ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF RADIOLOGY

CROSS-SECTIONAL STUDY ON PATTERNS OF BRAIN MRI FINDINGS IN PATIENTS WITH EPILEPSY SEEN IN THE NEURORADIOLOGY UNIT AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA UNIVERSITY, ADDIS ABABA, ETHIOPIA

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A SENIOR PAPER TO BE SUBMITTED TO RADIOLOGY DEPARTMENT, COLLEGE OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY,IN PREPARATION FOR PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE POST GRADUATE STUDY IN RADIOLOGY.

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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 is to assess the patterns of brain MRI findings in patients with epilepsy.

Method: A cross-sectional study was conducted at Tikur Anbessa Specialized Hospital(TASH) among patients with epilepsy evaluated at neuroradiology unit from August 2016 to December 2017.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 were collected by using structured data collection format, analyzed using SPSS version 20.0 software and results were displayed using descriptive statistics.

Results: A total of 378 patients had brain MRI done at the radiology unit for the clinical indication of seizure during the study period. Among whom 132 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 79(59.8%) were male, 50 (40.2%) were female, 59 (44.7%) were in the under 10 age group and more than two thirds of all patients were aged less than 20 years. The commonest type of seizure reported in this study was generalized tonic clonic seizure (GTC) accounting for 98 (74.2%) of the cases and 50(37.9%) of the patients had their first seizure between the age of 1-10. Abnormalities were detected on the brain MRI in about half 64 (48.5%) of the cases.

The commonest brain abnormality detected in this study was gliosis/brain parenchymal volume loss which was seen in 29 (45.3%) of the cases. The other abnormalities seen include mesial temporal sclerosis 8(12.5%) and brain tumor 8(12.5%). 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, young people aged less than 20years 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 mesial temporal sclerosis, brain tumors, infections and cortical malformations.

Key words: Epilepsy, TASH, MRI, Gliosis, Perinatal injury

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ABBREVIATIONS AND ACRONYMS

TASH----TikurAnbessa Specialized Hospital

MRI------Magnetic Resonance Imaging

ILAE-----International League Against Epilepsy

CD--------Cortical Dysplasia

DNET----Dysembryoplastic neuroepithelial tumors

PXA------Pleomorphic xanthoastrocytomas

AVM-----Arteriovenous Malformation

PBT------Primary brain tumor

GTC------Generalized Tonic Clonic seizure

EEG------Electroencephalogram

MTS------Mesial temporal sclerosis

CHAPTER ONE: INTRODUCTION

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.[1] 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.[2]

According to the WHO, approximately 50 million people currently live with epilepsy worldwide. The estimated proportion of the general population with active epilepsy at a given time is between 4 and 10 per 1000 people. Based on a review of 222 world-wide population based studies the point prevalence of active epilepsy was 6.38 per 1,000 persons while the lifetime prevalence was 7.60 per 1,000 persons. The annual cumulative incidence of epilepsy was found to be 67.77 per 100,000 persons. [3, 4] The overall incidence of epilepsy in North America, adjusted for age varied from 16 to 51 per 100,000 persons per year with similar incidence in European studies. Incidence is high in the first decade of life, lowest in adult years until the fifth decade of life, then higher. In US studies, the highest incidence was after age 75.[2] Incidence figures were higher in developing countries; up to 111per 100,000 in rural Chile and a study in Tanzania reported the incidence of epilepsy to be 77 per 100,000.[5, 6]

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.[7, 8] In a series of 912 Kenyan people, a study showed that the first two decades witness the greatest number of patients (68.5 %).[9] 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.[10] 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.[11]

The modern era of structural brain imaging with magnetic resonance (MR) has revolutionized our ability to identify epileptogenic brain lesions. With high-resolution MR scans, a wide variety of pathologic lesions can now be diagnosed routinely and non-invasively. Neuro imaging is always indicated in adults with new-onset seizures or epilepsy to identify structural causes of epilepsy, some of which may require treatment of their own.[12] After the first unprovoked seizure, imaging in adults has a clinically significant yield of about 10% and in patients with

intractable epilepsy MRI has a greater sensitivity for lesion detection, amounting to about85%.[13] Imaging in children is recommended when localization-related epilepsy is known or suspected, when the epilepsy classification is in doubt, or when an epilepsy syndrome with remote symptomatic cause is suspected. Nearly 50% of individual imaging studies in children with localization-related new-onset seizure were reported to be abnormal and 15–20% of imaging studies provided useful information on etiology or and seizure focus. A significant imaging abnormality in the absence of a history of a localization related seizure, abnormal neurologic examination, or focal electroencephalography (EEG) is rare. [14]

The imaging protocol should at least include a scan done on 1.5T or 3T machine with acquisition of Coronal T1-weighted (3 mm or less) perpendicular to the long axis of hippocampi; High-resolution volume (3D) acquisition (T1-weighted, GRE) with 1-mm isotropic voxels and Coronal T2 and coronal and axial (or 3D) FLAIR sequences with the minimum slice thickness possible.In most cases, evaluation of chronic seizures that have not changed in frequency or characteristics does not generally warrant use of IV contrast agents; exceptions are patients with known or suspected enhancing tumors or neurocutaneous syndromes. New-onset seizures in an adult require contrast-enhanced imaging in addition to routine MRI sequences.[15] Coronal images are very helpful in depicting the anatomical details of the temporal lobe structures, and especially of the hippocampus, as well as the cortex, where most epileptogenic lesions are encountered. As the search for asymmetries between both cerebral hemispheres is an important aspect of the neuro-radiological assessment, adequate patient positioning is crucial. As a general rule, both internal auditory meati should be identified on the same MR image.[16]

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.

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CHAPTER TWO: LITRATURE REVIEW

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.[16] 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%). [17]

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.[16] 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.[18]

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%.[20] 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.[21]

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%).[16, 22] 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 extraaxial primary brain tumors may be associated with seizures. Extra-axial tumors compress normal brain tissue, whereas intra-axial tumors infiltrate normal brain tissue.[23, 24] 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 in98 (30.3%) of them.[25, 26]

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.[27] 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.[13]

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.[19] 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.[28] 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.[10] 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.[29]

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 (meningococceal) and encephalitis commonly cause epilepsy and tuberculous meningitis causes long-term epilepsy in 8–14% of patients.[19, 30] In a study done in Sudan, epilepsy occurred in 11%of infants 3 years after meningococcal meningitis.[31] 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.[32]

Stroke is another common cause of epilepsy in the elderly population. Based on a review of studies that have been conducted of post ischemic stroke seizures and epilepsy it was found that the rate of post ischemic stroke epilepsy is 2% to 4% and is higher in those who have a late seizure.[33] In another prospective multicenter study on patients with stroke, seizures occurred in 10.6% of 265 patients with hemorrhagic and 8.6% of 1632 with ischemic stroke. Risk factors for seizure after ischemic stroke were cortical location of infarction and stroke disability. The only risk factor for seizure after hemorrhagic stroke was cortical location.[34] In a study done on patients admitted with the diagnosis of ischemic and hemorrhagic stroke to Tikur Anbassa Hospital; 14 (18.6%) of the 76 patients with ischemic stroke and 23 (31.9%) of the 72 patients with hemorrhagic stroke had seizures.[35]

CHAPTER THREE: OBJECTIVES

General objective

- To assess patterns of brain MRI findings among epilepsy patients seen at the Tikur Anbessa Specialized Hospital Neuroradiology unit from August 2016 to December 2017.

Specific objectives

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

CHAPTER FOUR: METHODS AND MATERIALS

Study area and period

The study was conducted at TASH, College of Health Sciences, Addis Ababa University, Addis Ababa, Ethiopia from January 1 – August 30, 2018. TASH is the largest referral as well as the main teaching hospital in the country. The radiology unit is one of the departments with a large patient flow giving services for up to 240,000 patients in 2017. The department has two CT scans (64 and 128 slice), 1 MRI machine (1.5T), 3 XRAY machines and an adult and a pediatric ultrasound unit.

Study design

Hospital based retrospective record review was conducted using a one and half year data from the Radiology Department.

Population

Source population

The source population was all patients with seizure who had evaluation with brain MRI at the radiology MRI unit in TASH with 1.5T MRI machine from August 2016 to December 2017.

Study population

The study population was all patients with epilepsy who had brain MRI done with epilepsy protocol at the radiology MRI unit in TASH with 1.5T MRI machine from August 2016 to December 2017.

Inclusion and exclusion criteria

Inclusion criteria

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

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.

Sampling technique and sample size

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

Variables and measurement

Independent variables: Age, sex, age at first seizure onset

Dependent variables: type of seizure, MRI result including location and type of abnormality, EEG findings

Data collection

There were a total of 378 patients who had brain MRI done at the radiology unit for the clinical indication of seizure during the study period that were identified from the daily registry. All MRI scans were done on a Philips Achieva 1.5T scanner and the sequences acquired were coronal and axial T1 inversion recovery with slice thickness of 2.5mm, coronal and axial T2 drive with slice thickness of 2.5mm, axial FLAIR with slice thickness of 5mm and sagittal T1 with slice thickness of 5mm. The images were reported by the senior or fellow neuroradiologist. Patient cards were collected from the archives and data regarding demographic, clinical information and imaging result were retrieved from the chart by the principal investigator and his colleagues.

Data analysis and interpretation

The data was checked for clarity and completeness and it were entered and analyzed using SPSS version 20.0 software. Results are presented using tables and figures represented in percentages and measures of central tendency, then summarization and comparison of data was done.

Ethical considerations

In order to respect patient's right and regulation of the hospital where the study was conducted, ethical considerations were 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.

CHAPTER FIVE: RESULTS

There were 132 patients who fulfilled the inclusion criteria and included in this study. Out of the included patients 79(59.8%) were male, 53 (40.2%) were female, 59(44.7%) were aged under 10 years and about two third of all patients 89(67.4%) were under 20 years of age. The mean age was 18.9 yrs with a median age of 13yrs. The least number of cases were seen in the 41-50 age group (3%) and those above 60 years of age made up 5.3% of the total (Table-1).

The reported age at first seizure was highest in the 1-10 age group in 50 cases (37.9%) and 28 (21.2%) occurred in the under 1 age group. The least reported age at first seizure was in those 60 yrs and above and the median age at first seizure is 7.5 yrs (Table-1).

Table 1: Demographic distribution and reported age at first seizure of patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

	Category	Frequency	Percent
Gender	Male	79	59.8
	Female	53	40.2
	Total	132	100.0
Age group	Under 10	59	44.7
	11-20	30	22.7
	21-30	17	12.9
	31-40	10	7.6
	41-50	4	3.0
	51-60	5	3.8
	61 and above	7	5.3
	Total	132	100.0
Age at first seizure	Under 1	28	21.2
	1-10	50	37.9
	11-20	26	19.7
	21-30	9	6.8
	31-40	6	4.5
	41-50	9	6.8
	51-60	4	3.0
	61 and above	-	-

The commonest type of seizure reported in this study was GTC 98 (74.2%) followed by focal seizure 21 (15.9%) with abscense and other types making up the rest. Only 16 (12.1%) of the scans were done after administering IV contrast media. The rest 116 (87.9%) 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 Tikur Anbessa Hospital radiology unit between August 2016 and December 2017 by seizure type and contrast administration.

	Category	Frequency	Percent
Seizure type	GTC	98	74.2
	Focal	21	15.9
	Abscense	3	2.3
	Other	10	7.6
	Total	132	100.0
Contrast given during examination	Yes	16	12.1
	No	116	87.9
	Total	132	100.0

The results of the brain MRI were normal in 68 (51.5%) of the patients and abnormality was detected in 64 (48.5%) of the cases. From the detected abnormalities 36 (56.3%) of the lesions involved multiple regions and the frontal and temporal lobes were involved in 18.8% of the cases each and 20 (31.3%) of the lesions involved single or both cerebral hemispheres. 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 Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

Result of brain MRI	Frequency	Percent
Normal	68	51.5
Abnormal	64	48.5
Total	132	100.0

Table 4: Distribution of number, location and cortical involvement of abnormal MRI findings in patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

	Category	Frequency	Percent
Number of lesions	Single	28	43.7
	Multiple	36	56.3
	Total	64	100.0
Location of lesions	Frontal lobe	12	18.8
	Parietal lobe	9	14.1
	Temporal lobe	12	18.8
	Multiple lobes	5	7.6
	Extraxial	6	9.4
	Single or both cerebral hemispheres	20	31.3
	Total	64	100.0
Cortical involvement	Yes	35	54.7
	No	29	45.3
	Total	64	100.0

Table 5: Distribution of abnormal brain MRI findings in patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

		Age group				
		Under 10	11-20	21-60	61 and above	Frequency n(%)
Type of brain abnormality	Developmental cortical malformation	2	1	1	0	4(6.3)
	Gliosis/parenchymal volume loss	18	5	3	3	29(45.3)
	Mesial temporal sclerosis	3	1	4	0	8(12.5)
	Vascular malformation	0	0	3	0	3(4.7)
	Brain tumor	1	0	5	2	8(12.5)
	Infection	0	1	1	1	3(4.7)
	Non-specific white matter lesions	1	2	2	1	6(9.4)
	Cerebellar atrophy	0	0	1	0	1(1.6)
	others	2	0	0	0	2(3.1)
	Total	27	10	20	7	64(100)

Among the brain abnormalities seen in this study 29 (45.3%) of the cases were gliosis/brain parenchymal volume loss. The other abnormalities seen include mesial temporal sclerosis 8(12.5%), brain tumor 8(12.5%), developmental cortical malformations 4(6.3%) and vascular malformations and infection 3(4.7 %) each. There were also non-specific white matter lesions which were seen in 6(9.4%) of the cases (Table 5).

The commonest cause of gliotic change identified based on imaging was perinatal injury 12 (41.4%) of the cases with previous stroke accounting for 27.6% , traumatic brain injury (TBI) and previous infection implicated in 3.4% of the cases each. Most of the gliotic lesions were seen in the less than 10 age group 18 (62%) (Figure 1).

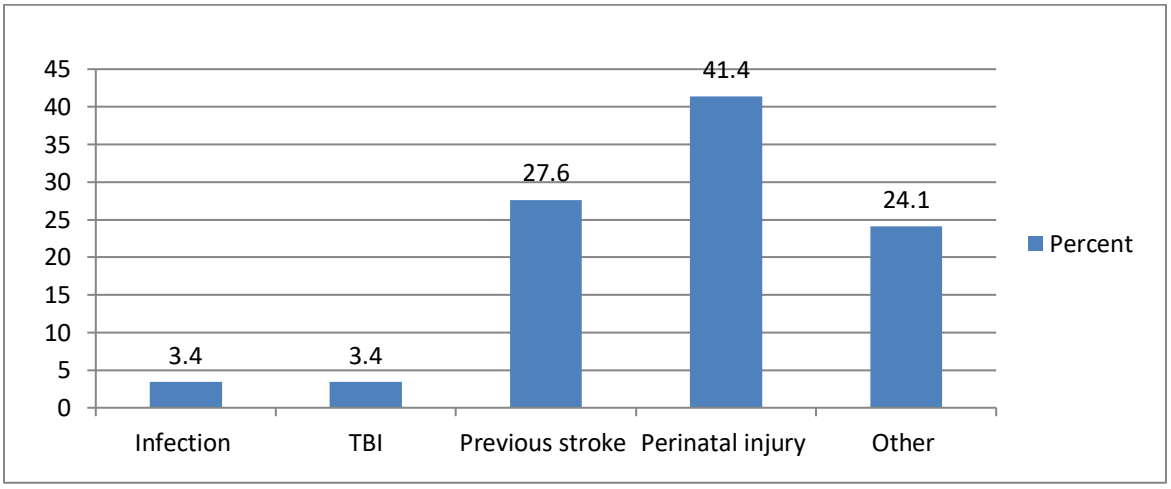

Figure 2: Causes of gliotic changes identified inpatients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

Among the cortical malformations there were 2 cases of pachygyria and 1 case each of focal cortical dysplasia and polymicrogyria but there were no other associated brain congenital malformations identified. There were a total of eight cases of brain tumor seen among which there were 5 cases of meningioma and 1 case each of low grade glioma, DNET and high grade glioma. From the three cases of infection two were brain abscesses and one was a case of cerebral hydatid cyst. There were two cases of AVM and one case of cavernoma which are the types of vascular malformation seen (Table 6).

Table 6: Types and frequency of abnormal MRI findings identified in patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

	Category	Frequency
Type of infection	Brain abscess	2
	Other	1
	Total	3
Type of brain tumor	Low grade glioma	1
	High grade glioma	1
	DNET	1
	Meningioma	5
	Total	8
Type of vascular malformation	Cavernoma	1
	AVM	2
	Total	3
Type of cortical malformation	Focal cortical dysplasia	1
	Polymicrogyria	1
	Pachygyria	2
	Total	4

EEG results were available in 92 (69.7%) of the cases out of which 65 (70.7%) showed abnormal findings. The EEG abnormalities were described as epileptiform discharges in 54 (83.1%) and non-specific findings in 11 (16.9%) of the cases. Most of the abnormalities were generalized (52.3%) while focal localized abnormalities constituted 31 (47.7%) of the cases. From the localized abnormalities most were in the temporal 9 (29%) and frontal 8 (25.8%) lobes with multifocal involvement in 8 (25.8%) of the cases (Table 7and 8).

Table 7: Number of patients with available EEG report and EEG findings in patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

	Category	Frequency	Percent
EEG findings available	Yes	92	69.7
	No	40	30.3
	Total	132	100.0
EEG finding	Normal	27	29.3
	Abnormal	65	70.7
	Total	92	100.0

Table 8: Conclusion and localization of abnormal EEG findings in patients with epilepsy who attended Tikur Anbessa Hospital radiology unit between August 2016 and December 2017

	Category	Frequency	Percent
Conclusion of EEG findings	Epiliptiform discharges	54	83.1
	Non-specific findings	11	16.9
	Total	65	100
Location of EEG abnormality	Generalized abnormality	34	52.3
	Focal abnormality	31	47.7
	Total	65	100
Location of focal EEG abnormality	Frontal lobe	8	25.8
	Temporal lobe	9	29.0
	Parietal lobe	5	16.1
	Occipital lobe	1	3.2
	Multifocal	8	25.8
	Total	31	100.0

CHAPTER SIX: DISCUSSION

Out of the included 132 patients, most (59.8%) were male and about two thirds of all patients were aged less than 20 years. Most (37.9%) of the patients had their first seizure between the ages of 1-10 where 21% had their first seizure while they were below one year of age. The commonest type of seizure reported in this study was GTC and abnormalities were detected on the brain MRI in about half of the cases. The commonest brain abnormality detected in this study was gliosis/brain parenchymal volume loss (45.3%) which was predominantly caused by perinatal insult (41.4%).

This study has shown that about two thirds of the patients with epilepsy were aged less than 20 years and very few patients were seen in the 40 years and above age group. This finding is consistent with a Kenyan study which showed that people in the first two decades of life shared the greatest number of epilepsy[9] The reported age at first seizure was in the under 20 yrs of age group in 78.8% of the cases which is comparable to a review study done on epidemiology and etiology of epilepsy in sub-Saharan Africa which found the reported age at first seizure onset was less than 20 years in 60% of the cases. Similarly to this sub-Saharan study, our study also did not show the bimodal distribution of age at first seizure onset seen in the developed countries. 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 48.5% of the scanned epileptic patients which is higher than 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). From the detected abnormal lesions 56.3% involved multiple regions and the frontal and temporal lobes were involved in 37.6% of the cases; these findings were similar to the above mentioned study[17]. In addition significant number of lesions involving single or bilateral cortical hemispheres and extraxial space were seen in our study.

The commonest brain abnormality seen in this study was gliosis/brain parenchymal volume loss (45.3%) which was also the commonest lesion seen in the less than 10 yrs age group(66.6%) with the predominant identified cause being perinatal injury(41.4%). 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 27.6% of the cases where most of the patients were in the older age groups (61 and above). This was also similar to other studies which reported stroke as a common cause of epilepsy especially in the elderly population[33, 34].

The other cause of epilepsy identified was mesial temporal sclerosis which accounted for 12.5% of the cases and which was also more commonly seen in younger age groups (below 30 years). 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]. The other identified cause in this study was brain tumor, from which meningiomas were the commonest tumors. This finding is supported by different studies which show significant number of meningioma cases present with seizure as first symptom and also meningiomas are the commonest intracranial tumors. Different studies reported low grade gliomas as the commonest type of brain tumor associated with epilepsy which was not the case seen in our study 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 4.7% 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 and infections constitute the least numbers 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 that of some infectious processes like neurocysticercosis and the preferential use of CT rather than MRI for assessment of acute infectious processes[19, 32].

EEG results were available in 69.7% of the cases with 70.7% abnormal findings which were mostly generalized epileptiform discharges and the EEG findings showed poor correlation with the MRI findings based on localization. This is similar to a study that correlated the clinical, EEG and imaging features of patients with cerebral cortical dysgenesis but differs from another study which studied the clinical correlation of MRI and EEG and found larger number of concordance between the two in patients with hippocampal atrophy [18, 36].

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. The lack of image database at the radiology unit was also an important limitation.

CONCLUSION

The commonest age group affected by epilepsy in this study was those aged below 20 years with high number of children aged below one year. 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 mesial temporal sclerosis, brain tumors, infections and cortical malformations.

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 -1 QUESTIONNAIRE

ADDIS ABEBA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

DEPARTMENT OF RADIOLOGY

PATTERNS OF MRI FINDINGS IN EPILEPSY PATIENTS

1. Patient Card No. _____

2. Age (In full years) _____

3. Sex 1. M ___ 2. F___

4. Age at first seizure _____

5. Seizure Type

    1. Generalized tonic-clonic
    2. Focal
    3. Absence
    4. Other

5. Year MRI was done (G.C.) 1. 2016 2. 2017

6. Contrast given: Yes_____ No_____

7. Result of the Brain MRI

    1. Normal 2. Abnormal

8. If MRI result is abnormal,

    1. Number of lesion/s

        1. Single_____ 2. Multiple_____

    2. Location of the lesion

        1. Frontal lobe
        2. Parietal lobe
        3. Temporal lobe
        4. Occipital lobe
        5. Posterior fossa

6. Basal ganglia
7. Extaaxial
8. Frontal and parietal
9. Frontal and posterior fossa
10. Single or both cerebral hemispheres
11. Parietal and occipital
12. Parietal and temporal

3. Cortical involvement

1. Yes___ 2. No____

9. Type of brain abnormality described

1. Developmental cortical Malformations
2. Gliosis/brain parenchymal volume loss
3. Mesial temporal sclerosis
4. Vascular malformation
5. Brain tumor
6. Infection
7. Others
8. Non-specific white matter lesions
9. Cerebellar atrophy

10. If the abnormality is a Brain tumor

1. Type of tumor described (First radiological differential diagnosis)
    1. Low grade glioma
    2. High grade glioma
    3. Metastasis
    4. DNET
    5. Ganglioglioma
    6. Oligodendroglioma
    7. PXA

8. Meningioma
9. Other

11. If the abnormality is a cortical malformation,

1. Type of malformation
    1. Focal cortical dysplasia
    2. Polymicrogyria
    3. schizencephaly
    4. Grey matter hetrotopia
    5. Cortical tubers (Tuberous sclerosis)
    6. Pachygyria
    7. Other
2. Are there other associated congenital anomalies
    1. Yes-------- 2. No--------
3. If there are other associated congenital anomalies, type of anomaly
    1. Chiari malformations
    2. Dandy-walker malformation
    3. Septo-optic dysplasia
    4. Corpus callosum agenesis/dysgenesis
    5. Holoprosencephaly
    6. sturge-weber syndrome
    7. Others

12. If the abnormality is a vascular malformation, type of malformation
    1. Cavernoma
    2. Arteriovenous malformation (AVM)
    3. Developmental venous anomaly (DVA)
    4. Mixed vascular malformation

13. If the abnormality is a gliotic change, cause of gliosis identified
    1. Previous infection

2. Traumatic brain injury

3. Previous stroke (Ischemic or Hemorrhagic)

4. Perinatal injury

5. Post-surgery

6. Other

14. If the abnormality is Infection, type of infection identified

1. Tuberculoma

2. CNS Toxoplasmosis

3. Brain abscess

4. Other

15. EEG findings available

1. Yes ___ 2. No_____

16. If yes to Q 15,

1. The EEG finding is;

1. Normal ____ 2. Abnormal_____

2. If the EEG finding is abnormal, conclusion of the findings,

1. Epileptiform discharges

2. Non-specific findings

3. If the EEG finding is abnormal, localization of the abnormality

1. Generalized EEG abnormality

2. Focal EEG abnormality

4. If Focal EEG abnormality, location of the focal abnormality;

1. Frontal lobe

2. Temporal lobe

3. Parietal lobe

4. Occipital lobe

5. Does the EEG localization correlate with the MRI finding

1. Yes------- 2. No----------