ORIGINAL RESEARCH PAPER

Radio-Diagnosis

SPECTRUM OF MRI FINDINGS IN PAEDIATRIC PATIENTS WITH EPILEPSY PRESENTING TO GGH, KURNOOL

KEY WORDS: EPILEPSY, MRI, CT

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ABSTRACT

Epilepsy is one of the most prevalent neurological disorders, with an incidence of about 50 new cases per 100,000 people annually. The diagnosis, management, and direction of the therapy of pediatric epilepsy are significantly influenced by recent advancements in neuroimaging. Further aiding in the location of the epileptogenic foci and directing potential surgical management of intractable/refractory epilepsy where required, functional neuroimaging provides additional information and may show abnormalities even in cases where MRI was normal.5 Neuroimaging identifies numerous focal lesions/pathologies that cause epilepsy. Even in low risk groups, neuroimaging yields high results. This study aims to analyze the spectrum of MRI findings in pediatric patients presenting with epilepsy to tertiary care hospital, GGH, Kurnool

INTRODUCTION

Unprovoked seizures that reoccur spontaneously are signature of epilepsy. Time-limited paroxysmal occurrences known as seizures are brought on by irregular, uncontrollable, rhythmic neuronal discharges in the brain.[1] Epilepsy is one of the most prevalent neurological disorders, with an incidence of about 50 new cases per 100,000 people annually.[2] Diagnosis of seizure involves identifying the symptoms, clinical diagnosis of the case, laboratory evaluation, EEG recording, lumbar puncture in suspected meningitis and neuro imaging.[3,4] The diagnosis, management, and direction of the therapy of pediatric epilepsy are significantly influenced by recent advancements in neuroimaging. Further aiding in the location of the epileptogenic foci and directing potential surgical management of intractable/refractory epilepsy where required, functional neuroimaging provides additional information and may show abnormalities even in cases where MRI was normal.[5] Neuroimaging identifies numerous focal lesions/pathologies that cause epilepsy. Even in low risk groups, neuroimaging yields high results.[6] The imaging modality of choice is MRI because of its superior resolution compared to CT and USG.[7] MRI provides detailed evaluation of small lesion, radiation free. Present study was aimed to study of role of MRI in evaluation of pediatric epilepsy at a tertiary hospital.

METHODOLOGY

Present study was Hospital based prospective study, conducted in Department of Radio diagnosis, government medical college, Kurnool, Andhra Pradesh, India. Study duration was of 1 year (June 2021 to June 2022).

Inclusion criteria: All pediatric patients (age under 12 years) referred from OPD and IPD who presented with epilepsy.

Exclusion criteria: Claustrophobic patients, Patients with metallic implants considered contraindicated for MR imaging. Patients with trauma. Patients with febrile seizure disorders.

After properly informing the parents and accompanying family members about the MRI scan, informed consent was obtained. The patient was next checked for aneurysm clips, ferromagnetic materials, etc. The patient's full clinical history, birth and immunization history, family history, and previous medical history were all recorded. Type of seizure, length of illness, and any related concerns were all noted. Complete CNS examination findings and physical examination findings for any indication of neurocutaneous stigmata were reported. Biochemical tests include full blood counts, renal and liver function assessments, blood sugar levels, and blood electrolytes levels as directed by cosultant were documented. Other lab tests, such as CSF analysis, serological testing for infections, and biochemical levels for leukodystrophies. For MRI, patient was positioned supine on scanning table, immobilization of the patient's head was achieved and the head coil was applied. Patients were subjected to MRI scanning. When necessary, adequate sedation was given by the anaesthetist. Magnetic Resonance Imaging was done with Machine, Philips Ingenia 1.5 Tesla MR System. Field of view was kept as small as possible (approximately 20 cms), Slice thickness- 3-5 mm, Interslice gap 1mm and Matrix 256 x256. Conventional MR imaging was performed by taking T1W (TE 23.0 ms, TR 1830 ms), T2W (TE 110 ms, TR 4500 ms), and FLAIR (TE 120 ms, TR 7500 ms) sequences in planes as mentioned below. Post gadolinium (dose 0.1mmol/kg) enhanced MRI was performed in Axial and Sagittal planes in selected cases depending on findings on non-contrast study or clinical suspicion. DWI (TE 85 ms, TR 2750 ms) and GRE (Gradient recalled echo) axial performed in all cases. When required, MR spectroscopy, venous 3D PCA (Phase Contrast Angiography) and MR angiography including TOF was done.

Pulse sequences and imaging planes: T1 Sagittal and Axial Pre and Post contrast. T2 Axial and Coronal. FLAIR Axial. DWI (Diffusion Weighted Imaging) Axial GRE (Gradient Recalled Echo) Axial T1 Inversion Recovery sequence.

In suspected temporal lobe epilepsy additional sequences are: T1 angled coronal, T1 3D isotropic acquisition. FLAIR angled coronal, T2 angled coronal were done. The MRI data analysed were Site, Signal Intensity, Number of lesions, Unilateral or Bilateral, any bleeding, Calcifications. Edema all around, mass effect, restriction to diffusion, and contrast enhancement of the lesion. Atrophy, hydrocephalus, abnormal meningeal enhancement, MR spectroscopy findings, and any other noteworthy positive findings. Final diagnosis was based on the medical history, clinical presentation, follow up CSF analysis, pathological, surgical findings when available and response to medical therapy. In inconclusive cases it was made by follow up MRI and treatment response. Data was collected and entered in MS Excel.

RESULTS

This study includes MRI brain evaluation of 100 cases of pediatric patients aged 0- 12 years. Most common age group in our study was 10-12yrs age (33%) followed by 0- 3 yrs (29 %). 58 patients (58%) were males and 42 patients (42%) were females. Male: Female ratio 1.3:1.

Table 1-age and sex distribution

Age group in years	Male	Female	total
0-3	16	13	29
4-6	14	4	18
7-9	11	9	20
10-12	17	16	33

60 patients(60%)presented with Generalized seizures, 29 patients (29%) presented with focal seizures while 11 patients (11%) had an unknown type.

Table 2: Distribution according to types of seizure

Type of seizure-focla/generalized	No of patients	percentage
Focal	29	29
Generalized	60	60
Unknown	11	11

85 (85%) of the 100 individuals tested had positive MRI results, whereas 15 (15%) had normal MRI results with no visible abnormalities. In the research, hypoxia ischemic encephalopathy (HIE) and its sequelae were shown to be the most frequent cause of epilepsy (35%), followed by infection (17%), malformations of cortical development (MCD) (8.2%), acquired metabolic diseases, and each vascular cause (3.5%). The majority of the infections found in our study's 32 patients were viral infections (12.5%), encephalitis (9.3%), meningitis (21.8%), and TB (40.6%). It was found that the most frequent cause of isolated temporal lobe epilepsy was mesial temporal sclerosis. Hippocampal atrophy and secondary alterations were seen in 100% of cases, but hippocampal T2 and FLAIR In 75% of individuals with temporal lobe epilepsy, hyper intensity and aberrant architecture were seen. Cortical development abnormalities were present in 6 individuals. Two patients (14.2%) had focal cortical dysplasia, whereas one patient (7.1%) each had polymicrogyria, heterotopia, schizencephaly, and holoprosencephaly. Cortical developmental abnormalities first showed up as seizures in young children. PRES (posterior reversible encephalopathy syndrome) as a result of hypertension noted in three individuals. Out of the 5 patients with a neoplastic origin one patient had glioblastoma multiforme and 2 patients had medulloblastoma and pilocytic astrocytoma each. Three individuals had vascular pathology identified. One patient had vasculitis, while two patients (66.6%) suffered arterial infarcts. One patient had ADEM while the other had tumefactive demyelination out of the two patients who showed demyelination on MRI.

Table 3: Etiology on MRI

S.NO	MRI FINDINGS	No. of patients
1	Hypoxic ischemic encephalopathy and sequalae	32
2	infection	15
3	Post ictal edema	7
4	Hydrocephalus	3
5	Arachnoid cyst	1
6	Subdural hematoma	1
7	Focal cortical dysplasia	2
8	Heterotopias	1
9	Polymicrogyria	1
10	Schizencephaly	1
11	Holoprosencephaly	1
12	Medulloblastoma	2
13	Pilocytic astrocytoma	2
14	Glioblastoma	1
15	Mesial temporal sclerosis	4
16	Infarcts	2
17	PRES	3
18	Tuberous sclerosis	1
19	Metachromatic leukodystrophy	1

In our study the most common age group showing pathology on MRI was 10-12yrs age, followed by 0-3yrs age group. The most common etiology seen on MRI was HIE and its sequelae while infection was second most common etiology. In age group 0-3yrs, there were total 27 patients (31.7%) with positive MRI, common etiologies were anoxia and HIE (8 patients), followed by infection (7 patients), and malformations of cortical development (3 patients). In age group 4-6yrs, total 14 (16.4%) had pathologies on MRI, infection was found to be most common cause (6 patients), followed by acquired metabolic diseases and miscellaneous (2 patients each). In age group 7-9yrs, total 14 (17.6%) had pathologies on MRI, infection was reported as most common cause (7 patients), followed by anoxia HIE and neoplasm (2 patients each). In age group 10-12yrs, total 29 (34.1%) had pathologies on MRI, infection was seen as most common etiology (12 patients), followed by anoxia and HIE (4 patients).

DISCUSSION

In present study, out of 100 patients maximum number of patients in the study were in the age group of 10-12 years (33%) followed by 0-3 years (29%). The mean age in our study was 6.2yrs. Similar findings were noted by Gulati P *et al.*,[8] in which maximum patients were in the age group 6-12 years. However the mean age our study is slightly lesser than the study by Wongladarom S *et al.*,[9](mean age was 7 years and 5 months). In our study of 100patients, 58% were males and 42% were females. Male : Female ratio was1.3:1. Our study correlates with the study done by Sanghvi JP *et al.*,[10]in which 60.5% were males and 31.7% were females. It also correlates with the study done by Amirsalari S *et al.*,[11]in which there were 57.7% boys and 42.5% girls. In our study of 95 patients, maximum number of patients, 60% presented with generalized seizures, 29% had focal seizure and 11 % were unknown type at presentation. Our study has similar results as that of study done by Rasool A *et al.*,[12]in which 276 patients were studied. In his study it was found that generalized seizures constituted the major seizure group (42%), followed by partial seizures (31.2%) and complex febrile seizure (23.2%). Our study also correlates with the study done by Chaurasia R *et al.*,[13]in which generalized seizures accounted for the major number of patients seen in 76.7%. In this study of total 100 patients, 85 patients (85%) had abnormal MRI findings. Our study is comparable with the study done by Kuzniecky R *et al.*,[14]in which MRI revealed abnormalities in 84% of patients. Resta *et al.*,[16]reported positive MRI in 51.3%, Cang *et al.*[15]in 41.7%. Our study shows a higher percentage, probably because of strict exclusion criteria's, which shows that patient selection, plays an important role in MR positivity rates. In our study, the most common cause of epilepsy was hypoxic ischemic encephalopathy and its sequalae (35%), followed by infection (17%), miscellaneous causes (14%) and malformations of cortical development (MCD) (8.2%). Our findings were contradicting with study done by Aarti Aanand*et al.*,[18]where 95 children under the age of 12 years were studied, infection (29.8%) was the most common etiology followed by anoxia and hypoxic-ischemic encephalopathy. Ojaswi B khandediya *et al.*,[19] also noted that infection was the most common etiology followed by Mesial temporal sclerosis and focal cortical dysplasia. In present study, isolated temporal lobe lesion was cause of epilepsy in 4 patients. Study done by J D Grattan Smith *et al.*,[20]showed

mesial temporal sclerosis was most common cause of temporal lobe epilepsy seen in 30 out of 53 children (57%), followed by tumours in 8 (15%), cavernous angioma in 1(1.8%) and ectopic gray matter in 1(1.8%) of patients. Sales LV *et al.*,[21] in which out of 31 patients with temporal lobe epilepsy, most common pathology was mesial temporal sclerosis seen in 9 (29.0%), dysplasia in 8 (25.8%), tumors in 2(6.4%), arachnoid cyst in 1 (3.2%) and choroid cyst in 1 (3.2%). In present study, 15 patients reported to had infection, tuberculosis (40.6%), encephalitis (9.3%), meningitis (21.8%), meninigo- encephalitis (9.3%), viral infection (12.5%) were common findings. Out of 6 patient of tuberculosis, 4 patients had leptomeningeal enhancement, 1 patient had tuberculoma, and 1 patient had tubercular abscess. In Gulati P, Jena A.N. *et al.*,[8]study, out of 345 patients with abnormal MRI, tuberculoma was the most common etiology and was seen in 98 (28.4%), followed by neurocysticercosis in 86(24.9%). In Chaurasia R *et al.*,[22] study, most common cause of epilepsy was CNS tuberculosis (30.3%), followed by Neurocysticercosis (11.0%) and Encephalitis (7.9%). However, our study is in discordance with Parihar Ravi Kumar *et al.*,[23] study, in which most common etiology was neurocysticercosis (55.81%) followed by tuberculoma (29.91%). In study by Mittal GK *et al.*,[24] out of 54 patients with Malformations of cortical development, Focal cortical dysplasia was the most common pathology reported in 16 patients(29.6%), Schizencephalyin8(14.8%),Polymicrogyriain8(14.8%),DNET in6(11.1%). For etiology in age group 0-3 years, our study correlates well with Khreisat WH *et al.*,[25]study, most common etiological factor found in this study was perinatal asphyxia seen in 55%, followed by CNS infection in 15%, anomalies of central nervous system in (9%), head injuries in (8%), congenital and prematurity in(5%).For etiology in older age group, our study correlates with Parihar Ravi Kumar *et al.*,[23]study, in which children in the age group of 28days to 18 years with partial seizures were studied. 6 patients (66.6%) in age group of 28days-5years, 18 patients (85.7%) in age group of >5- 10years and 12 patients (92.3%) in age group >10-18years had infection as the most common etiology. Thus infection had major burden in causing epilepsy with increasing age group. For etiology in older age group, our study also correlates with Gulati P *et al.*,[8]study, in which 170 children with chronic seizures were studied. Age distribution was done as follows: 0-1 year, 1-3 year, 3-6 year and 6-12 year. The etiologies were classified into Infections (tuberculomas, neurocysticercosis, meningitis), atrophy, vascular and miscellaneous causes. Infection was most common etiology in 6-12 years age group seen in 51.1%, followed by miscellaneous in 16.4%. In age group 0-1, 1- 3 and 3-6 years, infection was seen in 4.7%, 4.1% and 3%respectively. MRI plays an invaluable role in the evaluation of pediatric patients with seizure disorder. Accurate diagnosis of cause of seizure is important for treatment decision. With its high spatial resolution, excellent inherent soft tissue contrast, multi-planar imaging capability and lack of ionizing radiation; MRI has emerged as a versatile tool in imaging of pediatric patients with seizures. MRI not only identifies specific epileptogenic substrates, but also helps in determining specific treatment and predicts prognosis. Employing appropriate imaging protocols and reviewing the images in systemic manner helps in the identification of subtle epileptogenic structural abnormalities. MR imaging is superior neuroimaging with no radiation exposure and could be the first investigation of choice in epileptic syndrome, developmental cortical malformations, mesial temporal sclerosis. Its ability in identifying subtle lesions, location and extent of the lesions is excellent.

CONCLUSIONS

MRI is the first imaging modality of choice with a thorough MRI seizure protocol to confirm the accurate diagnosis, organize the care according to diagnosis, and aid in prognosis in the evaluation of young patients presenting with epilepsy. Children with newly diagnosed epilepsy and patients presenting with refractory seizures who have not been diagnosed by other imaging modalities benefit from the use of MRI, particularly those who have abnormal neurological examination results, focal seizures, or focal EEG abnormalities.

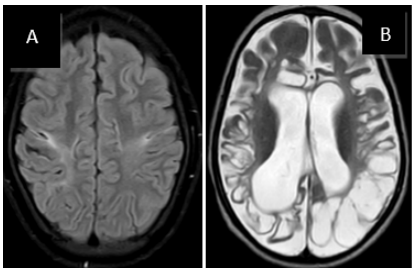

Fig.A.11 yr child with h/o GTCS showing perirolandic hyperintensities consistent with sequelae of birth asphyxia
Fig.B. 2 year old child showing cystic spaces in white matter of bilateral cerebral hemispheres s/o cystic encephalomalacia.

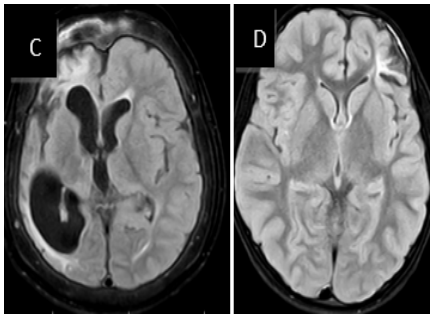

Fig.C.12 year old male patient with Dyke Davidoff Masson syndrome-atrophy of unilateral cerebral hemisphere, ipsilateral calvarial thickening and enlagerd ipsilateral frontal sinus
Fig.D.11 yaer old male presenting with refractory seizures showing polymicrogyria and positive Transmantle sign s/o Focal Cortical Dysplasia.

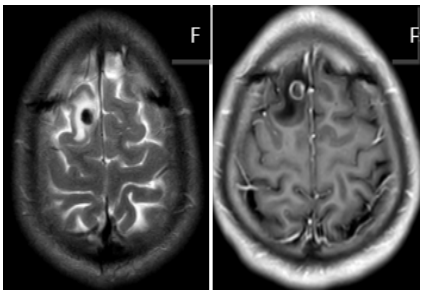

Fig.E-Intra axial T2 hypointense lesion with surrounding edema noted in right high frontal lobe. Fig.F- On post contrast peripheral ring enhancement noted s/o Tuberculoma.

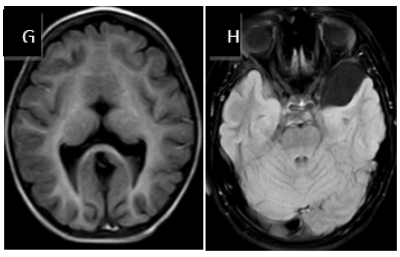

Fig.G.4 year old male child presented with refractory seizures, microcephaly and gross developmental delay. T1 axial MRI showed Semilobar Holoprosencephaly.
Fig.H. Extraaxial CSF signal intensity lesion noted anterior to left anterior temporal lobe consistent with Arachnoid Cyst.

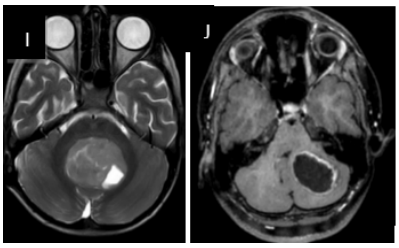

Fig.I. Axial T2 weighted image showing intermediate signal intensity lesion in the fourth ventricle. Biopsy proved it as Medulloblastoma

Fig.J. Axial T1 post contrast image showing cyst with enhancing mural nodule s/o Pilocytic Astrocytoma.

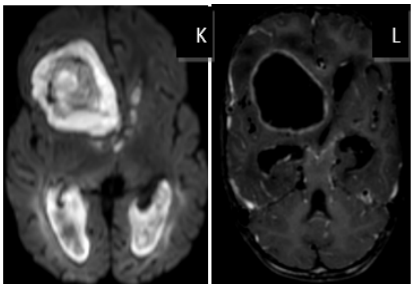

Fig.K, L. DWI showing diffusion restriction in right frontal lobe and in the ventricular system. On post contrast, smooth thin rim enhancement noted in right frontal lobe s/o Brain Abscess with intraventricular rupture.

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