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ROLE OF MRI IN MESIAL TEMPORAL SCLEROSIS

Radio-diagnosis

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ABSTRACT

Epilepsy is one of the most common neurologic conditions in the world and is of a major public health concern.Medial temporal lobe is the commonest source of intractable/refractory epilepsy. Magnetic Resonance has proved beyond doubt that it is the imaging modality in detecting Mesial temporal sclerosis(MTS) and hippocampal pathologies. We present 12 cases of MTS detected by MRI using conventional standard protocols.

KEYWORDS

Epilepsy; Mesial temporal sclerosis-MTS; Magnetic resonance imaging-MRI.

Introduction :
MTS is also known as hippocampal sclerosis is the commonest cause of refractory epilepsy1-3with an incidence of 60% to 80% of cases.4. Aetiology of MTS is unknown but complex febrile seizures, birth trauma, meningitis, or head injury are associated.

MRI is the imaging modality of choice for the evaluation of patients with MTS, since it can identify structural abnormalities. Recognition of subtle changes in medial temporal lobe architecture requires good knowledge of its MRI anatomy.

Primary radiological signs of MTS are :
1) A small atrophic unilateral hippocampus.

2) Hyperintensity on both T2 W and FLAIR images (Fluid attenuated inversion recovery images).

3) Loss of the hippocampal internal architecture and that of normal digitations of the head.

Secondary signs include:
1) Unilateral atrophy of the mamillary body, fornix columns (circuit of paper), and the amygdala.

2)Increased T2 W signal in the anterior temporal lobe white matter with loss of grey-white demarcation in the ipsilateral anterior temporal lobe.

3) Unilateral dilatation of the temporal horn (a less reliable secondary sign).

4) Unilateral atrophy of the collateral white matter bundle.

Materials and Methods
24 healthy adult volunteers (twelve men, twelve women) for MR imaging, which was performed between august 2018 and august 2019 as control subjects. The mean age of the 24 control subjects was 26 year. In control subjects, the internal structure was visible in all sections of the head, body, and tail of the hippocampus and it was possible to delineate continuous hippocampal striation.

12 patients of refractory epilepsy with clinical suspicion of MTS in our rural tertiary medical college with the clinical details enumerated in the column between august 2018 to august 2019 were evaluated with MRI .

Clinical Characteristics of Patients

No	AGE(Y)	SEX	Epilepsy predisposing factors	Age of seizure onset	Seizure type
1	20	M	f/h of epilepsy	5Y	A ,G
2	13	F	None	7Y	A,C
3	22	M	Febrile convulsion of infancy	1m	A,C
4	12	F	Gestational/perinatal injury	2Y	A,C
5	8	M	None	3Y	A,G
6	30	M	None	9Y	A,C
7	28	F	Gestational/perinatal injury/f/h-epilepsy	12Y	A,G
8	49	M	f/h of epilepsy	20Y	A,C
9	24	M	Febrile convulsion during infancy	8m	A,C
10	30	F	Febrile convulsions during infancy/f/h-epilepsy	10Y	A,C
11	12	F	None	6Y	A,G
12	7	F	Febrile convulsion of infancy	3 Y	A,C

f/h –family history A-Aura. C-complex partial seizure. G-generalized tonic-clonic seizure

The standard MR protocol we followed as follows : T1 WI sagittal for localising the hippocampus, Coronal high-resolution T2 WI and FLAIR perpendicular to hippocampal axis (3 - 4 mm slice thickness), Coronal SPGR T1 perpendicular to hippocampal axis (1.5 mm slice thickness).

Results:
The results were as follows: A small atrophic unilateral hippocampus [Figure 1-4],Hyperintensity on both T2 W and FLAIR images (Fluid attenuated inversion recovery images)[Figure 1-4], Loss of the hippocampal internal architecture and that of normal digitations of the head [Figure 2-4], were seen in 12 patients with refractory epilepsy(n=12) diagnosed to have MTS with primary signs as mentioned above .Visual assessment of size, architecture and signal intensity changes is quite sensitive, with the eye being able to detect asymmetry of 14% or more[5] .

Secondary signs : Unilateral atrophy of the mamillary body seen in three patients(n=3), whereas unilateral atrophy of fornix columns (circuit of paper) was seen in 3 patients (n=3) .Increased T2 W signal in the anterior temporal lobe white matter with loss of grey-white demarcation in the ipsilateral anterior temporal lobe was seen in two patients (n=2).Unilateral dilatation of the temporal horn (a less reliable

secondary sign)was seen in six patients(n=6). Unilateral atrophy of the collateral white matter bundle was seen in 2 patients(n=2).Incidental finding of left hippocampal incomplete inversion with more rounded,vertical and more medial orientation of left hippocampus noted in one patient with associated left MTS14. Overall four cases were diagnosed as right MTS and eight were diagnosed as left MTS with left sided hippocampal involvement more in our study.

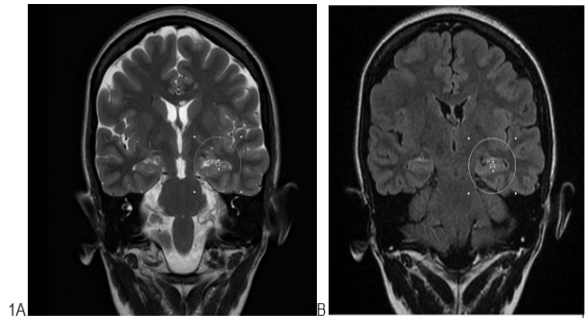

FIG:1.A & B: MRI coronal T2 and FLAIR hyperintense signal changes in body of left hippocampus with ipsilateral atrophy.

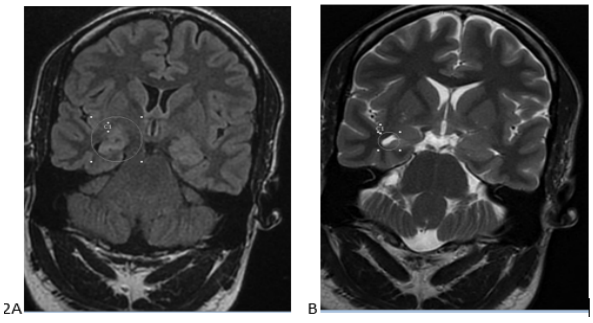

Fig 2.(A&B) . MRI coronal FLAIR and T2 images showing small size and hyperintensities in right hippocampus with loss of normal digitations with widening of right temporal horn.

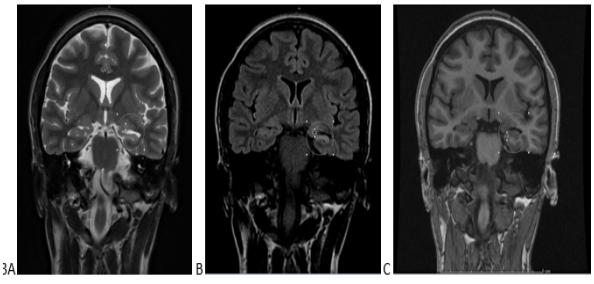

FIG 3A.MRI coronal T2 image showing unilateral dilatation of left temporal horn.B. Coronal FLAIR image showing atrophy and hyperintensity in body of left hippocampus with loss of normal digitations.c. Coronal SPGR T1 image showing atrophic left hippocampus with loss of internal architecture.

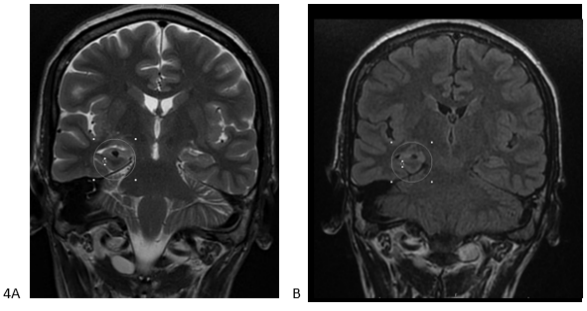

Fig 4.(A & B) : MRI Coronal FLAIR and T2 images showing hyperintense signal changes with atrophy of of body of right hippocampus with loss of internal architecture and tiny hypointense focus (calcification) within right hippocampus.GRE images not shown here showed blooming of tiny hypointense focus in right hippocampus.

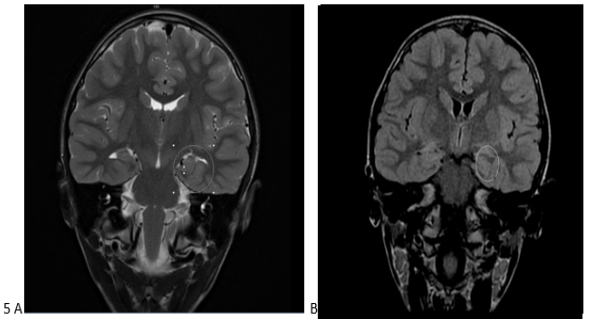

Fig 5.(A & B): MRI T2 and FLAIR images showing left hippocampal incomplete inversion with round , vertical and more medial orientation with subtle FLAIR hyperintensity.

Discussion:

The International classification of epilepsies and epileptic syndromes classifies clinical epilepsy into two broad categories, idiopathic (primary) and symptomatic (secondary) disorders5 . Primary epilepsies are genetically transmitted seizures that are not associated with other neurological disturbances or structural pathology and are usually benign. Secondary epilepsies, in contrast, are seizures resulting from a specific pathologic substrate that can be genetic or acquired ,MTS is one of the major cause of refractory epilepsy[5].

Anatomy of hippocampus; The upper surface of the temporal lobe is delimited from the frontal and parietal lobes by the sylvian fissure. No clear boundary is defined posteriorly, where it is separated from occipital and parietal lobes by an imaginary lateral parietotemporal line running downward from the posterior edge of the sylvian fissure (Figure A). The medial border is delimited by a line that connects the inferior fork of the sylvian fissure to the superior-lateral aspect of the choroidal fissure temporal horn complex . The temporal lobe is composed of neocortex and mesial temporal lobe structures, including the uncus, parahippocampal gyrus, amygdala (located superiorly and anteriorly to hippocampal head),

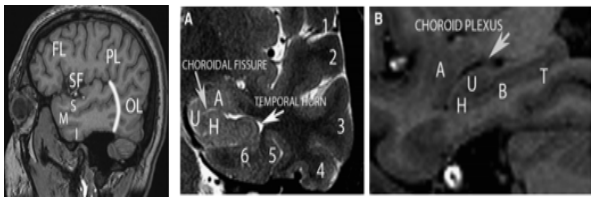

Fig A.FL-frontal,PL-parietal and OL- occipital lobes.s,m,I –gyrus. B.C sylvian fissure (1); superior (2), medial (3), inferior (4) temporal gyri; parahippocampal gyrus (5); collateral white matter (6); uncus (U); amygdala (A); and head (H), body (B), and tail (T) of the hippocampus

Magnetic resonance imaging (MRI) is the imaging investigation of choice for the diagnosis and has been shown to be highly sensitive and specific as in our study.In one patient incomplete hippocampal inversion with associated MTS was seen on left side with predominant left sided incomplete hippocampal inversion as mentioned in the literature findings of Stephen chan 14 and others. There is a wide range of complimentary imaging techniques available for diagnosing and locating Mesial Temporal Lobe Sclerosis. These include MR hippocampal volumetrics, MR hippocampal T2 relaxometry, MR Spectroscopy, Simple Photon Emission Computed Tomography (SPECT), Ictal SPECT and Positron Emission Tomography (PET). These methods all have high sensitivities but are either not available or not in common usage in our setting.

CT does not detect MTS at all . The overall percentage of success of CT in detecting lesions in focal epilepsies is low, approximately 30% . CT is however, recommended in emergency situation9. MR spectroscopy is still in the early stages of evaluation, especially single-voxel studies of the hippocampus and temporal lobe[10]

Ictal SPECT imaging with radiopharmaceutical is a tedious procedure requires computer-assisted techniques and trained radiologist. PET is very sensitive but is not universally available.[11]

MR spectroscopy would show reduced N-acetylaspartate levels in the

ipsilateral mesial temporal lobe assisting in the lateralisation of temporal lobe epilepsy (TLE), even in cases with negative MR images[13].

The hallmark of mesial temporal sclerosis on MR imaging is an atrophic hippocampus associated with hyperintense signal on long-repetition-time sequences confined to the hippocampus have 100% specificity and sensitivity.12. The use of secondary MR features can help improve the sensitivity and positive predictive value in this group of patients, especially when used in conjunction with other localizing techniques described above. The sensitivity and specificity of secondary MR features data are not so well documented . Bilateral hippocampal abnormalities,a secondary findings can determine the more important side to resect thus help in the diagnosis and lateralization of mesial temporal sclerosis.

Patients with medically refractory epilepsy due to mesial temporal sclerosis have only one reliable method for treatment: surgical resection of the hippocampus.

The limitations of the current study are largely related to the relatively small number of subjects imaged.

Conclusion:

MRI is the radiological imaging modality of choice for diagnosing MTS. Familiarity with the regional medial temporal lobe anatomy is important for correct MRI interpretation. Coronal high-resolution FLAIR is the best sequence to diagnose MTS, where hyperintensity and atrophy of the hippocampus are the most sensitive signs.

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