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ROLE OF MRI IN EVALUATION OF EPILEPSY IN PEDIATRIC AGE GROUP IN A TERTIARY CARE CENTRE OF JHARKHAND, INDIA- A PROSPECTIVE STUDY.

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Abstract.

Background:

Childhood epilepsy is a prevalent neurological disorder. Imaging, especially MRI of the brain, plays a pivotal role in diagnosing the underlying cause. This study aimed to assess the frequency of causative factors of epilepsy detected in MRI.

Materials and Methods:

This hospital-based prospective observational study was conducted in the Radiology Department at Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India from November 2021 to October 2022 in 100 children of 0 to 12 years of age referred from Pediatrics department for an MRI brain scan. MRI of the brain was performed in all cases and findings were analyzed and causes of epilepsy were assessed. Magnetic resonance spectroscopy (MRS) was also done when required for confirmation of diagnosis.

Results:

Positive findings in MRI were detected in 87% of children, and no abnormalities were detected in 13%. The majority of children belonged to the age group of 10-12 years (37%) and were predominantly males (66%). The most common cause of epilepsy was infections (27%) followed by hypoxic ischemic encephalopathy (22%). Tuberculoma was the most common infective cause of epilepsy in 59.3%. These were further followed by temporal lobe epilepsy and congenital malformations (11% each). The rest were other miscellaneous and idiopathic causes.

Conclusion:

MRI findings were specific to various conditions, helping in the localization and characterization of etiologies and playing a significant role in the evaluation of children who were newly diagnosed with epilepsy, especially those with partial seizures.

Recommendation:

Further research with a larger sample size and meta-analysis is recommended for more conclusive results.

Keywords: seizure, Epilepsy, MRI, Tuberculoma, Children, Submitted: 2023-09-15, Accepted: 2023-09-17

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1. INTRODUCTION:

A sudden and paroxysmal electrical discharge from the central nervous system (CNS) leading to involuntary sensory, motor, or autonomic disturbances that may be accompanied with or without sensorium alterations is called seizure [1].

The international organization against epilepsy defines epilepsy as a brain disease which has conditions as follows:

1. Two or more two seizures that occur within 24 hours.
2. Asingle seizure but with a 60% chance of reoccurrence after 2 such seizures in a decade.
3. Epilepsy syndrome is diagnosed.

Patients who have not had a single seizure over the past decade and have not been treated for it for the last five years or who had epilepsy syndrome which was age-dependent and now they have surpassed that age are considered epilepsy free. [2].

While the occurrence of epilepsy varies geographically, the worldwide average of epilepsy is 33.3 cases per lakh population [3]. However, developing countries have a higher ratio that is 187 cases per ten thousand of the population [3, 4]. The majority of the incidences of epilepsy are reported in a one-year-old patient and for most of the cases, the age ranges from one to 12 years [3,4].

The causes of epilepsies are diverse and may involve multiple factors [5]. Consequently, the examination of the fundamental components contributing to seizures will rely on the clinical circumstances, specifically, the specific syndrome, age, seizure types, comorbidities, and whether there are or lack of advancing or static mo- tor and cognitive disabilities, among other variables. In the present setting, alongside electroencephalograms (EEG), techniques for neuroimaging, specifically electromagnetic resonance imaging (MRI), hold significant importance as diagnostic tools for identifying the syndrome and potential causes of epilepsy [6].

In contemporary medical practice, the utilization of Magnetic Resonance Imaging (MRI) and Computed Tomography (CT) has witnessed a notable surge in their application to diagnose and assess seizures. Computed tomography (CT) exhibits limited sensitivity in the identification of minor cortical lesions, especially those located near the base of the skull, such as the orbitofrontal and medial temporal regions. The general accuracy of computed tomography (CT) in identifying lesions in cases of focal epilepsies is rather low, estimated to be around 30%. Consequently, while CT scans may serve as a valuable diagnostic tool for promptly assessing new-onset seizures in emergencies, they cannot replace magnetic resonance imaging (MRI) in the comprehensive evaluation of epilepsy. [7]. Compared to other neuroimaging techniques, MRI is considered superior because of its potential to portray clear neuroanatomy, outline vivid differentiation of gray matter and white matter, delineate myelination status, and detect focal structural lesions in the brain that serve as foci of seizures [8]. It is recommended that all individuals diagnosed with epilepsy undergo magnetic resonance imaging (MRI), except those who have very typical forms of primary generalized epilepsy, such as juvenile myoclonic epilepsy and childhood absence epilepsy. Additionally, individuals with benign focal epilepsies of childhood that exhibit characteristic clinical and electroencephalogram (EEG) features, such as benign epilepsy with centrotemporal spikes and early-onset childhood epilepsy with occipital spikes (Panayiotopoulos type), and who have responded well to antiepileptic drugs (AEDs), do not necessarily require an MRI [9].

1.1. Aims and objectives:

- To evaluate the pattern of MRI spectrum in children with epilepsy.
- To determine and characterize the brain lesions that lead to epilepsy in patients in the pediatric age group.

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- To assess the frequency of causative factors leading to epilepsy in patients in the pediatric age group

2. MATERIALS AND METHODS:

This hospital-based prospective observational study was conducted in the Radiology Department at Rajendra Institute of Medical Sciences (RIMS), Ranchi, Jharkhand, India from November 2021 to October 2022. The Institutional Ethical Committee of RIMS, Ranchi provided ethical approval for the study. Written informed consent was obtained from the parents/accompanying persons of all children included in this study. Confidentiality and data protection measures were strictly adhered to throughout the research process.

The study population included 100 children in the age group of 0 to 12 years, all referred to the Department of Radiology for MRI brain study. At the initial stage, several 200 patients were examined for eligibility, however, 100 patients were excluded from this study due to not being eligible. The guidelines of ILAE were followed in the research process. The inclusion criteria were all patients presenting with epilepsy between 0-12 years of age. Patients with claustrophobia and general contraindications of MRI were excluded. MRI brain scan was performed in Siemens Magnetom Symphony 1.5T MRI equipment. Magnetic resonance spectroscopy (MRS) was also done when required for confirmation of diagnosis.

3. RESULTS:

The present study revealed positive MRI findings in 87 (87%) children and normal MRI brains with no detectable lesion in 13 (13%) children (Graph 1). The majority of children belonged to 10-12 years of age comprised 37 patients (37%) and mostly were male (66%) (Table 1). Out of 100 patients, 70 (70%) patients showed generalized tonic-clonic seizures, while 30 (30%) patients showed partial seizures (Graph 2). Infections were the major constituent with 27 (27%) cases, followed by hypoxic ischemic encephalopathy in 22 (22%) cases. Temporal lobe epilepsy and congenital malformations constituted 11% each. Metabolic, vascular, and neoplastic causes constituted the remainder. 2(2%) cases had non-specific findings of post-chemotherpy leukoencephalopathy and focal demyelination, respectively (Table 2).

Among the 27 infective causes of epilepsy in this study, tuberculoma was the most common finding in MRI brain study in 16 patients (59.3%), followed by NCC in 7 patients (25.9%) (Table 3). 16 out of 22 (72.7%) children affected by HIE were in the age group of 0-3 years. Temporal lobe epilepsy was observed in 11 children. 6 of them were in the age group of 10-12 years (54.5%). Intracranial neoplasms were noted in 4 children in this study, out of which 3 had glioma and 1 had medulloblastoma.

4. DISCUSSION:

In this study, 66% of patients were males, while 34% were females. Similar male predominance was observed in the studies of Jagruti P. et al. [10], Zajac A. et al. [11], and Ton de Grauw TJ et al. [12]. 70% had generalized seizures and 30% had partial seizures, which were comparable to studies conducted by Jagruti P et al. [10]. In our study, the preponderance of patients was in the age group 10-12 years, which constituted 37% of the sample, followed by the 0-3yrs age group, which constituted 28%. The percentage of patients presenting with abnormal MRI findings was 87% in the present study, which is comparable to the study of Peretti P et al. [13]. However, a study conducted by Zajac A et al. [11] had a higher percentage of patients with normal findings, probably due to the small sample size.

In our study, 27% of children had infections, followed by hypoxic-ishemic encephalopathy in 22% of cases. Temporal lobe epilepsy and congenital malformation constituted 11% each. Simi- lar findings were noted in the study of Gulati P et al. [14] which is focused on infection, HIE, and neoplastic pathology. In the study of Wang PJ et al. [15], the study group consisted of pa- tients showing partial seizures, and hence tempo- ral lobe epilepsy (36%), and congenital malforma-

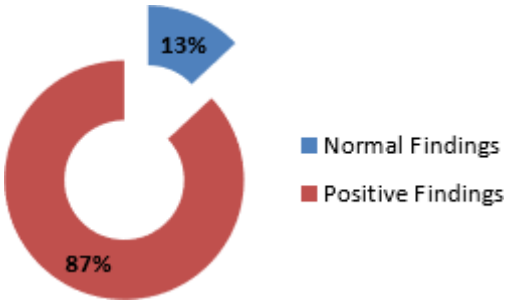

Figure 1: **MRI ftndings in epilepsy.**

Table 1: **Age distribution of children presenting with epilepsy.**

Age group	Male	Female	Total (%)
0-3 yrs	17	11	28(28%)
4-6 yrs	11	05	16 (16%)
7-9 yrs	16	03	19 (19%)
10-12 yrs	22	15	37 (37%)

Table 2: **Causes of epilepsy in children presenting with epilepsy.**

Causes of seizures	Male	Female	Total (%)
Infections	18	9	27 (27%)
H.I.E.	14	8	22 (22%)
Temporal lobe epilepsy	6	5	11 (11%)
Congenital	7	4	11 (11%)
Metabolic	2	3	5 (5%)
Vascular	3	2	5 (5%)
Neoplasm	3	1	4 (4%)
Other	2	0	2 (2%)
Idiopathic (Normal)	10	3	13 (13%)

Table 3: **Distribution of infective causes of epilepsy in MRI.**

Infections (n=27)	Male	Female	Total (%)
Tuberculoma	9	7	16(59.3%)
Neurocysticercosis (NCC)	6	1	7(25.9%)
Meningitis	1	0	1(3.7%)
Meningo-encephalitis	0	1	1(3.7%)
Encephalitis	1	0	1(3.7%)
Toxoplasmosis	1	0	1(3.7%)

tions (24.8%) were the common findings.

Out of 27% of cases of central nervous system infections presenting with seizures, tuberculomas were the most common cause which constituted 59.3% of cases in this study, the incidence was similar to that conducted by Gulati P et al. [14].

In our study, 55% of the 11% of patients with congenital malformation had cortical dysplasia, and 27% had Tuberous sclerosis. Patients having partial seizures with positive MRI findings (n=30), and cortical dysplasia (n=5) were present in 16.6% of cases. Wongladarom S et al [16] in their study reported cortical dysplasia in 31% patients of with partial seizures.

Hypoxic-ischemic encephalopathy (HIE) was the predominant etiology of epilepsy in 72.7% of cases, in the age group 0-3yrs. 11% of patients enrolled had epilepsy of the temporal lobe. In patients presenting partial seizures with positive MRI findings (n=30), mesial temporal sclerosis (n=8) was present in 26.6% of cases. This was similar to the study of Wongladarom S et al. [16], which indicated that 24% with partial seizures had mesial temporal sclerosis.

In our study, out of 100 patients, neoplastic lesions were observed in 4 (4%) cases. Gulati P et al. [7] (n=345) and Wang PJ et al. [8] (n=125) reported 17.3% and 16% cases of neoplasms respectively. The smaller number of cases in our study could be due to the small sample size.

5. CONCLUSION:

In the majority of cases (87%), MRI detects the underlying cause of epilepsy. Generalized seizures were more common than partial seizures. Among all the conditions, infections were the most common cause of epilepsy, and they were distributed in all age groups. MRI findings were specific to various conditions, helping us in the localization and characterization of etiologies. MRI has a significant role in the analysis of children who were newly diagnosed with epilepsy, especially those with partial seizures, EEG abnormalities, or neurologic deficits. To conclude, MRI is the most reliable non-invasive imaging technique to diagnose various CNS lesions in patients with pediatric epilepsy because of its potential to affect the outcome positively.

6. LIMITATIONS:

The limitations of this study include a small sample population who were included in this study. The findings of this study cannot be generalized for a larger sample population. Furthermore, the lack of a comparison group also poses a limitation for this study's findings.

7. RECOMMENDATION:

Further research with a larger sample size and meta-analysis is recommended for more conclusive results.

8. ACKNOWLEDGEMENT:

We are thankful to the patients; without them, the study could not have been done. We are thankful to the supporting staff of our hospital who were involved in the patient care of the study group.

9. LIST OF ABBREVIATIONS:

MRI- Magnetic Resonance Imaging
MRS- Magnetic resonance spectroscopy
CNS- Central nervous system
EEG- electroencephalograms
CT- Computed Tomography
AED- antiepileptic drugs
ILAE- International League Against Epilepsy
NCC- Neurocysticercosis
HIE- Hypoxic-ischemic encephalopathy

10. SOURCE OF FUNDING:

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11. CONFLICT OF INTEREST:

The authors report no conflicts of interest in this work.

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