

Frequency of Abnormal EEG Findings in Children from 1 Month to 16 Years of Age Presenting with Epilepsy to Shifa International Hospital Islamabad

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ABSTRACT

Objective: The objective of this study was to determine frequency of abnormal EEG findings in children from 1 month to 16 years of age presenting with epilepsy to Shifa International Hospital Islamabad.

Study Design: It was a cross-sectional study.

Setting: Research was conducted at Department of Pediatric Medicine, Shifa International Hospital Islamabad

Duration: Duration of study was 6 months from 31st May 2018 to 30th November 2018.

Material and Methods: This study involved 217 children of both genders aged between 1 month to 16 years diagnosed of epilepsy who were evaluated by EEG which was labeled abnormal if the wave frequency was 7 MHz or less. A written informed consent was obtained from parents of each patient.

Results: The mean age of the children was 7.3±4.4 years. Majority (n=106, 48.8%) of the children were aged 5 years and under followed by 57 (26.3%) children aged between 6-10 years and 54 (24.9%) children aged between 11-16 years. There were 131 (60.4%) male and 86 (39.6%) female children in the study group with a male to female ratio of 1.5:1. Generalized seizures were most frequent type of seizures and were observed in 173 (79.7%) children followed by partial (10.6%), absence (7.4%) and unprovoked (2.3%) seizures. The duration of epilepsy ranged from 1 to 24 months with a mean of 10.8±6.5 months. Abnormal EEG was noted in 170 (78.3%) children with epilepsy. There was no statistically significant difference in the frequency of abnormal EEG across various subgroups based on child's age (p-value=0.989), gender (p-value=0.900) and duration (p-value=0.958) and type of epilepsy (p-value=0.992).

Conclusion: Abnormal EEG was observed in a substantial proportion of children with epilepsy which advocates preferred use of EEG in the diagnostic evaluation of such children owing to its non-invasive nature, low cost and widespread availability.

Keywords: Epilepsy, Seizures, Electroencephalography

INTRODUCTION

Epilepsy is a common neurological illness that requires long-term care. Temporary manifestation of signs and/or symptoms due to abnormally excessive or synchronized neuronal activity in the brain; this is what we call a seizure. At least one unprovoked epileptic seizure, plus either a second unprovoked seizure or sufficient EEG and clinical information to effectively indicate a persistent susceptibility to develop recurrences [1], is required for a clinical diagnosis of epilepsy.

The World Health Organization (WHO) lists epilepsy as one of the major conditions that has far-reaching effects on both the affected person and his or her family and community. People under the age of 30 have the highest prevalence [2, 6]. While there are guidelines for providing epilepsy care in developed countries, the situation is very different in developing countries like Pakistan, where there is only one neurologist for 1.4 million (14lac) people, compared to the United States, which has one neurologist for every 26,000 people [7]. Based on the findings of a different study, the ratio of neurologists to epilepsy patients in Pakistan is 1 to 46200 [8]. This means that there are 1.38 million people with epilepsy in Pakistan.

The average prevalence of epilepsy in Pakistan is roughly 0.9%, according to estimates [6].

The rate of prevalence is higher in rural areas than in urban areas, but the explanation for this variation is unclear. People under the age of 30 have a higher incidence of epilepsy than any other age group [7]. During the first decade of life, epilepsy affects about 1 in every 150 children [2]. Different from poor countries, industrialized nations have a unique history of seizure origins. Studies conducted in the West have found that hypoxia at birth, anoxic episodes, head trauma, and neoplasm (often slow growing gliomas) are the most common triggers for seizures [5].

In children, seizures are a leading cause of both death and disability. In order to effectively care for a patient experiencing seizures, it is crucial to arrive at a correct diagnosis of the condition. Because of the potential benefits of EEG in categorising seizures, suggesting an etiology, guiding clinical care, and

providing evidence of localisation, it is advised that all cases of idiopathic seizure be investigated with EEG [6]. 73% of patients with partial seizures and 76% of patients with generalised seizures had abnormal EEGs, according to a study conducted in India [7].

The investigation was motivated by the fact that epilepsy is one of the most often seen neurological conditions requiring long-term care. It has far-reaching consequences for the individual, the family, and the community. The diagnosis of a seizure's kind is aided by EEG, which can then be used to guide care for the affected patient. Due to a lack of local data and the fact that most EEG studies have been conducted on adults, this research aims to establish the regularity with which aberrant EEG findings are seen in children under 16 years old who present with seizures. Therefore, local information is required to identify the root cause of childhood epilepsy. Different forms of seizures require different therapeutic approaches, therefore identifying the underlying cause (based on abnormal EEG) is crucial in managing therapy.

MATERIALS AND METHODS

This cross-sectional study was conducted at Department of Pediatric Medicine, Shifa International Hospital Islamabad. Duration of study was 6 months from 31st May 2018 to 30th November 2018. This research included a total of 217 children, ranging in age from one month to sixteen years old, who were diagnosed with epilepsy. After obtaining informed written consent from the patients' parents, a thorough recording of the patients' demographic information was carried out. All newborn infants, patients admitted with additional diagnoses such as head trauma, electrolyte abnormalities, febrile fits, central nervous system cancer, and children with central nervous system infections were excluded from the study.

All of the patients underwent an evaluation for epilepsy, which included a comprehensive history as well as EEG data. The patients were then categorised based on the results of the evaluation. The information was entered into a predesigned Performa. The neurophysiology lab at SIH Islamabad was the source of the data acquired. The entirety of the gathered

information was fed into SPSS version 16.0 in order to be examined. The numerical variables age and duration of epilepsy have been reported as the mean along with the standard deviation. A frequency and percentage breakdown of categorical variables, such as gender, type of epilepsy, and abnormal EEG diagnostic, have been provided. In order to analyse the effects of different impact modifiers, the data have been stratified according to age, gender, duration of epilepsy, and type of epilepsy. After stratification, a chi-square test was performed, and a p value of less than 0.05 was considered significant.

RESULTS

The age of the children ranged from 6 months 16 years with a mean of 7.3±4.4 years. Majority (n=106, 48.8%) of the children were aged 5 years and under followed by 57 (26.3%) children aged between 6-10 years and 54 (24.9%) children aged between 11-16 years. There were 131 (60.4%) male and 86 (39.6%) female children in the study group with a male to female ratio of 1.5:1. Generalized seizures were most frequent type of seizures and were observed in 173 (79.7%) children followed by partial (10.6%), absence (7.4%) and unprovoked (2.3%) seizures. The duration of epilepsy ranged from 1 to 24 months with a mean of 10.8±6.5 months as shown in Table 1.

Abnormal EEG was noted in 170 (78.3%) children with epilepsy as shown in Table 2. There was no statistically significant difference in the frequency of abnormal EEG across various subgroups based on patients age (p-value=0.989), gender (p-value=0.900) and duration (p-value=0.958) and type of epilepsy (p-value=0.992) as shown in Table 3.

Table 1 Baseline Characteristics of Study Sample

Characteristics	Study Sample n=217
Age (years)	7.3±4.4
• ≤5 years	106 (48.8%)
• 6-10 years	57 (26.3%)
• 11-16 years	54 (24.9%)
Gender	
• Male	131 (60.4%)
• Female	86 (39.6%)
Type of Seizures	
• Generalized Seizures	173 (79.7%)
• Partial Seizures	23 (10.6%)
• Absence Seizures	16 (7.4%)
• Unprovoked Seizures	5 (2.3%)
Duration of Epilepsy (months)	10.8±6.5
• ≤1 year	130 (59.9%)
• 1-2 years	87 (40.1%)

Table 2: Frequency of Abnormal EEG in Children with Epilepsy

EEG	Frequency (n)	Percent (%)
Normal	47	21.7
Abnormal	170	78.3
Total	217	100

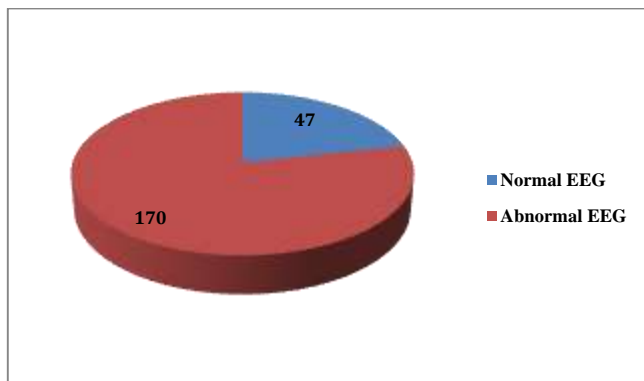


Figure 1: Frequency of normal EEG

Table 3: Stratification of Abnormal EEG across Various Subgroups

Subgroups	n	Abnormal EEG n (%)	P-value
Age			
• ≤5 years	106	83 (78.3%)	0.989
• 6-10 years	57	45 (78.9%)	
• 11-16 years	54	42 (77.8%)	
Gender			
• Male	131	103 (78.6%)	0.900
• Female	86	67 (77.9%)	
Type of Seizures			
• Generalized Seizures	173	135 (78.0%)	0.992
• Partial Seizures	23	18 (78.3%)	
• Absence Seizures	16	13 (81.3%)	
• Unprovoked Seizures	5	4 (80.0%)	
Duration of Epilepsy			
• ≤1 year	130	102 (78.5%)	0.958
• 1-2 years	87	68 (78.2%)	

Chi-square test, observed difference was statistically insignificant

DISCUSSION

Epilepsy is a neurological disorder that is characterised by repeated seizures that may come unexpectedly without any triggering causes. These seizures can happen to someone who has epilepsy at any point in their life. It is not a particular disease but rather a syndrome that can be brought on by a wide range of pathological insults affecting the cortex, such as tumours or hereditary channelopathies [1, 2]. Epilepsy is a common clinical presentation, accounting for 0.6% of hospital admissions³ in the United States in 2010. Epilepsy affects around 70 million people across the globe¹ at any given time. Even though seizures and epileptic syndromes are primarily diagnosed by meticulous history taking and physical examination, the electroencephalogram (EEG) continues to be an useful investigative tool [6]. The electroencephalogram (EEG) frequently offers corroborating evidence of seizure disorder and contributes to the categorization of seizure types and epilepsy. In addition, the results of the EEG are critical for identifying the location of the epileptic foci, and in some cases, they can even shed light on the patient's prognosis [6, 7]. The available information on the frequency of electroencephalographic anomalies among epileptic children varied throughout the current literature (Table 4). On the other hand, there was no such locally published material, which is what necessitated the present study.

The objective of this study was to determine frequency of abnormal EEG findings in children from 1 month to 16 years of age presenting with epilepsy to Shifa International Hospital Islamabad.

Table 4: Review of Existing Research Evidence on the Topic

Author	Year	Population	Abnormal EEG
Raffiei et al. ⁹	2004	Iran	39.1%
Joshi et al. ¹⁰	2005	Canada	39.4%
Deme et al. ¹¹	2016	India	44.7%
Marsan et al. ¹²	1970	British	56.0%
Owolabi et al. ¹³	2018	Nigeria	58.8%
Kanemura et al. ¹⁴	2012	Japan	66.7%
Baheti et al. ⁷	2003	India	73.0%
Doose et al. ¹⁵	1998	Germany	78.0%
Salinsky et al. ¹⁶	1987	America	84.0%
Bhuyan et al. ¹⁷	2017	India	88.9%
Present Study	2018	Pakistan	78.3%

In the present study, the mean age of the children was 7.3±4.4 years. Majority (48.8%) of the children were aged 5 years and under followed by 57 (26.3%) children aged between 6-10 years and 54 (24.9%) children aged between 11-16 years. Mehmood et al.¹⁸ (2014) reported similar mean age of 7.3±2.5 years in epileptic children presenting at POF Hospital, Wah Cantt. Shakirullah et al.⁶ (2018) reported comparable frequency of ≤5 (45.8%), 5-10 (27.1%) and 10-15 (27.1%) years age groups among such children at Lady Reading Hospital Peshawar. A

comparable mean age of 8.8±4.8 years has been reported by Pandey et al.¹⁹ (2014) among Indian such children.

We found that there were 131 boys (60.4% of the total) and 86 girls (39.6%) among the children who participated in the research, making the male to female ratio 1.5:1. Sahar et al.²⁰, who observed a male to female ratio of 1.6:1 at Fatima Jinnah Women University in Rawalpindi, reported finding a similar male predominance among these children. They found that there were more boys than girls. While Shakirullah et al.⁶ reported a similar male predominance at Lady Reading Hospital Peshawar with a male to female ratio of 1.7:1, Aziz et al.²¹ reported that the ratio at Jinnah Postgraduate Medical Centre in Karachi was 1.3:1. Pandey et al.¹⁹ reported a male predominance in India with a male to female ratio of 1.3:1, whereas Owolabi et al.¹³ reported it to be 1.5:1 in Nigerian children with the same condition. Both studies found a comparable male predominance.

In the present study, generalized seizures were most frequent type of seizures and were observed in 173 (79.7%) children followed by partial (10.6%), absence (7.4%) and unprovoked (2.3%) seizures. Our observation is in line with that of Shakirullah et al.⁶ (2018) who also reported similar distribution of generalized (79.6%), partial (9.8%), absence (7.2%) and unprovoked (3.4%) seizures in children presenting at Lady Reading Hospital Peshawar. Similar frequency of generalized (68.0%), partial (20.0%), absence (8.0%) and unprovoked (4.0%) seizures has been reported by Malik et al.²² (2011) at Sardar Family Hospital, Kangniwala in Gujranwala District. Aziz et al.²¹ also reported similar distribution of generalized (77.0%), partial (11.0%), absence (7.0%) and unprovoked (5.0%) seizures at Jinnah Postgraduate Medical Centre, Karachi. Our results are also comparable to those of Eyong et al.²³ (2017) who reported similar frequency of generalized (61.1%), partial (24.1%), absence (3.7%) and unprovoked (11.1%) seizures in India.

In the present study, abnormal EEG was noted in 170 (78.3%) children with epilepsy. Our results are comparable to those of Baheti et al.⁷ (2003) who reported comparable frequency of 73.0% in India. Doose et al.¹⁵ (1998) reported similar frequency of EEG abnormalities (78.0%) in German children with epilepsy while Salinsky et al.¹⁶ (1987) observed this frequency to be 84.0% in America (Table 4).

The present study is first of its kind in local population and adds to the available research evidence on the topic. It was found that a substantial proportion of children with epilepsy have EEG abnormalities which advocates preferred use of EEG in the diagnostic evaluation of such children owing to its non-invasive nature, low cost and widespread availability. A very strong limitation to the present study was that we didn't correlate the various patterns of EEG abnormalities with the underlying type of epilepsy which could have further helped in the diagnostic workup and management planning of such children. Such a study is highly recommended in future research.

CONCLUSION

Abnormal EEG was observed in a substantial proportion of children with epilepsy which advocates preferred use of EEG in the diagnostic evaluation of such children owing to its non-invasive nature, low cost and widespread availability.

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