ROLE OF MRI SCAN IN EVALUATING EPILEPSY IN PEDIATRIC AGE GROUP IN TERTIARY MEDICAL CENTRE IN SOUTH BIHAR

Dr Guddakesh Kumar	Post Graduate Resident, Department Of Radiodiagnosis, Narayan Medical College, Jamuhar, Bihar
Dr Chandan Kishore*	Associate Professor, Department Of Radiodiagnosis, Narayan Medical College, Jamuhar, Bihar *Corresponding Author
Dr Shamim Ahmad	Professor, Department Of Radiodiagnosis, Narayan Medical College, Jamuhar, Bihar
Dr Dipu Singh	Assistant Professor, Department Of Radiodiagnosis, Narayan Medical College, Jamuhar, Bihar

ABSTRACT
INTRODUCTION: Epilepsy is a disorder characterised by a long-lasting predisposition to epileptic seizures and the neurobiological, emotional, psychological and social effects of epileptic seizures. Epileptic seizures are known to be associated with irregular neuronal activity due to excessive or non-synchronous electrical discharge resulting from defects in the central nervous system inhibitory and/or excitatory pathway. Epilepsy is a chronic disease of frequent, uninduced seizures affecting 1 % of the world's population with an estimated occurrence of 68/100,000 per year**AIM AND OBJECTIVE:** To established the clinical types of seizure in pediatrics age group on conventional MR sequence,**MATERIAL AND METHODS:** The present prospective study had been undertaken at Narayan Medical College and Hospital, Sasaram. The study period is from January 2018 to September 2020. The study was done on 100 patients. All the cases presented with history of epilepsy undergo MRI in NMCH jamuhar. All the imagings will be performed using 1.5 Tesla MRI Magnetom Essenza, Siemens system **RESULT:** 50 % study subjects with GTCS had MR anomaly, 77.8% subjects with myoclonic seizure had anomaly at MRI, whereas 100% subjects with febrile seizure, neonatal seizure, motor seizure and tonic seizure had defect at MRI. **CONCLUSION:** My study concluded that infectious etiology (like NCC and tuberculoma) being prime cause of epilepsy in paediatrics age group here in southern Bihar and most common seizure associated with it is GCTS followed by myoclonic seizure.

INTRODUCTION

Epilepsy is a disorder characterised by a long-lasting predisposition to epileptic seizures and the neurobiological, emotional, psychological and social effects of epileptic seizures. Epileptic seizures are known to be associated with irregular neuronal activity due to excessive or non-synchronous electrical discharge resulting from defects in the central nervous system inhibitory and/or excitatory pathway. Epilepsy is a chronic disease of frequent, uninduced seizures affecting 1 % of the world's population with an estimated occurrence of 68/100,000 per year. [1]. As proposed by the International League Against Epilepsy in 2010, refractory epilepsy or drug-resistant epilepsy may be described as "the failure of adequate trials of two tolerated and properly chosen and used antiepileptic drug schedules (whether monotherapy or in combination) to achieve sustained seizurefreedom"[2]. This type of epilepsy is distinguished by the underlying subtle structural defect, neurocutaneous malformations, calcified / hemorrhagic lesions and metabolic anomalies that can be definitively identified with the assistance of neuroimaging. Latest developments in neuroimaging have made it possible to find epileptogenic foci even in refractory epilepsy via a multi-modal method. There are several suggestions for the widespread implementation of neuroimaging guidelines for the treatment of epilepsy, and Coryell et al. demonstrated a strong neuroimaging output in paediatric patients with early-life epilepsy (ELE)in a broad sample [3].

An epileptic seizure is defined as "an excessive burst of abnormally synchronized neuronal activity affecting small or large neuronal networks that results in clinical manifestations that are sudden, transient, and usually brief" Epilepsy is characterized by recurrent seizures secondary to a predisposition to generate abnormal electrical discharges from cortical grey matter, and is complicated by subsequent neurobiological, cognitive, psychosocial and occupational consequences. Up to 10% of the population will have at least one seizure in their lifetime, but only about 2% of the population will develop epilepsy. Seventy million people in the world have epilepsy, with between 34 and 76 new cases per 100,000 diagnosed every year.

Seizure is a paediatrics emergency. Seizure is a very common cause of child hospitalisation and results in high mortality and morbidity. Febrile seizures are the most common cause of acute seizures in paediatrics age around the globe. They account for the majority of seizures seen in children under 5 years of age. Acute symptomatic seizures with poor outcome are more common in tropical nations like India compared to febrile seizures. Acute seizures therefore appear to

be a golden risk factor for neurocognitive abnormality in paediatrics age group living in these nations. The prime cause of these acute seizures is the infection to the central nervous system. The incidence is revealed to be maximum among children younger than 3 years of age, with a declining frequency in higher age group. Geographical differences recognize common triggers in a specific area. Meningitis, viral encephalitis and neurocysticercosis are common culprits of this disease. These are related with higher morbidity and mortality at higher rates of recurring epilepsy. MRI recognises structural defects that need immediate care, such as high-grade gliomas and arteriovenous malformations, subtle structural abnormalities such as hippocampal sclerosis and cortical malformations. The detection of these conditions has long-term therapeutic and prognostic implications with respect to treatment options and the probablity of relapse or intractability.

AIM AND OBJECTIVES
1. To established the clinical types of seizure in pediatrics age group on conventional MR sequence
2. To study the distribution of specific type of seizures with MR abnormality.

MATERIAL AND METHODS
All patients presenting with acute symptoms of seizure or recurrent attacks, referred from emergency, outpatient or inpatient department was studied on 1.5 Tesla Magnetom Essenza, Siemens system, standardized multiplanar and multiecho sequence was obtained with and without IV MR contrast media administration.

There was a comprehensive history were taken along with clinical review. Duration of illness, type of seizures, and any related illness would be the notable points. To identify any neurological disorder, a thorough clinical and neurological evaluation was performed. A clinical etiological diagnosis was made on the basis of history and analysis.

INCLUSION CRITERIA:
1.All patients aged 1 month to 14 years irrespective of Gender.
2.All children with complaints of seizures (including recurrent episodes) children admitted including children with developmental delay, cerebral palsy, and mental retardation.

EXCLUSION CRITERIA:
1. Any previously diagnosed non central nervous system disorders liable to cause seizures.

2. Patients with known contraindications to MRI. Conditions like Claustrophobia, cardiac pacemaker, cochlear implants, and other routine contraindications for MRI.
3. Syncopal and hypoglycemic attacks, pseudo-seizures, drug induced seizures or following poisoning
4. Patients presenting with head injury.with seizures following head injury, Children with seizures following poisoning.

The present prospective study had been undertaken at Narayan Medical College and Hospital, Sasaram. The study period is from January 2018 to September 2020. The study was done on 100 patients. All the cases presented with history of epilepsy undergo MRI in NMCH jamuhar. All the imagings will be performed using 1.5 Tesla MRI Magnetom Essenza, Siemens system.

All patients were screened before entry into the MRI scanning room for ferromagnetic objects, cardiac pacemakers, and aneurysm clips, etc. Patients were examined in the supine position on the MRI machine after proper positioning and immobilization of the head was obtained. The head coil was used for the scan. Initial topogram of the head was obtained and sequences were planned according to the MRI seizure protocol. MRI protocol is as follow.

At 1.5 Tesla includes entire brain from nasion to inion. Conventional routine 5mm thickness.T1,T2 axial sequences, 1.5mm slice thickness coronal oblique. T1 weighted MPRAGE or SPGR images; 1.5mm slice thickness –are acquired as a 3 dimensional (3D) volume, thereby post processing and reformatting images into multiple planes.Protocol also includes coronal and axial T2FLAIR sequences with 2-3mm slice thickness 1mm inter slice gap. A conventional thin slice, T2 weighted axial and coronal sequence is obtained.

Gadolinium paramagnetic contrast agent used in MRI. Contrast agent was used if a known tumour or vascular malformation. Dosage was as 0.1mg/kg wt. The scans was studied in detail on monitor and finally films were taken for permanent record.

STATISTICAL ANALYSIS :
All the data were analyzed using SPSS package (Stata, version 23.0 SPSS INC, Chicago, IL, USA) for windows. The data were presented as descriptive statistics for continuous variables and percentage for categorical variables and was subjected Chi-square test, t test. Other values were represented in number, proportions (%) and mean ± SD. Statistical formulae used were as follows:

OBSERVATIONS
Table 1 : Age & Sex wise distribution of Subjects

Age in years	Male	Female	Total	Percentage
< 1	3	0	3	3%
1-3	5	4	11	11%
4-6	10	5	15	15%
7-9	9	4	11	11%
10-12	20	8	28	28%
>12	18	14	32	32%
Total	65	35	100	100%

Table 1 shows distribution of age and sex in study subjects. Maximum number of patients were in the age group of >12(32%), in which 18 were male and 14 were female. 28% study subjects were in the age group 10-12 yrs in which 20 were male and 8 were female. overall 65% subjects were male whereas 35% subjects were female.
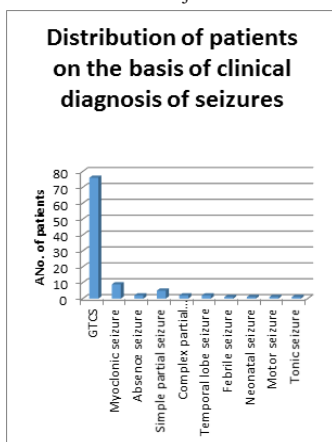

Distribution of patients on the basis of clinical diagnosis of seizures

Fig 1 shows distribution of study subjects on the basis of clinical diagnosis of seizure. Maximum 80% study subjects had GTCS, 9% had myoclonic seizure, 2% had absence seizure, 2% had simple partial seizure, 1% had motor seizure and 1 % had tonic seizure.
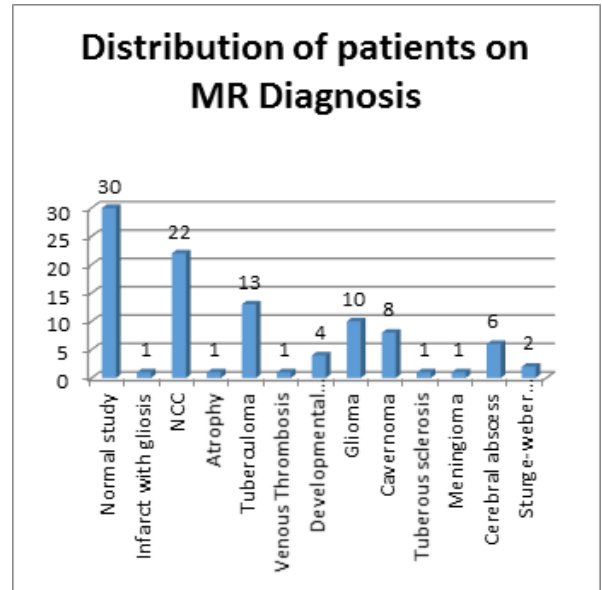

Distribution of patients on MR Diagnosis

Fig 2 shows distribution of study subjects as per MR diagnosis. 30 subjects had normal study. 22 had NCC, 13 had tuberculoma, 10 had glioma , 8 had cavernoma, 6 had cerebral abscess, 4 had developmental malformation, 1 had meningioma, 1 had tuberous sclerosis.

Table 2 : Distribution of specific type of seizures with MR abnormality

Clinical Diagnosis	No. of patients	Percentage
GTCS	42/80	50%
Myoclonic seizure	7/9	77.8 %
Absence seizure	1/2	50%
Simple partial seizure	1/2	50%
Complex partial seizure	1/2	50%
Temporal lobe seizure	1/2	50%
Febrile seizure	1/1	100%
Neonatal seizure	1/1	100%
Motor seizure	1/1	100%
Tonic seizure	1/1	100%

Table 2 shows distribution of specific type of seizures with MR abnormality.50 % study subjects with GTCS had MR anomaly, 77.8% subjects with myoclonic seizure had anomaly at MRI, whereas 100% subjects with febrile seizure, neonatal seizure, motor seizure and tonic seizure had defect at MRI.

DISCUSSION
Our study was a prospective study. The study was done in department of radiodiagnosis Narayan medical college and hospital Jamuhar Rohtas. In my study total number of 70 abnormal cases on sex wise distribution. Out of which 48 were males and 22 females were observed. The sex distribution of patients were male 65% and female 35%. Age & Sex wise distribution of Subjects,the maximum number of patients were in the age group of >12. Male: female in our study was 65 and 35 & correlates with the study conducted by Sanghvi et al. in which 60.5% were males and 31.7% were females.[8] Studies which conducted by Gulati et al., Amirsalari et al., and Zajac et al. also showed similar finding in which males out number females[6,9,10].

Our study is comparable with the studies of Chaurasia et al., Gulati et al., Kumar et al. and showed infection as the most common etiology in pediatric epilepsy[11,13,14] This might be due to a higher prevalence of infection in developing countries like India as well as developing state like Bihar, where I have conducted this study, which has a large population coming below poverty level and are forced to stay without proper hygiene in lack of economy,which makes the children prone for infection.

Infectious etiology was seen in normal 30% patients, NCC 22%, Tuberculoma 13%, Glioma 10%, Cavernoma 8%, Cerebral abscess-

6% S-Weber syndrome – 2%, Venous Thrombosis 1%, Developmental malformations -4%, Infaract with gliosis 1%, Atrophy 1 %. In Gulati et al. study, out of 158 patients with structural abnormalities on MRI, tuberculoma formation (tuberculosis) was the most common lesion present in 40% followed by neurocysticercosis in 17%.[6] In a study Chaurasia et al., Central nervous system Tuberculosis (30.3 percent) was the most common cause of epilepsy, followed by neurocysticercosis (11.0 percent) and encephalitis. (7.9%).[11]My study thus in discordance with the above-mentioned studies. However, our study correlates well with Kumar et al. study, in which most common etiology was neurocysticercosis (55.81%) followed by tuberculoma (29.91%).[14]

Arterial infarcts (excluding tuberculous) were seen in 3 patients (60.0%), arteriovenous malformation in 1 patient, and cavernous angioma with developmental venous anomaly in 1 patient. Our study does not correlate with the study conducted by Wongladarom et al., in which vascular disorder was responsible for epilepsy in 5 patients (5%).[7] Out of them, 8 patient had cavernous angioma, 4 patient malformation.

Out of 100 patients about 70% were diagnosed within 1 to 3 months of the seizure onset. Sheth R. [15] involving out of 110 patients about 72% were diagnosed within 1 to 3 months of the seizure onset.

In 70 out of 100 (70%) Patients displayed pathologies with magnetic resonance imaging. P.K. Duffner et al shows that 47 children with neurofibromatosis to determine whether the previously reported high signals on magnetic resonance imaging (MRI) (prolonged T2) correlated with CT, brainstem auditory evoked responses (BAER), EEG, clinical examinations, cognitive abilities, or seizure disorder. Thirty percent of children had a history of seizures and 70% had either learning disabilities or mental retardation. Overall, 74% had an abnormal MRI examination. Sixty-two percent had high signals (prolonged T2) on T2-weighted images.

In my study of total 100 patients, maximum 32% were in the age group of more than 12 years. The mean age group of my study population was 7.3. My study is in discordance with the study which was conducted by Gulati et al. in which the age range of patient was 6-12 years.[6] It also conflicts with the study performed by Wongladarom et al. in which mean age group of the study population was 7 year and 5 months[7]

This study emphasizes the revolution brought about by MRI in evaluating pediatric epilepsies. The results of our study as regards to sex distribution, most common type of epilepsy and its correlation with MRI, distribution according to type of etiology, infection, and distribution according to various etiologies and age group are comparable with previous published studies in literature. However, the results are discordance with previous studies regarding age distribution.

Generalized seizures (GCTS) constituted the major epilepsy group being present in as many as 66.3% in our study followed by myoclonic seizure and correlate well with the study conducted by Chaurasia et al. in which it was seen in 76.7% patients.[11] 80 patients (80%) had abnormal MRI findings in our study. Kuzniecky et al.found MRI abnormalities in 84% of patients[12]

Uses of MRI
MRI scanners are particularly well suited to image the non-bony parts or soft tissues of the body. They differ from CT, in that they do not use the damaging ionizing radiation of x-rays. The brain, spinal cord and nerves, as well as muscles, ligaments, and tendons are seen much more clearly with MRI than with regular x-rays and CT; for this reason MRI is gold choice for diagnosis in pathology involving the brain parenchyma.

In the brain, MRI can differentiate between white matter and grey matter and can also be used to diagnose aneurysms and tumors. Because MRI does not use x-rays or other radiation, it is the imaging modality of choice when frequent imaging is required for diagnosis or therapy, especially in the brain. However, MRI is more expensive than x-ray imaging or CT scanning. In our sample size of 100 padiatrics age group patients accompanying a clinical seizure diagnosis were choosen according to the criteria specified. All routine biochemical tests carried out as per proforma were reported in the clinical history of patient. Patients had seizures that ranged in length, ranging from a few days to a few months. The most common clinical diagnosis, comprising 80% of cases, was GTCS.

Struge-weber syndrome: Two patient brought out with MR features of Sturge weber syndrome showing focal cortical atrophy on right fronto-parietal and occipital lobe with predominant involvement of occipital lobe. According to Schmauser I, et al, The most sensitive imaging to expose the full extent of the lesions of Sturge-weber syndrome is MR. Out of the 70 children with at least MRI abnormality, the most common abnormalities were NCC -22%, Tuberculoma - 13%, Glioma -10%, Cavernoma -8%, Cerebral abscess-6% and developmental malformations -4%.

CONCLUSIONS
My study concluded that infectious etiology (like NCC and tuberculoma) being prime cause of epilepsy in paediatrics age group here in southern Bihar and most common seizure associated with it is GCTS followed by myoclonic seizure.

REFERENCES:
1. Fiest K.M., Sauro K.M., Wiebe S., Patten S.B., Kwon C.S., Dykeman J., Pringsheim T., Lorenzetti D.L., Jetté N. Prevalence and incidence of epilepsy: A systematic review and meta-analysis of international studies. Neurology. 2017;88: 296–303. doi: 10.1212/WNL.0000000000003509]
2. Kwan P., Arzimanoglou A., Berg A.T., Brodie M.J., Hauser W.A., Mathern G., Moshé S.L., Perucca E., Wiebe S., French J. Definition of drug resistant epilepsy: Consensus proposal by the ad hoc Task Force of the ILAE Commission on Therapeutic Strategies. Epilepsia. 2010;51:1069–1077. doi: 10.1111/j.1528-1167.2009.02397.x.
3. Coryell J., Gaillard W.D., Shellhaas R.A., Grinspan Z.M., Wirrell E.C., Knupp K.G., Wusthoff C.J., Keator C., Sullivan J.E., Loddenkemper T., et al. Neuroimaging of Early Life Epilepsy. Pediatrics. 2018;142:e20180672. doi: 10.1542/peds.2018-0672.
4. Wilke C., van Drongelen W., Kohrman M. Neocortical seizure foci localization by means of a directed transfer function method. Epilepsia. 2010;51:564. doi: 10.1111/j.1528-1167.2009.02329.x.
5. Adcock J.E., Wise R.G., Oxbury J.M., Oxbury S.M., Matthews P.M. Quantitative fMRI assessment of the differences in lateralization of language-related brain activation in patients with temporal lobe epilepsy. Neuroimage. 2003;18:423–438. doi: 10.1016/S1053-8119(02)00013-7.
6. Bjornson B.H. Watching the Brain at Work: Functional MRI for Children with Epilepsy. [(accessed on 28 May 2019)];.
7. Szaflarski J.P., Gloss D., Binder J.R., Gaillard W.D., Golby A.J., Holland S.K., Ojemann J., Spencer D.C., Swanson S.J., French J.A., et al. Practice guideline summary: Use of fMRI in the presurgical evaluation of patients with epilepsy: Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology. Neurology. 2017;88:395–402. doi: 10.1212/ WNL.0000000000003532.
8. Woermann F.G., Jokeit H., Luerding R., Freitag H., Schulz R., Guertler S., Okujava M., Wolf P., Tuxhorn I., Ebner A. Language lateralization by Wada test and fMRI in 100 patients with epilepsy. Neurology. 2003;61:699. doi: 10. 1212/ 01. WNL. 0000078815. 03224. 57.
9. Wellmer J., Weber B., Urbach H., Reul J., Fernandez G., Elger C.E. Cerebral lesions can impair fMRI-based language lateralization. Epilepsia. 2009;50:2213. doi: 10.1111/j.1528-1167.2009.02102.x.
10. Wagner K., Hader C., Metternich B., Buschmann F., Schwarzwald R., Schulze-Bonhage A. Who needs a Wada test? Present clinical indications for amobarbital procedures. J. Neurol. Neurosurg. Psychiatry. 2012;83:503–509. doi: 10.1136/jnnp-2011-300417.
11. Huster R.J., Debener S., Eichele T., Herrmann C.S. Methods for Simultaneous EEG-fMRI: An Introductory Review. J. Neurosci. 2012;32:6053–6060. doi: 10.1523/JNEUROSCI.0447-12.2012.
12. RanaAl-shami,Abdulhafeez M.Khair, Mahmoud Elseid, Khalid Ibrahim,Amna Al-hmad, Ahmed Elsetouhy, Hussein Kamel,Khalid AlYafei, Khalid Mohamed: Neuroimaging evaluation after the first afebrile seizure in children: A retrospective observational study.elsever.seizure 43 (2016)26-31
13. Todd W. Lyons, Kara B. Johnson, Kenneth A. Michelson, Lise E. Nigrovic, Tobias Loddenkemper, Sanjay P. Prabhu, Amir A. Kimia: Yield of Emergent Neuroimaging in Children with New-Onset Seizure and Status Epilepticus.the national centre for biotechnology information.seizure 2016 Feb;35:4-10
14. Ravinder Sahdev*, Akhilesh Rao, Shilpa Sinha: Neuroimaging in pediatric eizures. International Journal of Research in Medical Sciences.2017 Jan ;5(1):295-29
15. Hermann B, Seidenberg M, Bell B, Rutecki P, Sheth R, Ruggles K, Wendt G, O'Leary D, Magnotta V. The neurodevelopmental impact of childhood-onset temporal lobe epilepsy on brain structure and function. Epilepsia. 2002;43:1062–1071.