

Sudan University of Science and Technology
College of Graduated Studies



**Study of Brain Geriatric Consequences in Sudan using CT,
MRI**

دراسة تبعات الشيخوخة على المخ في السودان بواسطة الأشعة المقطعية و الرنين
المغناطيسي

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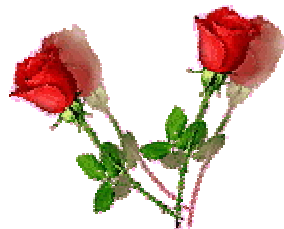
D e d i c a t i o n

This thesis is dedicated to the soul of my dad **Mohammed MukhtarAlaasr**, who taught me that the best kind of knowledge to strength me a long y lifehood. It is also dedicated to my mum **Aeisha**, who taught me that even the largest task can be accomplished if it is done one step at a time.

I dedicate the benefits of this humble work to my beloved sisters and brothers.

And special dedicate to my small family

And to my close friends



A c k n o w l e d g m e n t

Sincere thanks and deep gratitude to my
parent who foster me through my life up to
this stage of knowledge

And as well to all my teachers who illuminate
my life with supports and guidance during
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Table of Contents:

Chapter NO	Contents	Page
	الآية	II
	Dedication	III
	Acknowledgments	IV
	Contents	V
	List of figures	VII
	List of abbreviations	VIII
	Abstract	X
	ملخص البحث	X1
1	Chapter One	1
	1.1 Introduction	2
	1.2 Problem of the study	21
	1.3 Objective of the study	21
	1.4 Thesis outline	21
2	Chapter Two	23
	2.1 Literature review	

3	Chapter Three Methodology of the study 3.1 Materials 3.2 Method	33 33
4	Chapter Four 4.1 Results	35
5	Chapter Five 5.1 Discussion and Analysis	44
6	Chapter six 6-1 conclusion 6-2 Recommendations 6-3 References	49 52 53

List of Figures:

Fig. No.	Figure caption	Page
Figure (1.1)	Sagittal section view of the brain	5
Figure (1.2)	Ventricular system of the brain	5
Figure (1.3)	Some internal structures of the brain and highlighting the white and gray matter	6
Figure (1.4)	The venous drainage of the brain	13
Figure (2.1)	The correlation between the patient's age and the cranial volume in mm	25
Figure (2.2)	The correlation between patient age and the ventricles volume in mm.	26
Figure (2.3)	The ratio of brain ventricle\cranial volumes for common cranial pathologies	28
Figure (2.4)	Brain volumes of 7 Ugandan epilepsy	30
Figure (2.5)	The relation between the age and cranial vault for male and female	32
Figure (4.1)	The correlation between age in years and ventricle volume in cm ³ in Sudan	35
Figure (4.2)	The correlation between age in years and ventricles volume in cm ³ for male and female in Sudan	36
Figure (4.3)	The correlation between the age in years and ventricle to cranium volume ratio in Sudan	37

Figure (4.4)	The correlation between age in years and signal intensity (T_1) for gray and white matter in Sudan	38
Figure (4.5)	The correlation between age in years and signal intensity (T_2) for gray and white matter in Sudan	39
Figure (4.6)	The correlation between age in years and signal intensity (T_1, T_2) for white matter in Sudan	40
Figure (4.7)	The correlation between age in years and signal intensity (T_1, T_2) for gray matter in Sudan	41
Figure (4.8)	The correlation between age in years and HU for white and gray matter in Sudan	42
Figure (4.9)	The correlation between HU versus signal intensity of white and gray matter in Sudan	43

List of abbreviation:

MRI	Magnetic resonance image
CT	Computer tomography
HU	Hounsfield unit
SI	Signal intensity

ABSTRACT :

The aim of this study was assessment of geriatric brain consequences in Sudan by using computer tomography and magnetic resonance image.

The methodology was based on measurement of brain ventricles, cranial volume, Hounsfield unit, signal intensity of gray and white matters.

The results showed that: aging shows less significant ($R^2 = 0.4$) impact on ventricle volume generally (due to gender factor) and the correlation best fitted to equation: $y = 1.4588x - 40.742$, where x refers to age in years and y refers to ventricle volume in cm^3 . The impact of aging in ventricles volume for male and female shows significant ($p = 0.05$) increment in ventricle volume after 69 years with prominent effect among male; while before the age of 69 years old the impact on volume was so steady.

Aging was less significant ($R^2 = 0.4$) impact on ventricle/cranium volume ratio generally and the correlation has been increases following the aging increment that could be best fitted to equation: $y = 0.0005x - 0.0139$, where x refers to age in years and y refers to ventricle/cranium volume ratio.

The aging showed less significant impact ($R^2 = 0.3$) in signal intensity (T_1) of white and gray matter which are in decreasing proportionality with aging and having prominent high signal intensity of white matter relative to gray matter. The correlation between ageing and signal intensity for white/gray matter at (T_1) could be best fitted to equation $y = 0.9337x + 831.09$ (white matter) and $y = 1.2823x + 799.03$ (gray matter), where x refers to age in years and y refers to signal intensity

of (T_1). A reduced signal intensity has been noticed at (T_2) following aging for white and gray matter have with correlation could be fitted to equations of the form $y = -6.6489x + 1278.2$ (white matter) and $y = -4.7937x + 1028.4$ (gray matter).

In the correlation between age in years and signal intensity (T_1 , T_2) for white matter in; there is decreasing proportional correlation between aging and signal intensity (T_1 , T_2) for white matter with prominent signal of T_1 relative to T_2 . The relevant correlation could be fitted to equations: $y = -3.758x + 1035.7$ (white matter at T_1) and the other is $y = -4.7937x + 1028.4$ (white matter at T_2) with high significant correlation ($R^2 = 0.9$). same correlation has been noticed in the correlation between age in years and signal intensity (T_1 , T_2) for gray matter; with only shifting of signal intensity of gray matter at T_2 to higher value relative to T_1 .

In the correlation between age in year and the HU for white and gray matter; the age showed high significant ($R^2 = 0.8$) reducing impact in white matter HU that fitted to equations of the following forms: $y = 0.5274x + 9.6864$; while there is an increasing impact in gray matter HU that fitted to equation: $y = -0.2618x + 40.093$, where x refers to age in year and y refers to HU for relative white and gray matter.

In the correlation between HU (*CT parameter*) and signal intensity (*MRI parameter*) of white and gray matter, It is obviously noticed that: the HU influencing the signal intensity significantly ($R^2 = 0.7$) as increasing correlation fitted to equation: $y = 14.121x + 385.94$, and as a reduction significant ($R^2 = 0.8$) impact in gray matter that could be fitted the equation of the following form: $y = -10.614x + 1307.9$, where x refers to HU and y refers to signal intensity for white and gray matter.

الملخص :

الهدف من هذه الدراسة هو تقييم تبعات الشيوخه على المخ وما يحدث فيه من تغييرات وذلك باستخدام جهاز الأشعة المقطعية وجهاز الرنين المغناطيسي . استند منهج الدراسة على قياس البطينات الدماغية وحجم الجمجمة وقوة وتماسك الانسجة البيضاء والرمادية داخل المخ وكذلك نسبة تواجد السائل داخل المخ . أظهرت النتائج أن: الشيوخة تظهر تأثيراً أقل أهمية ($R^2 = 0.4$) على حجم البطين عمومًا (بسبب عامل الجنس) والعلاقة الأنسب للمعادلة $y = 1.4588x - 40.742$ ، حيث تشير x إلى العمر بالسنوات ويشير y لحجم البطين في CM3. تأثير الشيوخة في حجم البطينين للذكور والإناث يظهر زيادة معنوية ($p = 0.05$) في حجم البطين بعد 69 سنة مع تأثير بارز بين الذكور ؛ بينما قبل سن 69 سنة كان التأثير على الحجم ثابتاً جداً .

للشيوخة تأثير أقل أهمية ($R^2 = 0.4$) على نسبة حجم البطين / الجمجمة بشكل عام وكان الارتباط يزداد بعد زيادة الشيوخة التي يمكن تركيبها على نحو أفضل في المعادلة $y = 0.0005x - 0.0139$ ، حيث تشير x إلى العمر بالسنوات و y يشير إلى نسبة حجم البطين / الجمجمة.

أظهر التقادم تأثيراً أقل أهمية ($R^2 = 0.3$) في شدة الإشارة (T1) للمادة البيضاء والرمادية التي تتناقص تناسبياً مع تقدم العمر وتكون لها كثافة إشارة عالية بارزة لمادة بيضاء بالنسبة إلى الأم الرمادية. يمكن ربط العلاقة بين التقادم وكثافة الإشارة للمادة البيضاء / الرمادية عند (T1) بالمعادلة $y = 0.9337x + 831.09$ (المادة البيضاء) و ($y = 1.2823x + 799.03$ المادة الرمادية) ، حيث تشير x إلى العمر في سنوات و y تشير إلى شدة الإشارة من (T1) لوحظت شدة إشارة مخفضة عند (T2) بعد التقادم للمادة البيضاء والرمادية ذات العلاقة يمكن تركيبها في معادلات الشكل ($y = -6.6489x + 1278.2$ المادة البيضاء) و- $y = 4.7937x + 1028.4$ الرمادي .

في العلاقة بين العمر في السنة و HU للمادة البيضاء والرمادية ؛ أظهر العمر ارتفاعاً كبيراً ($R^2 = 0.8$) يقلل من التأثير في المادة البيضاء HU التي تتناسب مع معادلات الأشكال التالية $y = 0.5274x + 9.6864$ ؛ بينما هناك تأثير متزايد في المادة الرمادية HU التي تتناسب مع المعادلة $y = -0.2618x + 40.093$ ، حيث تشير x إلى العمر في السنة وتشير y إلى HU للمادة البيضاء والرمادية النسبية. في العلاقة بين HU معلمة (CT) وكثافة الإشارة (معلمة التصوير بالرنين المغناطيسي) للمادة البيضاء والرمادية ، من الواضح أنه: تؤثر HU على كثافة الإشارة بشكل ملحوظ ($R^2 = 0.7$) كعلاقة ارتباط متزايدة معادلة للمعادلة $y = 14.121x + 385.94$ ، وكتخفيض كبير ($R^2 = 0.8$) تأثير في المادة الرمادية التي يمكن تركيبها معادلة الشكل التالي $y = -10.614x + 1307.9$ ، حيث تشير x إلى HU و y تشير إلى كثافة الإشارة للأبيض والمادة الرمادية.