Original Research Article

A comparative study between EEG Done Early and Late in Complex Febrile Seizures in Paediatric Age Group at a Tertiary Health Care Centre

P. Srinivas[1], Varsha Kolachena[2], Sravanthi Veldanadi[3], P. K. Rajeev[4*]

[1]Professor, Department of Pediatrics, Government General Hospital, Government Medical College, Nizamabad, Telangana, India

[2]Post Graduate, Department of Pediatrics, Osmania Medical College Niloufer Hospital, Lakdikapul, Hyderabad, India

[3]Assistant Professor, Department of Pediatrics, Osmania Medical College, Koti, Hyderabad, Andhra Pradesh, India

[4]Associate Professor, Department of Pediatrics, Osmania Medical College, Koti, Hyderabad, Andhra Pradesh, India

Received: 05-09-2021 / Revised: 16-10-2021 / Accepted: 10-11-2021

Abstract

Introduction: Paediatric febrile seizures represent the most common childhood seizure disorders. Febrile seizures are defined by the International League Against Epilepsy as "a seizure occurring in childhood after 1 month of age, associated with febrile illness not caused by an infection of the central nervous system, without previous neonatal seizures or a previous unprovoked seizure, and not meeting criteria for other acute symptomatic seizures. **Materials and Methods:** This is a Prospective Comparative study. The study was conducted on 70 children admitted in the Department of Pediatrics at a Tertiary Care Teaching hospital for Complex febrile seizures, aged 3months to 5 years of age, who were diagnosed, evaluated with EEG, and treated for the complex febrile seizure; with a follow up after 2 weeks of the seizure episode, with a repeat EEG in the child. **Results:** Total no. of children enrolled in this study are 70. In these children; the comparison between early and late findings of EEGs were analysed and no statistically significant difference (p= 1.00) was found between the two Electroencephalograms performed early or late in the children with complex febrile seizures enrolled in our study. **Conclusion:** Our study concludes that there is no difference between an EEG performed early or an EEG performed late in children with complex febrile seizures, reflecting probable unnecessity in timing of the EEG in children with complex febrile seizures.

Keywords: EEG, Complex Febrile Seizures, Pediatric Age Group.

Introduction

Paediatric febrile seizures represent the most common childhood seizure disorders.

Febrile seizures are classified as Simple and Complex. A simple febrile seizure is a primary generalized, usually tonic-clonic attack associated with fever, lasting for a maximum of 15 minutes, and not recurrent within a 24-hour period. A complex febrile seizure is more prolonged (>15 minutes), is focal, and /or recurs within 24 hours. Majority of the febrile seizures are simple (70-75%), 9-35% of febrile seizures are complex[2].

There are no specific guidelines or recommendations on the timing or usefulness of an EEG in complex febrile seizure. According to the Cochrane review, there are no Randomized Control Trials to support or refute the use of EEG in complex febrile seizures[3].

*Correspondence

Dr. P. K. Rajeev

Associate Professor, Department of Pediatrics, Osmania Medical College, Koti, Hyderabad, Andhra Pradesh, India

E-mail: rajeevpk9@gmail.com

This prospective comparative study conducted in a Tertiary Care Institute, Hyderabad will analyse usefulness and compare early EEG findings (<2 weeks) and late EEG findings(>2weeks) in children aged 3 months to 5 years presenting to the Paediatric Department with complex febrile seizures.

Materials and Methods

This prospective comparative study was conducted on 70 children admitted in the Department of Pediatrics at a Tertiary care Teaching hospital for Complex febrile seizures, aged 3months to 5 years of age, who were diagnosed, evaluated with EEG, and treated for the complex febrile seizure; with a follow up after 2 weeks of the seizure episode, with a repeat EEG in the child.

Inclusion Criteria

1. Children aged between 3 months and 5 years of age with first episode of complex febrile seizure.
2. Children aged between 3 months and 5 years of age with recurrent complex febrile seizures.

Exclusion criteria

1. Children aged less than 3 months or more than five years with a febrile seizure.
2. Children with previous abnormal EEG showing epilepsy.
3. Children presenting as a simple febrile seizure.
4. Children presenting as unprovoked seizures.
5. Children presenting with seizures due to metabolic abnormality or space occupying lesions.
6. Children with a past history of neonatal seizures.

7. Children presenting with seizures due to any other cause (other than complex febrile seizure).

Statistical Analysis

The EEG performed in a child with complex febrile seizure in less than 2 weeks was compared with EEG in the child after 2 weeks using a standardised test for comparing non-parametric parameters, that is, the McNemar and the Sign test. The test was conducted using the IBM SPSS Statistics software. The result has been interpreted in the form of p value. With a p value of less than 0.05 being considered significant and p value greater than 0.05 being considered insignificant. Data was collected in a structured proforma and entered and managed on Microsoft excel sheet (Master chart). Data was also entered in to the IBM SPSS software for statistical analysis.

Results

Total no. of children enrolled in this study are 70. In these children; age wise distribution, sex wise distribution, biochemical parameters, variation in semiology of seizure, differences in the usage of antiepileptic, and the comparison between early and late findings of EEGs were analysed in the cases presenting with complex febrile seizures.

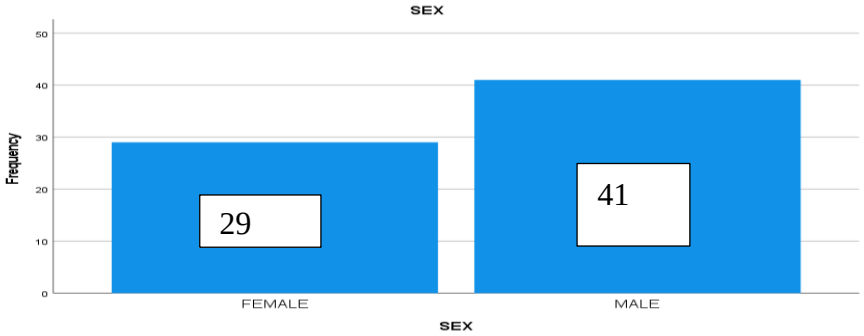


Fig 1: Showing gender distribution among children with complex febrile seizures

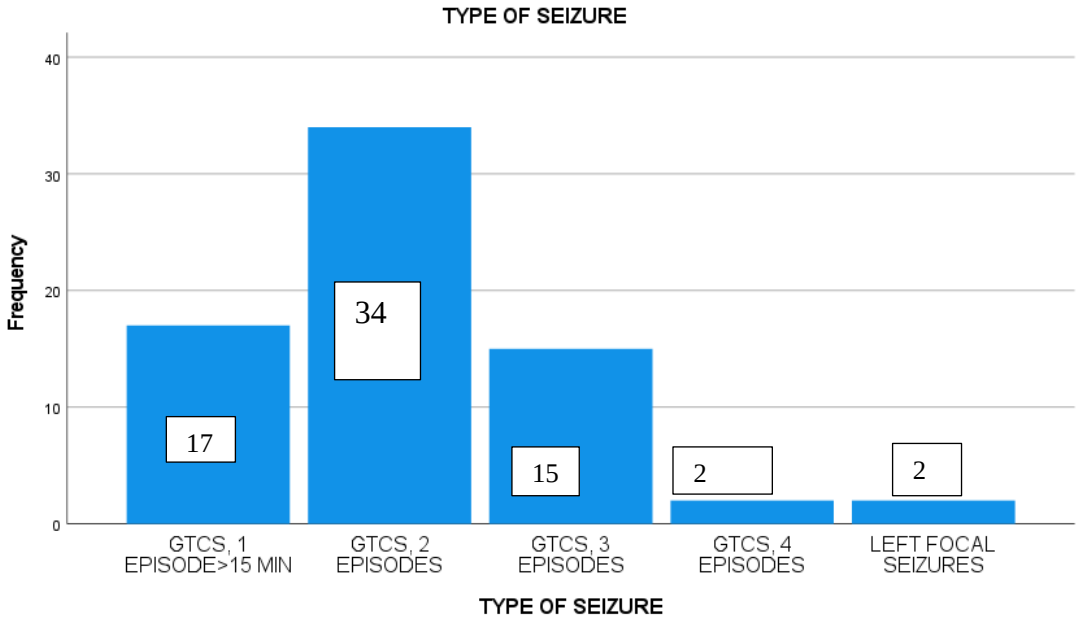


Figure 2: Showing semiology of seizure at presentation in children with complex febrile seizures.

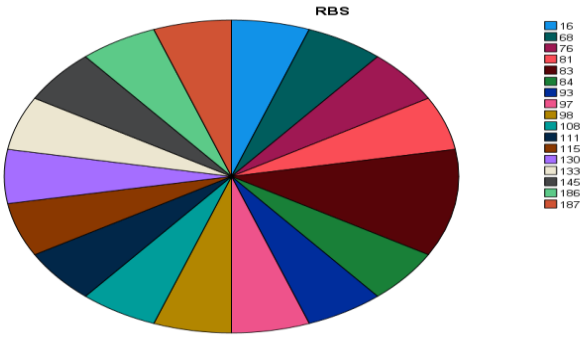


Figure 3: Showing absolute values of children with RBS checked prior to the onset of complex febrile seizure.

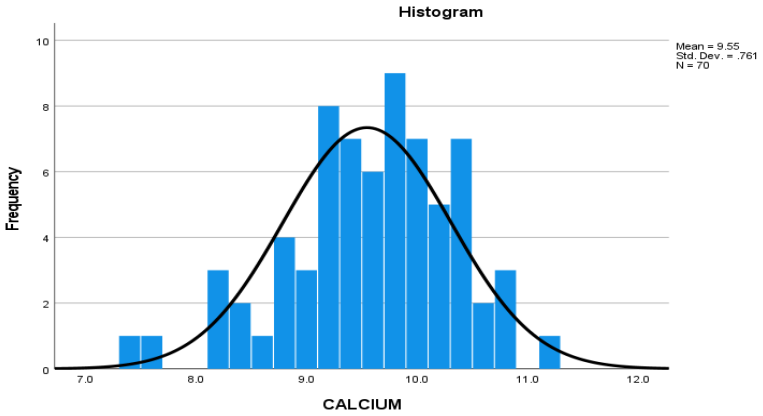


Figure 4: Showing serum calcium levels of the patients who presented with complex febrile seizures

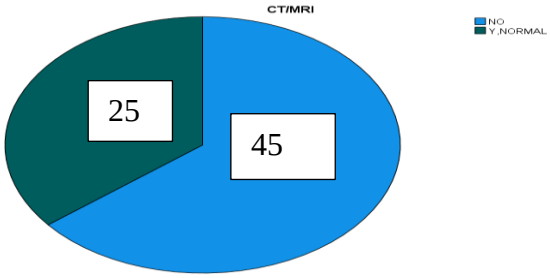


FiG 5: Showing the number of patients that underwent a neuroimaging (CT or MRI brain) in suspected cases after a complex febrile seizure and the subsequent results.

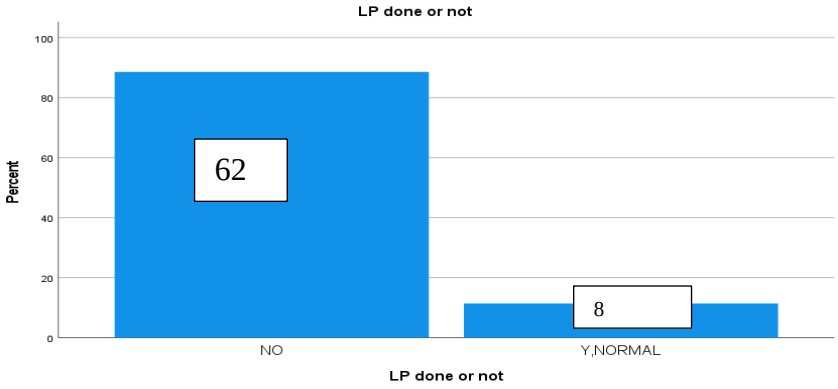


Fig 6: Lumbar Puncture of Patients After Complex Febrile Seizure

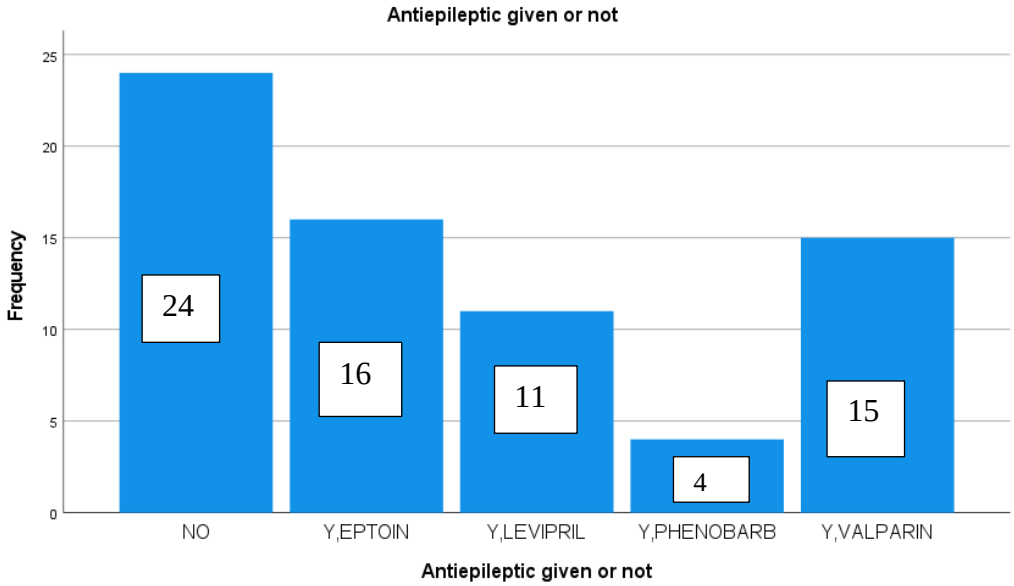


Fig 7: Showing the number of children that were initiated with antiepileptic drug therapy after complex febrile seizure.

Table 8: Showing the number of children with the findings of early (within 2 weeks) EEG of complex febrile seizure

EEG less than 2 weeks	Frequency	Percent	Valid Percent	Cumulative Percent
ABNORMAL, GSD	12	17.1	17.1	17.1
ABNORMAL, MULTIFOCAL ENCEPHALOPATHY	1	1.4	1.4	18.6
ABNORMAL, RIGHT HEMISPHERIC FOCUS	1	1.4	1.4	20.0
NORMAL	56	80.0	80.0	100.0
Total	70	100.0	100.0	

LATE (MORE THAN 2 WEEKS) EEG FINDINGS IN CHILDREN WITH COMPLEX FEBRILE SEIZURES

Table 9 :showing the late EEG (more than 2 weeks) findings in children with complex febrile seizure.

EEG more than 2 weeks	Frequency	Percent	Valid Percent	Cumulative Percent
ABNORMAL, PO FOCUS	1	1.4	1.4	1.4
ABNORMAL, GSD	15	21.4	21.4	22.9
NORMAL	54	77.1	77.1	100.0
Total	70	100.0	100.0	

Discussion

This prospective comparative study describes the comparative difference between EEG done early and late in children with complex febrile seizures admitted to a paediatric tertiary care centre. Along with the primary outcome other parameters in to consideration include age, sex preponderance, type of complex febrile seizure, associated family history, serum calcium levels, random blood sugar levels, neuroimaging, lumbar puncture if done have also been analysed.

In our study, 41.4% (n= 29) were girls and 58.6%(n=41) were boys. It suggested a possible male preponderance of occurrence of complex febrile seizures in our study. This was in accordance with the study conducted by Maytal et. Al[1]. In our study, 2 episodes of generalized tonic clonic seizures within a 24 hour period showed the maximum preponderance comprising of 48.6% percent patients (n=34) and the least being 2.9%(n=2) children showing left focal seizures. Of the 2 children with left focal seizures, 1 child showed an abnormal late (more than 2 weeks) EEG.

In our study, 17.1%(n=12) has a first degree relative with febrile seizures or epilepsy. 82.9% did not have a positive family history. Of the 12 patients with a positive family history, 2 patients (16%) had an abnormal late EEG (more than 2 weeks). 25.7 %(n=17) patients did undergo a Random Sugar level at the onset of seizure.5.8% (n=1) showed hypoglycaemia. Euglycemic levels between 70-140 were maintained in 82.3% of patients (n=14). 11.7%(n=2) children showed hyperglycaemia.

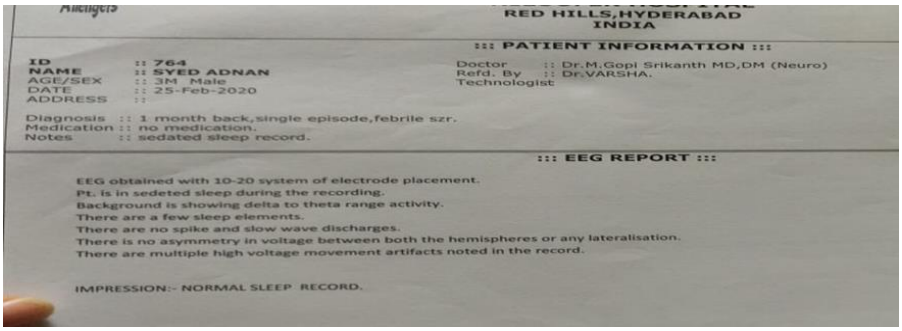
In our study 10% (n=7) of the patients had hypocalcaemia. Normal calcium levels were estimated as between 8.5-11.5 mg/dl. 90% of the children showed eucalcemic levels. Of the 7 patients, only 1 patient

had an abnormal late EEG as a finding. Other children showed normal findings in both early and late EEG.

Neuroimaging was done in children in suspected cases and in children with an abnormal neurological examination. 35.7%(n=25) underwent NSG /CT /MRI as per age-appropriate imaging and all 25 patients showed no neuroimaging abnormality (which also included 2 cases with focal seizures). 11.4% children(n=8) underwent a lumbar puncture in our study. LP was an indication if the child was less than 6 months old, an unimmunized child less than 1 year old and in children with clinical spectrum of meningitis. Initially, 74 patients were included in the study and 4 were excluded in accordance with CSF examination suggestive of meningitis and hence not fitting in the proper definition of febrile seizures. All 8 children in our study had a normal CSF examination.

65.7%(n=46) of our patients were started on any of the first line traditional antiepileptic medication(Phenobarbitone, Valproate, Carbamazepine, Phenytoin). 34.3%(n=24) patients received no antiepileptic or a single dose of Benzodiazepine. It is found that there is a judicious use of antiepileptic without documented EEG electrical activity in our institute in children with complex febrile seizures. This stands in accordance with the Cochrane review on drug management in febrile seizures[7-13]. Limitations have been put forth in their metanalysis as the studies with use of AED in febrile seizures were of insufficient quality design and evidence. Maximum use with Phenytoin with 34.7% is reported in our study.

A sample of a normal EEG report is depicted in the picture below. A normal EEG comprised of a child in a sedated state (sedated with melanin) with no spike and slow wave discharges with no asymmetry in the voltages noted. Comments on movement artifacts and sleep elements have also been duly noted.



RED HILLS,HYDERABAD
INDIA

::: PATIENT INFORMATION :::

ID :: 764
NAME :: SYED ADNAN
AGE/SEX :: 3M Male
DATE :: 25-Feb-2020
ADDRESS ::

Doctor :: Dr.M.Gopi Srikanth MD,DM (Neuro)
Refd. By :: Dr.VARSHA.
Technologist

Diagnosis :: 1 month back,single episode,febrile szr.
Medication :: no medication.
Notes :: sedated sleep record.

::: EEG REPORT :::

EEG obtained with 10-20 system of electrode placement.
Pt. is in sedeted sleep during the recording.
Background is showing delta to theta range activity.
There are a few sleep elements.
There are no spike and slow wave discharges.
There is no asymmetry in voltage between both the hemispheres or any lateralisation.
There are multiple high voltage movement artifacts noted in the record.

IMPRESSION:- NORMAL SLEEP RECORD.

Abnormal sleep record showed bursts of generalized high voltage sharp and slow wave discharges. Any asymmetry in voltage between both hemispheres or any lateralization were also duly mentioned in the interpretation in abnormal EEGs.

20% patients(n=14) showed an abnormal early EEG (performed within 2 weeks of seizure onset); 17%(n=12) showed an abnormal generalized seizure disorder as the most common EEG finding. 1 EEG (1.4%) was reported as abnormal multifocal encephalopathy, and 1 EEG (1.4%) was reported as Abnormal, right hemispheric focus.

The EEG was repeated after a duration of 2 weeks and the similar above recordings as described were noted. 16 patients showed an abnormal EEG (22.9%) of which 15 showed generalized seizure disorder and 1 EEG was reported to be abnormal with a bilateral parietooccipital focus. This above child however had a normal structure of brain on imaging.

Of the 70 children enrolled in our study, 78.5%(n=55) showed similar findings in early EEGs and late EEGs. 10%(n=7) showed abnormal early EEG finding with normal late finding on EEG. 11.4%(n=8) showed normal early EEG finding with abnormal late finding on EEG. Of the 55 subjects with similar early and late EEG findings; 14.5%(n=8) showed abnormality in both early and late EEG abnormalities and 85.5%(n=47) showed normal findings in both early and late EEGs.

Frequencies

		N
EEG more than 2 weeks - EEG less than 2 weeks	Negative Differences[a]	7
	Positive Differences[b]	8
	Ties[c]	55
	Total	70

a. EEG more than 2 weeks < EEG less than 2 weeks
b. EEG more than 2 weeks > EEG less than 2 weeks
c. EEG more than 2 weeks = EEG less than 2 weeks

Test Statistics[b]

	EEG less than 2 weeks & EEG more than 2 weeks
N	70
Exact Sig. (2-tailed)	1.000[b]

P value equal to 1.000(p>0.05); 95% cl

No statistical significant difference was found between the two electroencephalograms performed early or late in the children with complex febrile seizures enrolled in our study.

Conclusion

Our study concludes that there is no difference between an EEG performed early or an EEG performed late in children with complex febrile seizures, reflecting probable unnecessity in timing of the EEG in children with complex febrile seizures.

References

1. Maytal J, Steele R, Eviatar L, Novak G. The value of early postictal EEG in children with complex febrile seizures. Epilepsia. 2000 Feb;41(2):219-21.
2. Karimzadeh P, Rezayi A, Togha M, Ahmadabadi F, Derakhshanfar H, Azargashb E, Khodaei F. The best time for EEG recording in febrile seizure. Iranian journal of child neurology. 2014;8(1):20.
3. Shah PB, James S, Elayaraja S. EEG for children with complex febrile seizures. Cochrane Database of Systematic Reviews. 2017(10).
4. Yücel O, Aka S, Yazicioglu L, Ceran O. Role of early EEG and neuroimaging in determination of prognosis in children with complex febrile seizure. Pediatrics international. 2004 Aug;46(4):463-7.
5. Harini C, Nagarajan E, Kimia AA, de Carvalho RM, An S, Bergin AM, Takeoka M, Pearl PL, Loddenkemper T. Utility of

initial EEG in first complex febrile seizure. Epilepsy & Behavior. 2015 Nov 1;52:200-4.
6. Kuang YQ, Kong B, Yang T, Cheng L, Gu JW, Zhou HT, Lu M, Ran CM, Jiang LL, Cheng JM, Ma Y. Epileptiform discharges and frontal paroxysmal eeg abnormality act as predictive marker for subsequent epilepsy in children with complex febrile seizures. Clinical EEG and neuroscience. 2014 Oct;45(4):299-303.
7. Nelson KB, Ellenberg JH. Predictors of epilepsy in children who have experienced febrile seizures. New England Journal of Medicine. 1976 Nov 4;295(19):1029-33.
8. Kanemura H, Mizorogi S, Aoyagi K, Sugita K, Aihara M. EEG characteristics predict subsequent epilepsy in children with febrile seizure. Brain and Development. 2012 Apr 1;34(4):302-7.
9. Frantzen E, Lennox-Buchthal M, Nygaard A. Longitudinal EEG and clinical study of children with febrile convulsions. Electroencephalography and clinical neurophysiology. 1968 Mar 1;24(3):197-212.
10. Stores G. When does an EEG contribute to the management of febrile seizures?. Archives of disease in childhood. 1991 Apr;66(4):554.
11. Joshi C, Wawrykow T, Patrick J, Prasad A. Do clinical variables predict an abnormal EEG in patients with complex febrile seizures?. Seizure. 2005 Sep 1;14(6):429-34.
12. Offringa M, Newton R, Cozijnsen MA, Nevitt SJ. Prophylactic drug management for febrile seizures in children. Cochrane Database of Systematic Reviews. 2017(2).
13. Yamatogi Y, Ohtahara S. EEG in febrile convulsions. American Journal of EEG Technology. 1990 Dec 1;30(4):267-80.

Conflict of Interest: Nil Source of support: Nil