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# Study of Brain Morphology in Healthy Aging and Alzheimer Disease in Sudan using MRI

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**Abstract:** ***The present study fills a gap in the Study of Brain Morphology in Healthy Aging and Alzheimer disease in Sudan using MRI and the main objective of this study is to evaluate the Morphology of the Brain using MRI and CT in Healthy Aging and Alzheimer's in Sudan. This study was done in Sudan University of science and technology and Department of Diagnostic Radiology, Khartoum state Hospitals, Khartoum, Sudan, during the period from April 2015 to June 2017.This study included two groups. Group (A) were 100 healthy individuals, (66 males (66%), 33 females (44%). Group (B) 300 patients, 198 male (66. %) and 102 females (44.0%) with high probability of AD. The mean age of all patients is 45years ranging (15-75) years additional to control group. MRS studies were performed on 1.5 Tesla Toshiba Exclelart Vantage whole body MR systems using standard imaging head coil. The results of this study revealed that the most affected patients by Alzheimer's disease (AD) were male 202 (67%), their ages above 7th decay; the most common sign is Apraxia (77%) and Amnesia (76%). And this study revealed that Predemntia is most type affected by patients (35%) (72 male, 35 female). The majority of patients diagnosed in moderate stage of AD. Early stage of Alzheimer's disease (AD) is rarely affected by patients or rarely diagnosed because with hidden signs and symptoms. The causes the Alzheimer's disease (AD) in this study as the following the most cause of AD is Genetic factor 44% (80male, 52 females), Amyloid Hypothesis factor is 43 % (78 male, 52 females) and rare cause factor is Tau Hypothesis 07 %( 15 male, 06 females). Diagnostic Imaging Factors the Alzheimer's disease revealed that the Hypocampal Atrophy imaging factor is most predictive factors in diagnosis by Magnetic Resonance Imaging (MRI) (71%), Temporal lobe atrophy (MTA) factor (71%), Diffuse cerebral Atrophy factor is (68%) and Increase size of Ventricles factor(66%). This study concluded that the majority of patients were male, the most common sign is Apraxia, the majority of patients diagnosed in moderate stage of AD, the most cause of is Genetic factor and the Hypocampal Atrophy imaging factor is most predictive factors in diagnosis by Magnetic Resonance Imaging (MRI.***

**Keywords:** Alzheimer disease, neuropathology, brain atrophy, MRI

## 1. Introduction

Alzheimer's disease (AD) is a multifaceted disease in which cumulative pathological brain insults result in progressive cognitive decline that ultimately leads to dementia. Amyloid plaques, neurofibrillary tangles (NFTs), neurodegeneration, and inflammation are the well-established pathological hallmarks of AD. A plausible model for the development of AD posits that amyloid deposition occurs early in the process but by itself does not directly cause clinical symptoms [1, 2]. Neuronal and synaptic losses appear to be key determinants of cognitive impairment in AD [3, 4]. If neuronal loss leads to cerebral atrophy (as is likely), then it can be expected that cognitive decline and atrophy will be closely associated.

On the basis of this evidence, it has been hypothesized that AD pathological cascade is a two-stage process in which amyloidosis and neuronal pathology are largely sequential rather than simultaneous processes [5, 6]. There is also sufficient literature to support the fact that atrophy of the brain structures or neurodegeneration is the most proximate substrate of cognitive impairment in AD [7-9]. Structural magnetic resonance imaging (sMRI) measures brain morphometry and therefore can capture gray matter atrophy related to the loss of neurons, synapses, and dendritic de-arborization that occurs on a microscopic level in AD; white matter atrophy related to the loss of structural integrity of white matter tracts, presumably resulting from demyelination and dying back of axonal processes; and exvacuo expansion of cerebrospinal fluid (CSF) spaces. It has been shown that neuronal loss correlates with but exceeds NFT density in AD and is related directly to impaired cognitive function [10]. Neuronal loss also correlates with Braak NFT stage and quantitative NFT burden, validating sMRI as an AD biomarker [11-13]. According to our knowledge, information on dementia prevalence in Sudan is very limited.

The present study fills a gap in the Study of Brain Morphology in Healthy Aging and Alzheimer disease in Sudan using MRI and the main objective of this study is to evaluate the Morphology of the Brain using MRI and CT in Healthy Aging and Alzheimer's in Sudan.

## 2. Material and Method

The study is performed In Sudan. In Khartoum state hospitals (Omdurman Military Hospital, Khartoum Teaching hospital, Khartoum Public teaching Hospital, Khartoum North, Imperial Private Hospital and polyclinics privates).

This study include two groups.Group (A) were 100 healthy individuals, (66 males (66%), 33 females (44%).Group (B) 300 patients, 198 male (66. %) And 102 females (44.0%). with high probability of AD. The mean age of all patients is 45years ranging (15-75) years additional to control group. Standardized forms were used to collect data on mores variables divided into main categories, namely age, sex,

Signs the (AD), Types the (AD), and causes (AD) and Diagnostic Imaging Factors the (AD). Data collection according to work sheet (Appendix) includes all above variables data. (Attached sheet). Data analysis by using SPSS. 16 MRS studies were performed on 1.5 Tesla Toshiba whole body MR systems using standard imaging head coil. Routine brain MRI was performed in 3 orthogonal planes, including at least T1, T2, and fluid-attenuated inversion recovery (FLAIR) weighted images.

Coronal-oblique T1-weighted images are used for the assessment of medial temporal lobe and hippocampal atrophy. They are obtained in a plane orthogonal to the long axis of the hippocampus; this plane is orientated parallel to the brainstem. These should be thin-section images and are ideally obtained by reformatting a sagittal 3D T1 sequence through the entire brain. Additional sagittal reconstructions will enable the assessment of midline structures as well as parietal atrophy, which may be involved in certain neurodegenerative disorders. FLAIR images are used to assess global cortical atrophy (GCA), vascular white matter hyperintensities and infarctions. T2-weighted images are used to assess infarctions, in particular lacunar infarctions in the thalamus and basal ganglia, which can be missed on FLAIR images.

T2*-weighted images are necessary to detect microbleeds in amyloid angiopathy. These images can also depict calcifications and iron deposition.

DWI should be considered as a supplemental sequence in young patients or in rapidly progressive neurodegenerative disorders (DD - vasculitis, CJD).

## 3. Result Presentation:

**Table 1:** Shows Frequency Distribution of Diagnostic Imaging Factors the Alzheimer's disease

| Diagnostic Imaging Factors Of AD | Male | Female | Total | Valid percent |
|---|---|---|---|---|
| Hypocampal Atrophy | 130 | 86 | 216 | 71% |
| Temporal lobe atrophy (MTA) | 152 | 63 | 215 | 71% |
| Atrophy (Koedam score) | 126 | 39 | 165 | 55% |
| Posterior cortical atrophy | 99 | 76 | 175 | 58% |
| Diffuse cerebral Atrophy | 132 | 73 | 205 | 68% |
| Enlarge Sulci | 84 | 49 | 133 | 44% |
| Increase size of Ventricles | 121 | 79 | 200 | 66% |
| white matter lesions (Fazekas Scales) | 141 | 48 | 189 | 63% |

| | Frequency | Percent | Valid Percent |
|---|---|---|---|
| Male | 202 | 67 | 67 |
| Female | 100 | 33 | 33 |
| Total | 302 | 100 | 100 |

**Figure 1:** Show frequency Distribution of Patient Gender Affected by Alzheimer's disease (AD)

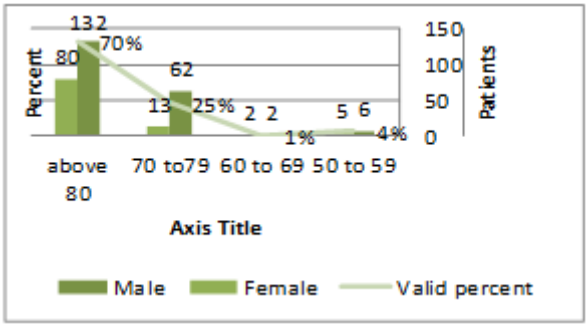


**Figure 2:** show Frequency Distribution of Patient Ages Affected by Alzheimer's disease (AD), the majority of patient's ages

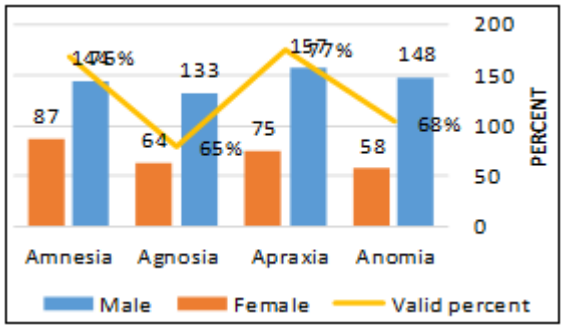


**Figure 3:** shows Frequency Distribution of Signs the Alzheimer's disease (AD)

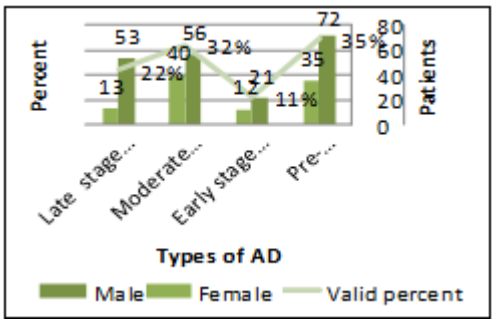


**Figure 4:** shows Frequency Distribution of Types the Alzheimer's disease

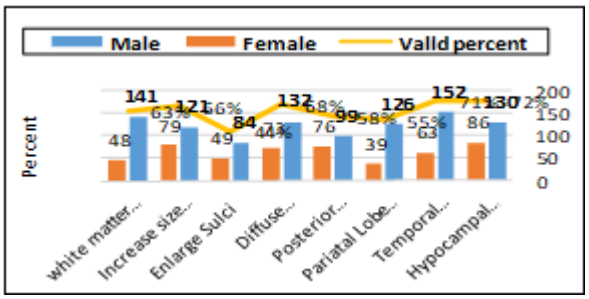


**Figure 5:** Shows Frequency Distribution of Diagnostic Imaging

## 4. Discussion

This study was done at Sudan University of science and technology and Department of Diagnostic Radiology, Khartoum state Hospitals, - Khartoum, Sudan, during the period from April 2015 to June 2017.The results of this study that the majority of patients were male 202 (67%) more than female 100(33%).and the Frequency Distribution of Patient Ages Affected by Alzheimer's disease (AD), the majority of

patients ages above 7th decay approximately male more female. The results of this study revealed that the most affected patients by Alzheimer's disease (AD) were male 202 (67%), their ages above 7th decay; the most common sign is Apraxia (77%) and Amnesia (76%). And this study revealed that Predemntia is most type affected by patients (35%) (72 male, 35 female).The majority of patients diagnosed in moderate stage of AD. Early stage of Alzheimer's disease (AD) is rarely affected by patients or rarely diagnosed because with hidden signs and symptoms. The causes the Alzheimer's disease (AD) in this study as the following the most cause of AD is Genetic factor 44% (80male, 52 females), Amyloid Hypothesis factor is 43 %( 78male, 52 females) and rare cause factor is Tau Hypothesis 07 %( 15 male, 06 females). Diagnostic Imaging Factors the Alzheimer's disease revealed that the Hypocampal Atrophy imaging factor is most predictive factors in diagnosis by Magnetic Resonance Imaging (MRI) (71%), Temporal lobe atrophy (MTA) factor (71%), diffuse cerebral Atrophy factor is (68%) and Increase size of Ventricles factor (66%). This study concluded that the majority of patients were male, the most common sign is Apraxia, the majority of patients diagnosed in moderate stage of AD, the most cause of is Genetic factor and the Hypocampal Atrophy imaging factor is most predictive factors in diagnosis by Magnetic Resonance Imaging (MRI).

## 5. Conclusion

This study concluded that the majority of patients were male, the most common sign is Apraxia, the majority of patients diagnosed in moderate stage of AD, the most cause of is Genetic factor and the Hypocampal Atrophy imaging factor is most predictive factors in diagnosis by Magnetic Resonance Imaging (MRI)

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