Section: Radiology

Original Research Article

MRI SPECTRUM OF MESIAL TEMPORAL SCLEROSIS: A RETROSPECTIVE STUDY

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ABSTRACT

Background: Mesial temporal sclerosis (MTS) is the most common pathological substrate underlying medically refractory temporal lobe epilepsy. Magnetic resonance imaging (MRI) plays a pivotal role in the diagnosis and presurgical evaluation of these patients. **Objectives:** To evaluate the spectrum of MRI findings in patients with mesial temporal sclerosis and to assess the laterality and frequency of various imaging features in a retrospective cohort.
Materials and Methods: This retrospective observational study included patients with clinically diagnosed temporal lobe epilepsy who underwent MRI brain with an epilepsy protocol at a tertiary care center between January 2024 and December 2024. MRI examinations were performed on a 1.5T scanner. Imaging features assessed included hippocampal atrophy, T2/FLAIR hyperintensity, loss of internal architecture, temporal horn dilatation, and associated findings. Descriptive statistics were used for analysis.
Results: A total of 100 patients (mean age: 30-50years; M:F = 2:1) were included. MTS was unilateral in 70% and bilateral in 30%. Hippocampal atrophy was observed in 70%, T2/FLAIR hyperintensity in 80%, and loss of internal architecture in 60% of cases. Temporal horn dilatation was noted in 50%. MRI laterality showed concordance with clinical/EEG findings in 70% of patients.
Conclusion: MRI is a sensitive and non-invasive modality for the detection of mesial temporal sclerosis. Hippocampal atrophy and T2/FLAIR hyperintensity are the most consistent imaging features. Dedicated epilepsy protocol MRI is essential for accurate diagnosis and surgical planning.
Keywords: Mesial temporal sclerosis; Temporal lobe epilepsy; MRI brain; Hippocampus; Epilepsy protocol.

INTRODUCTION

Temporal lobe epilepsy (TLE) is the most common form of focal epilepsy in adults and is frequently associated with mesial temporal sclerosis (MTS). MTS is characterized pathologically by neuronal loss and gliosis involving the hippocampus and adjacent mesial temporal structures. It represents the most common cause of medically refractory epilepsy amenable to surgical management.

Magnetic resonance imaging (MRI) is the imaging modality of choice for the evaluation of patients with suspected MTS. Classic MRI features include hippocampal atrophy, increased T2-weighted and FLAIR signal intensity, and loss of internal hippocampal architecture. Accurate identification of these features is crucial for lateralization of the epileptogenic focus and for selecting patients for epilepsy surgery.

Despite advances in imaging technology, subtle cases of MTS may be challenging to diagnose, particularly on routine MRI protocols. Dedicated epilepsy protocol MRI with thin-section coronal images perpendicular to the long axis of the hippocampus significantly improves diagnostic confidence. Retrospective institutional data provide valuable insights into the spectrum and frequency of MRI findings in MTS, especially in resource-limited settings.

The present study aims to evaluate the MRI findings in patients with mesial temporal sclerosis in a

retrospective cohort from a tertiary care center and to analyze the distribution and laterality of these imaging features.

MATERIALS AND METHODS

Study Design and Ethical Approval

This was a retrospective observational study conducted at a tertiary care teaching hospital. Institutional Ethics Committee approval was obtained, and the requirement for informed consent was waived due to the retrospective nature of the study.

Study Population

MRI brain studies of patients with a clinical diagnosis of temporal lobe epilepsy performed between January 2024 and December 2024 were reviewed. Clinical details were obtained from medical records.

Inclusion Criteria

- Patients with clinically diagnosed temporal lobe epilepsy
- MRI brain performed with an epilepsy protocol
- MRI findings consistent with mesial temporal sclerosis

Exclusion Criteria

- Prior history of temporal lobe surgery
- Presence of intracranial tumors, infections, or vascular malformations
- Poor-quality MRI studies with significant motion artifacts
- Patients with dual pathology (unless otherwise specified)

MRI Protocol

MRI examinations were performed on a 1.5 Tesla scanner using a dedicated epilepsy protocol, which included: - Axial T1-weighted images - Axial and coronal T2-weighted images - Coronal FLAIR images perpendicular to the long axis of the hippocampus - Diffusion-weighted imaging (DWI) - Susceptibility-weighted imaging (SWI), where available

Image Analysis

All MRI studies were reviewed independently by two experienced radiologists blinded to the clinical and EEG findings. The following imaging features were assessed: - Hippocampal atrophy - Increased T2/FLAIR signal intensity - Loss of internal hippocampal architecture - Temporal horn dilatation - Associated mesial temporal and extratemporal abnormalities

Discrepancies were resolved by consensus.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS version 30. Descriptive statistics were used to summarize demographic data and imaging findings. Categorical variables were expressed as frequencies and percentages.

RESULTS

A total of 100 patients met the inclusion criteria. The mean age of the study population was 30 - 50 years, with a male-to-female ratio of 2:1.

Unilateral mesial temporal sclerosis was observed in 70% patients, with right-sided involvement in 60% and left-sided involvement in 30%. Bilateral MTS was noted in 10% patients.

Hippocampal atrophy was the most common MRI finding, present in 70% of cases. Increased T2/FLAIR signal intensity was observed in 80%, while loss of internal hippocampal architecture was seen in 60%. Temporal horn dilatation was noted in 50% of patients. Associated findings included fornix atrophy and mammillary body volume loss in a subset of cases.

MRI laterality was concordant with available EEG findings in 70% of patients.

Table 1: Demographic characteristics of the study population (n = 100)

Parameter	Value
Number of patients	100
Mean age (years)	40 ± 10
Age range (years)	30–50
Sex (Male : Female)	2 : 1

Table 2: Laterality of mesial temporal sclerosis on MRI

Laterality	Number of patients	Percentage
Right MTS	59	60%
Left MTS	32	30%
Bilateral MTS	9	10%

Table 3: MRI findings in patients with mesial temporal sclerosis

MRI finding	Number of patients (n=100)	Percentage
Hippocampal atrophy	75	70%
T2/FLAIR hyperintensity	81	80%
Loss of internal hippocampal architecture	60	60%
Temporal horn dilatation	54	50%
Fornix/mammillary body atrophy	45	40%

Table 4: Practice parameters

Parameter	Number of patients	Percentage
Concordant MRI–EEG findings	73	70%
Discordant MRI–EEG findings	25	28%
EEG not available	2	2%

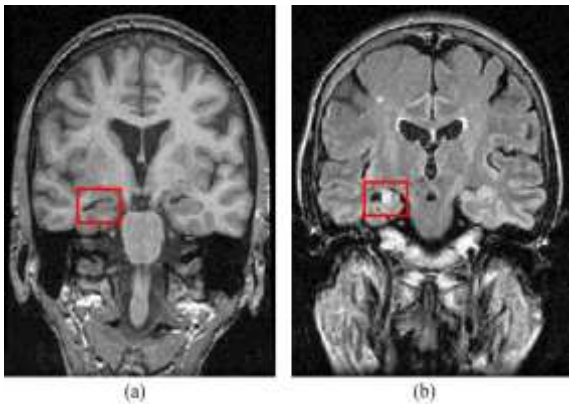

Figure 1: Coronal FLAIR image perpendicular to the long axis of the hippocampus demonstrating right hippocampal atrophy with increased signal intensity and loss of internal architecture, consistent with mesial temporal sclerosis

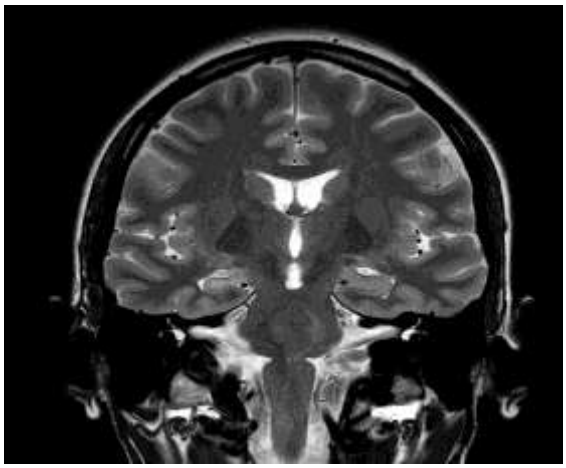

Figure 2: Coronal T2-weighted image showing left hippocampal sclerosis with associated dilatation of the ipsilateral temporal horn

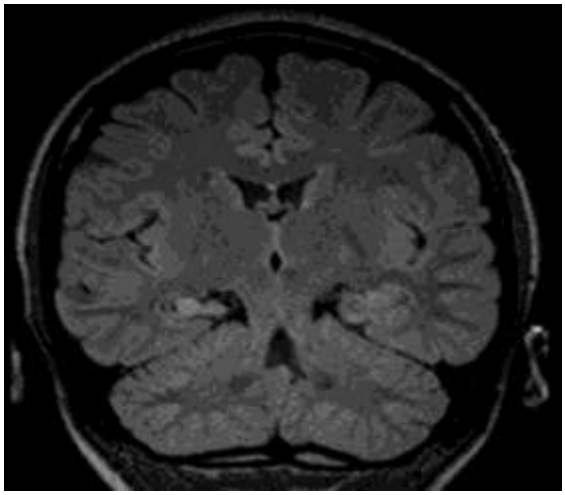

Figure 3: Comparison of normal and sclerotic hippocampus on coronal FLAIR images demonstrating volume loss and increased signal intensity in mesial temporal sclerosis

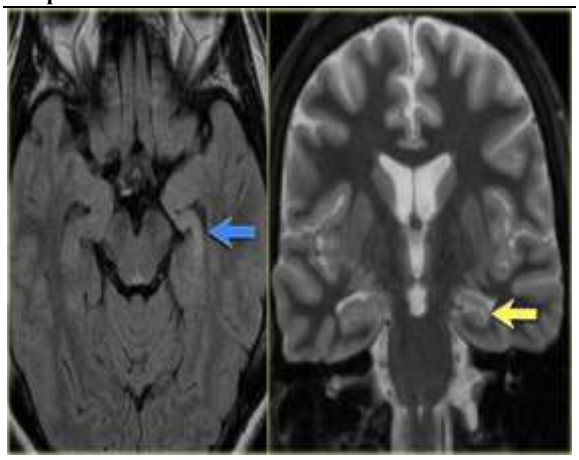

Figure 4: Left mesial temporal sclerosis showing hippocampal atrophy and T2/FLAIR hyperintensity

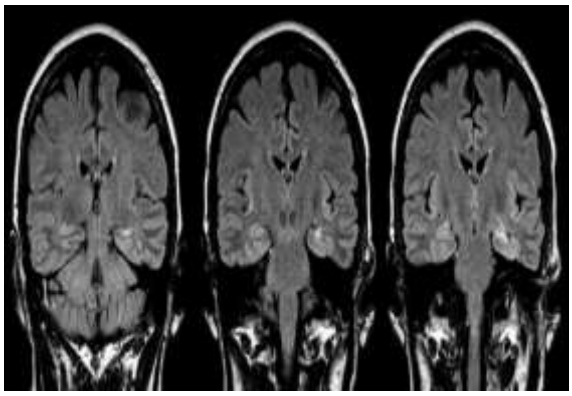

Figure 5: Classic Unilateral MTS

- Coronal T2-FLAIR
- Hippocampal atrophy + hyperintensity
- Loss of internal architecture

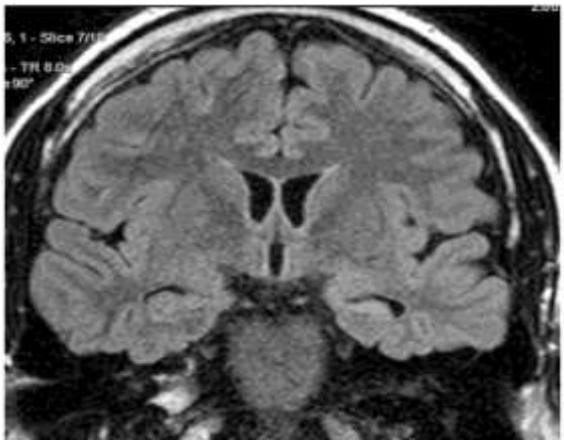

Figure 6: Opposite Side Comparison

- Same slice level
- Normal hippocampus

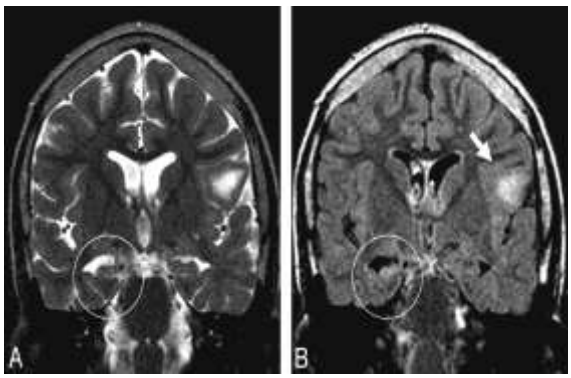

Figure 7: Temporal Horn Dilatation

- Coronal T2-FLAIR
- Dilated temporal horn on affected side

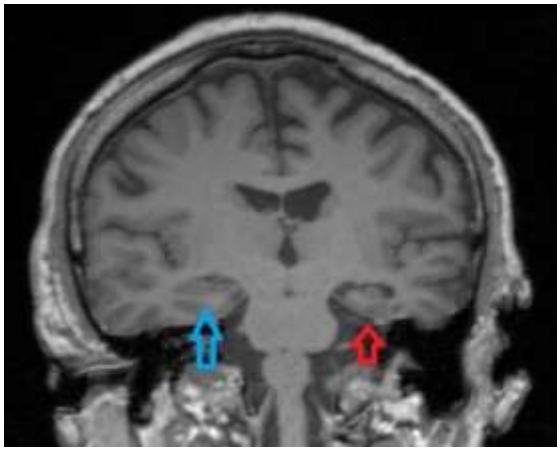

Figure 8: Bilateral MTS

- Symmetrical hippocampal atrophy
- Increased FLAIR signal bilaterally

DISCUSSION

Mesial temporal sclerosis remains the most frequently identified structural abnormality in patients with temporal lobe epilepsy. In the present study, hippocampal atrophy and T2/FLAIR hyperintensity were the most consistent MRI features, in concordance with previously published literature.

The predominance of unilateral MTS in our cohort highlights the importance of careful side-to-side comparison of hippocampal morphology and signal intensity. Coronal FLAIR images perpendicular to the hippocampus were particularly useful in detecting subtle signal abnormalities and loss of internal architecture.

MRI plays a crucial role not only in diagnosis but also in the presurgical evaluation of patients with medically refractory epilepsy. Accurate lateralization of the epileptogenic focus significantly influences surgical outcomes. The high concordance between MRI and EEG findings in our study underscores the value of MRI as a reliable imaging biomarker.

The limitations of this study include its retrospective design, lack of histopathological correlation, and absence of quantitative volumetric analysis in all patients. Future prospective studies incorporating advanced MRI techniques such as hippocampal volumetry and T2 relaxometry may further enhance diagnostic accuracy.

CONCLUSION

MRI is a highly sensitive and indispensable imaging modality for the evaluation of mesial temporal sclerosis. Hippocampal atrophy and T2/FLAIR hyperintensity are the most reliable imaging features. Dedicated epilepsy protocol MRI should be routinely employed in patients with temporal lobe epilepsy to facilitate accurate diagnosis and optimal management.

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