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MRI EVALUATION OF MEDIAL TEMPORAL SCLEROSIS IN PATIENTS WITH REFRACTORY SEIZURES

Radio-Diagnosis

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ABSTRACT

Background: Medial temporal sclerosis (MTS) is the most common structural abnormality underlying refractory temporal lobe epilepsy and represents a major cause of medically intractable seizures. Early and accurate diagnosis of MTS is critical, as it has direct implications for treatment planning, prognosis, and selection of patients for epilepsy surgery. Magnetic resonance imaging (MRI), particularly when performed using a dedicated epilepsy protocol, is the imaging modality of choice for evaluating hippocampal pathology. **Aim:** To evaluate the prevalence, laterality, and magnetic resonance imaging features of medial temporal sclerosis in patients presenting with refractory seizures. **Materials And Methods:** A retrospective observational study was conducted on 60 patients with refractory seizures, defined as failure of seizure control despite adequate trials of at least two appropriate antiepileptic drugs as documented in neurology records. All patients underwent MRI brain imaging using a dedicated epilepsy protocol on a 1.5 Tesla Siemens MAGNETOM scanner between January 2024 and December 2025. Imaging features evaluated included hippocampal volume loss, increased signal intensity on T2-weighted and FLAIR images, loss of internal hippocampal architecture, temporal horn dilatation, and associated temporal lobe atrophy. Data were analyzed using descriptive statistical methods. **Results:** MRI features consistent with medial temporal sclerosis were identified in 28 patients (46.7%). Unilateral involvement was more common than bilateral disease, with a slight right-sided predominance. Hippocampal volume loss and increased T2/FLAIR signal intensity were the most frequently observed imaging features. **Conclusion:** MRI is a reliable and non-invasive modality for the diagnosis of medial temporal sclerosis in patients with refractory seizures. Dedicated epilepsy MRI protocols significantly enhance detection of hippocampal abnormalities and play a pivotal role in identifying patients who may benefit from surgical intervention.

KEYWORDS

Medial temporal sclerosis, Refractory seizures, Epilepsy, MRI, Hippocampus

INTRODUCTION

Epilepsy is a chronic neurological disorder characterized by recurrent unprovoked seizures and affects approximately 50 million people worldwide. Although the majority of patients achieve adequate seizure control with antiepileptic drug therapy, nearly one-third continue to experience seizures despite optimal medical management. These patients are classified as having refractory or drug-resistant epilepsy and require further evaluation to identify potentially treatable causes.

Structural abnormalities of the brain are a major cause of refractory epilepsy, among which medial temporal sclerosis is the most frequently identified pathology. Histopathologically, MTS is characterized by neuronal loss and gliosis predominantly involving the hippocampus and adjacent mesial temporal structures. Clinically, MTS is strongly associated with temporal lobe epilepsy and is a well-established predictor of favorable outcomes following epilepsy surgery.

Magnetic resonance imaging has become the cornerstone of epilepsy evaluation due to its superior soft tissue contrast and ability to visualize hippocampal anatomy in detail. However, detection of MTS requires high-resolution imaging and dedicated epilepsy protocols, as subtle hippocampal abnormalities may be missed on routine brain MRI examinations. The present study aims to evaluate the MRI features of medial temporal sclerosis in patients with refractory seizures and to assess the prevalence and laterality of MTS in an Indian tertiary care population.

MATERIALS AND METHODS

This retrospective observational study was conducted at a tertiary care teaching hospital over a two-year period from January 2024 to December 2025 after obtaining institutional approval. Patient confidentiality was strictly maintained throughout the study.

Study Population:

Patients aged 18 years and above with a clinical diagnosis of refractory seizures were included. Refractory seizures were defined as failure to achieve sustained seizure control despite adequate trials of at least two appropriate antiepileptic drugs, as documented in neurology case records. Patients with intracranial tumors, infections, traumatic brain injury involving the temporal lobes, postoperative epilepsy, or incomplete MRI studies were excluded.

MRI Protocol: All MRI examinations were performed on a 1.5 Tesla Siemens MAGNETOM system using a dedicated epilepsy protocol. The protocol included axial and coronal T1-weighted images, axial and coronal T2-weighted images, fluid-attenuated inversion recovery (FLAIR) sequences, diffusion-weighted imaging (DWI), and coronal oblique T2-weighted images obtained perpendicular to the long axis of the hippocampus.

Image Analysis: MRI images were evaluated for features suggestive of medial temporal sclerosis, including hippocampal volume loss, increased signal intensity on T2-weighted and FLAIR images, loss of internal hippocampal architecture, asymmetric dilatation of the temporal horn, and associated ipsilateral temporal lobe atrophy. A diagnosis of MTS was made when two or more of these imaging criteria were present. Quantitative hippocampal volumetric analysis was not performed and is acknowledged as a limitation.

Statistical Analysis: Data were analyzed using descriptive statistics and expressed as frequencies, percentages, mean values, and standard deviations.

RESULTS

A total of 60 patients with refractory seizures underwent MRI brain imaging during the study period. Among these, 28 patients (46.7%) demonstrated MRI findings consistent with medial temporal sclerosis, while 32 patients (53.3%) showed no evidence of MTS.

The mean age of patients with MTS was 29.6 ± 8.4 years, with an age range of 18 to 52 years. There was a male predominance, with 17 males (60.7%) and 11 females (39.3%) affected.

Unilateral medial temporal sclerosis was observed in 21 patients (75%), whereas bilateral involvement was noted in 7 patients (25%). Among unilateral cases, right-sided MTS was identified in 12 patients (57.1%) and left-sided involvement in 9 patients (42.9%).

Hippocampal volume loss was the most common MRI finding, observed in 26 patients (92.9%), followed by increased signal intensity on T2-weighted and FLAIR images in 25 patients (89.3%). Loss of internal hippocampal architecture was identified in 22 patients (78.6%). Ipsilateral temporal horn dilatation and associated temporal lobe atrophy were observed in 19 (67.9%) and 15 (53.6%) patients, respectively. None of the patients demonstrated restricted diffusion or abnormal post-contrast enhancement.

TABLES

Table 1: Demographic Characteristics Of Patients With Medial Temporal Sclerosis (n = 28)

Parameter	Value
Mean age (years)	29.6 ± 8.4
Age range (years)	18–52
Male	17 (60.7%)
Female	11 (39.3%)

Table 2: Laterality Of Medial Temporal Sclerosis

Category	Number (%)
Unilateral MTS	21 (75%)
Bilateral MTS	7 (25%)
Right-sided MTS*	12 (57.1%)
Left-sided MTS*	9 (42.9%)

*Percentages calculated among unilateral cases

Table 3: MRI Findings In Medial Temporal Sclerosis

MRI Feature	Number (%)
Hippocampal volume loss	26 (92.9%)
T2/FLAIR hyperintensity	25 (89.3%)
Loss of internal hippocampal architecture	22 (78.6%)
Temporal horn dilatation	19 (67.9%)
Associated temporal lobe atrophy	15 (53.6%)

DISCUSSION

The findings of this study reaffirm medial temporal sclerosis as the most common structural abnormality associated with refractory temporal lobe epilepsy. The prevalence of MTS observed in the present study is comparable with previously published literature from Indian and international populations.

Unilateral MTS was more commonly observed than bilateral involvement, a finding of particular clinical importance as patients with unilateral disease are known to have better postoperative seizure outcomes following anterior temporal lobectomy. Hippocampal volume loss and increased T2/FLAIR signal intensity were the most consistent imaging features, reflecting the underlying histopathological changes of neuronal loss and gliosis.

The use of coronal oblique T2-weighted and FLAIR sequences perpendicular to the hippocampus was especially useful in detecting subtle hippocampal abnormalities. Routine MRI protocols without epilepsy-specific sequences may fail to identify early or mild cases of MTS, underscoring the importance of dedicated epilepsy MRI protocols in the evaluation of refractory seizures.

Limitations

The retrospective design of the study and the absence of quantitative hippocampal volumetric analysis are acknowledged limitations. Additionally, detailed electroencephalographic correlation was not available for all patients.

CONCLUSION

MRI plays a pivotal role in the evaluation of patients with refractory seizures by enabling accurate detection and characterization of medial temporal sclerosis. Dedicated epilepsy MRI protocols significantly enhance diagnostic confidence and assist in identifying patients who may benefit from surgical intervention.

Figures

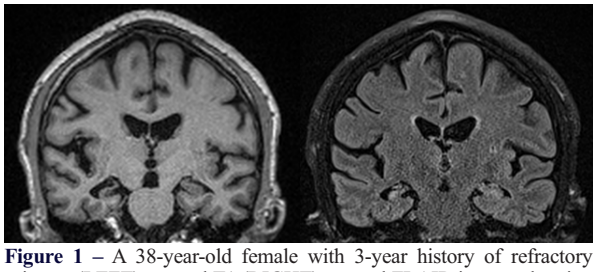

Figure 1 – A 38-year-old female with 3-year history of refractory seizures (LEFT) coronal T1 (RIGHT) coronal FLAIR images showing atrophy of right hippocampus with increased signal intensity on FLAIR, loss of gyration and prominence of the choroidal fissure. There is also atrophy of para hippocampal gyrus. The hippocampal architecture is lost which is consistent with right mesial temporal sclerosis.

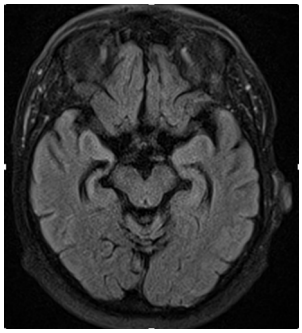

Figure 2 – A 31 year old male with 6 year history of refractory seizures. Axial FLAIR MRI image demonstrating **asymmetric volume loss and increased signal intensity of the hippocampus** with **associated ipsilateral temporal lobe atrophy**, supporting the diagnosis of medial temporal sclerosis.

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