Study of incidence of varied etiology of first episode Pediatric Seizures and its correlation with EEG and Neuroimaging

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ABSTRACT

Objective: To determine correlation between clinical features, EEG findings and neuroimaging (Magnetic Resonance Imaging) abnormalities in children with first seizure episode.

Materials and Methods: It is prospective study carried out from January 2017 to January2018. 74 children aged between six month to fifteen years with first seizure episode admitted in Pediatric Department of Prathima Institute of Medical Sciences were enrolled and detailed history and investigations including MRI,CT and EEG were done .Children with Neonatal seizures,Previous episodes of seizures, stroke in young, poisonings,malingering,pseudo seizures were excluded from the study.

Results: We investigated 6 months to 15-year-old children with first episode of seizure. Seventy four children were enrolled for investigation. There were 32 (43.3%) girls and 42 (56.7%) boys. 54 (66%) children had abnormal electroencephalography (EEG) and 35 of them had generalized epileptiform discharges and 19 had focal epileptiform discharges . Abnormal MRI was seen in 48 (64.8%) patients and consisted ring enhancing lesion (Neurocysticercosis and Tuberculomas),bilateral thalamic hypodensities,atrophy& gliosis, periventricular leucomalacia. Abnormal MRI findings had significant relation with abnormal EEG, age, positive family history for epilepsy, nutritional status,socio economic group,electrolyte abnormalities .

Statistically significant correlation found between MRI and EEG findings. Statistically significant correlation found between seizures and abnormal birth history, delayed development milestones, fever at the time of presentation, hypoglycemia, low socioeconomic status.

Conclusion: In children with abnormal EEG, neuroimaging should be considered. We suggest to use EEG for confirmation of epilepsy and perform MRI for patient with abnormal physical exams, focal neurologic deficits or focal EEG abnormalities.

Keywords: Epilepsy,EEG,milestones

INTRODUCTION

Determining the type of seizure is essential for focusing on diagnostic approach, selecting the appropriate therapy, and providing potentially vital information regarding prognosis.[1]

A seizure is a transient occurrence of signs and/or symptoms resulting from abnormal excessive or synchronous neuronal activity in the brain.The International League against Epilepsy (ILAE)Commission on Classification and Terminology, has provided an updated approach to classification of seizures. This system is based on the clinical features of seizures and associated electroencephalographic findings. A fundamental principle is that seizures may be either focal orgeneralized.

Focal seizures originate within networks limited to one cerebral hemisphere .Focal seizures are usually associated with structural abnormalities of the brain. Focal are divided into simple and complex.Generalized seizures arise within and rapidly engage networks distributed across both cerebral hemispheres. Generalized seizures may result from cellular, biochemical, or structural abnormalities. Febrile seizures are a separate category. Acute symptomatic seizures occur secondary to an acute problem affecting brain excitability such as electrolyte imbalance. Most children with these types of seizures do well. However, sometimes these seizures signify major structural, inflammatory, or metabolic disorders of the brain, such as meningitis, encephalitis, acute stroke, or brain tumor. Consequently, the prognosis depends on the underlying disorder, including its reversibility or treatability and the likelihood of developing epilepsy from it.

An unprovoked seizure is one that is not an acute symptomatic seizure. Epilepsy is a disorder of the brain characterized by an enduring predisposition to generate seizures and by the neurobiologic, cognitive,psychologic, and social consequences of this condition. Epilepsy is considered

to be present when 2 or more unprovoked seizures occur in a time frame of longer than 24 hours. Approximately 4-10% of children experience at least 1seizure (febrile or afebrile) in the 1st 16 yrs of life. The cumulative lifetime incidence of epilepsy is 3%, and more than half of the cases start in childhood.Seizure disorder is a general term that is usually used to include any 1 of several disorders, including epilepsy, febrile seizures, and possibly single seizures and symptomatic seizures secondary to metabolic, infectious, or other etiologies (e.g., hypocalcemia, meningitis).

5EEG is useful in classifying, supporting, confirming diagnosis of epilepsy and epilepsy syndrome. It distinguishes between seizure and non seizure states eg: fainting spells, hypoxic episode and breath holding spells.EEG is especially useful for diagnosing of absence attacks, myoclonic epilepsies ,non convulsive states, epilepsy syndromes ,SSPE and herpes encephalitis.

The role of neuroimaging in children presenting with new-onset febrile, afebrile seizures/unprovoked seizure is not well defined. Insufficient evidence is available to make a standard recommendation or guideline for the use of routine neuroimaging in children with first episode seizure.Neuroimaging specially computed tomography (CT) scan also has a critical role in the evaluation of patients with seizure for overruling the life-threatening causes.

MRI is the one of best neuroimaging study for the assessment of a child with seizures. MRI is more sensitive than CT scan for identifying brain abnormalityand dysplastic lesions especially in the hippocampus, acommon site of seizure onset . The Considerable MRI abnormalities in children with epilepsy were present in 16-21% and the most frequent structural abnormality are congenital impairments, neurocutaneous syndromes, malignancy, and evidence of encephalopathy due to trauma, infection or asphyxia insult .Recent advancements in neuroimaging including structural imaging (CT and conventional MRI) and functional imaging (PET, SPECT, functional MRI) could be useful to characterize brain abnormality in epileptic children. In this study we surveyed MRI findings in epileptic children and its relation with clinical and demographic findings in order to find better diagnostic and treatment modalities for these children in the future.

MATERIALS AND METHODS

The patients attending Pediatric department of Prathima Institute of Medical Sciences from January 2017 to January 2018 , were enrolled for the study as per the criteria mentioned. It was a prospective study conducted on children in age group of 6 month to 15 years having first seizure episode.

Inclusion criteria: All patients 6 month-15 years age group presenting in pediatric ward with the first episode of seizure.

Exclusion criteria: Neonatal seizures, previous episodes of seizures, stroke in young, poisionings, malingering, pseudoseizures.

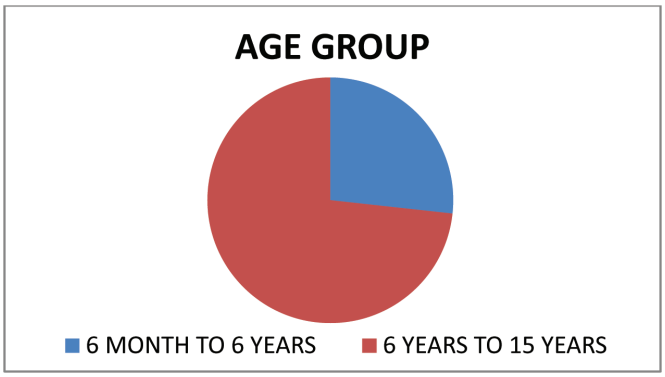
Detailed history was taken which included febrile or afebrile at the time of presentation of seizure,involuntary movements, socio-economic status, birth history, developmental milestones. Complete blood counts, blood sugar, serum electrolytes,fundoscopy and csf fluid analysis were done to identify seizure type . An EEG was performed in all the subjects in the study, using 18-channel EEG machine (Model EE 18) from Recorder and Medicare System. A total of 22 electrodes were placed using children montage. The EEG was analyzed by a clinical neurologist from the Department of Neurology. MRI was performed with 1.5 Tesla.Neuroimaging reports were categorized as normal and abnormal. Data was recorded as percentages. The proportional differences were measured by Chi-square analysis and Fisher's exact test.

RESULTS

Total of 74 children diagnosed with first seizure episode were enrolled.We attempted to determine the correlation of various clinical characteristics namely gender, age of onset, seizure type, abnormal movements, signs of raised intracranial pressure, head circumference, neuro cutaneous markers, frequency of convulsions, focal neurological deficits, neurological examination, etiology of seizure, family history of epilepsy, birth history, developmental history, nutritional history, socioeconomic status, fundoscopy findings, csf analysis results, trauma history outcome with EEG findings and neuroimaging (MRI) findings.

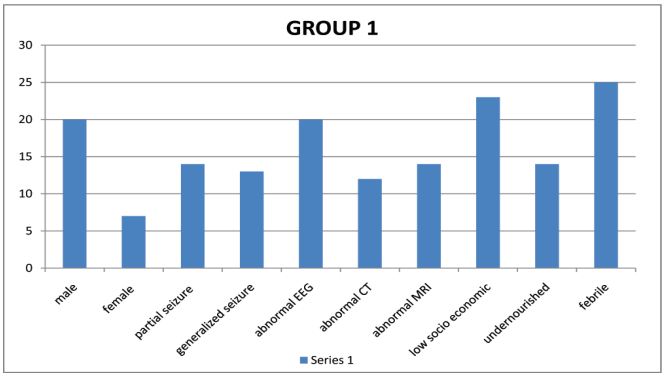
The study population ranged from six month to fifteen years. Patients were divided into two groups on the basis of age. Group one was constituted by children aged 6 month to 6 years and included 27/74(36.4%) patients. Group two was constituted by children >6 years to 14 years old and included 47/74 (63.6%) patients.[Figure 1]

Figure 1: Showing age distribution



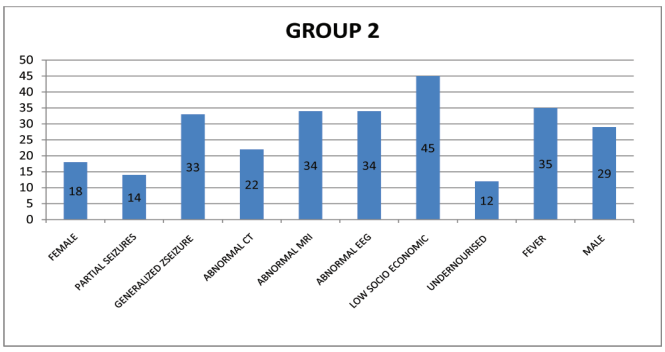
In Group one out of 27 members 20 are males and 7 are females.14 children presented with partial febrile seizure, 13 children presented with generalized seizure . Abnormal EEG was seen in 20 children .Abnormal CT was seen in 12 children .Abnormal MRI was seen in 14 children . 23 children belongs to low socio economic status and 14 were undernourished . 25 were febrile at the time of onset of fever. Febrile seizure is the most common type of seizure in this age group.[Figure 2]

Figure 2: Showing various parameters in group 1



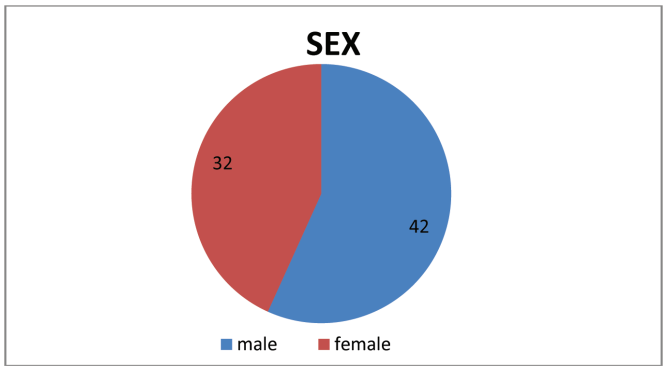
In Group two out of 47(63.6) members 29 are males and 18 are females. 14 presented with partial seizure, 33 were presented with generalized seizure was .Abnormal EEG was seen in 34 .Abnormal CT was seen in 22 .Abnormal MRI was seen in 34 .45 belongs to low socio economic status and 12 were undernourished.35 children were febrile.[Figure 3]

Figure 3: Showing various parameters in group 2



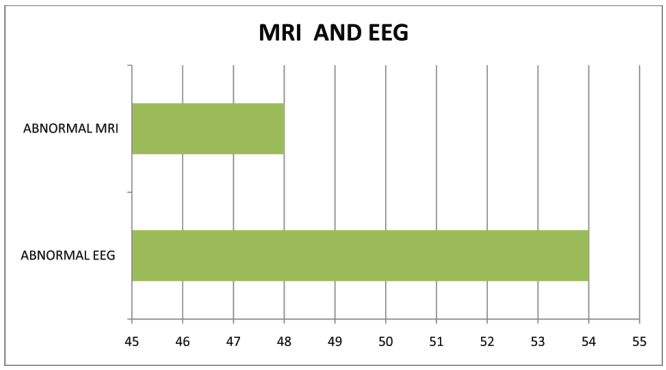
There are 32(43.2%) girls and 42 (56.7%) boys, aged 1 to 15-year-old. Male to female ratio was 1.3:1.There is male predominance with meaningful statistical difference. [Figure 4]

Figure 4: Showing sex distribution



28 (37.8%) patients presented with focal seizures and 46 (62.2%) with generalized seizures. 54 patients(66%) of the children had abnormal EEG. Of the 54 abnormal EEGs , 35 had generalized epileptiform discharges and 19 had focal epileptiform discharges. 20 patients (27%) had normal EEG. Abnormal MRI ispresentin 48 patients(64.8%). Most common MRI abnormality observed was ring enhancing lesion (19%). Of these, 12% children had Neurocysticercosis and 7% children with Tuberculomas. Other MRI abnormalities found were atrophy & gliosis, pachygyria, polymicrogyria, periventricular leucomalacia, encephalomalacia, choroidal cyst. A correlation was done between abnormal EEG and abnormal MRI.Abnormal EEG was seen in 54/74 children and abnormal MRI was seen in 48/74. [Figure 5]

Figure 5: Showing abnormal investigations



Abnormal CT was present in 36 patients. 60(81%) patients were febrile at the time of seizure and 14 (19%)were afebrile at the time of onset with significant p value. 29% children had abnormal findings on neurologic examination (8% of girls versus 19% of boys with significant statistical difference) and eleven (%) patients had delayed developmental mile stones (1.2% of girls against 8.7% of boys with meaningful statistical difference). 68 children (91.8%) belongs to low socio economic group with statistical significance . 26 (34%) patients were

under nourished, 9% of female children were affected versus 23% of male children with significant difference (P=0.01). Electrolyte abnormalities were present in 20 patients (27%), which is significant. Hypoglycemia in 14 patients(18.9%) with significant importance. 13(17.5%) patients had abnormal fundoscopy findings with significant relation to raised ict signs were present in 13 patients(17.5%).

Meningeal irritation signs were present in 10 patients(13.5%).5patients (6%) had positive family history of epilepsy, of them 40% of girls and 60% of boys had positive family history of epilepsy and inequality was non-significant (P=0.06) .Insignificant associations include 4(5.4%) patients with abnormal movements, 3(4%) with abnormal csffulid abnormality , asom/csomm in 2 patients(2.7%).

DISCUSSION

The purpose of this study is to establish whether the reported episode was a seizure, to determine the cause of seizure by identifying the risk factors and correlate them with radiological (CT and MRI) and electroencephalography (EEG) abnormalites.[1,2]

In this study total of 74 children diagnosed with first seizure episode were enrolled. Patients were divided into two groups on the basis of age. Group one was constituted by children aged 6 month to 6 years and included 27/74patients. Group two was constituted by children >6 years to 14 years old and included 47/74 patients.Group 1 are more prone for febrile seizures.[3]

Out of 74 patients,focal seizures were seen in 28 patients and generalized seizures in 46 patients.

The EEG is necessary to determine the epilepsy syndrome and the diagnosis of an epilepsy syndrome may be helpful in determining the need for imaging studies. The EEG is also useful in predicting the prognosis . In this study EEG abnormality was found in 54 patients,of them 35 had generalized epileptiform discharges and 19 had focal epileptiform discharges. Most common EEG finding was sharp spikes and waves.[4,5]

Neuroimaging is a useful tool to determine the etiology of seizure.Abnormal MRI is present in 48 patients(64.8%). Most common MRI abnormality observed was ring enhancing lesion (19%). Of these, 12% children had Neurocysticercosis and 7% children with Tuberculomas.Other MRI abnormalities found were atrophy & gliosis, pachygyria, polymicrogyria, periventricular leucomalacia, encephalomalacia, choroidal cyst.

We attempted to determine the correlation of various clinical characteristics namely gender, age of onset, seizure type, abnormal movements, signs of raised intracranial pressure, head circumference, neuro cutaneous markers, frequency of convulsions, focal neurological deficits, neurological examination, etiology of seizure, family history of epilepsy, birth history, developmental history, nutritional history, socioeconomic status, fundoscopy findings, csf analysis results, trauma history outcome with EEG findings and neuroimaging (MRI) findings.

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Meningeal irritation signs were present in 10 patients(13.5%).5 patients (6%) had positive family history of epilepsy, of them 40% of girls and 60% of boys had positive family history of epilepsy and inequality was non-significant (P=0.06). Insignificant associations include 4(5.4%) patients with abnormal movements, 3(4%) with abnormal csf fulid abnormality , asom/csomm in 2 patients(2.7%).

In this study both EEG and MRI were abnormal 37 in patients .But 17 patients who had abnormal EEG did not show any abnormality on MRI .One patient had abnormal MRI with normal EEG. So the accuracy of MRI showing abnormality,when EEG is abnormal is very significant.[9,10]

CONCLUSION

In children with abnormal EEG ,neuroimaging should be considered. We suggest to use EEG for confirmation of epilepsy and perform MRI for patient with abnormal physical exams, focal neurologic deficits or focal EEG abnormalities. MRI as an effective neuroimaging is recommended for epileptic children who have evidence of positive family history for epilepsy, dysmorphic appearance, abnormal physical neural examinations and higher age. Results of our study should be verified with another large patient population.

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