THE ROLE OF MAGNETIC RESONANCE IMAGING IN THE DIAGNOSIS OF DEMENTIA OF ALZHEIMER'S TYPE.

Essay

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By

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LIST OF ABBREVIATIONS:

٣D….……Three dimensional.

AD……....Alzheimer disease.

ADC.……The apparent diffusion coefficient.

APP…..….Amyloid beta precursor protein.

ASL……..Arterial spinning labeling.

BOLD…...Blood-oxygen-level dependent contrast.

CA……The coronal anatomic sectors of the hippocampus.

Cho...……Choline.

Cr…….Creatine.

CSI……Chemical shift imaging.

DTI……...Diffusion tensor imaging.

DMN……. Default mode network .

DWI……..Diffusion-weighted imaging.

FLAIR…..Fluid Attenuation Inversion Recovery.

fMRI…....Functional magnetic resonance imaging.

FA…….Fractional anisotropy .

FSE……...Fast spin echo.

GM……..Gray matter.

MCI……..Mild cognitive impairment.

MMSE…….Mini-Mental State Examination score.

MRS……MR spectroscopy.

MTI…….Magnetization transfer imaging.

MTR…….Magnetization transfer ratio.

NAA……N-acetyl aspartate.

NBM……The nucleus basalis of Meynert.

ROIs…….Regions of interest.

SDAT……Senile dementia of the Alzheimer's type.

SI……..The signal intensity.

SNR……..Signal/noise ratio.

VBM……Voxel-based morphometry.

WM…….White matter.

WMSHs……White matter signal hyperintensities.

INTRODUCTION

The dementia syndrome is clinically defined as acquired decline of memory and other cognitive domains with significant impairment of executive functioning and activities of daily living . The prevalence of dementia increases continuously with age and has been estimated to be about ١٪ in the age-group between ٦٥ to ٦٩ years and ٢٩٪ at age ٩٠ years and older(Stefan et al ,٢٠٠٨).

The most common known cause of dementia in the elderly is Alzheimer's disease (AD) , Memory impairment is usually the earliest manifestation . Differentiating the gradual decline in memory efficiency associated with typical aging from early AD is a diagnostic difficulty . There is no definite biomarker for the diagnosis, which provides the motivation to develop neuroimaging markers of early AD. (Kantarci et al, ٢٠٠٠).

Neuroimaging has dramatically changed our ability to accurately diagnose AD , new neuroimaging methods facilitate diagnosis of most of the neurodegenerative conditions after symptom onset and show promise for diagnosis even in very early or pre-symptomatic phases (Vitali et al , ٢٠٠٨) .

MRI, as a generally widely available non-invasive and relatively inexpensive technique, has the potential to significantly contribute to our ability to deal with the increasing impact of AD (Stefan et al ٢٠٠٨).

In principle, MR neuroimaging modalities can be divided into two groups ; Structural techniques, (volumetric MRI and diffusion-weighted (DWI) or diffusion tensor (DTI) MRI) and functional techniques (perfusion MRI, blood oxygenation level-dependent (BOLD) fMRI and MR spectroscopy) (Mueller et al , ٢٠٠٨) .

Several studies have shown that structural MRI estimates of tissue damage or loss in characteristically vulnerablee brain regions (such as the hippocampus and entorhinal cortex) are predictive of progression of mild cognitive impairment to AD. Moreover, the clinical utility of MRI in differentiating AD from other pathologies, such as vascular or non Alzheimer neurodegeneration, has been established (Frisoni et al, ٢٠١٠).

Other studies have investigated the cerebral tissue that had undergone metabolic and functional changes before occurrence of abnormal structural changes in the brain. , rendering it possible to set up safe and effective markers for early diagnosis of AD (Chen et al , ٢٠٠٩) .

AIM OF WORK

To highlight the role of different recent techniques of MRI in the evaluation of senile dementia of Alzheimer type.

Chapter ١

ANATOMY OF THE BRAIN

GROSS ANATOMY OF THE HUMAN BRAIN

The brain is that part of the central nervous system which lies within the cranial cavity. It is surrounded by three membranes collectively termed the meninges (Dura matter, arachnoid matter and pia matter) and they are continuous with their spinal counterparts through a foramen magnum. **(Romanes, ١٩٩٢)**.

Dura:

The cranial dura, or pachymeninx, is a tough, fibrous structure with an inner (meningeal) layer and an outer (periosteal) layer. The dural layers over the brain are generally fused, except where they separate to provide space for the venous sinuses and where the inner layer forms septa between brain portions. These septa are falx cerebri which extends down into the longitudinal fissure between the cerebral hemispheres, the tentorium cerebelli that separates the occipital lobes from the cerebellum, the falx cerebelli which projects between the cerebellar hemispheres, and the diaphragma sellae which forms an incomplete lid over the hypophysis in the sellae turcica.

Arachnoid:

The arachnoid, a delicate avascular membrane, covers the subarachniod space, which is filled with CSF. The subarachniod space between the arachniod and the pia is relatively narrow over the surface of the cerebral hemisphere, but it becomes much wider in areas at the base of the brain. These widened spaces are the subarachnoid cisterns.

Pia:

The pia is a thin connective tissue membrane that covers the brain surface and extends into sulci and fissures it combines with the ependyma and choroid vessels to form the choroid plexus of the ventricular system **(Waxman, ١٩٩٧).**