Study of Cases of Mesial Temporal Sclerosis Diagnosed on MRI

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ABSTRACT

Introduction: Temporal lobe epilepsy is the most common epilepsy syndrome in adults. In most patients, the epileptogenic focus involves the structures of the mesial temporal lobe. These structures include the hippocampus, amygdala and parahippocampalgyrus. MRI is the modality of choice to evaluate the hippocampus, however dedicated temporal lobe epilepsy protocol needs to be performed if good sensitivity and specificity is to be achieved. The purpose of this study is to evaluate the prevalence of Mesial Temporal sclerosis in our tertiary care setup and to study the MR findings in patients of Mesial Temporal Sclerosis.

Material and Methods: MR scans (epilepsy protocol done by 1.5T MRI) of 92 patients who presented with clinical features of temporal lobe epilepsy or partial seizers in the study period of 6 months were reviewed retrospectively. Imaging findings were described and tabulated and prevalence of mesial temporal sclerosis calculated.

Results: 25 out of 92 (27.2%) patients who had done MRI brain for clinical suspicion of temporal lobe epilepsy or partial seizers had mesial temporal sclerosis. Increased signal intensity of hippocampus constituted the commonest imaging finding seen in 21 out of 25 (84%) patients and it was best visualized in coronal T2 FSE high resolution images.

Conclusion: Mesial Temporal Sclerosis was the most common identifiable cause of seizures in our study. Of the six features described in cases of mesial temporal sclerosis on MRI, increased hippocampal signal intensity is the most consistent. Temporal lobe epilepsy protocol increases the sensitivity and specificity of the diagnoses compared to routine MRI brain study.

Keywords: MTS Brain, Epilepsy, MR epilepsy protocol, Temporal lobe epilepsy, Mesial sclerosis

INTRODUCTION

Temporal lobe epilepsy is the most common epilepsy syndrome in adults. Seizures usually begin in late childhood or adolescence. Virtually all patients have complex partial seizures, some of which generalize secondarily. In most patients, the epileptogenic focus involves the structures of the mesial temporal lobe. These structures include the hippocampus, amygdala and parahippocampal gyrus. Mesial temporal sclerosis is the commonest cause of partial complex seizures.[1-4]

Magnetic resonance imaging (MRI) is the imaging investigation of choice for the diagnosis and has been shown to be highly sensitive and specific, however dedicated temporal lobe epilepsy protocol needs to be performed if good sensitivity and specificity are to be achieved.[3,4]

Anti-epileptogenic drugs usually suppress secondary generalized seizures successfully but 50% of patients or more will continue to have partial seizures. When seizures persist, anterior temporal lobectomy is the treatment of choice.

The purpose of this study is to evaluate the prevalence of Mesial Temporal Sclerosis in our tertiary care setup and to study the MR findings in patients of Mesial Temporal Sclerosis.

MATERIALS AND METHODS

Study period: 6 months (25-3-2014 to 25-9-2014), Type of study: Retrospective study

Inclusion criteria: Cases of epilepsy with clinical features of temporal lobe epilepsy or partial seizers for which MRI brain was done during the study period.

Methods: MRI of Brain Epilepsy - imaging protocol (1.5T G.E. Scanner), T1W sagittal images for localizing the hippocampus, Axial FLAIR sequence, Coronal high-resolution T2 FSE and FLAIR perpendicular to hippocampal axis (2 mm) and Isotropic T1WI 3D inversion recovery SPGR.

92 patients had done MRI of brain (epilepsy protocol) for complaints of epilepsy or partial seizers during the study period of 6 months. Out of these 92 patients, 25 were diagnosed on MRI as having Mesial Temporal Sclerosis. MRI scans of the patients during the study period were retrieved from archives and reviewed retrospectively. Imaging findings of Mesial Temporal Sclerosis were described and tabulated and prevalence calculated.

RESULTS

Feature: 1 is - increased signal intensity in the hippocampus; 2- hippocampal atrophy or volume loss; 3- collateral white matter atrophy; 4- enlarged temporal horn; 5-diminished gray-white matter demarcation; and 6- smaller temporal lobe. (R: Right side, L: Left side, B/L: Bilateral involvement)

Details of the table: 25 out of 92 (27.2%) patients who had done MRI brain for clinical suspicion of temporal lobe epilepsy or partial seizers had mesial temporal sclerosis. Increased signal intensity of hippocampus constituted the commonest imaging finding seen in 21 out of 25 (84%) patients

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How to cite this article: Maulik Jethva, Manisha Panchal, Anjana Trivedi, Manish Yadav, Anirudh Chawla. Study of cases of mesial temporal sclerosis diagnosed on MRI. International Journal of Contemporary Medical Research 2016;3(2):496-498.

Patient	Side	MRI features					
		1	2	3	4	5	6
1.	R	+	-	-	-	-	-
2.	R	+	+	-	+	-	-
3.	R	+	+	-	-	-	-
4	L	+	-	-	-	-	-
5.	L	+	+	+	+	-	+
6.	R	+	+	-	+	-	-
7.	L	+	-	-	-	+	-
8.	R	+	-	-	-	-	-
9.	L	+	+	-	+	-	-
10.	L	-	+	-	-	-	-
11.	R	+	+	-	-	-	-
12	R	-	+	+	-	-	+
13	L	+	+	-	+	-	-
14	L	-	+	-	-	-	-
15	R	+	+	-	-	-	-
16	B/L	+	+	-	+	-	+
17	L	+	-	+	+	-	+
18	L	-	+	-	-	-	-
19	L	+	-	-	-	-	-
20	L	+	-	-	+	-	+
21	R	+	+	-	+	-	-
22	R	+	+	-	-	-	-
23	L	+	+	+	-	-	+
24	B/L	+	+	+	+	-	+
25	L	+	-	+	-	-	+
Total 25		21	17	6	10	1	8

Table-1: MRI **features**

and it was best visualized in coronal T2 FSE high resolution images. Hippocampal atrophy or volume loss was seen in 17 out of 25 (68%) patients. Collateral white matter atrophy, enlarged temporal horn and smaller temporal lobe was seen in 6/25 (24%), 10/25 (40%) and 8/25 (32%) patients respectively. Diminished gray-white matter demarcation was the rarest finding seen in only 1 of 25 (4%) patients diagnosed with mesial temporal sclerosis. The disease was bilateral in 2 of 25 (8%) cases and affected the left side (13 of 25; 52%) more frequently as compared to the right (10 of 25; 40%).

DISCUSSION

In the present study, MRI of Brain (Epilepsy protocol) of 92 patients, who presented with clinical features of temporal lobe epilepsy or partial seizures during the study period of 6 months were reviewed retrospectively. Out of these 92 patients, 25 were diagnosed as having Mesial Temporal Sclerosis. Mesial temporal sclerosis is the commonest histopathological finding in the patients undergoing surgery for temporal lobe epilepsy. It has been postulated that mesial temporal sclerosis may be related to a complicated delivery[1], febrile convulsions during childhood.[2-4] and status epilepticus.[5] These circumstances are believed to cause metabolic disturbances in neurons in the hippocampus, which may disappear and subsequently be replaced by gliosis.[5] This may lead to a change in signal intensity on MRI and a reduction in size of the hippocampus. Although MRI has proved much

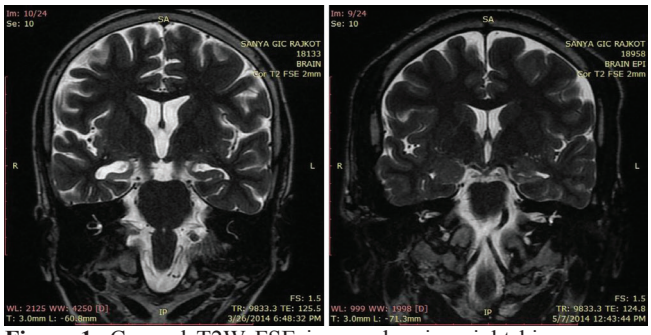

Figure-1: Coronal T2W FSE image showing right hippocampus region hyperintensity, volume loss with loss of head digitations and collateral white matter atrophy, volume loss in right temporal lobe- and dilation of temporal horn of right lateral ventricle; **Figure-2:** Coronal T2W FSE image showing volume loss and hyperintensity in left hippocampus.

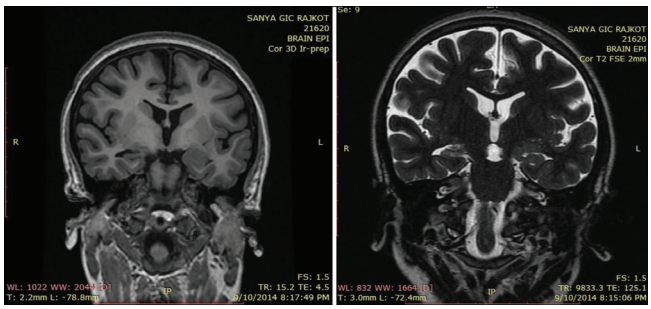

Figure-3: Coronal 3D IR sequence showing atrophy and volume loss of right hippocampus and of right mamillary body with dilatation of temporal horn of right lateral ventricle; **Figure-4:** Coronal T2 FSE image showing atrophy and hyperintensity of right hippocampus with dilatation of temporal horn of right lateral ventricle.

more sensitive than computed tomography in the detection of mesial temporal sclerosis[6], the incidence of mesial temporal sclerosis on MRI differs significantly between studies investigating patients with drug-resistant temporal lobe epilepsy (8% found by Brooks et al.[7]; Gates and Rodriguez, 55%[8]; Heinz, 62%[9]; Dowd, 64%[10]; Kuzniecky, 70%[11]; and 93% in a study by Jackson et al[12]). Various authors have proposed criteria for the diagnosis of mesial temporal sclerosis on MRI.[7,8,11,13,14] The optimal planes and sequences for the depiction of the hippocampus suggested by different authors[12] are the coronal and the axial images parallel to the temporal fossa or to the hippocampus using a T2-weighted sequence.[12]

MRI FEATURES OF MESIAL TEMPORAL SCLEROSIS

1. Increased Signal Intensity in the Hippocampus*:* (Fig: 1, 2 and 4) This MR criterion in the pathologic hippocampus is the most common finding in this study. It was seen in 21 out of 25 of our cases. Coronal high-resolution T2 FSE sequence perpendicular to hippocampal axis was most sensitive for detection of the feature.

2. Reduction in Size of the Hippocampus: (Fig: 1, 2, 3 and 4) The decreased hippocampal size was the next most common finding (17out of 25 patients). This criterion may be best assessed on the coronal images, the inversion-recov-

ery sequence being slightly better than the others. However, care has to be taken to obtain the images in an exact coronal plane, if necessary, using images angulated along the left-right axis as well as the caudal-cranial axis. The axial plane is inferior to the coronal plane for the depiction of this feature. The reduced hippocampal size would be expected to be present in all cases, as a result of scarring and retraction. However, it was not seen in all of our patients. In our study all patients with decreased hippocampal size showed concomitant ipsilateral increased signal on T2-weighted images.

3. Atrophy of Collateral White Matter Adjacent to the Hippocampus: (Fig: 1) The inversion-recovery sequence demonstrates a local reduction of the volume of the adjacent collateral white matter; however, it is well demarcated from the neighboring gray matter. A subtle rotated position of the patient's head may influence this finding so use of this feature for the diagnosis should be done only in combination with the other criteria for mesial temporal sclerosis.

4. Enlargement of the Temporal Horn of the lateral ventricle*:* (Fig: 1, 3 and 4) Based on findings in our 25 patients, we suggest that the criterion of a larger temporal horn is relevant for the diagnosis of mesial temporal sclerosis only if the ipsilateral hippocampus is smaller. If the hippocampi are symmetrical in size and signal intensity, an enlarged temporal horn may be considered a normal variant or the result of loss of temporal lobe parenchyma from causes other than mesial temporal sclerosis. The enlarged temporal horn was well appreciated in all planes and on T2-weighted and inversion-recovery sequences, the latter being slightly better. It was present in 10 out of 25 patients.

5. Diminished Gray-White Matter Demarcation in the Temporal Lobe: In the present study the reduced distinction between gray and white matter of the temporal lobe was an infrequent finding. The underlying cause of the altered gray-white matter distinction is not clear.

6. Reduction in Size of the Temporal Lobe: (Fig: 1) In this study the criterion of a reduced size of the temporal lobe was not considered an indication of mesial temporal sclerosis if it was a solitary finding. Jack et al[15] have measured the volumes of temporal lobes in patients without epilepsy and came to the conclusion that the left temporal lobe generally is slightly but significantly larger than the right temporal lobe. Reduced temporal lobe size was noted in 8out of 25 patients and was best appreciated on the coronal inversion-recovery images.

CONCLUSION

Mesial Temporal Sclerosis was the most common identifiable cause of seizures in our study. Mesial temporal sclerosis may have different appearances on MR images, resulting in a combination of above mentioned six features, of which increased hippocampal signal intensity is the most consistent finding. MR imaging with epilepsy protocol increases the sensitivity and specificity of the diagnoses compared to routine MRI brain study. The subtlety of the abnormalities of mesial temporal sclerosis on MR and the associated artifacts and pitfalls in the different scanning planes necessitate the use of multiple planes for confirmation.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 30-12-2015; **Published online**: 20-01-2016