

Clinical and Electroencephalography Profile in “Febrile Seizures in Children Aged between 6 To 12 Years”

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ABSTRACT

Introduction: Febrile seizures are the commonest epileptic disorder in children aged till 5 years. In some children febrile seizure tend to occur after the age of 6 years, although well reported phenomenon the Clinical and EEG features is less clear. Study aimed to analyse the Clinical and EEG profile in febrile seizures in Children aged between 6 to 12 years.

Material and methods: All patients - Typical and Atypical Febrile seizures in the age group 6-12 years attending the tertiary referral centre in eastern Tamilnadu were included. Patients with structural lesions, CNS infections and those with previous afebrile seizures were excluded. 30 Subjects fulfilling the criteria were included in the study. A careful neurological examination with appropriate laboratory tests, imaging and EEG was performed.

Results: Out of 30 children 22 were in the 6-9 age group and rest in 10-12 age group. 12 girls and 18 boys comprised the study group. 22 subjects (73.3%) presented with GTCS, 3 with focal seizures and 5 with febrile status. Family history of febrile seizure was present in 40% and family history of epilepsy in 26.6%. 4 children (13.3%) had behavioural problem and 33% had learning difficulty. EEG was abnormal in 60% of study population. Hyponatremia was found in 36.7% of the subjects. Imaging abnormality was noted in 3 subjects.

Conclusion: Abnormal EEG had significant positive association with learning difficulty ($p < 0.05$). Hyponatremia had significant association with occurrence of febrile status.

Keywords: Late Onset Febrile Seizures, Learning Difficulty, Hyponatremia.

INTRODUCTION

Most common cause of convulsions in young children is febrile seizures. In children younger than 5 years the estimated prevalence of Febrile Seizures is 2-4 percent to as high as 15% in some populations. Febrile Seizures are Age-dependent phenomenon, likely related to a vulnerability of the developing nervous system to the effects of fever in combination with an underlying genetic susceptibility. Febrile seizures (FS) in children 6 months to 5 years of age have been well studied and researched. The recurrence rate is 30-40% and the risk of subsequent epilepsy is low and they have excellent neurological outcome

The generally accepted criteria for febrile seizures include¹:

1. A convulsion associated with an elevated temperature greater than 38° C
2. A child younger than six years of age
3. No central nervous system infection or inflammation
4. No acute systemic metabolic abnormality that may

produce convulsions

5. No history of previous afebrile seizures

Febrile Status Epilepticus was defined as a single seizure or a series of seizures without full recovery in between lasting more than 30 minutes that also met the definition of a febrile seizure.²

The most accepted pathology is pro-convulsant effects of fever-induced factors (e.g., interleukin-1beta) in individuals who are susceptible based upon the stage of brain development and genetic susceptibility. Some temperature sensitive ion channels in the brain may trigger fever-associated synchronized neuronal activity. Hyperthermia-induced hyperventilation and alkalosis is also thought to play a role.³

In some children, FS occur after 5 years of age, and although it is a well-reported phenomenon, it's less researched and the prognosis for such children is less clear. At times 'Late-onset febrile seizures' not only leave the diagnosis of febrile seizures in doubt, they also cause much parental anxiety. The aim of this retrospective study was to characterize the clinical and electroencephalographic features and the neurologic outcome in 30 children who had FS after 6 years of age.⁴ Study aimed to analyse the Clinical and EEG profile in febrile seizures in Children aged between 6 to 12 years.

MATERIAL AND METHODS

A cross-sectional study was carried out in a group of children who suffered from febrile convulsions after 6 years of age. All of these children were admitted in the two hospitals involved in the study in a tertiary referral centre in eastern Tamil nadu (Paediatric Department and the Division of Neurology). The study period was December 2017 to May 2018 (6 Months). All patients – Simple and complex Febrile seizures in the age group 6-12 years were included in the study. Patients with structural lesions, CNS infections, known severe neurological disability, patient refusal and

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those with previous afebrile seizures were excluded. The Institutional Ethical Board approved for the procedures. 30 Subjects fulfilling the criteria were included in the study after obtaining written informed consent from their parents. CNS Infections was considered and appropriately ruled out on clinical grounds and with a lumbar Puncture in some cases. 8 patients underwent LP (5 with febrile status and 3 with Focal Seizures) Complex seizures were defined as either focal or multiple seizures, seizures longer than 15 minutes, or a combination of these; simple seizures were defined as generalized seizures or seizures shorter than 15 minutes. The EEG were performed the EEG lab according to the standards laid by American Clinical Neurophysiological Society for the recording of paediatric EEG's and lasted at least 30 minutes. All the recordings were performed within 72 hours of the seizure event. 10-20 system was followed for application of EEG electrodes and was recorded with digital EEG machines. The studies were performed with subjects awake and asleep without using any sedatives. Recordings were interpreted using a time constant of 0.3 and a high-frequency filter of 70 Hz. A notch filter (50 Hz) was used only if line artefact was present. The number of seconds per page and sensitivity were attuned to improve the visual display. To maintain blinding each EEG was given an ID and was subsequently interpreted by two Neurologists who were blinded to the seizure semiology, imaging and other lab findings. They were only provided with the age of the patient as it was important in interpreting the results. A consensus was reached if there was any discrepancy in the two reports. Data analysis was carried out using Epi-info Software.

RESULTS

Out of 30 children 22 were in the 6 to 9 years age group. 12 girls and 18 boys comprised the study group. Generalised Tonic Clonic Seizure was the most common type (73.3%) of seizure followed by Febrile status (16.6%) and focal seizures (10%). Family history of Febrile seizure was noted in 40% and family history of Epilepsy was present in 26.6%. Of the 30 patients 22 patients (73.3%) had some form of atopic disease. Most common was Allergic Rhinitis (72.2%) followed by Asthma (22.7%) and Atopic dermatitis (4%). 11 children (36.6%) had previous history of Febrile Seizure before 6 years and mean age of onset of Febrile seizure in them was 9 months. Among the others who never had febrile seizures before 6 years the mean age of onset was 6.5 years. 50% of the children had more than 5 episodes at the time of inclusion in the study. The most common preceding illness to Fever was URI (43%) followed by otitis. Learning Difficulty was noted in 10 patients (33.3%), 3 had ADHD, 7 had Low average IQ). 4 patients (13.3%) had MRI Brain abnormalities -2 had T2 signal abnormality in hippocampus and 2 had asymmetrical hippocampal volume. EEG was found to be abnormal in 60% (18/30 patients) of the study group. Results are summarised in Table 1.

Among the abnormal EEG's Non Epileptiform activities was seen in 72.2% (13/18) and Epileptiform activities in 27.7% (5/18). Among the Non Epileptiform abnormalities most

Non Epileptic (n=13)	Slowing	Focal (n=7)
		Diffuse (n=3)
	Focal Attenuation (n=3)	
Epileptic (n=5)	Focal Sharps/spike (n=2)	
	Generalised Spike and wave (n=3)	

Table-1: EEG characteristics

Characteristics	N
Age group	
6-9 years	22
10-12 years	8
Gender Distribution	
Girls	12
Boys	18
Type of Seizures	
GTCS	22
Focal	3
Status	5
Family History Of Epilepsy/Seizure	
Absent	17
Present	13
Preceding Infection	
URI	13
Otitis	6
AGE	5
Pneumonia	3
Others	3
Atopic Diseases	
Absent	13
Present	17
Asthma	5
Allergic Rhinitis	16
Dermatitis	1
Learning Difficulty	
ADHD	3
Low IQ	7

Table-2: Demographic and Clinical Characteristics of the Study Population

frequent was Slowing noted in 76.9% of which Focal slowing accounted for (70%) and Diffuse (30%). Focal Attenuation was noted in (38.4%) of the Non Epileptiform discharges of which 40% had focal slowing along with attenuation. Epileptiform Discharges was present in (27.7%) of all EEG abnormalities. Focal sharp waves or spikes were seen in only 2 tracings (These were temporal) and generalized spike and wave discharge was found in 3 patients. Out Of 5 children with Febrile status 4 had hyponatremia at the time of admission (Serum Sodium < 135 mEq/L). A summary of the results is given in Table 2.

DISCUSSION

Febrile seizures are typically related to an age group less than 5-6 years of age, due to the characteristics of the developing brain. Most children out grow this by 6 years of age after which the incidence is very low. But there are a group of children who continue to develop febrile seizures beyond 6 years of age. Generalized epilepsy with febrile seizures plus (GEFS plus), a term first used by Scheffer and Berkovic and later expanded by Singh et al described a novel genetic

epilepsy syndrome with heterogeneous presentations.⁵ ILAE has recognised Febrile Seizure Plus as a part of GEFS+. Unlike classical FS it starts earlier (before 6 months with a mean of 1 year), often multiple and continue beyond age of 5 years with remittance achieved by around 11 years. In some children with FS+ all seizures after 5 yrs. are febrile, while in some others they are all afebrile.⁶

In our study there was a slight male predominance 1.5:1, the world wide estimated prevalence is around 1.6:1. The slight male predominance may be due to the imbalance in sex ratio and may be an excess parental concern to the male child. Majority of the seizures was noted in the 6-9 age group (73.3%), which supports the fact that FS+ tends to remit by around 11 years of age.^{6,7} In a study by Seinfeld et al among first-degree relatives of children with febrile seizures, 10 to 20 percent of parents and siblings also have had or will have febrile seizures.⁸ In our study it was around 60% which may be due to prevalent consanguineous marriage in the study population. Increased association between febrile convulsion and allergic rhinitis in children was described in a nationwide population-based retrospective study by Lin WY et.al.⁹ A similar result was observed in our study also, allergic rhinitis was found to have significant association with Febrile seizure ($P < 0.05$). This may be due to the fact that both diseases have similar cytokine profile and specific viral infection association. EEG findings after the febrile seizures were surprising in various aspects. A remarkable 72% had some form of EEG abnormality. EEG abnormalities were more common in children with Complex febrile seizure, but was not statistically significant. Most common EEG abnormality found was Non epileptiform abnormalities – slowing and attenuation. This makes sense because febrile seizures are not epilepsies instead they are considered to reflect an acute injury to neurons which may predispose to future epilepsy. This fact was further supported by the fact that 4 patients who had MRI changes had same lateralization in EEG. Interestingly most of the EEG abnormalities were right sided. In animal models of hyperthermic seizures it is seen that hippocampus abnormalities although asymmetrical was found more in Right side. In children with Late onset or persisting Febrile seizures -Abnormal EEG had significant positive association with learning difficulty ($P < 0.05$). This again underscores the fact there is some amount of neuronal injury is occurring in these children. Another interesting observation was the association of the hyponatremia ($P < 0.019$) with febrile status. Measurement of the serum sodium is a valuable investigation in the child with a febrile convulsion.¹⁰ The lower the serum sodium level, the higher the probability of a repeat convulsion /Febrile Status. For this reason, aggressive hydration with hypotonic fluids should generally be avoided in children with febrile seizures.

CONCLUSION

Acute EEG can not only predict the acute changes, but also throws some light on the long-term outcomes. EEG a readily available bedside tool, non-invasive and cheap investigation can predict children who may be at future risk for epilepsy.

A trial of antiepileptic's can be tried in them. Future serial monitoring of EEG along with MRI and clinical follow up may serve to identify the at risk patients.

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