شبكة المعلومات الجامعية
التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

HANAA ALY

INTRODUCTION

Brain tumors have increased in incidence over the past 30 years. Approximately one-third of tumours are malignant and the remainder are benign or borderline malignant ***(Kohler et al., 2011)***.

It is mandatory to classify the patients into low and high grade neoplasms as in fact that is the most important prognostic factor for the patient, and has critical therapeutic implications, as high grade lesions are treated differently from low grade lesions; patients with high grade lesions receive radiotherapy or combined radiochemotherapy whether resectable or not. While, low grade lesions are amenable to surgical resection with curative intent. Adjuvant radiochemotherapy is only recommended in patients with incomplete resectable tumor or for patients older than 40 years regardless of the resection extent ***(Ding et al., 2014).***

It has been shown that neoangeogenesies and neovascularization plays an important central role in the tumor growth and spread. This includes new vessels development in order to feed the growing tumor cells.

As the tumor aggressiveness increases it tends to have more dense growth of blood vessels, which are tortuous and are of wider calibre having immature walls with increased endothelial gaps. Hence, these vessels are leaky leading to intra tumoral haemorrhage ***(Mohammed et al., 2017).***

Susceptibility weighted imaging (SWI) is a 3D gradient-echo MR technique that is based on blood oxygen level dependent (BOLD) induced phase effects between the venous blood and the surrounding brain parenchyma. SW-MR imaging allows for noninvasive visualization of small veins at submillimeter resolution and, therefore, is used to depict venous architecture in brain lesions ***(Hsu et al., 2016).***

The extreme sensitivity of SWI for the detection of neovascularity (venous blood), haemorrhage, and calcification has been an indispensable tool for characterization of the internal architecture of brain tumours. Furthermore, SWI has been shown to correlate with increased cerebral blood volume (CBV) on MR perfusion and corresponds to tumor grade on histology ***(Aydin et al., 2017).***

The SWI image consists of 4 sets of images: filtered phase images, magnitude images, minimal intensity projection (minIP) and the final SWI images. These images allows us to assess both tubular and non-tubular intratumoral SWI signal , often forming conglomerates, which are thought to represent areas of increased microvascularity and haemorrhage, also it allows us to differentiate calcium from haemorrhage, which enables better characterization of tumoral tissue ***(Hsu et al., 2016).***

AIM OF THE WORK

Is to evaluate the role of Susceptibility weighted imaging in assessment of adults intra axial brain neoplasms, and its ability to characterize them into high and low grade lesions in comparison to histopathology which will be used as gold standard.

Chapter 1
ANATOMY OF THE BRAIN

The brain is the vital neurological organ which is housed in the skull and bathed in cerebrospinal fluid (CSF) and is composed of:

- Cerebrum.
- Diencephalon.
- Brainstem.
- Cerebellum.

Cerebrum:

- The cerebrum is a paired neural structure composed of the two cerebral hemispheres (left and right) each containing a central cavity, the lateral ventricle. It occupies most of the intracranial cavity and lies in the supra-tentorial compartment of the cranial cavity above the tentorium cerebelli and is connected to the brainstem via the cerebral peduncles.

The two hemispheres are nearly of equal size, they are linked together by the commissural fibers and are partially separated by a deep median cleft, the great longitudinal (interhemispheric) fissure. Each hemisphere is divided into lobes and consists of an external highly convoluted mantle of cortical gray matter, white matter, basal ganglia as well as a single pituitary gland situated between both cerebral hemispheres ***(Ryan et al., 2011).***

Cerebral cortex

The outer most layer of the cerebrum is the cortex, which has a gray appearance hence the term "gray matter." The cortex is a folded structure; each fold is termed a gyrus, while each groove between the folds is termed a sulcus.

The superolateral surface of each cerebral hemisphere has two deep sulci; which are:

1- The lateral sulcus, also known as the sylvian fissure, separating the frontal and temporal lobes.

2- The central sulcus (of Rolando), which passes upwards from the lateral sulcus to the superior border of the hemisphere. This separates the frontal lobe from the parietal lobe ***(Ryan et al., 2011).***

The parieto-occipital sulcus on the medial surface of the cerebral hemisphere separates the parietal and occipital lobes. On the lateral surface of the hemispheres there is no complete sulcal separation of the parietal, temporal and occipital lobes. The boundary between the parietal and temporal lobes lies on a line extended back from the lateral sulcus. The boundary separating the parietal and temporal lobes from the occipital lobe, is a line between the parieto-occipital sulcus and the pre-occipital notch, also known as the lateral parieto-occipital line ***(Ryan et al., 2011).*****(Figs 1&2).**

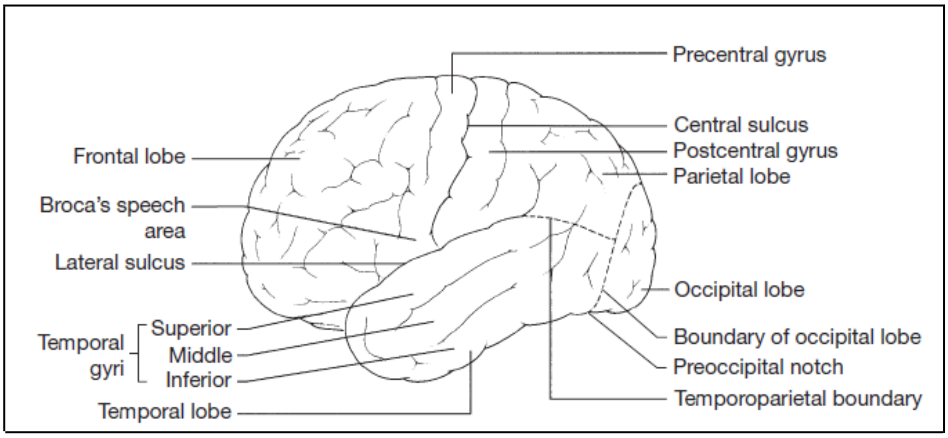

Figure (1): Cerebral hemisphere lobes ***(Ryan et al., 2011)***.

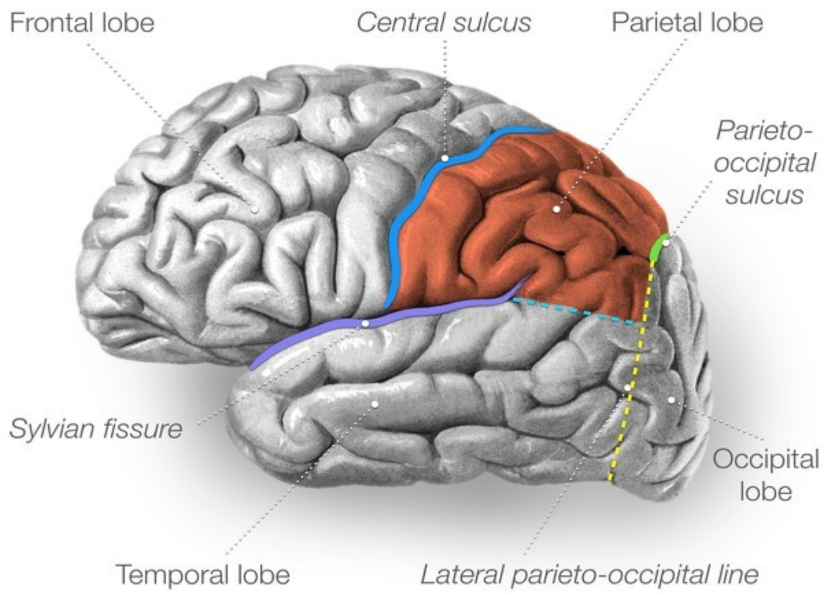

Figure (2): Diagram showing the boundaries between the cerebral hemispheres ***(Paulsen and Waschke, 2013).***

Lobes of the brain (Fig.3):

Each cerebral hemisphere is divided into four lobes of unequal size. In addition to these four lobes, some authors add an insular and a limbic lobe.

i. The Frontal lobe

The frontal lobe is the largest lobe of the brain and includes the entire cortex anterior to the central sulcus and superior to the lateral sulcus. The frontal lobe is roughly pyramidal in shape, with three cortical surfaces:

1- Lateral surface (largest).

2- Medial (interhemispheric) surface.

3- Inferior surface.

Each surface is divided into different gyri by several sulci, the details of which are beyond the scope of this thesis, however the most important gyrus is the precentral gyrus which lies on the lateral surface of the frontal lobe and harbors the primary motor cortex. The premotor cortex lies within the gyrus anterior to the precentral gyrus ***(Ryan et al., 2011).***

ii. The Parietal lobe

The parietal lobe is seen posterior to the central sulcus, superior to the lateral sulcus and a line drawn from its posterior end to the occipital lobe. It accounts for 19% of total neocortical volume and has a medial and a lateral surface. The post central gyrus, which lies on its lateral surface, harbors the primary somato-sensory cortex. The superior & inferior parietal lobules lie posterior to postcentral gyrus ***(Ryan et al., 2011).***

iii. <u>The Occipital lobe</u>

The occipital lobe is the smallest lobe accounting for only 18% of the total neocortical volume. It is separated from the parietal and temporal lobes on the medial surface by the parieto-occipital sulcus and on the lateral side by the lateral parieto-occipital line. The primary visual cortex lies on medial occipital surface ***(Ryan et al., 2011).***

iv. <u>The Temporal lobe</u>

The temporal lobe lies inferior to the lateral sulcus and anterior to the occipital lobe and can be divided into a supero-lateral and infero-medial surfaces. The temporal lobe is divided into five gyri by four sulci which are oriented largely parallel to the Sylvian fissure and are arranged from supero-lateral to infero-medial. The superior temporal gyrus harbors the primary auditory cortex.The temporal lobe also harbors major subdivisions of the limbic system ***(Ryan et al., 2011).***

v. The insular lobe:

It's the cortical region hidden within depths of lateral (sylvian) fissure; covered by frontal, temporal and parietal opercula ***(Ryan et al., 2011).***

vi. The limbic lobe:

It includes the subcallosal, cingulate, parahippocampal as well as the hippocampus gyri ***(Ryan et al., 2011).***

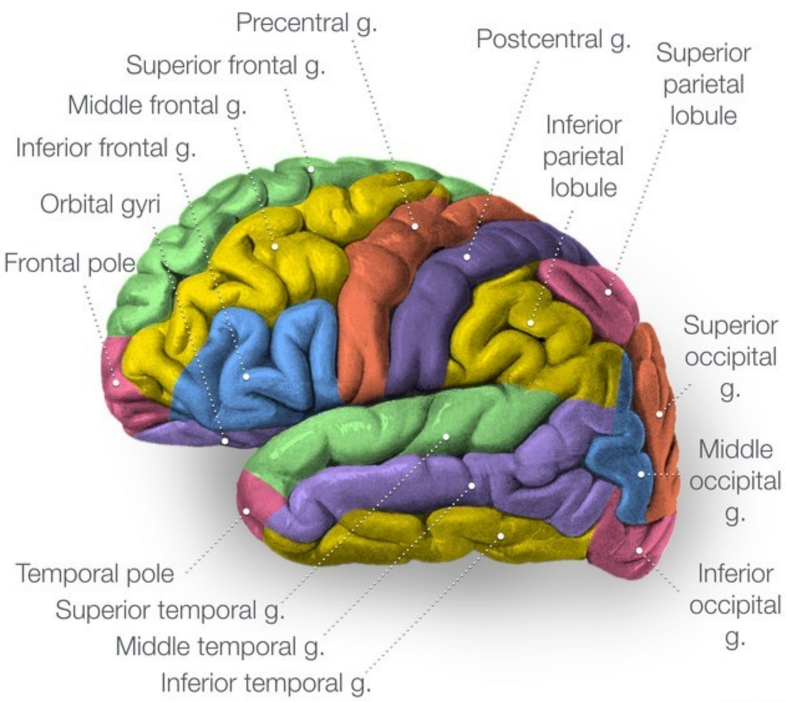

Figure (3): Diagram depicting the lateral aspect of the different lobes of the brain and their respective gyri ***(Paulsen and Waschke, 2013).***

White matter tracts

Below the cortex are the axons, which are long fibers that emanate from and connect the neurons. Axons are insulated by myelin, which increases the conduction speed. Myelin is what gives the white appearance to these fibers of the brain hence the term "white matter**"** ***(Harnsberger et al., 2006).***

There are three types of white matter fibers within the cerebral hemispheres **(Fig. 4)**:

1. **Association fibers:** They interconnect cortical areas of the same hemisphere. They are classified into short and long association fibers. Short association fibers course within the white matter to interconnect adjacent gyri; such as the subcortical U fibers. Long association fibers interconnect different lobes within the same hemisphere over long distances. Fibers of this type include cingulum, superior longitudinal, inferior longitudinal fasciculus, superior and inferior occipito-frontal fascicule, uncinate fasciculus and fornix ***(Naidich et al, 2012).***

2. **Projection fibers:** They interconnect the cortical (superficial) areas with the deep nuclei, brain stem, cerebellum, and spinal cord. Internal capsule is the largest projection fiber.
3. **Commissural fibers:** They interconnect similar cortical areas between opposite hemispheres. Fibers of this type typically include corpus callosum, anterior and posterior commissure ***(Ryan et al., 2011).***

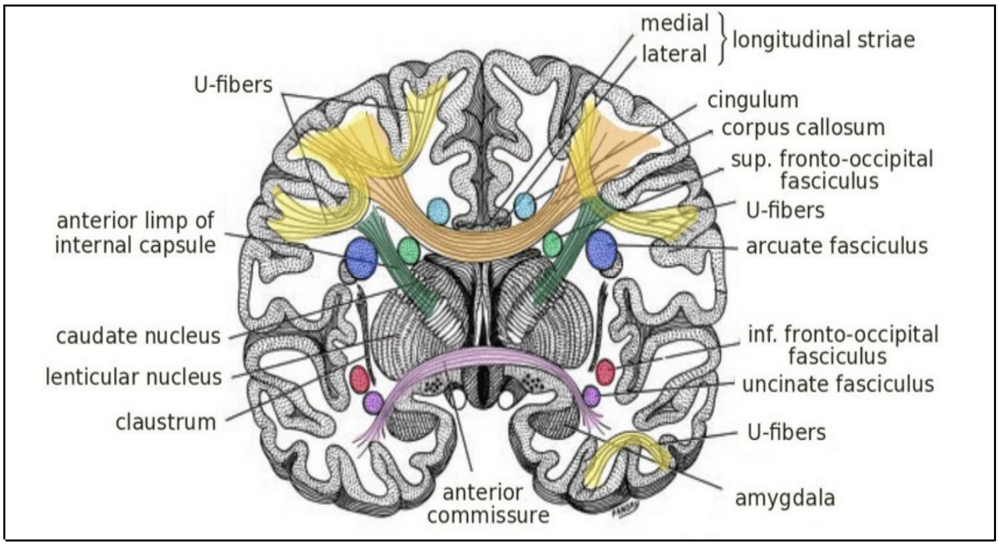

Figure (4): Diagram showing the different types of white matter tracts in the coronal view ***(Harnsberger et al., 2006).***

Basal ganglia

The basal ganglia are a group of grey matter nuclei in the deep aspects of the brain that are interconnected with the cerebral cortex, thalami and brainstem.

In a strict anatomical sense, it contains three paired nuclei that together comprise the corpus striatum:

- Caudate nucleus.
- Lentiform nucleus, which is furtherly classified into:
    - Putamen.
    - Globus pallidus.

Functionally, two additional nuclei are also part of the basal ganglia:

- Subthalamic nuclei.
- Substantia nigra.

(Ryan et al., 2011)

Pituitary gland

The pituitary gland sits atop the base of the skull in a concavity within the sphenoid bone called the sella turcica, immediately below the hypothalamus and the optic chiasma. The pituitary gland is divided into anterior and posterior parts. The anterior lobe is almost five times larger than the posterior lobe. It produces hormones in response to factors carried from the hypothalamus by the hypophyseal portal veins.

The posterior pituitary is a direct extension from the hypothalamus, connected to it via the infundibular stalk, which is also considered part of the neurohypophysis. The posterior lobe is made up of nerve fibers whose cell bodies lie in the hypothalamus. Oxytocin and antidiuretic hormone are synthesized in the hypothalamus and travel down the stalk to be released in the posterior pituitary ***(Ryan et al., 2011).***