Section: Paediatrics

Original Research Article

UTILITY OF MRI IN FIRST UNPROVOKED SEIZURE IN PEDIATRIC AGE GROUP

Srishti Trivedi[1], Sharja Phuljhele[2], Prankur Pandey[3], Vivek Patre[4]

[1]PG Resident, Department of Paediatrics, Pt. J.N.M.M.C, Raipur, Chhattisgarh, India
[2]HOD and Professor, Department of Paediatrics, Govt. Medical College, Mahasamund, Chhattisgarh, India
[3]Assistant Professor, Department of Paediatrics, Pt. J.N.M.M.C Raipur, Chhattisgarh, India
[4]Professor, Department of Radiodiagnosis, Pt. J.N.M.M.C Raipur, Chhattisgarh, India.

Received : 17/09/2024
Received in revised form : 06/11/2024
Accepted : 22/11/2024

Keywords:
First unprovoked seizure, Magnetic Resonance Imaging (MRI), Abnormal brain finding, Developmental delay, Encephalomalacic change, tuberculoma, pontine glioma.

Corresponding Author:
Dr. Srishti Trivedi,
Email: srishti.trivedi26@gmail.com

DOI: 10.47009/jamp.2024.6.6.133

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2024; 6 (6); 703-707

Abstract

Background: Seizure is an emergency that needs utmost importance in pediatric setup pertaining to prompt action following an appropriate diagnosis. There is a paucity of data regarding the incidence of structural brain lesion in first unprovoked seizure. Aim of the study is to study the utility of MRI in first unprovoked seizure in pediatric age group. **Materials and Methods:** A Descriptive study held in Paediatric department of Dr. BRAMH Raipur, where 73 patients with first unprovoked seizure based on the current prevalence studies of seizure in Raipur district of Chhattisgarh were included and after thorough clinical history and examination, were subjected to Magnetic resonance Imaging (MRI). The obtained results were then categorized and studied as abnormal therefore establishing the utility of MRI for prompt and appropriate treatment accordingly. **Result:** Of the 73 patients studied, about 64 % (n= 47) were male and 36% (n=26) were female and the most common age group amongst the study was 8 – 11 years accounting for 26%(n=19). All the patients underwent MRI after which 68% (n = 50) had positive MRI findings. 37% (n= 27) had developmental delay present out of which 85% (n= 23) had positive MRI finding. 76.7 % (n=56) patients had generalized seizure while 23.3% (n= 17) had focal seizure according to ILEA classification of which the most common Focal seizure was Focal tonic seizure and 82.4 % (n=14) had positive MRI findings. The most common Generalized seizure was Generalized tonic clonic seizure (GTCS) 73.2%, 56 patients with Generalized seizure, 64.3% (n=36) had positive MRI finding while 35.7 % had negative. The most common MRI finding detected was Encephalomalacic changes 20% (n= 10) followed by Infective and Brain malformations 18% (n = 9). Atrophic and metabolic changes constituted 8 % (n= 4) while Vascular constituted about 6 % (n= 3). Demyelinating and Neoplastic changes were 4% (n=2) while the others comprised of 14 % (n=7). The most common Infective finding was that of Tuberculoma 66.7% (n=6) and one case each of neurocysticercosis, Encephalitis and HIV encephalopathy, The neoplasm detected in MRI was pontine glioma in 2 cases. **Conclusion:** Seizure being a wholesome contributor in paediatric morbidity and mortality requires prompt methods in diagnosing the cause behind it. MRI is one such specific measure guiding us in knowing the pathology thus enabling us to treat the patient better with increased positive outcome in the patients. Therefore, MRI must be an elective Investigation in the seizure profiling of a child.

INTRODUCTION

Seizure is defined as paroxysmal modification of the neurocognitive function that occurs due to increased,[1] hypersynchronous discharging neurons in the central nervous system. First unprovoked seizure in paediatric age group, demands a thorough examination and investigations. Magnetic resonance imaging of brain is a neuroimaging tool which aids in diagnosing significant causes of seizures and can help in predicting the recurrence and refractoriness of seizures and can help in formulating treatment protocol for the patient.[2,3] Precise diagnosis of the seizure type, evaluating probable causative factor which precipitated the event, is vital for the management of the patient. The evaluation involves clinical history, examination and investigations in which MRI plays a pivotal role.[2,3] In our study we aim to find out whether MRI should be performed in

ISSN (O): 2687-5365; ISSN (P): 2753-6556

the first unprovoked seizure episode in paediatric age group.

Aim and objectives: AIM -To study the utility of MRI in first unprovoked seizure in pediatric age group.

Objectives - Primary objective – To study the utility of MRI in first unprovoked seizure in pediatric age group.

Secondary objective- (A) To evaluate distribution of seizure type in child and most common type. (B) To find distribution of imaging findings in the child.

MATERIALS AND METHODS

Study Design: This study is a descriptive study conducted in the Department of Pediatrics, Pt. J.N.M. Medical College, Raipur from Feb 2023 – May 2024 after obtaining proper clearance from ethical and scientific committee.

Inclusion Criteria

All patients of first unprovoked seizure admitted in department of pediatrics after proper explanation of the study and written consent/ assent.

Exclusion Criteria

Patients with known case of seizure disorders and provoked seizures were excluded. Patients who cannot undergo MRI like critically sick patient, Pt. with deranged RFT and patients having metallic implant.

Materials required: Magnetom skyra 3 tesla mri machine serial No. 45445, in the department of Radiology in Dr. B.R.A.M .H, Raipur.

Sampling Procedure: Children with seizures who underwent extensive examination and, following a careful medical history, were classified as "unprovoked," meaning they had no prior risk factors. An MRI of the brain was conducted of these patients as part of their clinical care. Those patients who met the eligibility requirements after obtaining both accent and written informed consent were included in the study after matching the inclusion and exclusion criterion. After recording the basic information, pertinent clinical history was recorded, such as the history of birth asphyxia and pertinent family history, a thorough clinical examination was conducted to search for seizure type, developmental delay, and other physical findings. The patient was given a full pre-anaesthesia examination, and if necessary, the anaesthetist sedated them. A brain MRI was carried out and the results were assessed. In the paediatric wards, patients received the prescribed care in accordance with the guidelines.

Sample Size: Applying the prevalence of seizure in pediatrics dept. in DR. BRAMH Raipur Chhattisgarh, minimum required sample size was 73 subjects.

Statistical analysis - MRI Results along with all the details of history and examination was tabulated in Microsoft Excel. The data was analysed using the Statistical Package for Social Sciences (SPSS) version 20.0, and tables and charts were made using Microsoft Excel. Descriptive analyses were presented as proportions for count data and as mean with standard deviation (S.D.) for continuous data. Chi squared test was used to compare the results of brain imaging with sociodemographic data to determine independence. When one or more of the expected cell counts were less than five, the Fisher's exact test was utilized. The 95% Confidence Interval was computed using the Wald adjustment proportion algorithm. The statistically significant level of $P < 0.05$ was selected.

RESULTS

There was a total of 73 patients included in the study of which about 64 % (n= 47) were male and 36% (n=26) were female.

The most common age group amongst the study was 8 – 11 years accounting for 26% (n=19), while the second most common being 11- 14 years 24.7% (n= 18). The least number of patients were in the age group 6 months- 2 years 11% (n=8).

In our study all the patients underwent MRI after which 68% (n = 50) had positive MRI findings with proportion of 68.49 % ± 10.96 and 95% Confidence interval of 57.53- 79.45 %.

Of the patients with positive MRI finding, 64% (n= 32) were male and 36 % (n= 18) were female.

Age 6 months – 2 years had 100% (n=8) positive MRI findings, while age group 2-5 years, 5-8 years and 11-14 years had approx. 62-66% positive findings. Age group 5-8 years had the lowest 36% (n=5) positive MRI finding.

The study group, consisting of 73 patients, 76.7 % (n=56) had generalized seizure while 23.3% (n= 17) had focal seizure according to ILEA classification.

The most common Focal seizure was Focal tonic seizure ,58.8% (n=10) and the least were focal clonic and focal epileptic spasm 11.8% (n=2).

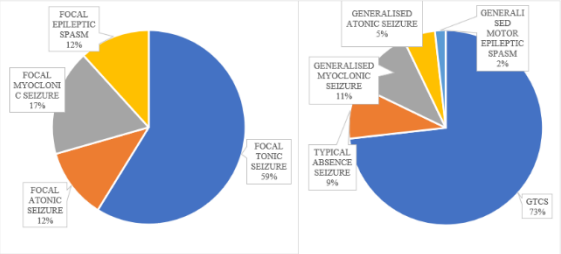

Figure 1: Depicts that out of 23 % (n= 17) of FOCAL SEIZURE patients, maximum 59% (n= 10) had focal tonic seizures, followed by 17 % (n= 3) had focal myoclonic seizure and equal number of patients,12 % (n= 2) had focal clonic and focal epileptic spasms. Out of 77 % (n= 56) of GENERALIZED SEIZURE patients, maximum 73.2% (n= 41) had GTCS, followed by 10.7% (n= 6) had generalized myoclonic seizure, 8.9% (n=5) had typical absence seizure, 5.4 % (n= 3) had generalized atonic seizure and 1.8% (n=1) had generalized motor epileptic spasms.

Of the 17 patients with Focal seizure, 82.4 % (n=14) had positive MRI findings with all (100%) of the

ISSN (O): 2687-5365; ISSN (P): 2753-6556

focal tonic and focal clonic seizure patients had positive MRI finding.

The most common Generalized seizure was Generalized tonic clonic seizure (GTCS) 73.2% (n= 41), followed by Generalized myoclonic and typical absence seizure with 10.7% (n= 6) and 8.9% (n= 5) respectively and the least common Generalized seizure was Generalized motor epileptic spasm 1.8% (n=1).

Of the 56 patients with Generalized seizure, 64.3% (n=36) had positive MRI finding while 35.7 % had negative. GTCS had 73.2 % (n=30) MRI positivity, while the only case of generalized motor epileptic spasm showed positive MRI result. All the 5 cases of typical absence seizure showed no abnormality on MRI.

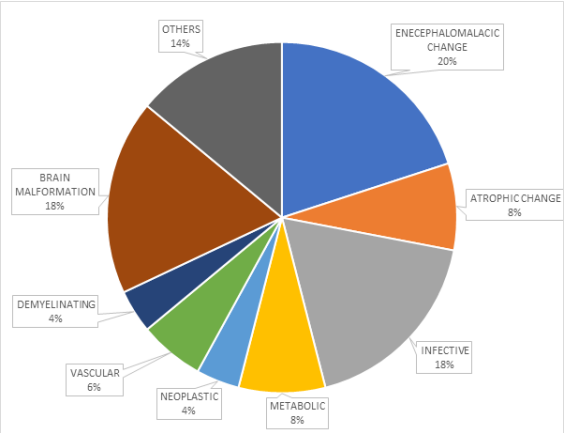

Figure 2: distribution of various types of lesions on MRI

Of the 73 patients about 37% (n= 27) had developmental delay present out of which 85% (n= 23) had positive MRI finding. P value came out to be 0.019 (<0.05) showing association between Developmental delay and MRI finding in our study.

20.5% (n= 15) of the 73 patients had history of birth asphyxia out of which 86% (n= 13) had positive MRI finding. P value came out to be 0.089 (>0.05) showing no association between birth asphyxia and MRI finding in our study.

19% (n= 14) of the study group had family history of seizure, out of which 50% (n= 7) had positive MRI finding. P value came out to be 0.098 (<0.05) showing no association between family history and MRI finding in our study.

The maximum developmental delay (53.6%) and birth asphyxia (29.3%) were present in patients with GTCS type of seizure.

[Figure 2] Shows various MRI findings according to table 18, that is maximum of 20 % (n=10) had encephalomalacic changes followed by 18 % (n= 9) in infective and brain malformation groups. 14 % (n=7) belonged to OTHERS category while 8 % (n= 4) had atrophic and metabolic change son MRI. Vascular cause contributed 6% (n=3) while minimum being 4% (n=2) in both the groups Metabolic and demyelinating each.

Distribution of various types of lesions on MRI in infective group, where of 9 patients, 6 were of tuberculoma and a case each of neurocysticercosis, encephalitis and HIV encephalopathy.

Distribution of various types of lesions on MRI in metabolic group, where of the 4 patients, 1 patient each of hepatic encephalopathy, hypoglycemic encephalopathy, Wilson's disease and glutaric aciduria type 1 were there.

Distribution of various types of lesions on MRI in vascular group, where of the 3 patients, 1 was of venous malformation and 2 of ischemic injury (1 acute and 1 chronic infarct).

Distribution of various types of lesions on MRI in brain malformation group, where of the 9 patients 3 had cystic malformation (2 of arachnoid cyst and 1 of sebaceous cyst), 2 belonged to malformation of cortical development (1 case each of microcephaly and a case of megaencephaly), while 2 cases of Joubert's syndrome was observed.

Distribution of various types of lesions on MRI in neoplastic group, where both the patients were of pontine glioma.

Distribution of various types of lesions on MRI in others group, of the 7 cases there were a case each showing thinning of corpus callosum with mild diffuse atrophy, mild periventricular bilateral frontal non-specific white matter signal intensity changes, battered baby, hemosiderosis, bilateral mesial temporal sclerosis, tuberous sclerosis and post ictal changes in right parieto-occipital cortex.

Table 1: Association of developmental delay with presence of mri finding (2×2 table).

		MRI finding		total
		Absent	Present	
Develop-mental delay	Absent	19	27	46
	Present	4	23	27
		23	50	73
	Value	Degree of freedom		P- value
PEARSON CHI- SQUARE	5.53	1		0.019

P- value <0.05, significant result.

There is association between Developmental delay and MRI abnormality.

Table 2: association of birth asphyxia with presence of MRI finding (2×2 table)

		MRI finding		Total
		Absent	Present	
Develop-mental delay	Absent	21	37	56
	Present	2	13	15
		23	50	73

ISSN (O): 2687-5365; ISSN (P): 2753-6556

	Value	Degree of freedom	P- value
Pearson chi- square	2.89	1	0.089
Fischer exact test			0.123

P- VALUE and Fischer exact >0.05, non-significant result.
There is NO association between BIRTH ASPHYXIA and MRI abnormality.

Table 3: association of family history with presence of MRI finding (2×2 table)

		MRI finding		Total
		Absent	Present	
Develop-mental delay	Absent	16	43	59
	Present	7	7	14
		14	50	73

	Value	Degree of freedom	P- value
Pearson chi- square	2.75	1	0.098

P- VALUE >0.05, non-significant result.
There is association between FAMILY HISTORY and MRI abnormality.

Table 4: distribution of various types of lesions on MRI

MRI finding	Number of patients	Proportion	95% confidence interval
Encephalomalacic change	10	20 % ± 11.08 %	8.92 – 31.08 %
Atrophic change	4	8 % ± 7.51 %	0.49 – 15.51 %
Infective change	9	18 % ± 10.64 %	7.36 – 28.64 %
Metablolic	4	8 % ± 7.51 %	0.49 – 15.51 %
Neoplastic	2	4 %± 5.43 %	0 – 9.43 %
Vascular	3	6 % ± 6.58 %	0 – 12.58 %
Demyelinating	2	4 % ± 5.43 %	0 – 9.43 %
Brain malformation	9	18 % ± 10.64	7.36 – 28.64 %
Others	7	14 % ± 9.61 %	– 23.61 %

DISCUSSION

In our study the yields of recognizing lesions which had epileptogenic potential is 68.49 % (95 % CI-57.53%-79.45%). Our study is well supported by results of study conducted by Rachna Chaurasia et al 4 (2013) In which 271 patients were evaluated for seizures, cases where causes of epilepsy were provoked such as electrolyte imbalance, fever, dehydration were excluded from the study. Out of 271 cases, 191 cases (70.4%) had positive MRI findings. Our study was supported by Denise Apolot et al,[5] (2022), A cross sectional study performed in a study population of 147 children of age between 1 day to 17 years, every child was subjected to brain MRI. Among the children with seizures, structural abnormality prevalence was 74.15% (109/147) with 95% CI 66.38-80.65%. Our study is supported by, Shinnar et al,[6] (2000) who conducted a study on 411 children, who were afebrile. 218 children underwent neuroimaging and MRI was done in 59 patients. The most common lesion found in study was encephalomalacia (n=16) and cerebral dysgenesis (n=11). In nine children there was presence of atrophy. Mesial temporal sclerosis was found in 3 patients. This study concluded that MRI may reveal a greater proportion of imaging abnormalities. In our study the most common finding was encephalomalacic changes. Similar findings were present in studies by Mehmet Alp Dirik and Burcin Sanlidag,[7] (2018) and Tahir Hakami et al,[8] (2013). In our study it was found that the frequency of imaging abnormalities was significantly higher children with development delay. Our study is supported by study done by R.Hourani et al,[9] (2021), in which frequency of neuroimaging abnormality in children with development delay was 57% (95% CI 50.4%-63.3%) also in the study it was found that the frequency to find the epileptogenic abnormality increased as the development delay severity worsened. Our study results are in consistence with a study conducted by C. A.Nbudishi et al,[10] (2016), in which 72.7% patients had generalized seizure, 18.6% patients had partial seizures and 8.7 % cases were seizures of unknown origin. In a study done by Reem A Ayoubi et al,[11] (2023), done on 171 patients, 95 were males (55.5%) and 76 were females (44.5%), which is in concordance with our study where proportion of males was greater than proportion of females. In a study conducted by Mohsen Molla Mohammadi et al,[12] (2013) on 96 patients with first unprovoked seizure, 70.8 % patients had no history of seizure in family in accordance with our study finding of negative family history being 81%. In our study 15 patients had presence of birth asphyxia and 13 out of those (86%) had positive MRI findings. More studies are required to find out association between birth asphyxia and neuroimaging findings.

CONCLUSION

Seizures in paediatric population presents as a challenge. In our study, the children with first unprovoked seizures were evaluated and MRI as a diagnostic tool was used to find out the lesion. The new International League Against Epilepsy classification stresses on the importance of aetiology at every step of diagnosis. The previous guidelines on neuroimaging have advised to perform neuroimaging in cases with focal neurological deficits, children

ISSN (O): 2687-5365; ISSN (P): 2753-6556

with development delay, uncontrolled seizures and new onset seizures with status epilepticus or clinical features such as raised intracranial tension. This approach might not helpful in early diagnosis of newly developing seizures in a developmentally normal child with no neurological deficits which might lead to missing a diagnosis and can hamper the management of the patient. In our study 68% children who presented with first unprovoked seizures had abnormal MRI findings and thus MRI helped in evaluating the cause of seizures. This practise will help us to diagnose the lesions that need urgent management or need different treatment approach (tuberculomas, tumours or mesial temporal lobe epilepsy) and will help us to explain the prognosis to the patient in a better way. We need more studies with larger cohort to provide us information regarding role of MRI in unprovoked seizures in children.

REFERENCES

1. Stafstrom CE, Carmant L. Seizures and epilepsy: an overview for neuroscientists. Cold Spring Harb Perspect Med. 2015 Jun 1;5(6): a022426. doi: 10.1101/cshperspect.a 022426. PMID: 26033084; PMCID: PMC4448698.
2. Semah F, Picot MC, Adam C, Broglin D, Arzimanoglou A, Bazin B, Cavalcanti D, Baulac M. Is the underlying cause of epilepsy a major prognostic factor for recurrence? Neurology. 1998 Nov;51(5):1256-62. doi: 10.1212/wnl.51.5.1256. PMID: 9818842.
3. Chuang, Nathaniel A. M.D.; Otsubo, Hiroshi M.D.; Chuang, Sylvester H. M.D. Magnetic Resonance Imaging in Pediatric Epilepsy. Topics in Magnetic Resonance Imaging 13(1):p 39-60, February 2002.
4. Chaurasia R, Singh S, Mahur S, Sachan P. Imaging in pediatric epilepsy: spectrum of abnormalities detected on MRI. Journal of Evolution of Medical and Dental Sciences. 2013 May 13;2(19):3377-88.
5. Apolot D, Erem G, Nassanga R, Kiggundu D, Tumusiime CM, Teu A, Mugisha AM, Sebunya R. Brain magnetic resonance imaging findings among children with epilepsy in two urban hospital settings, Kampala-Uganda: a descriptive study. BMC Medical Imaging. 2022 Oct 6;22(1):175.
6. Shinnar S, O'Dell C, Mitnick R, Berg AT, Moshe SL. Neuroimaging abnormalities in children with an apparent first unprovoked seizure. Epilepsy Res. 2001 Mar;43(3):261-9. doi: 10.1016/s0920-1211(00)00206-0. PMID: 11248538.
7. Dirik MA, Sanlidag B. Magnetic resonance imaging findings in newly diagnosed epileptic children. Pakistan Journal of Medical Sciences. 2018 Mar;34(2):424.
8. Hakami T, Mcintosh A, Todaro M, Lui E, Yerra R, Tan KM, French C, Li S, Desmond P, Matkovic Z, O'Brien TJ. MRI-identified pathology in adults with new-onset seizures. Neurology. 2013 Sep 3;81(10):920-7.
9. Hourani R, Nasreddine W, Dirani M, Hmaimess G, Sabbagh S, El Tourjuman O, Wazne J, Toufaili H, AlArab N, El Dassouki M, Beydoun A. When should a brain MRI be performed in children with new-onset seizures? Results of a large prospective trial. American Journal of Neuroradiology. 2021 Sep 1;42(9):1695-701.
10. Ndubuisi CA, Mezue WC, Ohaegbulam SC, Chikani MC, Ekuma M, Onyia E. Neuroimaging findings in pediatric patients with seizure from an institution in Enugu. Nigerian Journal of Clinical Practice. 2016 Jan 26;19(1):121-7.
11. Alyoubi RA, Daghistani RK, Albogmi AM, Alshahrany TA, AlAhmed AB, Fayoumi TA, Alotibi FA, Alyazidi AS, Alyoubi Jr R, Alshahrany T, AlAhmed A. The Spectrum of MRI and Electrographic Findings in Pediatric Patients with Seizures: A Retrospective Tertiary Care Center Study. Cureus. 2023 Mar 7;15(3).
12. Molla Mohammadi M, Tonekaboni SH, Khatami A, Azargashb E, Tavasoli A, Javadzadeh M, Zamani G. Neuroimaging findings in first unprovoked seizures: a multicentric study in tehran. Iran J Child Neurol. 2013 Fall;7(4):24-31. PMID: 24665314; PMCID: PMC3943050.

ISSN (O): 2687-5365; ISSN (P): 2753-6556