



EFFECTIVENESS OF MRI IN COMPARISON WITH CLINICAL EVALUATION IN PAEDIATRIC POPULATION PRESENTING WITH SEIZURE AT TERTIARY CARE CENTRE: A COMPARATIVE STUDY

Radio-Diagnosis

Dr Sanjay Kumar	Professor and HOD, Department of Radiodiagnosis, Shri Balaji Institute Of Medical Science, Raipur(C.G.)
Dr Aman Agrawal*	Assistant Professor, Department of Radiodiagnosis, Chhattisgarh Institute of Medical Science, Raipur(C.G.) *Corresponding Author
Dr Shubhkirti Agrawal	Assistant Professor, Department of Radiodiagnosis, Pt. JNM Medical College, Raipur(C.G.)

ABSTRACT

Background: A seizure occurs when there's a sudden and abnormal surge of synchronous neuronal activity in the brain. MRI becomes crucial in the diagnostic process for children with newly diagnosed epilepsy. It serves as the primary imaging tool to accurately diagnose the condition, devise appropriate management strategies based on the diagnosis, and provide insights into the prognosis of the patient. The study was conducted to compare the effectiveness of MRI in comparison with clinical evaluation in paediatric population presenting with seizure at tertiary care centre.

Methods: This study was analytical hospital based study done at Dept of Radiodiagnosis, Pt. J.N.M. Medical College, Raipur during N'ovember 2021 to October 2022. A total sample size of 76 patients with epilepsy between age <18 years admitted in hospital was included in the study. Detailed analysis and association of MRI findings with clinical profile was done and results was tabulated. The statistical software namely SPSS 22.0 used for the analysis of the data. **Results:** Majority of the patients were of 0 to 3 years age group (34.21%). Male to female ratio of was found to be 1.53: 1. Presence of positive clinical history or examination findings significantly increases the number of positive MRI scans with significant association ($P<0.001$). **Conclusion:** Positive clinical history or examination findings significantly associated with MRI scan findings.

KEYWORDS

MRI, Epilepsy, Paediatric Seizure, Neuroimaging

INTRODUCTION

A seizure occurs when there's a sudden and abnormal surge of synchronous neuronal activity in the brain. This can lead to a range of symptoms, from dramatic convulsions to more subtle experiences that might not be obvious to an observer.¹ While the exact causes of seizures can vary, statistics show that around 5-10% of the population will experience at least one seizure, with the highest occurrence in early childhood and late adulthood. Epilepsy, defined by two or more unprovoked seizures, affects approximately 0.3-0.5% of people globally, with a prevalence estimated between 5 to 30 individuals per 1000.²

In certain types of epilepsy, like typical childhood absence epilepsy, and uncomplicated febrile seizures in children with normal neurological exams, neuroimaging studies like MRI may not be necessary.^{3,4} However, for children with newly diagnosed epilepsy, especially those showing abnormal neurological signs, focal seizures, or specific EEG abnormalities, MRI becomes crucial in the diagnostic process.⁵ It serves as the primary imaging tool to accurately diagnose the condition, devise appropriate management strategies based on the diagnosis, and provide insights into the prognosis of the patient.⁶

The introduction of MRI has revolutionized the evaluation and management of seizures, offering significant advantages in both diagnosis and treatment planning.

Therefore, the present study was conducted to compare the effectiveness of MRI in comparison with clinical evaluation in the pediatric population presenting with a seizure at the tertiary care centre.

METHOD

The present hospital based analytical study carried out at Dept of Radiodiagnosis, Pt. J.N.M. Medical College, Raipur during November 2021 to October 2022. The study was conducted after obtaining clearance from the Ethical Committee of the institute. The study population was children with epilepsy who have been advised MRI Brain by their clinician as part of their routine clinical management. A total sample size of 76 patients with epilepsy between age <18 years admitted in hospital were included in the study. Patients with chronic renal failure, age>18years, not fit for MRI and not willing to participate were excluded. Relevant clinical history and medical details like age, perinatal history, age of onset of seizure and any coexisting disease was recorded on the Case record form. MRI imaging of these patients was performed on a "MAGNETOM SKYRA 3 TESLA MRI MACHINE SERIAL No. 45445. Detailed analysis and association of MRI findings

with clinical profile was done and results was tabulated. The statistical software namely SPSS 22.0 was used for the analysis of the data. P value <0.05 was considered statistically significant.

RESULT

Most of children were in age group 0 to 3 years i.e. 26 (34.21%). Ratio of male to female patients participating in present study was found to be 1.53: 1.

Table No: 1) Demographic Profile Among Cases:

Demographic profile	No. of Patients (n=76)	Percentage
Age group (years)	0-3	34.21
	4-6	15.78
	7-9	14.47
	10-12	17.10
	13-15	11.84
	16-18	6.57
Gender	Male	60.52
	Female	39.47

Patient presenting with generalized onset seizure was found to be significantly more (89.5%) than the patient presenting with focal onset seizures. (10.5%)

Table No: 2) Based On Type Of Epilepsy:

Type of seizure	Frequency	Percentage
Focal onset	8	10.5
Generalized onset	68	89.5
Total	76	100

Out of 76 patients, 52 patients (68.42%) had one or the other abnormality in MRI Brain study whereas 24 (31.58%) patients had normal study.

Table No: 3) Distribution Of Patients Based On Mri Results: (n=76)

MRI results	Frequency	Percentage
Normal	24	31.58
Abnormal	52	68.42
Total	76	100

Total 46 patients out of 76 had either positive clinical history (of perinatal history or positive family history) or abnormal findings on clinical examination. Out of these 46, 40 people had abnormal MRI. Only 6 patients were found to have abnormal clinical history with normal MRI Finding.

Out of 30 patients with no obvious abnormality in clinical history (of perinatal history or positive family history) and normal findings on clinical examination, 17 patients had normal MRI. Presence of positive clinical history or examination findings significantly increases the number of positive MRI scans with significant association. ($P<0.001$)

Table No: 4) Distribution Of Patients Based On Examination Findings And Association With Mri Findings: (n=76)

MRI finding	Clinical history/examination findings		P value
	Normal	Abnormal	
Normal (n=24)	17	06	$\chi^2=16.37$ ($P<0.0001$)
Abnormal (n=52)	13	40	
Total (n=76)	30	46	

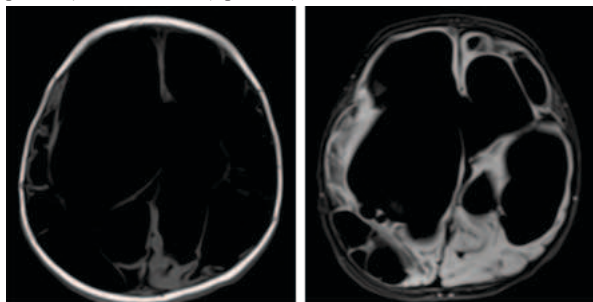
DISCUSSION

Approximately 5 percent of children have an episode of convulsion before they reach age of 5 years. The occurrence of epilepsy is approximately 0.3–0.5% across various populations globally, with epilepsy prevalence estimated at 5–30 per 1000.²

Patients who experience seizures can exhibit a diverse range of MRI abnormalities, contingent upon the underlying cause. MRI serves as a crucial tool in assessing paediatric patients with seizure disorders, aiding in the accurate diagnosis of the underlying cause of seizures and thus guiding in treatment decisions.³

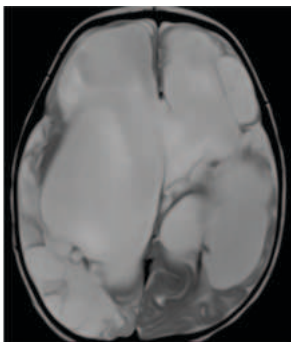
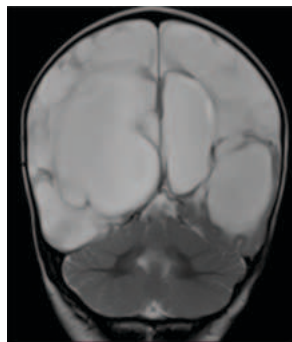
The present prospective study was conducted for period of 8 months and consisted of 76 clinically diagnosed cases of epilepsy in the age group of 0-18 years to compare effectiveness of MRI in comparison with clinical evaluation in paediatric population presenting with seizure at tertiary care centre.

Hypoxic ischaemic encephalopathy (14 patients) was found to be the most common cause of seizures, followed by infections (8 patients). Granulomatous lesions, encephalitis, and meningitis constituted majority of the seizure patients with infections. Tubercular brain abscess and acute disseminated encephalomyelitis were other infective causes of pediatric seizures. Other notable causes were of vascular origin (7 patients), temporal lobe epilepsy (4 patients), neoplastic (4 patients) and metabolic (2 patients).



T1 Axial

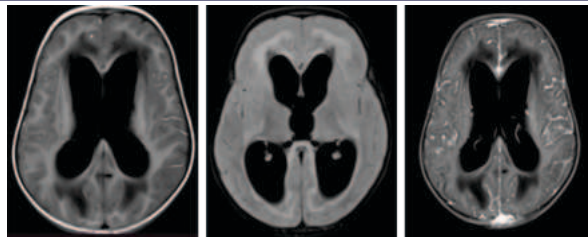
Flair Axial



T2 Coronal

T2 Axial Image

Fig. 1 MRI brain of 6 months old male child presented with multiple episodes of generalized convulsions and excessive cry since birth showing multiple T1/FLAIR hypointense, T2 hyperintense CSF intensity cystic lesion in periventricular and subcortical white matter in bilateral cerebral hemisphere with relative spacing of left occipital lobe, dilated bilateral lateral, 3rd and 4th ventricle and causing mass effect over bilateral thalamus, basal ganglia and midbrain suggestive of sequelae of hypoxic ischemic encephalopathy

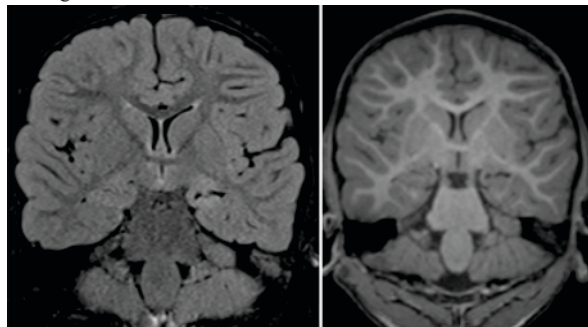


T1 Axial

Flair Axial

T1 FS Post Contrast Axial

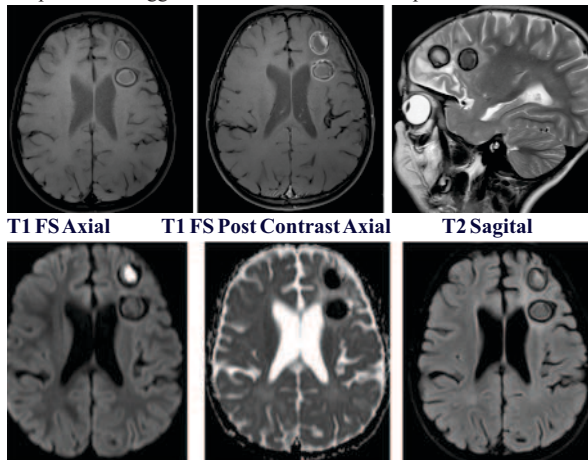
Fig. 02 MRI brain of 2 year old female child who presented with fever, 1 episode of convulsion involving right upper and lower limb 7 days back and left sided weakness since 15 days showing dilated bilateral lateral ventricles, 3rd and 4th ventricles with periventricular ooze, moderate leptomeningeal contrast enhancement along bilateral cortical sulcus with enhancing exudates noted involving suprasellar, perimesencephalic, ambient and sylvian cisterns suggestive of meningitis.



Flair Oblique Coronal

T1 Oblique Coronal

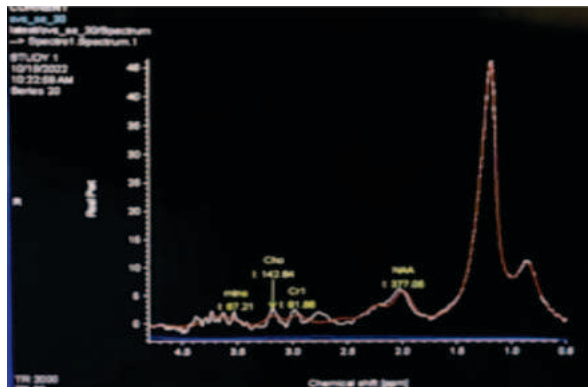
Fig. 03 MRI Brain of 4 year old child with history of multiple episodes of right sided seizure showing T2/FLAIR hyper intensity with volume loss in left hippocampus with mildly prominent left lateral ventricle temporal horn suggestive of left sided mesial temporal sclerosis.



Dwi Axial

Adc Axial

Flair Axial



Mr Spectroscopy

Fig. 04 MRI Brain of 6 year old male child presented with multiple episodes of generalized seizure since 4 years showing 2 well defined

T1/T2/FLAIR heterogeneously hyperintense lesion with hypointense rim showing peripheral rim enhancement on T1 post contrast scan and diffusion restriction on DWI sequence associated with surrounding edema and gliotic changes. It showed blooming foci in rim on SWI sequence in left frontal lobe. On MR Spectroscopy on single voxel, lipid peak was seen. Features were suggestive of tubercular abscess.

Developmental venous anomaly was found to be most common vascular cause of paediatric seizure. Other vascular causes noted were cortical venous thrombosis, hemorrhagic infarct, high flow arteriovenous malformation and Posterior reversible encephalopathy syndrome. Pontine glioma and craniopharyngeoma were found to be the intracranial neoplastic cause while direct extension of Ewing's sarcoma of scalp into the right temporal lobe was found in one patient. Chronic bilirubin encephalopathy and Juvenile onset metabolic leucodystrophy were found to be metabolic causes of paediatric seizures in the study. Other causes includes degenerative changes, Chiari II malformation with intraventricular haemorrhage and Posterior quadrantic dysplasia.

Maximum number of patients in the study are of age group 0-3 years i.e. 26 patients which constitutes 34.21 % of total patients with mean age of 4.32 ± 3.12 years.

Similar findings were observed by Wongladarom et al.⁷ and Doescher JS et al.⁸ where mean age was 5.12 years and 4.23 years respectively.

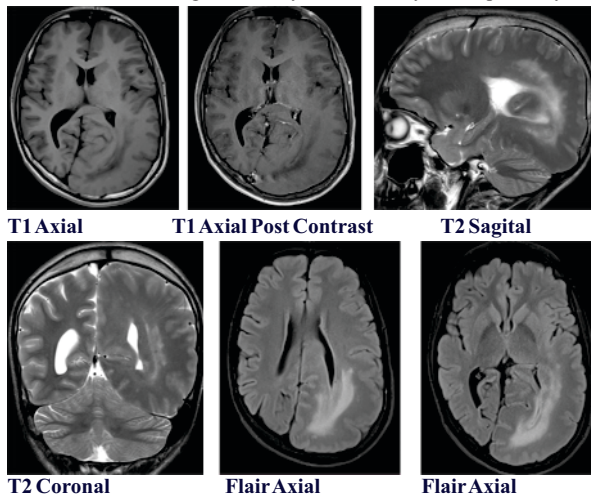


Fig. 05 MRI Brain of 17 year old male patient with childhood seizure showing diffuse enlargement of left temporo-parieto-occipital lobe with sparing of ipsilateral frontal lobe and malformed posterior horn of left lateral ventricle with periventricular T2/FLAIR hyperintensity. Poor gray white matter differentiation, cortical thinning and focal cortical dysplasia in form of pachygyria and polymicrogyria involving mentioned left hemispherical lobe suggestive of posterior quadrantic dysplasia.

Male to female ratio in the study came out to be 1.5:1 with 46 males and 30 females. Slight male preponderance for epilepsy in children was noted.

Similar findings were observed by Doescher JS et al.⁸ where majority of the patients in study were males. (50.2%)

In the study, generalized onset seizures patients were more (89.5 %) than focal onset seizures (10.5%). This finding is comparable with study conducted by Gulati P et al.⁹ where more than 70% patients presented with generalized seizures.

In the present study, out of 76 patients, 53 patients (69.7%) had abnormality in MRI Brain study whereas 23 patients (30.26 %) had normal study. This finding in our study was comparable with a previous study done by Zajac A et al.¹⁰ and Aloui-Kasbi N et al.¹¹

Zajac A et al.¹⁰ studied a group of 45 patients between age of 6 months to 18 years (mean age 11 year) with 19 females and 26 males. The history indicated the primary generalized character of seizures. Out of 45 children, MRI findings were normal in 14 cases, while the remaining showed pathological results.

It was noted in the study that total 46 patients out of 76 had either positive clinical history (of perinatal or positive family history) or abnormal findings on clinical examination. Out of these 46, 40 people had abnormal MRI. Only 6 patients were found to have abnormal clinical history with normal MRI Finding. Out of 30 patients with no obvious abnormality in clinical history (of perinatal or positive family history) and normal findings on clinical examination, 17 patients had normal MRI. Presence of positive clinical history or examination findings significantly increases the number of positive MRI scans with significant association. ($P < 0.001$)

This finding in our study was comparable with a previous study conducted by Zajac A et al.¹⁰ and Aloui-Kasbi N et al.¹¹ which shows significant association between MRI findings and clinical findings.

The present study concludes that presence of positive clinical history or examination findings significantly increases the number of positive MRI scans. It is recommended that MRI brain should be considered as primary investigation for evaluating children with new onset seizure as MRI is capable of accurately identifying, localizing, and characterizing the underlying intracranial abnormality responsible for a condition which enables healthcare professionals to plan further management strategies accordingly.

REFERENCES

- Lowenstein D.H. (2014). Seizures and epilepsy. Kasper D, & Fauci A, & Hauser S, & Longo D, & Jameson J, & Loscalzo J(Eds.), Harrison's Principles of Internal Medicine, 19c. McGraw Hill. Daniel Kenney and Elaine Wirrell. Patient considerations in the management of focal seizures in children and adolescents; Adolesc Health Med Ther. 2014; 5: 49-65.
- Daniel Kenney and Elaine Wirrell. Patient considerations in the management of focal seizures in children and adolescents; Adolesc Health Med Ther. 2014; 5: 49-65.
- Sander JWAS, Hart YM, Johnson AL, Shorvon SD. National general practice study of epilepsy: newly diagnosed epileptic seizures in a general population. Lancet, 1990; 336: 1267-71.
- Rebecca S. N. Liu, Louis Lemieux, Gail S. Bell, Sanjay M. Sisodiya, Philippa A. Bartlett, Simon D. Shorvon, Josemir W.A. S. Sander, John S. Duncan. Cerebral Damage in Epilepsy: A Population-based Longitudinal Quantitative MRI Study. Epilepsia, 2005; 46(9): 1482-1494.
- Craven IJ, Griffiths PD, Bhattacharyya D, Grunewald RA, Hodgson T, Connolly DJA, et al. 3.0-tesla MRI of 2000 consecutive patients with localization - related epilepsy. The Br J of Radiology, 2012; 3 (12):11-16.
- R. A. Umap, Navid Shattari, Shephali Pawar. Role of magnetic resonance imaging of brain in the evaluation of paediatric epilepsy. International Journal of Contemporary Medicine Surgery and Radiology. 2020;5(1):A10-A15.
- Wongladarom S, Laothamatas J, Visudtibhan A, Sawatsut P. Magnetic resonance imaging of the brain in epileptic pediatric patients: review of the experience in Ramathibodi Hospital. J Med Assoc Thai 2004 Sep; 87(9):1092-9.
- Doescher JS, deGrauw TJ, Musick BS, Dunn DW, Kalnin AJ, Egelhoff JC, Byars AW, Mathews VP, Austin JK. Magnetic resonance imaging (MRI) and electroencephalographic (EEG) findings in a cohort of normal children with newly diagnosed seizures. Journal of child neurology. 2006 Jun;21(6):490-5.
- Gulati P, Jena A, Tripathi RP, Gupta AK. Magnetic resonance imaging in childhood epilepsy. Indian Pediatr. 1991 Jul; 28(7):761-5.
- Zajac A, Herman-Sucharska I, Krocicka S, Kubik A, Nardzewska- Szczepanik M. Brain MRI data in children with so called primary generalized seizures. Przegl Lek 2007; 64(11):942-5
- Aloui-Kasbi N, Azzabi O, Bousetta K, Karboul L, Bellagha I, Sammoud A, Bousnina S, Hammou A. [First seizure in children. Exploration strategy]. Tunis Med 2004 Dec; 82(12):1091-6.