Volume : 4 | Issue : 1 | January 2015 • ISSN No 2277 - 8179

Research Paper

Medical Science

KEYWORDS :

Role of MRI (Magnetic Resonance Imaging) Brain In Epilepsy

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ABSTRACT

The main purposes of neuroimaging in epilepsy patients are to identify underlying structural or metabolic abnormalities that require specific treatment and to aid in formulating a syndromic or etiological diagnosis. Many imaging modalities for investigating seizures are available like neurosonogram, computerized tomography (CT scan) of brain, magnetic resonance imaging (MRI) of brain, functional MRI, positron emission tomography (PET), single photon emission computed tomography (SPECT). Of these various modalities MRI is most important modality for evaluation of structural disorders causing epilepsy. So, role of MRI to be evaluated in patients with epilepsy.

AIMS AND OBJECTIVES:

- *To evaluate role of MRI in differentiating primary and secondary epilepsy.*
- *Investigate the incidence of structural abnormalities in epilepsy.*
- *To identify different structural (except neoplasm) and metabolic causes in patient with secondary epilepsy.*
- *Classify causes of epilepsy according to age of patients & specific seizure type.*
- *Systematically evaluate role of MRI epilepsy protocol in epileptic patients.*
- *To evaluate sensitivity and specificity of hippocampal pathology with epilepsy protocol.*
- *Establish role of MRI in management and follow-up of epilepsy.*

EXCLUSION CRITERIA

- *All patients with seizures due to neoplasm*
- *All patients with electrolyte disturbances, alcohol and drug abuse*
- *All patients with neonatal asphyxia, perinatal trauma and congenital infections*

INTRODUCTION

Epilepsy is one of the common neurological disorder world wide. At least fifty million people in the world suffer from recurrent non provoked seizures. Incidence of epilepsy is clearly higher in developing countries than in developed countries.

A seizure is defined as a paroxysmal alteration in neurologic function due to excessive electrical discharge from the central nervous system. Epilepsy is defined as a condition of recurrent seizures, and medical intractability as recurrent seizures despite optimal treatment under the direction of an experienced neurologist over a 2-3-year period.

The main purposes of neuroimaging in epilepsy patients are to identify underlying structural or metabolic abnormalities that require specific treatment and to aid in formulating a syndromic or etiological diagnosis. Neuroimaging is even more important for those patients who have medically intractable seizures. Advances in technology to localize epileptogenic focus substantially improved the success of surgical treatment.

Structural disorders and metabolic disorders can be associated with seizure and detected on imaging. Structural disorders can be hippocampal or mesial temporal sclerosis, cortical developmental malformations or neuronal migration disorders, phakomatoses, vascular abnormalities, infections, neoplasms and scar epilepsy. However neoplastic causes of epilepsy are excluded in this study.

Many imaging modalities for investigating seizures are available like neurosonogram, computerized tomography (CT scan) of brain, magnetic resonance imaging (MRI) of brain, functional MRI, positron emission tomography (PET), single photon emission computed tomography (SPECT). Of these various modalities MRI is most important modality for evaluation of structural disorders causing epilepsy. So, role of MRI to be evaluated in patients with epilepsy.

material and methods

This is a prospective, single-center, observational study. The Department of Imaging & Radiology provides a full range of services of diagnostic imaging to all the patients of hospital.

We included 60 patients with epilepsy between the period of JUNE 2013 to JUNE 2014.

Each patient was studied in detail with relevant to clinical history, examination and laboratory investigation.

They all are examined using magnetic resonance imaging of brain as prime diagnostic modality at our institution.

INCLUSION CRITERIA

Patients with any of the following are included in present study.

- All patients with known case of partial seizures between age ranging since birth to 35 years.
- Onset of generalized or unclassified seizures in the first year of life, or in adulthood
- Evidence of a fixed deficit on neurological or neuropsychological examination
- Difficulty obtaining seizure control with first-line antiepileptic drugs (AEDs).

RESULTS

A total 60 patients with up to 35 years of age were studied. The detailed information regarding Age, sex, clinical presentation, different lesion causing epilepsy with their radiological findings and further management & follow up are given in master chart. Following data are observed in present study.

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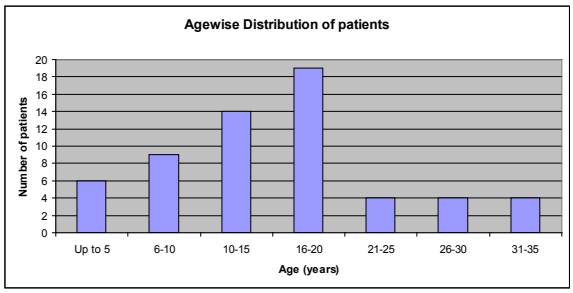
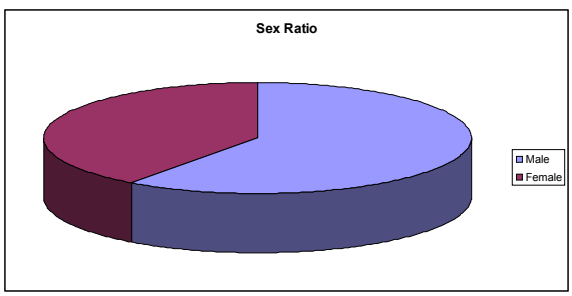
AGEWISE DISTRIBUTION OF LESION



Maximum number of patients were seen in age group16 to 20 years. Youngest patient was 4 months old having lissencephaly& oldest patient was 34 yrs old having scar epilepsy.

SEXWISE DISTRIBUTION OF LESION



In study there were 36(60%) male patient & 24(40%) female patients

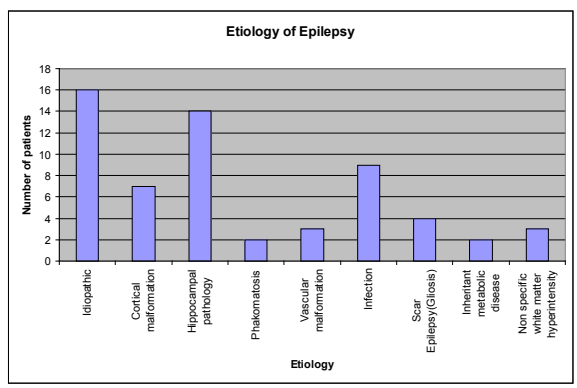
In present study maximum no. of male and female patients was in age group of 16 to 20 years.

Table No.1: DISTRIBUTION AND FREQUENCY OF VARIOUS LESIONS

Lesion	Total cases	% incidence
Cortical malformation	7	11.7%
Schizencephaly	1	1.7%
Lissencephaly	1	1.7%
Cortical heterotopia	2	3.3%
Focal cortical dysplasia	3	5%
Hippocampal pathology	14	23.3%
Unilateralhippocampal sclerosis	9	15%
Bilateralhippocampal sclerosis	5	8.3%
Infection	9	15%
Tuberculoma	6	10%
Neurocysticercosis	2	3.3%
Abscess	1	1.7%
Vascular Malformation	3	5%
Pail AVM	3	5%
Abnormal white matter	5	8.3%
Leukodystrophy(LD)	2	3.3%
Nonspecific hyperintensity	3	5%
Phakomatosis	2	3.3%
Tuberous sclerosis	1	1.7%
Sturge weber syndrome	1	1.7%
Gliosis(Scar Epilepsy)	4	6.7%
H/O previous trauma	3	5%
H/O cerebro vascular accident	1	1.7%
Normal MRI study	16	26.7%
Total	60	100%

In this study most common lesion was hippocampal pathology (23.3%) followed by tuberculoma (10%).

Table No.2: DISTRIBUTION OF LESION ACCORDING TO ETIOLOGY



Most of epilepsy are idiopathic (26.7%), however hippocampal pathology (23%) and infections (15%) are common causes of epilepsy.

Table No. 3 AGE WISE DISTRIBUTION OF VARIOUS LESIONS IN EPILEPSY

Age(in years)	Idiopathic	Cortical malformation	Hippocampal Pathology	Phakomatosis	Vascular malformation	Infection	Gliosis	Abn. White matter hyperintensity	Total
<5	-	4	-	-	-	-	-	1	5
5-10	3	2	-	1	1	2	-	1	10
11-20	9	1	13	1	1	3	2	3	33
21-30	2	-	1	-	1	3	1	-	8
31-35	2	-	-	-	-	1	1	-	4
Total	16	7	14	2	3	9	4	5	60

Most common cause of epilepsy according to age group
First decade - cortical malformation.
Second decade-hippocampal pathology
Third decade-infection

Table No. 4: SEIZURE TYPEWISE DISTRIBUTION OF VARIOUS LESIONS IN EPILEPSY

	Partial seizure	Partial seizure with secondary generalisation	Generalized Seizure	Total
Hippocampal pathology	11	3	-	14

Cortical malformation	4	2	1	7
Schizencephaly	1	-		
Lissencephaly	-		1	
Cortical heterotopia	1	1	-	
Focal cortical dysplasia	2	1	-	
Phakomatosis	-	1	1	2
Tuberous sclerosis	-	-	1	
Sturge weber Syndrome	-	1	-	
Vascular malformation	2	1	-	3
Infection	1	4	4	9
Abscess	-	1	-	
Tuberculoma	-	2	4	
Neurocysticercosis	1	1	-	
Gliosis	2	1	1	4
Abn. White matter hyperintensity	1	-	4	5
Leukodystrophy	-	-	2	
Nonspecific	1	-	2	
Normal MRI findings	5	2	9	16
Total	26	14	20	60

Most common lesion causing partial seizure is hippocampal sclerosis. While partial seizure with secondary generalization is commonly seen in infections, cortical malformation and idiopathic epilepsy. Generalized seizures is most common feature of idiopathic epilepsy followed by abnormal white matter hyperintensity and infection.

Table No. 5: ROLE OF EPILEPSY PROTOCOL IN VARIOUS LESIONS IN EPILEPSY

LESION	Routine protocol	Epilepsy protocol+ /-volumetry
Cortical malformation	5	7
Schizencephaly	1	1
Lissencephaly	1	1
Cortical heterotopia	1	2
Focal cortical dysplasia	2	3
Hippocampal pathology	8	14
Unilateralhippocampal sclerosis	6	9
Bilateralhippocampal sclerosis	2	5
Phakomatosis	2	2
Tuberous sclerosis	1	1
Sturge weber syndrome	1	1
Vascular Malformation	3	3
Pail AVM	3	3
Infection	9	9
Tuberculoma	6	6
Neurocysticercosis	2	2
Abscess	1	1
Gliosis(Scar Epilepsy)	4	4
H/O previous trauma	3	3
H/O cerebro vascular accident	1	1
Abnormal white matter	5	5
Leukodystrophy(LD)	2	2
Nonspecific hyperintensity	3	3
Normal MRI study	24	16

Out of 14 patients with hippocampal pathology diagnosed on epilepsy protocol with or without volumetry, only 8 patients were diagnosed with routine protocol. While 7 patients with cortical malformation were diagnosed on epilepsy protocol with or without volumetry, only 5 patients were picked up on routine protocol.

Table 8: FOLLOW UP AND FURTHER MANAGEMENT

Out of 60 patients presented with epilepsy 45% of patients responded to antiepileptic drugs, 13.3% of patients required specific medical management and 26.7 % of patients treated with surgical management. 5% of patients were expired. Rest of the patients could not be traced for follow-up.

Type of Lesions	Anti epileptic drugs	Specific Medical Mx	Surgical Mx	Expired	Follow-up not available	Total
Cortical malformation	2	-	2	1	2	7
Schizencephaly	1	-	-	-	-	1
Lissencephaly	-	-	-	1	-	1
Cortical heterotopia	1	-	-	-	1	2
Focal cortical dysplasia	-	-	2	-	1	3
Hippocampal pathology	3	-	11	-	-	14
Unilateral hippocampal sclerosis	2		7	-	-	9
Bilateralhippocampal sclerosis	1		4	-	-	5
Infection	-	8	1	-	-	9
Tuberculoma	0	6	-	-	-	6
Neurocysticercosis	0	2	-	-	-	2
Abscess			1			1
Vascular Malformation	1	-	2	-	-	3
Pail AVM	1	-	2	-	-	3
Abnormal white matter	3	-	-	2	-	5
Leukodystrophy(LD)	-	-	-	2	-	2
Nonspecific hyperintensity	3	-	-	-	-	3
Phakomatosis	2	-	-	-	-	2
Tuberous sclerosis	1	-	-	-	-	1
Sturge weber syndrome	1	-	-	-	-	1
Gliosis(Scar Epilepsy)	4	-	-	-	-	4
H/O previous trauma	3	-	-	-	-	3
H/O cerebro vascular accident	1	-	-	-	-	1
Normal MRI study	12	-	-	-	4	16
TOTAL	27	8	16	3	6	60

DISCUSSION

Among all the patients with epilepsy causes in descending order are idiopathic (26.7%) followed by hippocampal pathology (23.3%), Infections(15%), Cortical malformation(11.7%), abnormal white matter hyperintensity (8.3%), gliosis (6.7%), AVM(5%) and phakomatoses (3.3%).

Among epileptic patients with abnormal MRI findings, unilateral hippocampal sclerosis was most common structural lesion comprising 15% followed by tuberculoma comprising 10%.

Among patients with epilepsy, cortical malformations was most common cause of epilepsy in <10 years of age. While hippocampal pathology and infections were commonest structural abnormality in 11-20years and 20-35 years of age respectively.

Volume : 4 | Issue : 1 | January 2015 • ISSN No 2277 - 8179

Most common lesion causing partial seizure is hippocampal sclerosis (42.3%). While partial seizure with secondary generalization is commonly seen in infections (28.6%). Generalized seizures is most commonly associated with idiopathic epilepsy (45%) followed by abnormal white matter hyperintensity and infections (20%).

Most of structural brain abnormalities lead to epilepsy were located in temporal lobe (30%) followed by frontal lobe(13.3%). Thus temporal lobe lesions were more epileptogenic.

Abnormal white matter hypointensity on T1W images and hyperintensity on T2W images were most common finding on MRI study comprising 31.7%.

CONCLUSION

MRI reveals significant number of structural abnormalities in patients with focal seizures, symptomatic generalized seizures, refractory epilepsy, patients with focal neurological deficit and patients with early(infants) or late(adult) onset of epilepsy. Thus incidence of structural abnormality is more in this group of patients.

Structural abnormalities are more common with partial seizure then generalized seizures. Underlying cause of epilepsy varies significantly with age.

Epilepsy protocol has better yield, sensitivity and specificity than routine protocol in patients with hippocampal pathology and cortical malformation. In order to maximize the potential of the technique, the protocol should be crafted to the needs of the individual epilepsy patient.

MRI has a major impact on management of epileptic patients. MRI identify causative lesion and localize it, thus helps to identify further line of management (medical or surgical). MRI is useful to plan surgical management and for post-operative followup.

Thus we conclude that MRI is most important & reliable structural neuroimaging modality to evaluate the patients with epilepsy.