

Original Research Article

A clinical study of new onset seizures in children aged 3-12 years

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ABSTRACT

Background: Seizures are common in pediatric age group and less than 1/3rd of seizures in children are caused by epilepsy. Aim of present study was to analyze the etiological factors and clinical profile of new onset seizures in children aged 3-12 years.

Methods: This was a prospective study done at a tertiary care center of south India. Authors analyzed 98 children aged 3-12 years presenting with new onset seizures. Proper history and investigations including EEG, and CT brain were done to confirm the etiology.

Results: Out of 98 children 51 were 3-5 yrs of age and 47 were 6-12 years. 66.3% had generalized seizure and 33.6% had partial seizure. Partial seizure were more common in 5-12 years of age. Intracranial infections were the leading cause (73/98) which included neurotuberculosis (26/73), NCC (20), bacterial meningitis (12), cerebral malaria (8) and viral encephalitis (7). Intracranial infections were the leading cause in both age groups. Space occupying lesions were more common in 6-12 years (46.8%) as compared to 3-5 years (19.6%). NCC and Tuberculoma were the leading CT findings in both age groups. There was significantly high incidence of focal EEG changes in partial seizure group compared to generalized seizure group.

Conclusions: Intracranial infections were leading cause of new onset seizures especially GTCS. Good clinical evaluation and judicious use of investigations should be ensured. CT brain and EEG are more likely to be informative in partial seizures than in generalized seizures.

Keywords: CPS-complex partial seizures, CT-computed tomography, GTCS-generalized tonic clonic seizures, EEG-electroencephalography, NCC-Neurocysticercosis

INTRODUCTION

A seizure is an occurrence of signs or symptoms due to abnormal excessive or synchronous neuronal activity in the brain. When the above is associated with motor component then they are known as convulsions. Epilepsy is a condition characterized by recurrent (two or more) unprovoked seizures occurring 24 hours apart.¹ Seizures are common in pediatric age group and occur in 10% of children. Less than 1/3rd of seizures in children are caused by epilepsy.² Etiological spectrum of acute symptomatic seizures in developing countries is different from

developed countries. In developing countries like India, intracranial infections still constitute the single largest cause of childhood seizures.³⁻⁵ The tremendous advances in neuroradiological investigations and EEG have resulted in a series of noninvasive diagnostic procedures. However, it is not always that the information derived from these investigations changes the line of management and there is always a concern regarding cost and radiation exposure.^{6,7} Hence it is essential to evolve a method to identify children with symptomatic epilepsy by clinical criteria so that seizures are better managed and expensive investigations can be judiciously used.

Aim of present study is to study the etiological factors and clinical profile for new onset seizures in children aged 3-12 years and to assess the role of EEG and Neuroimaging in diagnosing the etiology.

METHODS

This was a prospective study done at a tertiary care center of south India from December 2016 to December 2017.

Inclusion criteria

- All children aged 3-12 years who presented with new onset seizures were included.

Exclusion criteria

- Children with previous history of seizures, developmental retardation and prior neurological abnormality, seizure mimics and trauma were excluded.

After getting informed written consent from the parents, the data was collected and entered in a preformed Performa. All efforts were made to investigate the cases completely wherever indicated to reach a definitive diagnosis regarding seizure type and etiology. Cases, where data, either clinical or investigative, was inadequate were excluded from the study. Classification of seizure types was based on the Commission on Epidemiology and Prognosis, 2010 International League against Epilepsy (ILAE).^{8,9} History obtained from a reliable witness regarding detailed description of the episode or personal observation during hospitalization primarily formed the basis for identifying the seizure disorder. Relevant investigations like routine blood counts, chest X-ray, Mantoux test, C. S. F. analysis, fundus examination, EEG, relevant and possible investigations for metabolic cause and CT brain were done to confirm the clinical suspicion about the nature of the seizure disorder and its etiology.

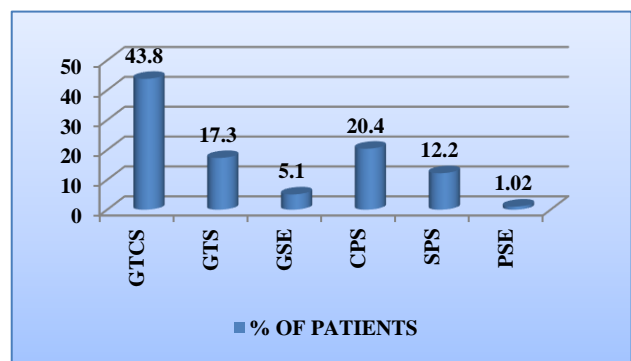
Statistical analysis

Statistical analysis was done using SPSS. The difference between two or more proportions was tested using "Chi-square test". In situations where the expected cell value

was less than 5, Fisher's exact test was used. P value<0.05 was considered to be significant.

RESULTS

Out of 187 children who presented with seizures, 98 children were included in final analysis. 65 children (66.3%) presented with generalized Seizure and 33 (33.6%) with partial seizure. Generalized tonic clonic seizures (GTCS) was most common type seen in 43.8% followed by complex partial seizures (CPS) in 20.4%, simple partial seizures (SPS) in 12.2%, generalized tonic seizures (GTS) in 17.3% and status epilepticus (SE) in 6.1%. (5 patients had generalized status epilepticus (GSE) and 1 had partial status epilepticus (PSE)) (Figure 1).



GTCS-generalized tonic clonic seizure; GTS- generalized tonic seizure; GSE-generalized status epilepticus; CPS-complex partial seizure; SPS-simple partial seizure; PSE-partial status epilepticus.

Figure 1: Type of seizures in children aged 3-12.

The mean age for generalized seizures was 6.8yrs and that of partial seizure it was 7.3 years. Patients were divided based on age of presentation into preschool (3-5 years) age group which included 51 children and school (6-12 years) age group having 47 children. The Male: Female ratio was 1.04:1 and its association with type of seizure was not significant.

Partial seizures occurred more frequently in children 6-12 years of age where as generalized seizures were common in both age groups, but the association was not significant (Table 1).

Table 1: Age distribution with seizure type.

Age group (in years)	Generalized seizure		Partial seizure		Total
	n (65)	Mean age	n (33)	Mean age	
3-5 years	37 (56.9%)	4.4	14 (42.4%)	4.9	51
6-12 years	28 (43.1%)	9.1	19 (57.5%)	9.7	47
Total	65	6.8	33	7.3	98

χ^2 -1.308, p-value 0.25 (not significant)

Total 13.2% children had family history of seizure, 15.4% had generalized seizure and 9.1% had partial seizure, there was no significant difference in the family history ($P=0.321$) (Table 2).

Most common etiology of seizures was intracranial infections in 73/98 patients (74.4%) which included Neurotuberculosis (T.B. meningitis/ Tuberculoma) (26/73) as leading cause, followed by Neurocysticercosis including calcification (20/73), pyogenic meningitis

(12/73), cerebral malaria (8/73) and viral encephalitis (7/73). 2% of seizures were caused by cerebrovascular accidents (1 infarct and 1 cerebral venous thrombosis).

Hypertensive encephalopathy accounted for 2 cases and poisoning for 1 case. Febrile seizures made their first appearance in only 3 % of cases (Table 3). About 6% of cases were identified as epileptic syndromes and in 11% cases cause could not be identified.

Table 2: Family history of seizures.

Seizure type	Family history		Total
	Present	Absent	
Generalized seizure (N=65)	10 (15.4%)	55 (84.6%)	65
Partial seizure (n=33)	3 (9.1%)	30 (90.9%)	33
Total (n=100)	13 (13.3%)	86 (86.7%)	98

Fisher's pvalue-0.321 (not significant)

Table 3: Etiology of seizures as per age group and type of seizure.

Etiologies	3-5 years	6-12 years	Total	%	GTCS	GTS	SE	SPS	CPS
Intracranial infections	25	16	41	42.8					
Tuberculous meningitis	9	5	14	14.2	7	3	2	0	2
Pyogenic meningitis	8	4	12	12.2	6	3	1	0	2
Cerebral malaria	4	4	8	8.2	4	2	1	0	1
Viral encephalitis	4	3	7	7.1	3	1	1	0	2
Space occupying lesions	10	22	32	32.65					
Neurocysticercosis	6	13	19	19.38	5	2	0	7	5
Tuberculoma	4	8	12	12.24	3	2	0	3	4
Brain abscess	0	1	1	1.02	1	0	0	0	0
Cerebrovascular accidents	1	1	2	2.04					
Infarct	0	1	1	1.02	0	0	0	0	1
Cerebral venous thrombosis	1	0	1	1.02	1	0	0	0	0
Metabolic	2	1	3	3.06					
Poisoning	1	0	1	1.02	1	0	0	0	0
Hypertensive encephalopathy	1	1	2	2.04	0	1	0	0	1
Calcification	1	0	1	1.02	1	0	0	0	0
Febrile seizures	3	0	3	3.06	3	0	0	0	0
Epileptic syndromes	3	2	5	5.1	1	0	1	1	2
Unidentifiable	6	5	11	11.22	7	3	0	1	0
Total	51	47	98	100	43	17	6	12	20

Intracranial infections were leading cause of seizures in both age groups, 49% in 3-5 years and 34% in 6-12 years. Space occupying lesions was more common in 6-12 years making 46.8% as compared to 19.6% in 3-5 years.

Intracranial infections were more likely to present as generalized seizures (83%) whereas space occupying lesions were more likely to present as partial seizures (58%). Etiology could not be identified in 15.3% of generalized seizures and 3% of partial seizures. Meningitis accounted for 32% (n=32) of seizures.

Tuberculous meningitis was the most common meningitis (n=14, 42.42%), followed by bacterial meningitis (36.4% and viral 21.2%. 60 patients underwent lumbar punctures. C. S. F. findings were informative only in cases of meningitis that were 10 pyogenic, 14 tuberculosis and 6 viral. 4 cases showed turbid C.S.F. or frank pus.

In 3-5 years age group, most common cause of generalized seizure was TB meningitis but most common cause of partial seizure was NCC but in 6-12 years age most common cause of generalized seizure was

unidentified and most common cause of partial seizure was again NCC (Figure 2).

CT scan was done in a total of 87 patients. Out of these CT with positive findings were found in 35% in generalized group and 63.7% in partial group. The difference was statistically significant (Table 4).

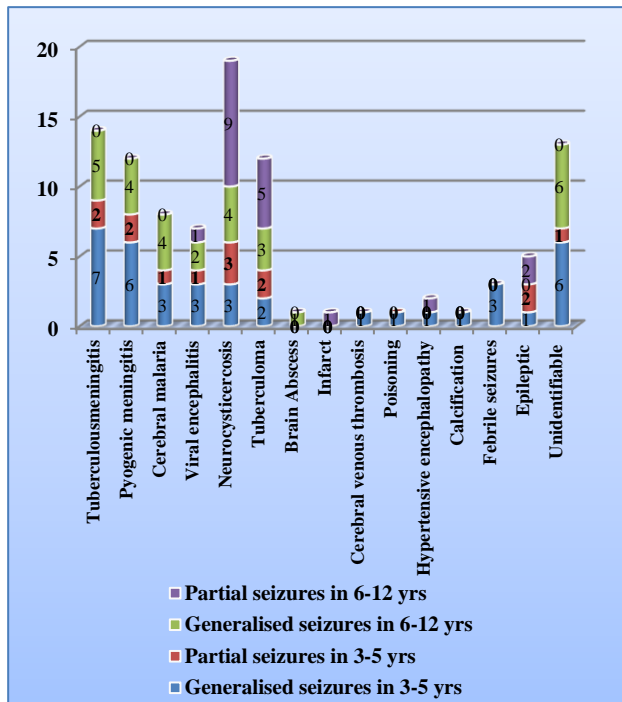


Figure 2: Etiologies in relation to age and type of seizures.

Table 4: CT scan findings in different type of seizures.

CT scan	Generalised seizures	Partial seizures	Total
Normal	35 (65%)	12 (36.3%)	47
Abnormal	19 (35%)	21 (63.7%)	40
Total no CT done	54/65	33/33	87

$\chi^2=5.58$, p value-0.018 (Significant).

Table 5: Neuroimaging findings and age distribution.

Abnormalities	3-5 years	6-12 years	Total
Neurocysticercosis	6	13	19
Tuberculoma	4	8	12
Abscess	0	1	1
Vascular	2	2	4
Hydrocephalus (post meningitis)	1	-	1
Cerebral edema	1	1	2
Calcification	1	-	1
Total	15	25	40

Table 6: EEG changes in different type of seizures.

Seizure type	EEG normal	EEG abnormal	Total
Generalized seizure (39/67) (n=39)	14 (41%)	20 (59%)	34
Partial seizure (22/33) (n=22)	4 (15%)	23 (85%)	27
Total (61/98)	18 (30%)	43 (70%)	61

P value-0.0249 (Significant).

Table 7: Electroencephalogram findings.

Seizure type	Normal EEG	Generalized EEG changes	Focal EEG changes	Total
Generalized seizure	14 (41%)	16 (47%)	4 (12%)	34
Partial seizure	4 (15%)	13 (48%)	10 (37%)	27
Total	18 (30%)	29 (48%)	14 (22%)	61

The p-value is 0.020901 (Significant).

Among CT findings (Figure 3), NCC was a major finding (47.5%) followed by Tuberculoma (30%). Abscess, hydrocephalus and calcification made 2.5% each, cerebral edema 5%, vascular events made 10%. NCC and Tuberculoma were leading CT finding in both age groups (Table 5). EEG was significantly showing abnormal findings in patients presenting with partial seizures (Table 6). Among 98 children included in study, 14(22%) had focal EEG changes, 29(48%) children had generalized EEG changes and 18(30%) had normal EEG findings as shown in Table 7. There was significantly high incidence of focal EEG changes in partial seizure group compared to generalized seizure group.

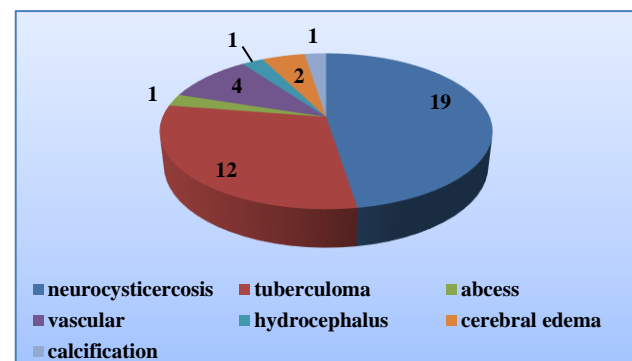


Figure 3: CT findings in total number of patients.

DISCUSSION

Regarding age of presentation in present study, partial seizures were more common in school age (6-12 year) group (57.5%) than preschool age (3-5 year) group (43.1%). The mean age of generalized seizure was 6.8yrs and 7.4 years for partial seizures. The difference in these two groups was not statistically significant. Zajac A et al and Ramesh Baheti et al also observed no statistical significance in age distribution of seizures.^{10,11}

In a study made by Misra S et al, generalized seizures were more common. Also, Locham KK et al at Rajindra hospital, Patiala found that generalized seizures were seen in 64% while partial seizures in 36%.^{12,13}

Singh RD et al also found in their study that 249(75%) patients had generalized seizures and 82(25%) had focal seizures. GTCS occurred in 177(71%) patients, tonic seizures occurred in 58(23%) patients, myoclonic seizures occurred in 10 (4%) patients, and other types occurred in 4(2%) patients.¹⁴ 28(8%) patients had status epilepticus. These studies were similar to present findings as 65 children (66.3%) presented with generalized seizure and 33(33.6%) with partial seizure in present study. In present study generalized tonic clonic seizures (GTCS) was most common type seen in 43.8% followed by complex partial seizures (CPS) in 20.4%, simple partial seizures (SPS) in 12.2%, generalized tonic seizures (GTS) in 17.3% and status epilepticus (SE) in 6.1%.

Another study by Saha SP et al concluded that simple partial seizures constituted 10.5% of total seizures, complex partial constituted 21.1% of total seizures.¹⁵ In a study made by Singhi S et al, seizures were partial complex in 65% and simple partial in 35%.¹⁶ Present results are comparable with these studies.

Male: Female ratio in present study population was 1.04:1 and the difference was not statistically significant. In a study made by Baheti R et al, there was no statistical significance in sex distribution of seizures.¹¹ Males were more affected than females in a study by Redda Tekle-Haimanot et al and Shankar P Saha et al.^{15,17}

Family history of seizures was present in 14% of children. There was no significant difference in the positive family history between generalized and partial seizure groups in present study. Redda Tekle-Haimanot et al observed positive family history in 22%.¹⁷ Positive family history was observed in 21% of first degree relatives-by Alizadeh Taheri P et al.¹⁸

In the present study CNS infections were on top of the list, constituting 74.4% of etiologies. Out of these, Tuberculosis made a major part, Tuberculomas and tuberculous meningitis together constituted 26.5%. In 20.4% cases Neurocysticercosis was found, which constituted another major cause. Other causes were

pyogenic meningitis, cerebral malaria and viral meningoencephalitis.

In present study intracranial infections were more common in preschool age group (49%) as compared to school age group (34%). Granulomas including neurocysticercosis and tuberculomas were more common in school age group. Etiology was more readily identifiable in school age group (88.24%) compared to preschool age group (89.4%) though there was not much difference.

In a study made by Locham KK et al, meningitis made 40% of etiologies and neurocysticercosis made 22%.¹³ In present study meningitis made 42.8% of etiologies while neurocysticercosis made 19.4% of etiologies which is closely correlating. Infarcts made 12% of seizures in the above mentioned study while in present study infarcts made 4%. Out of 4%, 2% infarcts were caused by tuberculous meningitis.

As per study done by Dalmia R et al, out of 331 children CNS infections contributed 31%.¹⁴ Febrile seizures, space occupying lesions (SOL) and seizure disorder accounted 21% each. Metabolic causes and others inclusive of hypertensive encephalopathy and head injury accounted for 3% of all patients. CNS infections (32/90, 35%) was the most common etiology in 5-10 yrs age group while SOL (26/76,34%) and epilepsy (26/76,34%) were equally common in 10-18 yrs age group.

In present study, NCC was more common in school age group (67%) than preschool (33%). In a study made by Locham KK et al, out of total cases of NCC, 20% of cases occurred below 5 years and 80% above 5 years.¹³

A study done by Kanitkar M et al concluded that CT scan abnormality was detected in 66% cases.¹⁹ Single or multiple tuberculomas were noted in 24% cases, cortical atrophy in 14% cases, focal calcification in 10%, haemorrhage in 3% and subdural effusions in 2%.

In a study done by Baheti R et al, 50% of children with partial seizure and 35% of children with generalized seizure had abnormal CT findings.¹¹ Jagar H et al observed abnormal CT findings in 68% of children with partial seizure.²⁰ Shinnar S et al observed 21% of children had abnormality; focal encephalomalacia and cerebral dysgenesis were the most common abnormality.²¹ Berg AT et al observed abnormality in 12.7% of those imaged.²² Misra S et al observed CT Brain was abnormal in 75% of children with seizure disorder, ring enhancing lesion was the commonest abnormality (54%) followed by brain atrophy.¹² In present study CT brain with positive findings were found in 35% in generalized group and 63.7% in partial group. The difference was statistically significant. NCC was the most common finding (47.5%) followed by Tuberculoma (30%) in present study.

Overall electroencephalogram findings were abnormal in 70% of cases who underwent EEG in present study. Among patients with generalized seizures 59% had abnormal electroencephalogram and among patients with partial seizures 85% had abnormal EEG.

Baheti R et al observed that 76.9% of children had abnormal EEG in generalized seizure group and 73.0% of children had abnormal EEG in partial seizure group.¹¹ Betting LE et al observed that 33% of children with idiopathic generalized seizure having EEG abnormality.²³ In a study done by Shinnar S et al EEG abnormality was observed in total 42% of children.²⁰ Among children with abnormal EEG, 56% had partial seizure and 35% had generalized seizure and the difference was statistically significant.

The limitation of present study was small sample size. Larger studies with more number of children will be more informative. More studies in future are needed as etiological pattern of seizures may change with time.

CONCLUSION

Generalized seizures were more common presentation than partial seizures in children 3-12 years age. Intracranial infections were leading cause of new onset seizures especially GTCS. By bringing down rate of infection by strict measures of hygiene and immunization, the rate of seizures and long term neurological sequelae can be reduced as intracranial infections are still leading cause of seizures in developing countries. Good clinical evaluation should be ensured before doing CT scans as exposure of pediatric patients to radiation and its effects are still being studied and also CT and EEG are more likely to be informative in partial seizures than in generalized seizures.

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