

Role Of Electroencephalogram And Neuroimaging In First Onset Afebrile And Atypical Febrile Seizure In Children At Tertiary Care Hospital- Retrospective Study

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Abstract

To study and to Identify & Classify children presented with first onset Unprovoked seizure, atypical febrile seizure and to correlate with EEG and Neuroimaging findings.

Subject and methods – Data collected from case records of patients admitted with unprovoked seizures between age group 6 months to 5 yrs between 2022-2023 were included in this study.

Results – In 100 children in the age group 6 months – 5 years admitted with first onset afebrile seizure and atypical febrile seizure were reviewed. Out of these children less than 2yrs are more commonly affected (52 %) and males are more commonly affected (64 %), family history of seizures is seen in 24 %, Children with history of consanguineous marriage are 13 %

In this study children with generalized seizure are 46 % abnormal EEG seen in 37 % and 24 % has abnormal Neuroimaging, both EEG and Neuroimaging are abnormal in 53 %.

In Partial seizures (22%), abnormal EEG and Neuroimaging is seen in 64% of children and 86% of children with abnormal EEG had abnormal neuroimaging.

Conclusion – There is strong significant correlation between EEG and Neuroimaging in both generalized and partial seizures hence all children with first unprovoked /afebrile seizure should always be evaluated with neuroimaging and EEG

Key words – Seizures, EEG, Afebrile seizure, MRI.

Introduction –

As per the statistics about 10 % of the population are at risk of having seizure in their lifetime. and it is one of the important causes of visit to emergency department.

The combination of Seizure history, EEG and Neuroimaging allows clinician to make accurate diagnosis and early management by appropriate antiepileptic drugs.

Although EEG is recommended as a part of Neurological evaluation of the child with apparent first unprovoked seizure, role of Neuroimaging is not well defined.

Neuroimaging is useful in knowing the etiology of Unprovoked seizure.

However, there is no standard recommendation or guidelines for Neuroimaging in children with unprovoked seizure.

This study aims to identify and classify the children who presented and admitted with first onset unprovoked seizure, atypical seizure and correlating them with EEG and MRI findings, emphasizing early detection to predict prognosis and prevent complications

Source of data-

All children aged from 6 month to 5 years presenting to the hospital with first onset afebrile and atypical febrile seizure in Govt General Hospital Kadapa

Materials and Methods –

All children aged from 6 months to 5 years presenting to the hospital with first onset afebrile and atypical febrile seizure are included in this study

Exclusion criteria –

1. Children with seizure suspected to indicate a central nervous system infection (Meningitis, Encephalitis)
2. Children with seizure due to Hypoglycemia, Hypomagnesemia
3. Children with at least one episode of afebrile seizure in the past
4. Seizure following Neurotrauma
5. Seizures in children with Cerebral palsy, Mental retardation and CSOM
6. Children with Simple febrile seizure

Methodology:

This cross-sectional study was conducted in Dept of Pediatrics GMC Kadapa, Andhra Pradesh a tertiary care hospital. Descriptive and inferential statistical analysis were conducted in present study. Chi-Square /Fisher exact test has been employed to determine significance of study parameters on categorical scale between two or more groups. Diagnostic statistics has been performed to determine correlation of seizure type with EEG and Neuroimaging.

Results –

Generalized seizures are more common in children under two years (30%).

partial seizures are more frequently observed in 2-5 years age group (12%)

Atypical febrile seizures more frequently observed in 2-5 years age group (19%)

Table -1: Age distribution with seizure type:

Type of seizure	6 months – 2 years	2-5 years
Partial	10 (10%)	12 (12%)
Generalized	30 (30%)	16 (16%)
Atypical febrile	11 (11%)	19 (19%)
Unclassified	1 (1%)	1 (1%)
Total	52 (52%)	48 (48%)

Among 100 children ,62% of children with seizures EEG is Normal and 38% EEG is abnormal

Table -2: EEG Findings:

EEG	No of Patients	Percentage
Normal	62	62 %
Abnormal	38	38 %
Total	100	100 %

45 % of abnormal EEG have generalized seizure type (17 children), 37 % of abnormal EEG have partial seizures (14 children), Partial seizures have more abnormal EEG (64% of partial seizures) , atypical febrile seizures have 16% of abnormal EEG and 20 % of atypical febrile seizures presented with abnormal EEG

The most frequent abnormal finding on EEG in children with abnormal EEG is sharp waves (24 % of abnormal EEGs)

Table- 3: EEG Distribution

Type of seizure	EEG	
	Normal	Abnormal
Partial	8	14 (37 %)
Generalized	29	17 (45 %)

Atypical	24	6 (16 %)
Unclassified	1	1 (2 %)
Total	62	38

Of 38 children with abnormal EEG only 23 (61% of abnormal EEG) children had both abnormal MRI and EEG, remaining 15 children had normal MRI (39% of abnormal EEG) 5 children with normal EEG had abnormal MRI (8 % of normal EEG children) and remaining 57 children had both normal EEG and MRI. there is significant correlation between abnormal EEG and abnormal MRI

Table – 4: MRI and EEG Correlation:

MRI Findings	EEG findings		Total	P value
	Normal	Abnormal		
Normal	57	15	72	< 0.0001
Abnormal	5	23	28	
Total	62	38	100	

Discussion –

Seizures are a frequent and critical medical emergency within the realm of pediatrics, often leading to significant hospitalization rates among children. These episodes are notably linked with considerable risks, both in terms of immediate life- threatening conditions and long-term health implications. The incidence of seizures is most prominent in children aged between 1 to 24 months, with the frequency diminishing as they grow older. Approximately 10% of the general population will experience a seizure at some point in their lives, whereas epilepsy, which is characterized by recurrent seizures, affects about 2% of the population¹.

Numerous studies have observed a slight predominance in the occurrence of seizures among males². For a child's first afebrile seizure, the Quality Standards Subcommittee of the American Academy of Neurology, together with the Child Neurology Society and the American Epilepsy Society, advises the routine use of an electroencephalogram (EEG) as part of the diagnostic process. The EEG is crucial for identifying specific types of epilepsy syndromes, which can significantly influence subsequent decisions regarding further imaging requirements. Additionally, EEG results are instrumental in forecasting the likelihood of future seizure episodes.³

In cases where children display postictal focal neurological deficits, such as Todd's paresis, which do not resolve quickly, or if they fail to return to their baseline neurological state within several hours post-seizure, immediate neuroimaging is essential. The National Institute for Health and Care Excellence (NICE) guidelines

recommend that everyone diagnosed with epilepsy undergo magnetic resonance imaging (MRI)⁴. This recommendation is based on MRI's capability to produce detailed images of the brain, aiding in the identification of any structural anomalies that might be responsible for seizure activity.

Moreover, the International League Against Epilepsy (ILAE) Subcommittee for Pediatric Neuroimaging has established guidelines for imaging in infants and children who were recently diagnosed with epilepsy. These guidelines ensure that the appropriate imaging techniques are utilized to detect potential anatomical or functional brain abnormalities.

The current study aims to evaluate the roles of EEG and neuroimaging in children experiencing their first afebrile or atypical febrile seizures. The goal is to identify any significant correlations among the findings from EEG and neuroimaging.

Understanding such correlations could improve diagnostic accuracy and inform treatment strategies, thereby enhancing the management and outcomes in pediatric patients with seizure disorders.

Sex –

In this study males are more frequently presented with seizures compared with females; male to female ratio is 64 % to 36 %. This trend of male predominance is consistent with several other studies.

Age –

In this study majority of children are presenting with seizures are less than 2 yrs accounting for 52 % of children, with highest prevalence in the 1- 2 yr age group at 38 %. Generalized seizure were most common in children under 2 yrs (30%), while partial seizures more frequently seen in 2-5 yrs age group (12%), Additionally atypical febrile seizure were predominantly observed in the 2-5 yrs age group (19%)

Family history – family history of seizures reported in 24 % of children. This percentage closely correlates with findings from other studies.

Seizure type – In this study regarding distribution of seizure type 46 % presented with generalized seizure, 22 % presented with partial seizure ,30 % with complex partial seizure and 2 % with unclassified seizure

EEG –

Out of 100 children in this study 38 % are having abnormal EEG findings. 45% of children with Generalized seizure exhibited EEG abnormalities 64% of children with partial seizures exhibited EEG abnormalities 20% of children with atypical febrile seizures exhibited EEG abnormalities

Neuroimaging – in the current study 72% children showed normal neuroimaging and 28% had abnormal neuroimaging. In this current study 24% of children presenting with generalized seizure had abnormal neuroimaging, 64 % children presenting with partial seizure had abnormal neuroimaging. 28 % of children with atypical febrile seizure showed abnormal neuroimaging.

In this study, children with generalized seizures there is compelling correlation between abnormal EEG and abnormal Neuroimaging. Specifically, children who exhibited abnormal EEG patterns were significantly more predisposed to show structural abnormalities on neuroimaging compared to those with normal EEG

This association strongly correlated by a highly significant p-value of less than 0.0004 highlighting the diagnostic synergy between EEG for assessing brain electrical activity and neuroimaging for identifying structural anomalies that may contribute to seizure etiology

Conclusion –

There is a strong correlation between EEG and Neuroimaging in both Generalized and partial seizure, hence children with first unprovoked /afebrile seizure should always be evaluated with Neuroimaging and EEG.

There is no significant correlation between EEG and Neuroimaging in atypical febrile seizure and with abnormal EEG need not always further evaluated with Neuroimaging

Children with Unclassified seizure, 50 % of Unclassified seizure had both abnormal EEG and Neuroimaging, hence children with unclassified seizure had both abnormal EEG and Neuroimaging, hence children with unclassified seizure should always be evaluated with EEG and Neuroimaging.

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