higher brain functions, the study should start by understanding the normal brain anatomy. This will help to imagine the various brain areas which collaborative work result in communication.

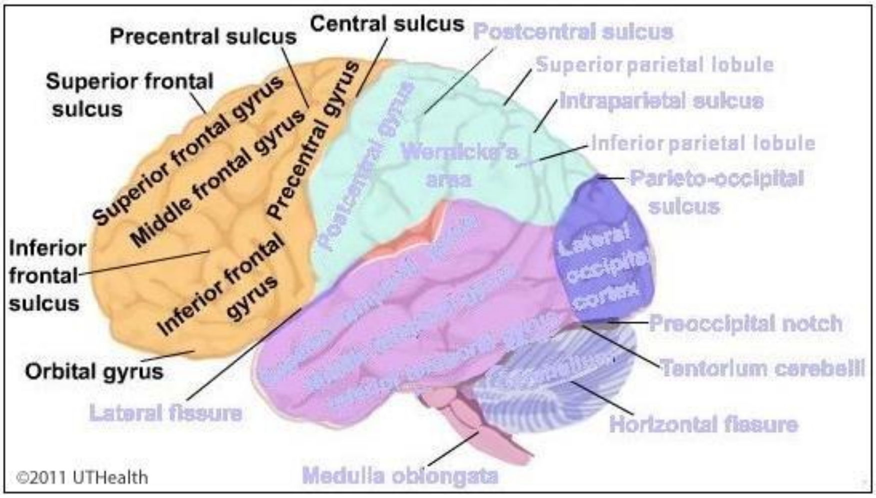

Figure (1): Sulci and gyri of the brain.

On the lateral surface, the most prominent sulcus is the Sylvian Fissure (SF), the most horizontal sulcus running anteroposteriorly.The SF sparates the temporal lobe, below form the fontal and parietal lobe above.The other prominent sulcus, usually continous, on the lateral surface of the hemisphere is the Central sulcus. This sulcus separates the frontal lobe, in front, from the parietal lobe behind ***(Brodal, 1981)***.

There are two other prominent sulci to consider in the dorsolateral surface of the frontal lobe, namely the superior frontal sulcus and the inferior frontal sulcus.Both run anteroposeriorly from the pre-central sulcus toward the polar region of the frontal lobe, usually stopping before the pole ***(Damasio and Damasio, 2001).***

In realtion to language, the inferior frontal sulcus is probably the most of the two, given that it forms the superior limit of the inferior frontal gyrus in which the frontal operculum is found, traditionally called Broca's area when the left hemisphere is considered ***(Brodal, 1981).***

In the temporal lobe, there is one consistent sulcus parallel to sylvian Fissure, the superior temporal sulcus. Together with the sylvian fissure it delineates the superior temporal, which corresponds to Broadmann's area 22. Another sulcus, also parallel, can be seen on the lateral surface, the inferior temporal sulcus. It creates the separation between the middle temporal gyrus containing Broadmann's area 21, above, and the inferior temporal gyrus containing Broadmann's area 20 below. The posterior sectors of both these gyri contain Broadmann's area 37, which continues into the inferior mesial surface of the temporal lobe ***(Damasio and Damasio, 2001).***

The parietal lobe is also subdivided by a prominent anteroposteriorly running sulcus, the intraparietal sulcus containing Broadmann's area 40 and 39, from the superior parietal lobule containing Broadmann’s area 5 and 7.The inferior parietal lobule is itself subdivided into two major gyri, namely the supramarginal gyrus, anteriorly (Broadmann’s area 40) sitting on top of the sylvian fissure and its posterior end and the angular gyrus or Broadmann’s area 39 sitting behind the former around the posterior end ***(Brodal, 1981).***

There is no distinct sulcus separating the occipital from the temporal lobe. However, in the mesial aspect of the occipital itself there is a distinct and consisitent sulcus, running anteroposteriorly, the calcarine fissure, whose two lips contain the primary visual cortex or Broadmann’s area 17.The calcarine fissure separates the mesial aspect of the occipital lobe into two sectors; the supracalcarine region or cuneus, containing Broadmann’s area 18 and 19 and the infra calcarine region, also containing Broadmann’s area 18 and 19 ***(Ono et al., 1990).***

Typically the occipito-parietal sulcus and the calcarine sulcus join just behind the posterior end of the corpus callosum, which is also known as splenium. The cortex between splenium and the juncture of the occipito-parietal and calcarine sulci is usually referred to as the retrosplenial area, which contains several different cytoarchitectotonic areas ***(Damasio et al., 1996).***

Also there are important subcortical grey matter structures, within the temporal lobe, in the depth of the parahippocampal gyrus, rather are the hippocampus proper and