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St. Paul's Hospital Millennium Medical College



SPHMMC

DEPARTMENT OF RADIOLOGY

A RETROSPECTIVE STUDY ON PATTERNS OF BRAIN MRI FINDINGS IN PATIENTS WITH PEDIATRIC EPILEPSY SEEN IN THE RADIOLOGY DEPARTMENT AT SPHMMC, ADDIS ABABA, ETHIOPIA

INVESTIGATOR: DR. MERON NIGUSSIE (MD, RADIOLOGY RESIDENT)

A PROPOSAL PAPER TO BE SUBMITTED TO SPHMMC RADIOLOGY DEPARTMENT IN PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE CERTIFICATE IN RADIOLOGY.

AUGUST, 2019

ADDIS ABABA, ETHIOPIA

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ABSTRACT

Background: Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures. It can result from inherited (genetic) or acquired factors or a combination of both. Important causes include infections, head trauma, vascular malformations, brain tumors and stroke. MRI can diagnose these wide varieties of pathologic lesions routinely and noninvasively.

Objective: The objective of this study was to assess the patterns of brain MRI findings in pediatric epilepsy patients in SPHMMC

Method: A retrospective cross-sectional study was conducted at SPHMMC among pediatric epilepsy patients evaluated at radiology department from March 2018 to August 2019 G.C. All patients who fulfill the International League Against Epilepsy (ILEA) criteria of epilepsy and who had brain imaging done on a 1.5T MRI machine with standard epilepsy protocol were included in this study. Data was collected by using structured data collection format, analyzed using SPSS version 20.0 software and results was displayed using descriptive statistics. The total budget required for the study was 25,443 birr.

Results: A total of 243 patients had brain MRI done at the radiology unit for the clinical indication of seizure during the study period. Among whom 162 patients who had at least one epileptic seizure, who had their brain MRI done on standard epilepsy protocol and whose charts were retrievable were included in this study. Out of the included patients 90(55.6%) were male, 72 (44.4%) were female, 58 (35.8%) were in the 0-6 years age group, 15(9.5%) were between 6 and 12 years of age and more than half of all patients (55%) were aged between 12 and 18years. The commonest type of seizure reported in this study was generalized tonic clonic seizure (GTC) accounting for 87 (53.7%) of the cases and 74(45.7%) of the patients had their first seizure between the age of 12-18 while 68(42%) had their first seizure before 6 years of age. Abnormalities were detected on the brain MRI in about 56 (34.6%) of the cases.

The commonest brain abnormality detected in this study was gliosis/brain parenchymal volume loss which was seen in 30 (53.6%) of the cases. The other abnormalities seen include developmental cortical malformation 6 (10.7%) , mesial temporal sclerosis 4(7.1%) and brain

tumor 3(5.4%). The commonest cause of gliotic change identified was perinatal injury 12(41.4%) and 18(62%) of the gliotic lesions were seen among children aged less than 10 years.

Conclusion: In this study, children aged between 12 and 18 years were more affected by epilepsy where GTC was the commonest seizure type. Gliosis or brain parenchymal volume loss predominantly caused by perinatal injury was the commonest type of brain abnormality. The other lesions identified included developmental cortical malformations, mesial temporal sclerosis, brain tumors and infections.

Key words: Seizure, Epilepsy, SPMMC, MRI, Gliosis, Perinatal injury

SAINT PAUL’S HOSPITAL MILLENNIUM MEDICAL COLLEGE
DEPARTMENT OF RADIOLOGY

This is to certify that the research paper prepared by Dr Meron Nigussie, entitled “**A RETROSPECTIVE STUDY ON PATTERNS OF BRAIN MRI FINDINGS IN PATIENTS WITH PEDIATRIC EPILEPSY SEEN IN THE RADIOLOGY DEPARTMENT AT SPHMMC, ADDIS ABABA, ETHIOPIA**” is submitted in partial fulfillment of postgraduate study in radiology and meets the accepted standards with respect to the originality and quality.

Name _____

Signature _____

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ABBREVIATIONS

AVM..... Arteriovenous Malformation

CD Cortical Dysplasia

EEG Electroencephalogram

GTC Generalized Tonic Clonic Seizure

ILAE International league Against Epilepsy

MRI Magnetic Resonance Imaging

MTS Mesial Temporal Sclerosis

NCDS----- Non-Communicable Disease

PBT ----- Primary brain tumor

SPHMMC ----- St. Paul Hospital Millennium Medical College

Title

- i. ABSTRACT.....
- ii. ACKNOWLEDGMENT.....
- iii. ABBREVIATIONS

Table of Contents

1. CHAPTER ONE: INTRODUCTION	1
1.1 BACKGROUND	1,2
1.2 STATEMENT OF THE PROBLEM	3
2. CHAPTER TWO: LITRATURE REVIEW	4-7
3. CHAPTERTHREE:SIGNIFICANS OF THE STUDY.....	8
4. CHAPTER FOUR: OBJECTIVES.....	9
4.1 General objective.....	9
4.2 Specific objectives	9
5. CHAPTER FIVE: METHODS AND MATERIALS	10-13
5.1 Study area and period	10
5.2 Study design	10
5.3 Population	10
5.3.1 Source population	
5.3.2 Study population.....	
5.4 Inclusion and exclusion criteria	10
5.4.1 Inclusion criteria	10
5.4.2 Exclusion criteria.....	11
5.5 Sampling technique and sample size.....	11
5.6 Variables and measurement	12
5.7Data collection	12
5.8Data analysis and interpretation	12
5.9 Data quality control	12

5.10 Ethical considerations	13
5.11 operational definition	13
6.CHAPTER SIX: RESULT	14-20
7.CHAPTER SEVEN: DISCUSSION	21,22
8.CONCLUSION	23
9.REFERENCES:	24-26
9.ANNEX:	
9.1QUESTIONNAIRE	27-30

LIST OF TABLES

Table 1: Demographic distribution and reported age at first seizure of patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 2: Distribution of patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019 by seizure type and contrast administration

Table 3: Brain MRI results of patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 4: Distribution of number, location and cortical involvement of abnormal MRI findings in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 5: Distribution of abnormal brain MRI findings in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 6: Causes of gliotic changes identified in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 7: Types and frequency of abnormal MRI findings identified in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Table 8: Types and frequency of cortical malformations identified in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND

Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological and social consequences of this condition. The definition of epilepsy requires the occurrence of at least one epileptic seizure. Epilepsy is not one condition, but rather a diverse family of disorders, having in common an abnormally increased predisposition to seizures and it can result from inherited (genetic) or acquired factors or a combination of both. In children developmental brain malformations are an important cause and infections, head trauma, vascular malformations, brain tumors, parasitic infections, stroke, autoimmune and inflammatory disorders are also considered important risk factors for epilepsy.

Epilepsy is the most common NCD of neurological origin that affected over 50million people worldwide. Unlike many of the NCDs Epilepsy is more prevalent in children and young adults. Over 85% of the Epilepsy cases are found in low and middle-income countries of Africa that has the greatest number of the world's population under the age of 15 years. 70% of the people with Epilepsy can live a seizure free life if treated and despite that 90% of the people with seizure in sub-Saharan Africa do not receive treatment. (2)

About 100 million people worldwide will have at least one epileptic seizure at some point in their lives. The condition has serious physical, psychological, social and economic impact on the affected person and his families. (2)

A systematic analysis of 32 studies to estimate the prevalence of epilepsy in sub-Saharan Africa showed active epilepsy affects 4.4 million people in Sub-Saharan Africa. The prevalence of active epilepsy peaks in the 20–29 age group at 11.5/1000 and again in the 40–49 age group at 8.2/1000. The lowest prevalence value of 3.1/1000 is seen in the 60+ age group.[23, 24] In a series of 912 Kenyan people, a study showed that the first two decades witness the greatest number of patients (68.5 %).[25] A review study on epidemiology and etiology of epilepsy in sub-Saharan Africa found that the reported age at seizure onset was before age 20 years in more than 60% of cases and the bimodal distribution seen in developed countries was not seen in studies done in sub-Saharan Africa. The study also showed a predominance of generalized tonic-clonic seizures (GTCS)

among the seizure types. [5] In a study done in rural central Ethiopia, an incidence rate of 64 per 100,000 inhabitants was reported. Both incidence and prevalence were higher in males. It has been estimated that the prevalence of active epilepsy worldwide is 8% of the general population. (2)

Modern neuroimaging is central to the assessment of patients with epilepsy and has dramatically modified their management. (3).MRI can identify substrates underlying epilepsy and guide clinicians in the determination of treatment and prognosis. (3) In newly diagnosed epilepsy MRI may identify an epileptogenic lesion in 12-14% of the patients but up to 80% of the patients with recurrent seizures have structural abnormalities evident on MRI. (3)

In developed countries Hippocampal sclerosis and Malformations of cortical Development are the most commonly identified structural causes of intractable seizures followed by Vascular Malformations, Tumors and Post-traumatic Inflammatory and Ischemic lesions. (3) In general, all patients with epilepsy or whose chronic epilepsy has not been fully assessed should be investigated with MRI. (3)

1.2. STATEMENT OF THE PROBLEM

Epilepsy is a common disorder and it has a social, economic, and health burden not only to the affected individual but also the community in general. The main purpose of neuroimaging in epilepsy patients is to identify underlying structural abnormalities that require specific treatment (surgery in most instances) and also to aid in formulating syndromic or etiologic diagnosis. MR imaging is an excellent tool for detecting these anatomic abnormalities that underlie regional brain epileptogenesis. The past decades have seen the rapid development of brain imaging techniques, both in terms of acquisition and of image processing, which are affording new insights into the causes and consequences of epileptic seizures and the epilepsies. MRI scanners have become widely available in developed countries, however in developing countries like Ethiopia MRI is a new diagnostic tool that is only found in a few centers. As per the knowledge of the author, there is only a single study which has described the neuroimaging findings of patients with epilepsy in Ethiopia. Furthermore, studies identifying the underlying anatomical causes of epilepsy on brain MRI using standardized epilepsy protocols are lacking. This study will try to assess the various structural causes of pediatric seizures that are detected on MRI done at SPMMC in the last one and a half year and so will be used as a baseline study for future larger studies. The information that will be gathered from this study will be used to draw recommendation to the health sectors and the society on the preventable causes of structural brain lesions that will lead to seizure such as Encephalomalacia which is often a result of Hypoxic-Ischemic Encephalopathies that result from complications related to birth. The study also will emphasize the importance of MRI in assessing and managing pediatric patients with seizure and will underlie that MRI is a valuable asset. This information may be used to inquire for more MRI machines in the country.

CHAPTER TWO: LITRATURE REVIEW

2.1 Most common causes for epilepsy identified on MRI include post-traumatic brain lesions (encephalomalacia), tumors, vascular malformations and infections. Additionally, MRI is particularly helpful in identifying further entities commonly seen in patients with intractable epilepsy, such as hippocampal sclerosis and abnormalities of cortical development. [7] In a study done on 181 patients with epilepsy presenting to Tikur Anbessa Teaching Hospital and Yehuleshet Higher Clinic in Addis Ababa, neuroimaging demonstrated abnormal intracranial structural lesions in 65 of 181 (35.9%) of epileptic patients (31% with CT; 38% with MRI). Brain lesions were single in 28 (42.8%) and multiple in 23 (35.4%) patients. Twenty-seven (41.5%) of these lesions originated in or involved the temporal or frontal lobes. The imaging findings demonstrated intracranial space occupying lesions (ICSOL) in 17 (9.4%) patients (with 64.7% brain tumors), cerebral infarctions in 15 (8.3%), cortical atrophy in 9 (5.0%), and gliosis in 7(3.9%). [4]

2.2 Developmental disorders have been increasingly recognized on MRI in children and young adults with epilepsy, accounting for up to 50% of pediatric cases of intractable epilepsy, and about 25% of those in young adults.[7] In a study done in the UK that reviewed the clinical, EEG and neuroimaging features of 100 adult patients with Cerebral cortical dysgenesis (CD) the commonest subcategory detected were dysembryoplastic neuroepithelial tumors (DNET) and other lesions seen included grey matter heterotopias, focal macrogyria/polymicrogyria and tuberous sclerosis. In this research the median age of the participants was 27 years and the median age at seizure onset was 10 years. There was also poor correlation between the epileptic syndromes and EEG abnormalities and the location/extent of CD as defined by MRI. [21]

2.3 Hippocampal sclerosis is the most common epileptogenic substrate seen throughout various surgical epilepsy series with the most important MR findings in hippocampal sclerosis being atrophy and abnormal T2 signal intensity.[19] The sensitivity of MR in detecting hippocampal sclerosis by qualitative assessment is in the range of 80% to 90%.[22] In a study assessing the value of MRI in 48 patients treated surgically for temporal lobe epilepsy, 34 of 48 (71%) epileptic patients demonstrated abnormalities on MRI scans. These results show that MRI is a sensitive technique for localizing lesions in patients with intractable temporal lobe seizures. [9]

2.4 Tumor-associated epilepsy is an important contributor to morbidity in patients with brain tumors and Perilesional tissue alterations play a vital role in the generation of tumor-associated seizures. Brain tumors constitute 2% to 4% of epileptogenic substrates in the general epilepsy population and epilepsy associated seizures occur in 20-45% of patients with primary brain tumors. Temporal or frontal lobe location is associated with more seizures than lesions in other lobes and about 70% of those tumors causing epilepsy are found in the temporal lobes and in most cases near the cortex (90%). [7, 10] The histological characteristics of tumors influence their propensity to generate seizures. Low-grade primary brain tumors (PBTs) grow slowly; invade normal surrounding tissues and have a high frequency of epilepsy while high-grade gliomas like glioblastoma multiforme less frequently cause seizures. In a study done on 229 patients who were surgically treated for PBT associated with epilepsy, histopathological analysis showed 144(70%) WHO Grade I tumors, 59 (29%) WHO Grade II lesions and 4 (1%) WHO Grade III tumors. Most tumors were in the temporal lobe (83%). Tumor location also plays a critical role as both intra and extra axial primary brain tumors may be associated with seizures. Extra-axial tumors compress normal brain tissue, whereas intra-axial tumors infiltrate normal brain tissue. [11, 12] Meningioma is the most common benign intracranial tumor, and seizures are a common manifestation of meningioma with evidence of severe peri-tumoral edema significantly contributing to preoperative epilepsy. In a retrospective study of 222 surgically treated meningiomas, it was found that 26.6% of the patients presented with epilepsy as their initial symptom and another study analyzing 323 patients with intracranial meningiomas aged 10 to 79, showed preoperative seizures were observed in 98 (30.3%) of them. [13, 14]

2.5 Vascular malformations constitute 5% of epileptogenic substrates in the general epilepsy patients. Arterio-venous malformations (AVMs) and cavernous malformations are the most common vascular malformations causing seizures in epilepsy patients. [15] In one study comparing the MR imaging and histopathologic findings in 117 patients with refractory epilepsy, findings consisted of vascular abnormality in 7% of the cases. The sensitivity of MR imaging versus histopathologic findings was 95 % and specificity of 87%. The commonest vascular malformation seen was cavernous malformation (3 cases) and occult AV malformation and high flow AV malformation occurred in 2 cases each. [6]

2.6 A number of entities that are associated with epilepsy have histological findings of gliosis (neuronal loss) in common. Gliosis is the end result of various focal and diffuse central nervous system injuries. Examples include trauma, infection, and infarctions, which may be focal or diffuse. [8] Brain injury occurring in the perinatal or postnatal period leads to a pattern of encephalomalacia. Perinatal pathology is a frequent cause of epilepsy and it constitutes 1-36% of cases from developing countries. [16] Hypoxic-ischemic encephalopathy is the most frequent type of perinatal pathology that predisposes to epilepsy. The causes of perinatal hypoxia include severe maternal cardiovascular diseases, placental and umbilical cord disease, prolonged labor, prematurity, Neonatal bilirubinaemic encephalopathy and airway obstruction at birth. The mothers may also be malnourished, anemic and exposed to a variety of infections that could affect the baby in utero or at delivery. [5] In a study done on 112 children with epilepsy in a rural district of Tanzania Adverse perinatal events were present in 16 (14%) of the cases. [17]

2.7 Infections are the cause of epilepsy in up to 26% of patients based on a review of studies done in sub-Saharan Africa and seizures can be an early clinical sign in bacterial, viral, fungal, mycobacterium, and parasitic infections. In the acute phase, the seizures may be related to the host's inflammatory response, and may be due to gliotic changes in the chronic phase. With the recent advances in imaging tuberculosis and neurocysticercosis are increasingly documented as the most common infections with seizure presentation in developed and developing countries. Bacterial meningitis (meningococcal) and encephalitis commonly cause epilepsy and tuberculous meningitis causes long-term epilepsy in 8–14% of patients. [8, 18] In a study done in Sudan, epilepsy occurred in 11% of infants 3 years after meningococcal meningitis. [19] In another study done in Tikur Anbassa Hospital which reviewed the clinical and imaging findings of intracranial tuberculomas seizure was the commonest presentation occurring in 60 % of the cases. [20]

2.8 Magnetic resonance imaging (MRI) is the most important noninvasive imaging modality, and is mandated in the pre-surgical evaluation of children with epilepsy together with electroencephalography (EEG). Several series have documented that complete lesional resection is the best predictor for favorable postsurgical outcomes. While structural MRI provides exquisite anatomic delineation because of its high spatial resolution and intrinsic soft tissue contrast, it also has its limitations. For instance, MRI may fail to identify subtle lesions that

account for up to 20–30% of refractory partial epilepsy, often related to subtle focal cortical dysplasia with microdysgenesis only revealed on histopathology. The identification of these lesions may be possible with other imaging modalities such as positron emission tomography (PET) or, in some instances, diffusion tensor imaging. In addition, in multifocal or diffuse diseases (such as in tuberous sclerosis), even though structural abnormalities can be sensitively depicted by MRI, it may be difficult to determine which of the lesions are epileptogenic and therefore targeted for surgical intervention. In such cases, additional information afforded by advanced MRI or physiologic imaging techniques including diffusion weighted imaging (DWI), MR spectroscopy, and single photon emission computed tomography (SPECT) or PET may be useful. Pre-surgical localization of these lesions, surgical planning and predicting outcome is therefore best accomplished by a multi-modality approach, incorporating structural, functional and physiologic techniques (including functional MRI [fMRI], and magnetoencephalography [MEG]) in addition to the EEG

CHAPTER THREE: SIGNIFICANS OF THE STUDY

This study will assess the prevalence of structural causes for pediatric seizure disorders that are depicted on MRI and hence will emphasize the role of MRI in the diagnosis, treatment and prognosis of pediatric seizure disorders. This information will be used to inquire more MRI machines in the country. As per the knowledge of the author there is only one research done on the topic in Ethiopia which was done in Tikur Anbesa Hospital thus only little is known about the size of the problem. This study will add to the only one existing. This study will be the first of its kind to be done at St. Paul hospital Millennium Medical College and hence will serve as a reference for future studies.

CHAPTER FOUR: OBJECTIVES

4.1. General objective

- To assess patterns of brain MRI findings among pediatric epilepsy patients seen at SPHMMC radiology department, Addis Ababa Ethiopia from March 2018 to August 2019.

4.2. Specific objectives

- To assess the demographic distribution of patients with pediatric epilepsy
- To assess the age at first seizure and the type of seizure in pediatric patients
- To describe the various brain MRI findings in patients with pediatric epilepsy.
- To describe causes associated with the brain MRI findings of patients with pediatric epilepsy.

CHAPTER FIVE : METHODS AND MATERIALS

5.1. Study area and period

The study was conducted at SPHMMC, Addis Ababa, Ethiopia from March 2018 to August 2019. SPHMMC is the largest referral as well as among the main teaching hospital in the country. The radiology department is one of the departments with a large patient flow giving services for up to 5000 patients in 2018. The department has One CT scan (64 and 128 slice), One MRI machine (1.5T), Two X-RAY machines and an adult and a pediatric ultrasound unit.

5.2. Study design

Retrospective cohort study was conducted based on record review using a one and half year data from the Radiology Department of SPMMC.

5.3. population

5.3.1 Source population

The source population was all pediatric patients who had evaluation with brain MRI at the radiology MRI unit at SPHMMC with 1.5T MRI machine from March 2018 to August 2019.

5.3.2 Study population

The study population was all pediatric patients with epilepsy who had brain MRI done with epilepsy protocol at the radiology MRI unit at SPHMMC with 1.5T machine from March 2018 to August 2019

5.4. Inclusion and exclusion criteria

5.4.1 Inclusion criteria

All patients who fulfill the (ILEA) criteria of epilepsy definition and who had brain MRI done on standard epilepsy protocol.

5.4.2 Exclusion criteria

All patients who do not fulfill the definition of epilepsy, who have correctable underlying metabolic disorder identified; those without proper epilepsy protocol brain MRI and patients whose medical record chart could not be retrieved.

5.5. Sampling technique and sample size

All patients who fulfill the inclusion criteria were included in the study.

The sample size was calculated using a formula for estimating a single population

$$n = \frac{Z(a/2)^2 P(1-P)}{d^2}$$

where

n is the required sample size

Z(a/2) is the critical value at 95% level of significance (1.96)

d is precision of measure (acceptable margin of error)

p is the prevalence of MRI findings in pediatric patients with seizure in one study 12%

p =

d =

$$n = \frac{(1.96)^2 0.12(0.88)}{0.05^2} = 162$$

5.6. Variables and measurement

Age, sex, age at first seizure onset, type of seizure, MRI result including location and type of abnormality,

5.7. Data collection

Patients who had brain MRI done at the radiology department for the clinical indication of pediatric seizure during the study period were identified from the daily registry. Patient cards were collected from the archives after receiving permission from the respective authorities and data regarding demographic, clinical information and imaging result were retrieved from the chart by the principal investigator and his colleagues who were responsible for safe handling of the data collected with questionnaire which was placed in the investigator's locker until data analysis began.

5.8. Data analysis and interpretation

Descriptive statistics was used to infer results. Microsoft excel was used to generate tables. Editing and sorting of the questionnaires was done to determine completeness manually. Data entry and analysis was performed using SPSS version 20.0. Descriptive statistics such as frequency distribution and measure of central tendency and variability (mean and standard deviation) were computed to describe the major variables of the study. To indicate the strength and statistical significance of the association of the selected independent and dependent variables crude and adjusted odds ratio were used. For all statistical tests used in this study the significant level for bi-variate and multivariate analysis was set at $p\text{-value} < 0.2$ and < 0.05 respectively. The analysis was done using chi-square and binary logistic regression.

5.9 DATA QUALITY CONTROL

The questionnaires was designed in English language and pre-tested on 8 records of patients similar to the study population (5% of the sample size) in the study hospital that were not included in the study. The finding of the pre-test was incorporated into the final instrument of the study. The data collectors were given training by the PI on the final questionnaire and data collection technique.

5.10. Ethical considerations

In order to respect patient's right and regulation of the hospital where the study was conducted, ethical considerations was taken into account. Confidentiality of information was secured by removing individual identifiers including name and addresses of patents. Approval from the Radiology Department Research and Ethics committee (REC) was obtained and formal letter was written from the department to the medical record archive before commencing the data collection process

5.11 OPERATIONAL DEFINITIONS

Epilepsy is disorder of the brain that is characterized by an enduring predisposition to generate epileptic seizures which is practically applied as having two unprovoked seizures > 24hrs apart.

Seizure is a transient occurrence of signs and symptoms due to excessive or synchronous neuronal activity in the brain.

Significant MRI Abnormalities are MRI findings reliably likely to be related to seizure disorder consistent with other classifications of epileptogenic lesions. This were defined a priori as at least one of the following: Leukomalacia/Gliosis, Encephalomalacia, Any Grey matter lesion, Mass lesion, Hemorrhage, Vascular lesion, Hippocampal Abnormality, Ventricular Enlargement > 1.5cm or Prominence of the extra-axial fluid spaces > 1cm

CHAPTER SIX: RESULTS

There were 162 patients who fulfilled the inclusion criteria and included in this study. Out of the included patients 90(55.6%) were male, 72(44.4%) were female, 89(55%) were aged between 12 and 18 years and 58(35.8%) of patients were under 6 years of age. Both the mean and median age was 9 years.

The reported age at first seizure was highest in the 12-18 years age group accounting for 74(45.7%) cases and 68 (42%) occurred in the under 6 years age group. The least reported age at first seizure was in those between 6 and 12 years and the median age at first seizure is 9 years (Table-1).

Table 1: Demographic distribution and reported age at first seizure of patients with epilepsy who attended SPMHC Hospital radiology unit between March 2018 and August 2019

	Category	Frequency	Percent
Gender	Male	90	55.6
	Female	72	44.4
	Total	162	100.0
Age group	0 – 6	58	35.8
	6 - 12	15	9.2
	12 – 18	89	55
	Total	162	100.0
Age at first seizure	0 - 6	68	42
	6 - 12	20	12.3
	12 – 18	74	45.7
	Total	162	100

The commonest type of seizure reported in this study was GTC 87 (53.7%) followed by focal seizure 48 (29.6%) with absence and other types making up the rest. Only 6 (3.7%) of the scans were done after administering IV contrast media. The rest 156 (96.3%) of the scans were done with epilepsy protocol and without administration of contrast media (Table 2).

Table 2: Distribution of patients with epilepsy who attended SPMHC Hospital radiology unit between March 2018 to August 2019 by seizure type and contrast administration.

	Category	Frequency	Percent
Seizure type	GTC	87	53.7
	Focal	48	29.6
	Absence	16	9.9
	Other	11	6.8
	Total	162	100.0
Contrast given during examination	Yes	6	3.7
	No	156	96.3
	Total	162	100.0

The results of the brain MRI were normal in 106 (65.4%) of the patients and abnormality was detected in 56 (34.6%) of the cases. From the detected abnormalities 30 (54.5%) of the lesions involved multiple regions and temporal and frontal lobes were involved in 25.5 and 16.4% of the cases respectively and 12 (21.8%) of the lesions involved multiple lobes . Extraxial lesions accounted for 9.4% of the cases. Most of the abnormalities involved the cortex (54.7%) (Table 3 and 4).

Table 3: Brain MRI results of patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Result of brain MRI	Frequency	Percent
Normal	106	65.4
Abnormal	56	34.6
Total	162	100.0

Table 4: Distribution of number, location and cortical involvement of abnormal MRI findings in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Category		Frequency	Percent
Number of lesions	Single	25	45.5
	Multiple	30	54.5
	Total	55	100.0
Location of lesions			
Frontal 9	lobe	16.4	
Parietal 8	lobe	14.5	
Cortical	Yes	46	83.6
Occipital 9	lobe	16.4	
Posterior 3	fossa	5.4	
Multiple 12	lobes	21.8	
Total 55		100	

involvement	No	9	16.4
	Total	55	100.0

Table 5: Distribution of abnormal brain MRI findings in patients with epilepsy who attended SPMHC Hospital radiology unit between March 2018 and August 2019

Type of brain abnormality		0 – 6 years	6 – 12 years	12 – 18 years	Frequency n(%)
	Developmental cortical malformation	3	0	3	6(10.7)
	Gliosis/parenchymal volume loss	13	4	13	30(53.6)
	Mesial temporal sclerosis	0	0	4	4(7.1)
	Vascular malformation	0	1	2	3(5.4)
	Brain tumor	0	0	3	3(5.4)
	Infection	0	1	0	1(1.8)
	Non-specific white matter lesions	1	2	3	6(10.7)
	Cerebellar atrophy	0	0	0	0(0)
	others	0	02	01	3(5.4)
	Total	17	10	29	56(100%)

Cause of gliotic change	Frequency	Percent
Perinatal Injury	13	43.33%
Previous stroke	7	23.33%
Other	10	33.33%
Total	30	100%

Table 6: Causes of gliotic changes identified in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Among the cortical malformations there were 3 cases of focal cortical dysplasia and 1 case each of pachygyria and polymicrogyria but there were no other associated brain congenital malformations identified. There were a total of two cases of brain tumor seen both cases were ganglioglioma. There was only one case of infection and it was a case of TB Meningitis. There were two cases of AVM and one case of developmental venous anomaly which are the types of vascular malformation seen .

Table 7: Types and frequency of abnormal MRI findings identified in patients with epilepsy who attended SPMMC Hospital radiology unit between March 2018 and August 2019

Category		Frequency
Type of infection	Brain abscess	
	Other	1
	Total	1
Type of brain tumor	Low grade glioma	2
	High grade glioma	0
	DNET	0
	extra axial	0
Type of vascular malformation	DVA	1
	AVM	2
	Total	3

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Table8: Type of cortical malformation

FocalCortical Dysplasia	3
Polymicrogyria	1
Pachygyria	1
Total	5

CHAPTER SEVEN: DISCUSSION

Out of the included 162 patients, most (55.6%) were male and more than half of all patients were aged between 12 and 18 years and Most (45.7%) of the patients had their first seizure in the similar age while 42% had their first seizure while they were below six years of age. The commonest type of seizure reported in this study was GTC and abnormalities were detected on the brain MRI in about 34.6% of the cases. The commonest brain abnormality detected in this study was gliosis/brain parenchymal volume loss (53.6%) which was predominantly caused by perinatal insult (43.3%).

This study has shown that more than half of the patients with epilepsy were aged between 12 and 18 years and very few patients were seen in the 6-12 years age group. The reported age at first seizure was between 12 and 18 years of age group seen in 45.7% of the cases. The commonest seizure type seen in this study was GTC which is also similar to a metanalysis done on epidemiology of epilepsy in sub-saharan Africa [10]. Most of the brain scans done in this study were done without the administration of IV contrast media which is consistent with the epilepsy protocol recommendations as most patients with chronic seizures or patients who are not suspected of having brain tumor do not require contrast enhanced scans[15].

In our study abnormalities were detected in 34.6% of the scanned pediatric epileptic patients which is comparable to results reported by a study done in Tikur Anbessa hospital and Yehuleshet higher clinic (38%) which used 0.3T machine. The higher detection rate in the current study might be related to the appropriate epilepsy protocol followed and the higher magnetic strength of the MRI machine used in the present study (1.5T) at SPMMC. From the detected abnormal lesions 21.8% involved multiple regions and the frontal and temporal lobes were involved in 16.4% and 25.5% of the cases respectively; these findings were similar to the above mentioned study[17].

The commonest brain abnormality seen in this study was gliosis/brain parenchymal volume loss (53.6%) with the predominantly identified cause being perinatal injury(43.3%). These findings were higher than other studies which show perinatal injury constitutes 1-36% of causes of epilepsy in developing countries [28]. Another study from Tanzania also reported perinatal injury as a common cause for epilepsy [29]. This high number is likely related to the low level of perinatal care in developing countries including Ethiopia which will predispose the fetus/neonate to perinatal hypoxia from conditions like prolonged labor and prematurity. Another common cause of gliosis identified in the study was previous stroke, accounting for 23.3% of the cases and in the rest of the cases with gliosis(33.3%) no identified cause was found.

The other cause of epilepsy identified was mesial temporal sclerosis which accounted for 7.1% of the cases. These findings are supported by similar reports in different studies that show mesial temporal sclerosis as one of the common causes of epilepsy [19-21]. In this study brain tumor was identified as a cause in only 2(3.6%) of the cases and both were found to be gangliogliomas. Different studies reported low grade gliomas as the commonest

type of brain tumor associated with epilepsy which supports the result seen in our study although the percent is significantly low and this might be due to the difference in the epidemiology of the population studied and also the difference in the inclusion criteria for the study as patients with other presenting symptoms like headache and weakness were not included [19, 22, 26].

Vascular malformations constituted 5.4% of the abnormalities detected in this study and AVMs are the commonest type which is similar to figures seen in the general epileptic population [13, 27]. The other causes identified in this study including cortical malformations which constituted 10.7% of the cases and Focal cortical Dysplasia accounted for the majority. Infection constitute the least numbers (1.8%) which is lower than different studies including review studies from sub-Saharan Africa. This difference might be due to the different epidemiology of the study populations as well as the preferential use of CT rather than MRI for assessment of acute infectious processes [19, 32].

LIMITATIONS

The major limitations faced in conducting this research were the loss of patient's charts and lack of proper recording of patient data in the MRI registry.

CONCLUSION

The commonest age group affected by epilepsy in this study was those aged between 12 and 18 years. GTC was the commonest seizure type identified. The most frequent type of brain abnormality seen was gliosis or brain parenchymal volume loss predominantly caused by perinatal injury. The other lesions identified included developmental cortical malformation , mesial temporal sclerosis, vascular malformations, brain tumors and infection.

RECOMMENDATION For services and policy

More emphasis should be given for antenatal follow up and perinatal care to prevent adverse pregnancy outcomes like hypoxic ischemic brain injuries and the results should be communicated to the concerned service units such as pediatrics and Gynecology departments and policy makers.

For research

- Population based researches are recommended as it would give more reliable magnitude of epilepsy in Ethiopia
- Further prospective researches in collaboration with the neurology department should also be undertaken especially on MRI and EEG correlation
- The radiology department should start to develop its own imaging database for researches that will be undertaken in the future

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ANNEX – I QUESTIONNAIRE

SPHMMC, SCHOOL OF GRADUATE STUDIES
DEPARTMENT OF RADIOLOGY
PATTERNS OF MRI FINDINGS IN PEDIATRIC EPILEPSY PATIENTS

1. Patient Card No. _____
2. Age (In full years) _____
3. Sex
 - a) M
 - b) F
4. Age at first seizure _____
5. Seizure Type
 - a) Generalized tonic-clonic
 - b) Focal
 - c) Absence
 - d) Other
6. Year MRI was done (G.C.)
 - a) 2017
 - b) 2018
7. Contrast given:
 - a) Yes
 - b) No
8. Result of the Brain MRI:
 - a) Normal
 - b) Abnormal
9. If MRI result is abnormal; number of lesion/s
 - a) Single

- b) Multiple

10. Location of the lesion

- a) Frontal lobe
- b) Parietal lobe
- c) Temporal lobe
- d) Occipital lobe
- e) Posterior fossa
- f) Basal ganglia
- g) Extraaxial
- h) Frontal and parietal
- i) Frontal and posterior fossa
- j) Single or both cerebral hemispheres
- k) Parietal and occipital
- l) Parietal and temporal

11. Cortical involvement

- a) Yes
- b) No

12. Type of brain abnormality described

- a) Developmental cortical Malformations
- b) Gliosis/brain parenchymal volume loss
- c) Mesial temporal sclerosis
- d) Vascular malformation
- e) Brain tumor
- f) Infection
- g) Non-specific white matter lesions
- h) Cerebellar atrophy
- i) Others

13. If the abnormality is a Brain tumor, type of tumor described (first radiological differential diagnosis)?

- a) Low grade glioma
- b) High grade glioma
- c) Metastasis
- d) DNET
- e) Ganglioglioma
- f) Oligodendroglioma
- g) PXA
- h) Meningioma
- i) Other

14. If the abnormality is a cortical malformation;

a. Type of malformation?

- i. Focal cortical dysplasia
- ii. Polymicrogyria
- iii. Schizencephaly
- iv. Grey matter heterotopia
- v. Cortical tubers (Tuberous sclerosis)
- vi. Pachygyria
- vii. Other

b. Are there other associated congenital anomalies?

- i. Yes
- ii. No

c. If there are other associated congenital anomalies, type of anomaly?

- i. Chiari malformations
- ii. Dandy-walker malformation
- iii. Septo-optic dysplasia
- iv. Corpus callosum agenesis/dysgenesis

- v. Holoprosencephaly
- vi. sturge-weber syndrome
- vii. Others

15. If the abnormality is a vascular malformation, type of malformation?

- a) Cavernoma
- b) Arteriovenous malformation (AVM)
- c) Developmental venous anomaly (DVA)
- d) Mixed vascular malformation

16. If the abnormality is a gliotic change, cause of gliosis identified?

- a) Previous infection
- b) Traumatic brain injury
- c) Previous stroke (Ischemic or Hemorrhagic)
- d) Perinatal injury
- e) Post-surgery
- f) Other

17. If the abnormality is Infection, type of infection identified?

- a) Tuberculoma
- b) CNS Toxoplasmosis
- c) Brain abscess
- d) Other