

Dedication

This thesis is dedicated to my loving wife and the rest of my family- my wonderful parents, brother, in-laws nieces, and nephews. To my brilliant colleagues, fellows, residents and technologists who have taught me the art of MRI.

Acknowledgments

First I would like to thank God for the opportunity to be involved in this project, the wisdom to undertake it, and the determination to see it through.

I would like to express my sincere thanks to all my colleagues who have provided suggestion and contribution. My gratitude is extended to my supervisor Dr. Caroline Edward for her helps. Their works have stimulated and fostered my efforts in producing this research.

In addition I must also thanks Dr. Mawia Abdalla head of Neurology department Wad Madani Teaching Hospital for their guidance and help.

I wish to acknowledge the university diagnostic center , department of MRI for their assistance in compiling the cases.

Abstract

The purpose of this study was to detect epilepsy using MRI as volumetric tools to measure hippocampal volume and area. In addition to determine whether or not there is a relation between age and seizure onset, duration of epilepsy, seizure frequency, and treatment on patients with epilepsy.

29 patients were diagnosed with temporal lobe epilepsy according to EEG result and clinical data underwent MR imaging. 17 control group were studied retrospectively, absolute and normalized hippocampal measurement were compared between the patients and control group. T1 and T2 weighted images in oblique coronal plane were obtained for consecutive patient (11 male & 18 female) compared with control group (6 male & 11 female). The volume and area of hippocampus were quantitatively measured using manual tracing. The radiologist independently reviewed the MR imaging findings of the hippocampus regarding atrophy, abnormal signal intensity, on each side.

High signal intensity (75.9%) of the hippocampus in T2 weighted MR images in patients with epilepsy when low signal was visible in control group. The volume was found to be smaller in epileptic patients compared with the healthy control. There were mild decreasing in seizure frequency according to anti epileptic drugs in patients with epilepsy.

The study findings support the view that high signal intensity on T2 and hippocampus reduction are associated with epilepsy.

الملخص

الهدف الاساسى من الدراسه هو تحديد دقة و م قدرة التصوير بالرنين المغنطيسى على تشخيص مرض الصرع واستخدام الادوات المتوفره فى برنامج الكمبيوتر الخاص بالرنين لقياس حجم ومنطقه الحصينى بالجهاز الحوفى فى الدماغ.

ايضا دراسه العلاقه بين حدوث التشنجات ومدة التشنج وتكراره وعلاقه استعمال العلاج فى تقليل مدة التشنجات.

أستخدمت فى الدراسه 29 مريض (11 من الذكور, 18 من الاناث) كان

تشخيصهم المبدئى صرعه فى الفص الصدغى وفقا لنتيجه رسم المخ والمعلومات السريرييه التى أخذت من المرضى وتم تحويلهم للتصوير بالرنين المغنطيسى .

أخذت عينه من الاشخاص الاصحاء مجموعها 17 الذين تمت دراستهم بدقه وتم قياس الحصينى بالجهاز الحوفى ومقارنته بين الأشخاص الأصحاء والمرضى تم التصوير بالرنين المغنطيسى فى زمن الراحة الأول والثانى بمقاطع تاجيه مائله وعموديه على محور الفص الصدغى .

تم قياس حجم ومساحة الحصينى يدويا ,ومن ثم معاينه صور الرنين المغنطيسى بواسطة اختصاصى لتشخيص حالة الحصينى من حيث الضمور وتغير شدة الإشارة .

لوحظ تغير فى شدة الإشارة فى زمن الراحة الثانى للحصينى بالنسبه لمرضى الصرعه مقارنة بوجود أشاره طبيعيه لوحظت بالنسبه للأشخاص الأصحاء.

أهم النتائج التى استنتجت بالنسبه لمرضى الصرعه مقارنة بالأشخاص الأصحاء هى ضمور حجم الحصينى عند المرضى المصابين بجميع أنواع الصرعه مقارنة بالأشخاص الأصحاء. وايضا وجد أن هنالك نقصان فى مده

حدوث وتكرار التشنجات بالنسبة للمرضى الذين يتناولون الادوية المضادة للتشنجات بانتظام.

خلاصه هذه الدراره تصب وتدعم وجهة النظر القائله بأن مرضى الصرع بجميع أنواعه لديهم تغير فى شدة الأشاره بصورة الرنين المغنطيسى فى زمن الراحه الثانى مع نقصان فى حجم الحصينى م قارنه بالأشخاص الأصحاء.

List of Abbreviations

AED	Anti epileptic drug
ATL	Anterior Temporal Lobectomy
BBB	Blood Brain Barrier
CPS	Complex Partial Seizure
CSF	Cerebrospinal Fluid
CT	Computed Tomography
EC	Elevated Extracellular
EEG	Electroencephalography
FLAIR	Fluid attenuated inversion recovery
FS	Febrile Seizure
GABA	Gamma-aminobutyric acid
GEF+	Generalized epilepsy with febrile seizures plus
GSW	Generalized Spike Wave
HF	Hippocampal Formation

HIV	Human Immunodeficiency Virus
HS	Hippocampal Sclerosis
IGE	Idiopathic Generalized Epilepsy
ILAE	International League Against Epilepsy
LRE	Localization Related Epilepsy
MCD	Malformation of Cortical Development
MRI	Magnetic Resonance Imaging
MTLE	Medial Temporal Lobe Epilepsy
MTS	Mesial Temporal Sclerosis
PLHS	Partial Loss of the Hippocampal Striation
PWE	Person with Epilepsy
ROI	Region of Interest
T1	T1 Relaxation Time
T2	T2 Relaxation Time
TLE	Temporal Lobe Epilepsy

Table of Contents

Dedication	i
Acknowledgment	ii
Abstract (English Language)	iii
Abstract (Arabic Language).....	iv
List of Abbreviations	v
List of Contents	vii
List of Figures	ix
List of Tables	x
1. Introduction	1
1.2. Problem	2
1.3. Objectives	3
1.4. Justification of the study	3
1.5. Significance of the study	3
1.6. Overview of the study	4
2. Literature Review and Previous Studies	5

2.1. Anatomy and Physiology of the Brain	5
2.1. 1.Brain Organization Protection and Blood Supply	5
2.1.2. Cerebrospinal Fluid	6
2.1.3.The Brain stem.....	7
2.1.4. The Cerebellum	9
2.1.5. The Diencephalon	10
2.1. 6.The Cerebrum	12
2.1.7. The Limbic System	13
2.1.8. Hemispheric Lateralization	15
2.1.9. Brain Waves	17
2.2. Epilepsy	18
2.2.1. Etiology	20
2.2.2. Classification of Seizures and Epilepsies	22
2.2.3. Classification of Epileptic Syndrome	24
2.2. 4.Incidence	26
2.3. Previous Studies	28
3. Methodology	37
3.1. Materials	37
3.2. Volume Measurement Manually	39
3.2. 4.Methods of Data Aanalysis	40
4. Results	41
5. Discussion, Conclusion and Recommendations	51

5.1. Discussion	51
5.2. Conclusion	55
5.3. Recommendations	56
6. References	57
Glossary	60

List of figures:

Figure 1- 1. Major Part of the Brain	6
Figure 1- 2. Transverse Section of Brain Showing Choroid Plexuses	7
Figure 1- 3. The Brain Stem	9
Figure 1- 4. Mid Sagittal Section of Cerebellum and Brain Stem	10
Figure 1- 5. Sagittal Section of Brain Showing Hypothalamic Nuclei.....	11
Figure 1- 6. Right Lateral View With Temporal Lobe out away	12
Figure 1-7. Anterior View of Frontal Section of Basal Ganglia.....	13
Figure 1- 8. The Limbic System	14
Figure 1- 9. Functional Area of Cerebrum	16
Figure 1- 10. Types of Brain Waves Recorded in An electroencephalogram ...	18
Figure 3-1 .MRI Plane for Evaluation the Hippocampus	38
Figure 2-3. Manual Tracing of the Hippocampus Region	39
Figure 4-1. The Relation Between the Epilepsy Duration and the Age.....	43

Figure 4-2. The Relation Between the Epilepsy Frequency and the Age.....	45
Figure 4-3. The Relation Between Seizure Frequency and Rt Hippocampal Area.....	47
Figure 4-4. The Relation Between Seizure Frequency and Right Hippocampal Volume.....	48
Figure 4-5. The Relation Between Seizure Frequency and Lt Hippocampal Area.....	49
Figure 4-6. The Relation Between Seizure Frequency and Left Hippocampal Volume.....	50

List of Tables

Table (4-1) Shows Mean and Standard Deviation of the Selected Variables.....	41
Table (4-2) Shows the Distribution of Gender.....	41
Table (4-3) Shows the Frequency of Epilepsy Duration.....	42
Table (4-4) Shows the Frequency of EEG Result.....	43
Table (4-5) Shows the Frequency of T2 Signal.....	44
Table (4-6) Shows the Relationship Between Treated and None Treated.....	44
Table (4-7) Shows the Correlation Between Seizure Frequency & Treatment ...	44
Table (4-8) Shows Correlation between EEG, Epilepsy Duration, and Lt Hippocampal Area.....	45
Table (4-9) Shows T-Test Difference Between Male& Female Measurement ...	46
Table (4-10) Shows the Measurement of Aarea and Volume Between None Treated & Treated in Mean and Std. Deviation and p-value.....	46
Table (4-11) Shows the T2 Signal Status in Normal & Abnormal as Std. Deviation and P-value.....	47
Table (4-12) Shows Mean and Standard Deviation of the Abnormal	

and Control Group and the *P* Value for Area & Volume of Hippocampus.....50