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Prevalence of mesial temporal sclerosis in patients with epilepsy who underwent magnetic resonance imaging in Gondar university hospital, North-West Ethiopia 2020

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Abstract

Background- Mesial temporal lobe sclerosis is commonly associated with intractable temporal lobe epilepsy and is seen in about 60% to 80% of cases. This study is aimed at determining the prevalence of mesial temporal sclerosis on MRI among all epilepsy patients.

Methods- Hospital based retrospective cross-sectional study in adult patients referred for MRI of the brain from January 2019 - September 2020 were conducted. The study is carried out at the University of Gondar Referral Hospital with a 1.5T Philips MRI machine, in Gondar town located 741 k.m. northwest of Addis Ababa.

Results - A total of 77 patients were included, out of which 61 had generalized tonic clonic epilepsy, 7 had focal impaired awareness seizures, 6 had focal to bilateral tonic clonic and 2 had focal aware. Features of mesial temporal sclerosis were identified in 8 of 77 (10.4 %) of the cases, all of them had generalized tonic-clonic epilepsy & none of our participants with mesial temporal sclerosis had focal impaired awareness seizures. Mesial temporal sclerosis in our study is found to equally involve the right (50 %) and left (50 %) sides and none of our patients have bilateral involvement, and the most common findings are hippocampal atrophy in 6 out of 8 (75 %) of the cases and increased hippocampal signal intensity in 5 of 8 (62.5 %).

Conclusion - The prevalence of mesial temporal sclerosis in patients with epilepsy is found to be less than what is documented in most literatures.

Keywords: Mesial temporal sclerosis; Temporal lobe epilepsy; Hippocampal atrophy; Magnetic resonance imaging; Temporal horn

1 Introduction

Mesial temporal lobe sclerosis (MTS), also known as hippocampal sclerosis, is most commonly associated with intractable temporal lobe epilepsy and is seen in about 60% to 80% of cases. It is the most common structural abnormality seen in human epilepsy and pathologically, is characterized by neuronal cell loss, gliosis and sclerosis within the mesial temporal lobe. These changes are responsible for the MRI findings (1).

In a study performed by Berkovic and colleagues, sensitivity of a high-resolution MRI scan with a 1.5-Tesla MRI for mesial temporal sclerosis was as high as 97%, and specificity was 83%. The authors reported on patients who underwent MRI and who later received anterior temporal lobectomy. Radiologic findings were correlated with

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pathologic findings. MRI findings of mesial temporal sclerosis have also been correlated with surgical outcome. Patients with mesial temporal sclerosis that was visible on magnetic resonance images (and that was subsequently confirmed on pathology) were found to have improved postsurgical outcomes, with high seizure-free rates or substantial improvement in seizures in comparison with patients who had normal MRI findings (12).

Multiple structural and functional imaging modalities are available to diagnose MTS and to guide surgical treatment of medically intractable seizures. Most clinical MR imaging studies are sufficient to detect gross hippocampal atrophy changes; however, early changes of hippocampal atrophy may be overlooked by even experienced radiologists because of their subtlety (4).

A study conducted in India revealed 25 out of 92 (27.2%) patients with epilepsy had mesial temporal sclerosis on MRI with the most consistent finding being increased T2 signal intensity seen in 21 out of 25(84%) patients (3).

Another study conducted in Brazil showed ninety (75%) of the 120 patients with mesial temporal sclerosis had signal abnormalities on coronal FLAIR images (5). This figure is higher than usually reported in the literature where an increased T2-weighted signal in the white matter, resulting in a loss of gray-white matter definition, has been found in 32% to 71% on MR images of patients with mesial temporal sclerosis.

In Canada, about 21% of patients with epilepsy experience drug-resistant focal impaired awareness seizures. Intractable focal impaired awareness seizures are common in temporal lobe epilepsy, which is often associated with hippocampal sclerosis. Considering the localization the temporal lobe is the most prevalent epileptogenic foci (2).

Although the imaging findings commonly show abnormalities only in the mesial temporal lobe, tissue damage in patients with temporal lobe epilepsy is analyzed using volumetric measurements of the amygdala and hippocampus in another study. As there is a large and intricate network of connections involving all structures in the medial temporal lobe, it is possible that damage to the medial temporal lobe may extend beyond the amygdala and the hippocampus, which may contribute to the symptoms of temporal lobe epilepsy (6).

The involvement of the medial temporal lobe in addition to the amygdala and hippocampus is associated with poor prognostic factors and resistance to therapy. These poor prognostic factors are occurrence of focal to bilateral seizures, automatisms and the number of previously used anti-epileptic drugs (7).

Another study correlated the MRI findings of high signal on T2-weighted images with SPECT and inter-ictal surface EEG. The MRI findings correlated well to the EEG in half of the cases and to SPECT in one third of cases. And MRI, SPECT and EEG were congruent in about a quarter of cases (8). So, the MRI findings are mostly consistent with functional activity of the epileptogenic focus.

2 Material and methods

Hospital based retrospective cross-sectional study was conducted at the University of Gondar Referral Hospital, found in Gondar town, which is the capital town of the North Gondar administrative zone, located 741kms northwest of Addis Ababa. Gondar university hospital is one of the biggest tertiary level referral and teaching hospitals in the Amhara Regional State. According to records from the hospital's information center, every year more than 200,000 people visit the hospital which serves as referral hospital for more than 5 million in the surrounding catchment area with varying climatic and geographical distributions.

The study was done from March – August 30, 2020 and included 77 clients with epilepsy who were sent from all departments for MRI from January 2019 - September 2020.

After ethical approval, MRI images and charts of the selected patients were reviewed by the responsible senior radiologists and the findings were recorded on the questionnaire by the primary investigator.

Data completeness was checked on each data collection day by the principal investigator. Data clearance and cleaning was done before data entry to the computer. Data will be entered and analyzed using SPSS 20 statistical software.

Ethical approval was obtained from the ethical review committee of Institutional Review Board of University of Gondar. Privacy and confidentiality of information recorded on all epileptic clients involved in the study is ensured.

3 Results

Of the total 77 epileptic clients 53.2 % were males and 46.8 % were females. And considering the age category half of them (50.6 %) were children and adolescents, below the age of 20. The remaining age groups from age 20 to 40 comprise about 28.6 % and those above age of 40 were 20.8 %; with a mean age of 27 years.

Table 1 Gender characteristics of the study participants

	Frequency	Percent
Male	41	53.2
Female	36	46.8
Total	77	100.0

Regarding the type of epilepsy 79.2 % of the participants had generalized tonic-clonic epilepsy, followed by focal impaired awareness in 9.1 %.

Table 2 Frequency distribution of the type of epilepsy in study participants

Type of epilepsy	Frequency	Percent
Focal aware	2	2.6
Focal impaired awareness	7	9.1
Focal with motor and non-motor signs and symptoms	1	1.3
Focal to bilateral tonic-clonic	6	7.8
Generalized tonic-clonic	61	79.2

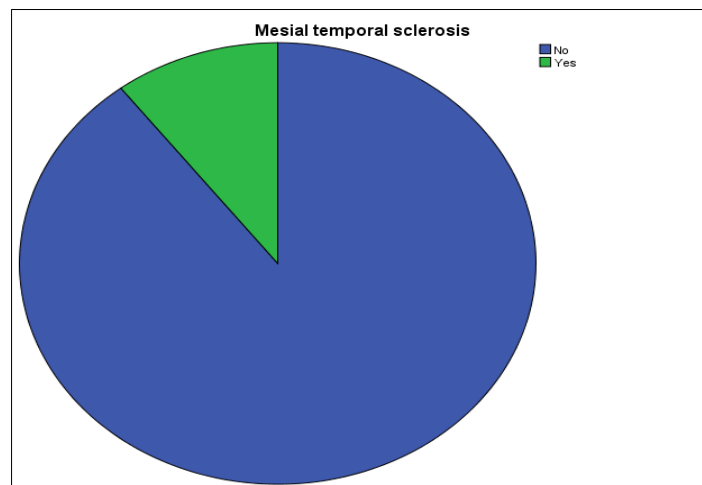


Figure 1 Frequency of mesial temporal sclerosis in the study participants

Features of mesial temporal sclerosis were identified in 8 of 77 (10.4 %) of the study participants, all of which had generalized tonic-clonic epilepsy equally involving the right (50 %) and left (50 %) sides and none of focal impaired awareness epilepsy patients had mesial temporal sclerosis. The most common finding being hippocampal atrophy seen in 6 out of 8 (75 %) of the cases followed by increased hippocampal T2 signal intensity seen in 5 of 8 (62.5 %). The temporal horn is enlarged in 4 out of 8 cases (50 %). The other features of mesial temporal sclerosis including collateral white matter atrophy, diminished gray-white matter demarcation and smaller temporal lobe were not identified in any of the cases.

Table 3 Prevalence of MRI abnormalities other than mesial temporal sclerosis in the study participants

Other abnormalities	Frequency	Percent
None	48	62.3
Congenital malformation	7	9.1
Infectious or inflammatory diseases	3	3.9
Cerebrovascular diseases	16	20.8
Tumors	3	3.9

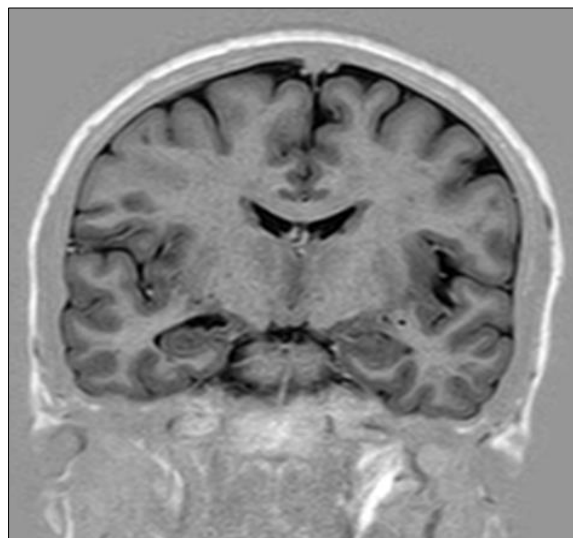


Figure 2 Coronal T1 inversion recovery spot image shows prominent right choroidal fissure with dilated temporal horn of the right lateral ventricle

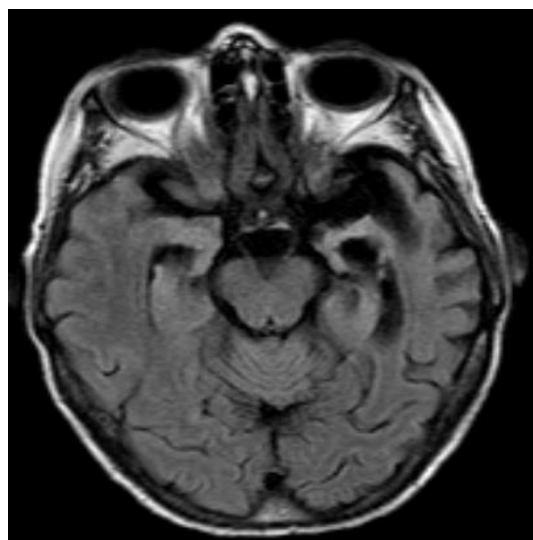


Figure 3 Axial FLAIR spot image shows asymmetrically dilated left temporal horn of the lateral ventricle with increased signal of the hippocampus

Other abnormalities were identified in 29 cases (37.6 %) and of which cerebrovascular diseases comprise 20.8 %, congenital malformation 9.1 %, infectious conditions and tumors each account about 3.9 %. And no remarkable finding was noted in 62.3 % of the cases.

4 Discussion

Our study has analyzed 77 patients with epilepsy and found only 8 patients (10.4%) with mesial temporal sclerosis, all of which had generalized tonic-clonic epilepsy equally involving the right (50 %) and left (50 %) sides, with the most common finding being hippocampal atrophy seen in 6 out of 8 (75%) and increased hippocampal T2 signal intensity is noted in 5 of 8 (62.5 %). The predominance of hippocampal atrophy over increased hippocampal T2 signal intensity could partly be explained by the delay in imaging as most patients have to wait until they fulfill one of the indication criteria for imaging and those with mesial temporal sclerosis develop atrophy after hippocampal gliosis eventually until imaging. The temporal horn is enlarged in 4 out of 8 cases (50 %). The other features of mesial temporal sclerosis including collateral white matter atrophy, diminished gray-white matter demarcation and smaller temporal lobe were not identified in any of the cases.

Out of the 8 patients with mesial temporal sclerosis none of them had focal impaired awareness epilepsy which could be because of the delay in imaging of focal epilepsy where in resource limited setting like ours imaging is reserved until first line antiepileptic drugs fail to control the epilepsy, patients develop focal neurologic deficits or the epilepsy starts to generalize. So we could have missed a lot number of patients with focal epilepsy who are not sent for imaging and in our sample patients with generalized tonic clonic epilepsy hold the major share of 79.2 % versus 13% of patients with focal epilepsy.

A study conducted in India revealed 25 out of 92 (27.2%) patients with epilepsy had mesial temporal sclerosis on MRI with the most consistent finding being increased T2 signal intensity seen in 21 out of 25(84%) patients (3). Comparing the number of patients with mesial temporal sclerosis our study has a small number of cases as compared to the one in India.

Another study conducted in Brazil showed ninety (75%) of the 120 patients with mesial temporal sclerosis had signal abnormalities on coronal FLAIR images (5). This has a higher number of patients with mesial temporal sclerosis as compared to our study where we have total of 77 patients and early imaging of patients with epilepsy would probably be demonstrated as increased T2 hippocampal signal intensity as opposed to delayed imaging as in ours where the predominant finding noted is hippocampal atrophy. Another possibility for the discrepancy is the study has analyzed a known 120 epileptic patients with mesial temporal sclerosis and ours used a general sample of epileptic patients due to causes other than mesial temporal sclerosis.

In Canada, about 21% of patients with epilepsy experience drug-resistant focal impaired awareness seizures. Intractable focal impaired awareness seizures are common in temporal lobe epilepsy, which is often associated with hippocampal sclerosis. Considering the localization the temporal lobe is the most prevalent epileptogenic foci (2). In our study significant proportion of patients with epilepsy are those with generalized tonic-clonic epilepsy (79.2%) and its of which mesial temporal sclerosis is identified in 10.4 % of the total patients; none of focal impaired awareness patients had mesial temporal sclerosis in our study which may be explained partly by the eventual disease progression from focal impaired epilepsy to generalized tonic-clonic epilepsy or due to the delay in imaging in a resource limited setting like ours until patients fulfill the criteria.

A study done in London found 10–20% out of 55 patients with epilepsy have bilateral hippocampal sclerosis (12). We have found only unilateral mesial temporal sclerosis in 8 patients of which 50% have involvement of the right side and 50 % on the left side; none of our patients have bilateral involvement which could be because of the small number of patients with mesial temporal sclerosis detected in our study.

5 Conclusion

The study has shown less prevalence of mesial temporal sclerosis in patients with epilepsy, lack of bilateral involvement among mesial temporal sclerosis patients contradicting to the literature documented facts of high prevalence & high bilateral occurrence of the disease. The possible explanation could be less meticulous evaluation of MRI images & less standardized MR image quality to show subtle changes in the department, the small sample of the study as well as the retrospective nature of the study may have contributed in the missing of some cases. These above facts require evaluation of image quality & interpretation of MR images in the department & the research shall be conducted with large sample size & at a prospective method.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors of this manuscript have no relevant financial or other relationships to disclose.

Statement of ethical approval

Ethical approval was obtained from the ethical review committee of Institutional Review Board of University of Gondar, Gondar, Ethiopia.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study and privacy and confidentiality of information recorded on all epileptic clients involved in the study is ensured.

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