

Original Article**Role of MRI in Paediatric Epilepsy**

Authors

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**Dr T. Savitri****Abstract****Background**

- Seizure is a paroxysmal alteration in neurological function resulting from abnormal excessive cortical neuronal electrical activity.
- Epilepsy is a chronic condition characterised by recurrent seizures
- 5% of children are at risk for epilepsy.
- In order to diagnose the cause of epilepsy various investigations like NSG, XRAY, CT, MRI, EEG are used.
- MRI has emerged as an important tool in detecting etiology of epilepsy.

**Objectives**

1. To detect and characterize various lesions causing epilepsy in pediatric age group(0-12 years).
2. To detect the frequency with which they occurred using MRI.

**Material and Methods**

**Type of Study:** Prospective hospital based study among 60 paediatric patients presented with epilepsy referred to the Department of Radio diagnosis, King George Hospital, Visakhapatnam.

- 1) All the patients were subjected to MRI using GE 1.5 Tesla.
- 2) Sequences :T1,T2, FLAIR, GRE, Diffusion
- 3) CEMRI,MRS, MRV were included when indicated.
- 4) Lesions were characterized in location, signal intensity using different sequences

**Results:** In our study, we have found 36 (60%)patients had positive findings on MRI while 24(40%) patients had normal MRI. Among 60 patients, incidence is more in 7-12 yrs group f/b 1-3 yrs. Among 60 patients, patients with normal MRI are 24(40%), Infectious etiology-13(33.3%), Hypoxic etiology-8(13.3%), Congenital-6(10%), Demyelinating-4(6.6%), Vascular-3(5%), Tumours-2(3.4%)

**Discussion:** Out of 60 patients, epilepsy incidence is more in 7-12 years(45%) f/b 1-3 years (21.6%), The Male:Female ratio-1.2:1. 36 patients have abnormal findings in our study in which infection is the most common etiology(33.3%) followed by hypoxia(11.6%) .Metabolic causes include least common etiology (1.4%) followed by vascular causes(3.4%)

**Conclusion:** MRI having high spatial resolution, excellent inherent soft tissue contrast, multiplanar imaging capability and being non radiation modality, emerged as an important tool in imaging of pediatric epilepsy, MRI can identify, localize and characterize subtle lesions with better spatial and temporal resolution. MRI thus became the investigation of choice in the evaluation of Pediatric epilepsy.

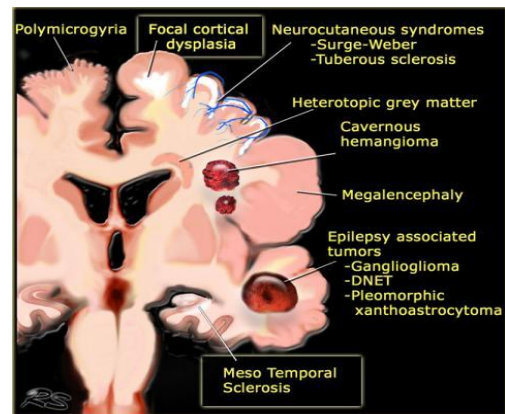
## Introduction

- ❖ Seizure is a paroxysmal alteration in neurological function resulting from abnormal excessive cortical neuronal electrical activity.
- ❖ Epilepsy is a chronic condition characterised by recurrent seizures.
- ❖ It affects 1% of the world population with an annual incidence of 68/100,000 per year.
- ❖ Each year approximately 30,000 new cases of pediatric epilepsy are reported. Approximately 25% of these cases are refractory to medical therapy, and patients are often severely debilitated by this disease.
- ❖ In patients with refractory epilepsy, neuroimaging is crucial for precisely identifying epileptogenic foci that are potentially amenable to surgical resection for possible cure.
- ❖ Refractory epilepsy is characterized by an underlying subtle structural defect, neurocutaneous malformations, calcified/hemorrhagic lesions and metabolic abnormalities which can be identified with the help of neuroimaging. Recent advances in neuroimaging have made it possible to localize epileptogenic foci even in refractory epilepsy through a multi-modality approach.
- ❖ MRI Imaging has emerged as more diagnostically valuable due to its
  - 1) Detailed depiction of neuroanatomy
  - 2) Excellent grey white matter differentiation
  - 3) Status of myelination
  - 4) Better spatial and temporal resolution
  - 5) Better tissue characterization of lesion

## Common causes of Epilepsy

The illustration summarizes the most common causes of seizures in patients with medically uncontrollable epilepsy.

Some lesions are readily detected on conventional MRI, but some lesions are detected only by dedicated MRI protocol



**Fig.1:** Most common causes of epilepsy in paediatric patients

## Aims and Objectives

- 1) To detect and characterize various lesions causing epilepsy in pediatric age group(0-12 years)
- 2) To detect frequency with which they occurred using MRI.

## Materials and Methods

**Type of study::**Prospective hospital based study among 60 paediatric patients presented with epilepsy referred to the Department of Radio diagnosis, King George Hospital, Visakhapatnam.

- 1) All the patients were subjected to MRI using GE 1.5 T
- 2) Sequences :T1, T2, FLAIR, GRE, Diffusion
- 3) CEMRI, MRS, MRV were included when indicated.
- 4) Lesions were characterized in location, signal intensity and contrast enhancement using different sequences

**Inclusion Criteria:** All pediatric patients (age group <12 years) who presented with epilepsy, referred from pediatric department

## Exclusion Criteria

- 1) Patients with claustrophobia, metallic implants.
- 2) Patients with trauma.
- 3) Patients who are uncooperative.

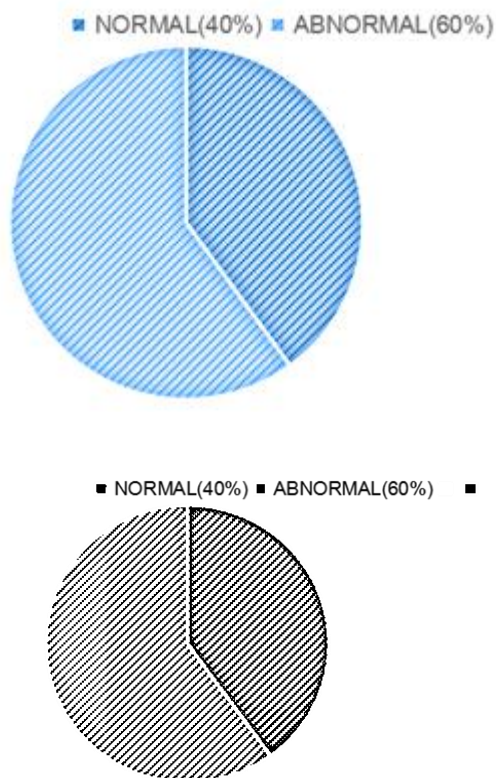
## Statistical Analysis

Done by using SPSS version 25. Parametric tests such as t-test categorical variables tested by chi

square test. P-value less than 0.05 considered to be statistically significant

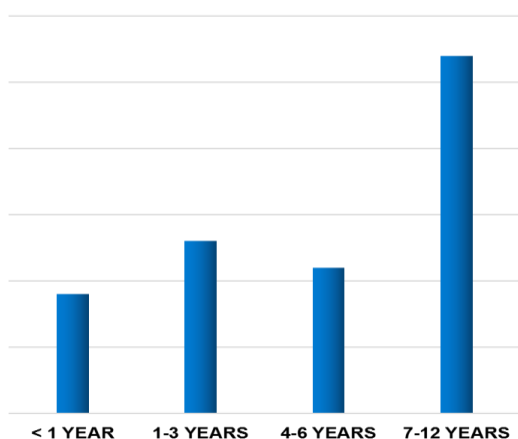
**Results**

Out of 60 patients 36 (60%) patients had positive findings on MRI while 24(40%) patients had normal MRI.



**Fig 2:** Percentage of normal and abnormal MRI

**1. Age Wise Distribution**



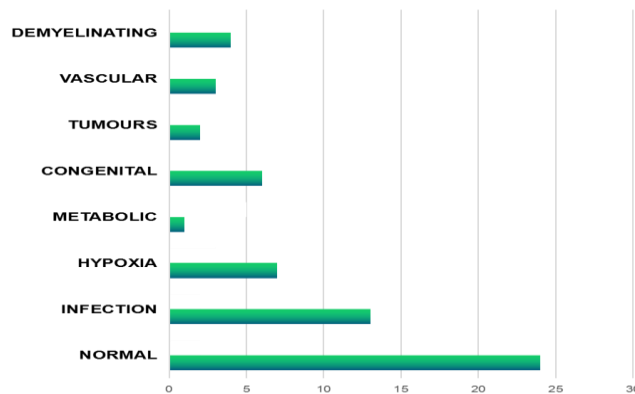
**Fig 3;** Age wise distribution of epilepsy patients

Among 60 patients

- < 1 year (15%)
- 1-3 years (21.6%)
- 3-6 years (18.4%)
- 7-12 years (45%)

Incidence is more in 7-12 yrs group f/b 1-3 Years

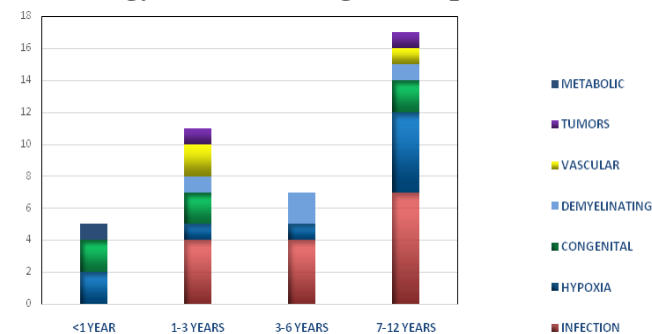
**2. Etiology**



**Fig 4:** Etiology of epilepsy

- Among 60 patients, patients with Normal MRI-24(40%)
- Infectious etiology-13(33.3%)
- Hypoxic etiology-8(13.3%)
- Congenital-6(10%)
- Demyelinating-4(6.6%)
- Vascular-3(5%)
- Tumours-2(3.4%)

**3. Etiology in Various Age Groups**



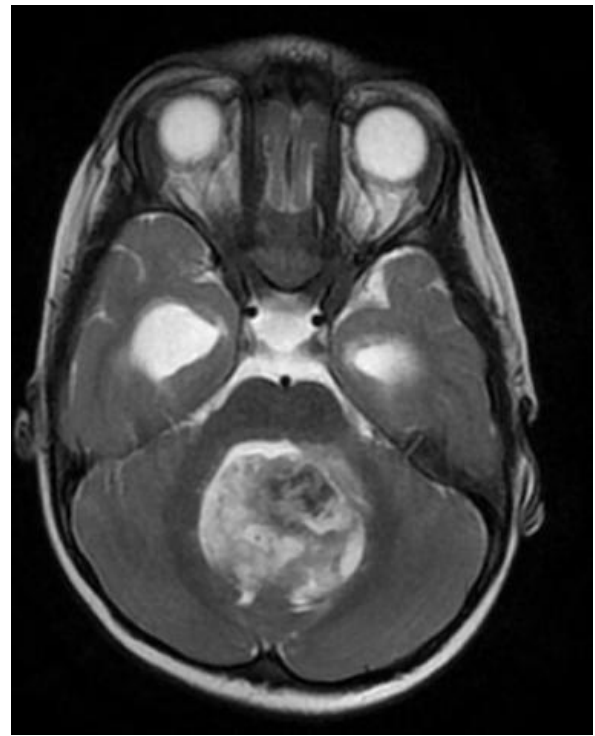
**Fig 5:** Etiology of epilepsy in various age groups

## Discussion

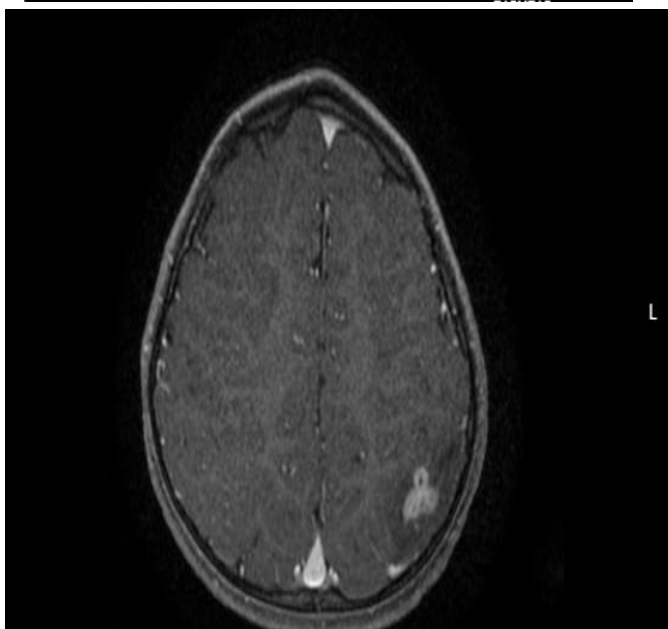
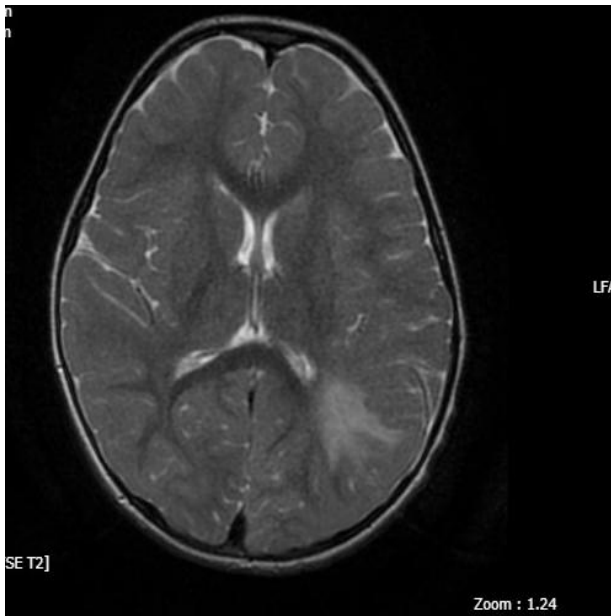
- ❖ In a study total of 60 patients, incidence is more in age group of 7-12 years followed by 1-3 years. Our study is in discordance with Anand et.al in which 0-3 years are the maximum age group and is in concordance with Gulati et.al in which maximum patients are in age group of 6-12 years.
- ❖ In our study male, female ratio is 2.3:1 and is correlated with anand et.al in which 70% are males and 30% females and also with Gulati et.al and Sanghi et.al
- ❖ 60% patients had abnormal findings in our study
- ❖ Our study has infection as the most common cause of epilepsy. It is in concordance with the Anand et.al which also has the infection as the most common cause
- ❖ In our study, Tuberculosis is the most common cause followed by NCC followed by Encephalitis followed by viral meningitis. It is in concordance with Anand et.al in which TB is seen in 28%, followed by NCC in 24% patients. It is also in concordance with the Gulati et.al where TB is seen in 40% followed by NCC in 17%
- ❖ But it is in discordance with the Kumar et.al, where the most common cause is NCC (55%) followed by tuberculoma in 29.9%
- ❖ In our study, HIE is 2<sup>nd</sup> most common cause in which Leukomalacia is the most common cause seen in 62.5% of patients, Ulegyria in 25% and porencephalic cyst in 12.5% of patients. There is no hemorrhage in our study.
- ❖ This is in concordance with Anand et.al , where Leukomalacia is seen in (52.4%), followed by cystic changes in 38%, white matter volume loss in 33.3% patients and hemorrhage in 4.7%
- ❖ This is in discordance with Alan and Sahu, where there is more ICH (35%), followed by Leukomalacia in 28.8% patients.
- ❖ In our study, congenital abnormalities constitute 10%, where polymicrogyria is seen in 20%, Heterotopia in 10%, Holoprosencephaly in 10%, Sturge weber syndrome in 1% patients. Joubert's anomaly in 1% patients. All constitute equally in our study.
- ❖ This is in discordance with Sad eck et al, in which Lissencephaly is seen in 42% patients and FCD in 10% cases and also is in discordance with Gugor et al where Polymicrogyria is most common cause with 53.4%.
- ❖ Metabolic disease seen in 1 patient it is in concordance with Anand et al where 2 patients are with metabolic disease. No other comparable data is available.
- ❖ Neoplasms constitute (3.4%) seen in 2 patients. Ependymoma is seen in one patient, lymphoma seen in 1 patient. This is in concordance with Zajac et al, where in a study of 45 patients, 2 has brain tumors and is also in concordance with Anand et al in which 3 patients has brain tumors.
- ❖ In our study, vascular cause is seen in 3 patients, Arterial infarcts (33%), Moya moya disease(33%), CSVT (33%). It doesn't correlate with Anand et al in which arterial infarcts seen in 3 patients with Av malformations (1), cavernous angioma (1), DVA in 1 patient.
- ❖ In our study, demyelinating disease are seen in 6.6% patients, typical findings of ADEM in 3 patients in concordance with Anand et al where 3 patients has demyelinating disease in which typical ADEM in 1 patient (33.3%)
- ❖ No other comparable studies were found



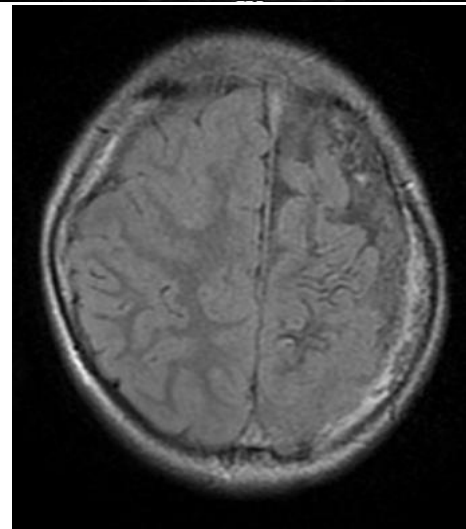
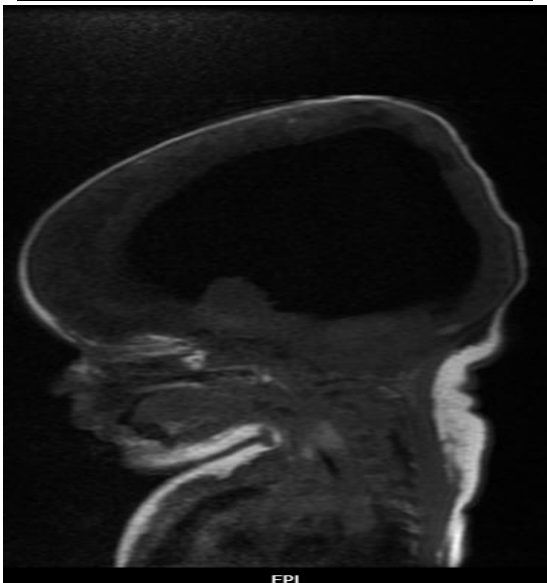
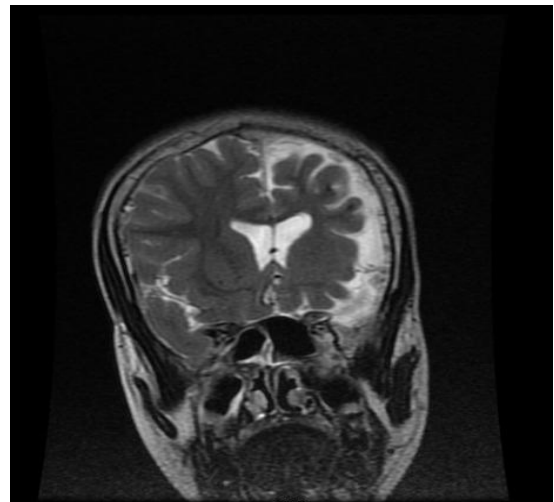
- ❖ Among 60 patients, <1 year (15%), 1-3 years (21.6%), 3-6 years (18.4%), 7-12 years (45%)
- ❖ Infection is more common cause in all age groups.
- ❖ Our study has no Mesial Temporal Sclerosis which is in discordance with Anand et al where Mesial Temporal Sclerosis constitutes 57% of children.



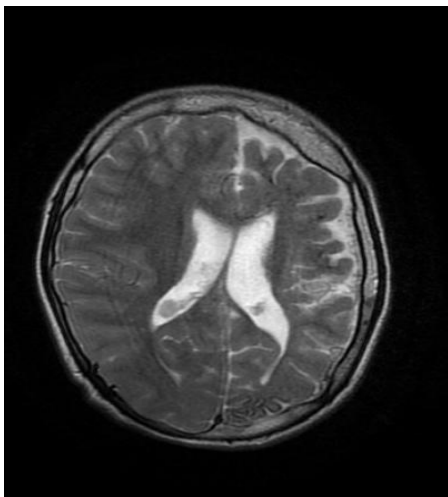
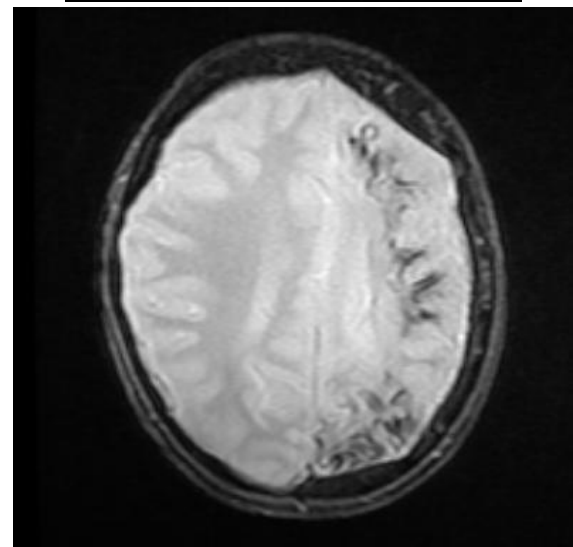
**Fig 8:** T2 Axial T2 & Sag T1 MRI in 3 yr male 4th Ventricular lesion with Supratentorial hydrocephalus- s/o ependymoma.



**Fig.7:** T2 Axial T2 and CEMRI of 3 Yr Female Conglomerate ring enhancing lesions with perifocal edema s/o tuberculoma



**Fig 9:** T2 Axial & T1 Sag MRI 5 days child  
Gross enlargement of posterior segments of lateral ventricles, Overriding of 3rd ventricle, absent corpus callosum - f/s/o corpus callosal agenesis and subependymal nodular heterotopias.



**Fig 10:** T2 Axial and Coronal of 12 yr Male showing hemiatrophy with volume loss  
T2 FLAIR & GRE MRI Shows  
Left hemispherical edema with thickened calvarium.  
Left Fronto Parietal gliosis with Calcification- f/s/o Sturge Weber Syndrome.

### Conclusion

- ❖ MRI having high spatial resolution, excellent inherent soft tissue contrast, multiplanar imaging capability and being non radiation modality, emerged as an important tool in imaging of pediatric epilepsy.
- ❖ MRI can identify, localize and characterize subtle lesions with better spatial and temporal resolution.
- ❖ MRI thus became the investigation of choice in the evaluation of Pediatric epilepsy.

Ethical clearance Taken from ethics committee

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### Abbreviations

MRI-magnetic resonance imaging

CEMRI-Contrast enhanced magnetic resonance imaging

MRS-Magnetic resonance spectroscopy

MRV-Magnetic resonance venogram

NSG-Neurosonogram

CT-Computed tomography

EEG-Electroencephalogram

ADEM-Acute demyelinating encephalo myelitis

MTS-Mesial Temporal Sclerosis