

Original Research Article

Etiological evaluation of convulsions in children between 1 month to 5 years of age

Mamillapalli Bharathi, A. Panchalaiah*

Department of Pediatrics, Narayana Medical College and Hospital, Chintha Reddy Palem, Nellore, Andhra Pradesh, India

Received: 15 June 2017

Revised: 24 June 2017

Accepted: 08 July 2017

***Correspondence:**

Dr. A. Panchalaiah,

E-mail: research.nmch@rediffmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Convulsions are the most common pediatric neurological disorder worldwide. The incidence is highest in children younger than 3 years of age with a decreasing frequency in older children. The different causes of seizures are febrile convulsions, CNS infections, neurologic or developmental, metabolic, traumatic or vascular, idiopathic or epilepsy, oncologic. The objective of our study is to find out the various etiologies of convulsions in children between 1 month to 5 years of age.

Methods: 200 consecutive cases admitted to the hospital with convulsions in this particular age group were studied by detailed history, thorough examination and stepwise investigations including blood counts, CSF analysis, EEG and neuroimaging studies.

Results: The most common cause for seizures in our study was febrile seizures (34.5%). Hypocalcemic seizures were the predominant cause (13%) between 1 month to 1 year of age. Other causes included viral encephalitis (20%), pyogenic meningitis (11%), TB meningitis (8.5%), epilepsy (8%), hypoglycemia (2%), neurocysticercosis (1%), head injury (1%) late HDN (0.5%). Cerebral palsy, mental retardation syndromes with developmental delay and epilepsy constituted 5.5% of the cases.

Conclusions: Convulsions in children can be due to various underlying pathology. A detailed history, thorough examination and certain investigations helps to recognize the cause for the convulsions and can be treated accordingly.

Keywords: Convulsions, Epilepsy, Seizures, Viral encephalitis

INTRODUCTION

Seizure constitutes the commonest neurological problem in children with significant epilepsy having its onset in childhood.¹ A seizure is a transient occurrence of signs and/or symptoms resulting from abnormal excessive or synchronous neuronal activity in the brain. Acute symptomatic seizures occur secondary to an acute problem like electrolytes disturbances, meningitis, encephalitis, acute stroke, or brain tumor. An unprovoked

seizure is one that is not an acute symptomatic seizure. Remote symptomatic seizure is one that is considered to be secondary to a distant brain injury, such as an old stroke. Reflex seizures are usually precipitated by a sensory stimulus such as flashing lights. 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. For clinical purposes, epilepsy is considered to be present when 2 or more

unprovoked seizures occur in a time frame of longer than 24 hr.²

There is limited data regarding acute seizures episodes from developing countries. The limited data show that incidence and prevalence rates are surprisingly similar to those in developed countries.³ Current study aims to find the common etiology of seizures in children between 1 month to 5 years presenting to Narayana medical college hospital, Nellore during a period of 2 years.

Although the outlook for most children with symptomatic seizures or those associated with epilepsy is generally good, seizures may signal a potentially serious underlying systemic or central nervous system (CNS) disorder that requires thorough investigation and management. These patients require aggressive stabilization, resuscitation and concurrent implementation of diagnostic testing, monitoring and pharmacological interventions.

METHODS

The study was done on 200 consecutive cases admitted to pediatric ward and PICU of the hospital to know the various etiologies of convulsions in children between 1 month to 5 years of age during the period between December 2013 and November 2015. The consecutive cases of convulsions in children between 1 month to 5 years admitted to Narayana medical college hospital, Nellore formed the study group.

200 consecutive children between 1 month to 5 years of age admitted with convulsions were included. The history and examination of subjects included in the study were recorded in the proforma designated for the study.

It is prospective case study

Inclusion criteria

- Children between 1 month to 5 years who presented with convulsions.

Exclusion criteria

- Cases with toxicological causes of convulsions.
- Children less than 1 month and more than 5 years of age.

The following investigations were done stepwise depending on the clinical presentation.

- Complete blood counts which included total count, platelet count, hemoglobin, differential count.
- Metabolic screening like serum electrolytes, serum calcium, serum glucose
- Lumbar puncture and CSF analysis
- Electroencephalograph
- CT scan and

- MRI as and when required

As the present study is a descriptive study, no statistical analysis was done. All the data are expressed as percentages.

RESULTS

This table shows the incidence of convulsions in different age groups. Occurrence of convulsions was highest 84 (42%) in the age group between 1 month to 1 year.

Table 1: Incidence of convulsions in different age groups.

Age group	No. of cases	Percentage
1m-1yr	84	42
1yr-3yr	46	23
3y-5y	70	35

Of the 200 cases included in study, 122 (61%) were males and 78 (39%) were females.

Type of convulsions

Maximum number of cases were GTC 186 (93%). 14 cases of focal seizures were noted of which 3 had left focal and 11 had right focal seizures.

Table 2: Symptoms associated with convulsions.

Symptoms	No. of cases	Percentage
Fever	154	77
Altered sensorium	83	41.5
Headache	15	7.5
Cough	43	21.5
Vomiting	58	29
Lethargy	22	11
Irritability	36	18
Ear discharge	13	6.5

Table 2 shows various clinical symptoms associated with convulsions. Fever was the predominant symptom 154 (77%) followed by altered sensorium 83 (41.5%) and vomiting 58 (29%). 46 (23%) had a past history of convulsions. 18 (9%) had a family history of convulsions. 190 (95%) had a normal developmental history and other 5 had GDD history.

Neurological signs

89 (44.4%) had altered sensorium, 54 (27%) had meningeal irritation, 7 (3.5%) had neurological deficit.

Serum calcium

Baseline serum calcium levels were done in all patients and 28 (14%) patients had low serum calcium (<8.4mg/dL).

Glucose

All the patients, who presented with seizures had serum glucose estimation simultaneously with CSF analysis and 3 (1.5%) cases had low serum glucose [< 40 (mg/dL)]. Only 50 (25%) had low CSF glucose (<40 (mg/dL).

CSF protein and Cell count

86 (43%) had low CSF protein while 114 (57%) had elevated CSF protein (<50 mg/dL). In CSF cell count, Pleocytosis was seen in 61 (30.5 %)cases (<4 /cumm). EEG was done in 16 cases and 14 (7%) had GM type while 2 (1%) had PM type.

CT Findings

Table 3 shows the various CT findings. Of the 200 cases 65 cases underwent was CT scan and abnormalities like cerebral edema (11.5%), hydrocephalus (6.5%), basal exudates (4.5%) infarct (1.5%) were noted. 8.5% of cases had cerebral atrophy.

Table 3: CT Findings.

CT findings	No. of cases	Percentage
Hydrocephalus	13	6.5
Basal exudate	9	4.5
Infarct	3	1.5
Tuberculoma	0	0
Edema	23	11.5
Others	17	8.5

Etiology of convulsions age wise

Febrile seizures were the commonest cause between 1 to 5 years. Hypocalcemic seizures were predominant (13%), between 1 month to 1 year.

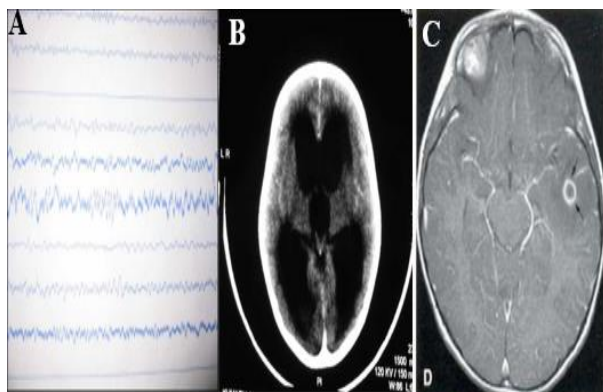


Figure 1: A. EEG recording showing burst of sharp waves suggestive of seizure activity, B. CT section showing communicating hydrocephalus, C. Post contrast section showing ring enhancing lesion in neurocysticercosis.

Table 4: Etiology of convulsions age wise.

Etiology	0.1-1 (yrs)	001-2 (yrs)	002-3 (yrs)	003-4 (yrs)	004-5 (yrs)
Febrile seizures	18	19	8	12	12
Pyogenic meningitis	17	3	1	1	0
Hypocalcemic seizures	26	0	0	0	0
Hypoglycemic	4	0	0	0	0
Viral encephalitis	4	4	9	9	14
Head injury	1	0	0	1	0
TB meningitis	2	3	2	6	4
Late HDN	1	0	0	0	0
Epilepsy	8	1	1	1	5
Neuro-cysticercosis	0	0	0	1	1
Others	2	4	1	3	1

Etiology of convulsions

Various etiologies of convulsions in present study. Febrile seizures the commonest cause of convulsions in our study 69 (34.5%), followed by infectious and metabolic causes. In present study 15 cases (22%) had family history of febrile seizures.

Table 5: Etiology of convulsions.

Diagnosis	No. of cases	Percentage
Febrile seizures	69	34.5
Pyogenic meningitis	22	11
Hypocalcemic seizures	26	13
Hypoglycemic	4	2
Viral encephalitis	40	20
Head injury	2	1
TB meningitis	17	8.5
Late HDN	1	0.5
Epilepsy	16	8
Neurocysticercosis	2	1
Others	11	5.5
Total	200	

Of the 40 cases diagnosed as viral encephalitis in present study, dengue serology was done in all cases and 22 (55%) had serology positive for dengue. 3 (7.5%) cases had JE serology positive.

DISCUSSION

The present study was done to know the various etiologies for convulsions in children between the age group of 1 month to 5 years.

A total of 200 consecutive cases admitted to the hospital with convulsions over a period of 20 months were studied.

Incidence of seizures in particular age groups

In present study, we recorded the highest incidence of seizures in the age group of 1 month to 1 year 84 (42%), followed by 70 (35%) in the age group of 3 to 5 years and least between 1 year and 3 years, 46 (23%). A survey done to know the prevalence of epilepsy, found that the peak age of onset was around 1 year and 90% of the attacks occurred during the first three years.⁴ In a study done in 256 cases of bacterial meningitis over a period of 8 years, 83.6% of the cases were <3 years.⁵

Sex incidence

The incidence of seizures in our study was more in males, accounting to 122 cases (61%) while females were 78 cases (39%). One of the reasons for the above observation could be the reason that conditions like febrile convulsions are more common in males with a sex ratio varying between 1.4 to 1 and 1.2 to 1.⁶ Another study done in 256 cases of pyogenic meningitis showed that the male: female ratio was 1.46:1.⁵

Type of seizure

In this study, we observed that the commonest seizure type was GTC 186 (93%). The remaining 14 (7%) patients had focal seizures of which right focal was in 11 (5.5%) patients and left focal in 3 (1.5%) patients. In the literature, available it is noted that generalized tonic clonic, (GTC) seizures are the most common type of childhood seizures, occurring in almost 61% of cases.⁶

Symptoms

In the present study of the total 200 cases, majority of the patients presented with fever (77%), altered sensorium (41.5%) and vomiting (29%). Cough (21.5%), loose stools (15.5%), irritability (18%), lethargy (11%) headache (7.5%) and ear discharge (6.5%) were the other minor symptoms. Febrile seizures are due to febrile illnesses from common infections such as tonsillitis, upper respiratory infections, and otitis media.⁷ In current study, most cases of febrile seizures were associated with symptoms of upper respiratory tract infection or acute gastroenteritis.

Past history of seizures

Of the 200 cases studied, 23% had a past history of convulsions. The reason for this could be due to the fact that conditions like epilepsy and febrile convulsions are known to have recurrent seizures. These two conditions formed major etiological groups in our study. The risk of recurrence is 25-30% in cases of febrile convulsions.³⁷ Recurrence of febrile seizures is by far the larger risk associated with febrile convulsions. Approximately 30-37% of the patients with febrile convulsions experience at least 1 recurrence. Half of the children who have one recurrence experience a further attack. Half of the

recurrence take place within 6 months of the initial episode, and roughly 3/4th of all recurrence occur within 1 year. Recurrences are more common when the first seizure occurs early. It was found that recurrence risk was highest for the infants in the first year of life (48%) and lowest for those who were 4 years of age (15%).⁴

Family history of seizures

In present study, 9% of total cases had a family history of convulsions. Most cases of seizures appear to be familial or atleast to occur in patients with a strong family history of seizures of various types, thereby supporting the role of genetic factors in the origin of epileptic phenomena in the first 2 years of life. More than half of the patients studied by Watanabe et al had a family history of epilepsy or febrile convulsions.

Developmental history

Developmental history was normal in 95% of cases, while 5% had delayed developmental milestones. Approximately 25% of children who have recurrent seizures during the first year excluding neonatal and infantile spasms are developmentally and neurologically abnormal at the time of first seizure.⁸

Neurological signs

In this present study, 44.5% of the cases presented predominantly with altered sensorium, 27% with meningeal irritation and 3.5% had neurological deficit on examination. Most cases of febrile convulsions are not associated with any neurological deficit, but some of the unilateral seizures may be followed by a Todd hemiplegia that usually lasts for a few hours but may persist upto several days, the incidence being only 0.4 %.⁶

Lumbar puncture

All children with first febrile seizures under the age of 12 months are recommended to have a lumbar puncture and examination of CSF. A study conducted in Children's Hospital at Sheffield among 452 children concluded that lumbar puncture should be considered for those who present with neurological signs and symptoms pointing to intracranial disease, other than seizure itself but not in children with simple febrile convulsion.⁹

The presence of PMN cells raises the suspicion of pathologic process. An elevated PMN count suggests bacterial meningitis or the early phase of aseptic meningitis. CSF lymphocytosis indicates aseptic, tuberculous or fungal meningitis.¹⁰ CSF proteins elevated in 57% of cases and was normal in 43%. The CSF protein may be elevated in many processes, including infectious, immunologic, vascular and degenerative diseases as well as tumors of the brain and spinal cord.¹⁰ Low CSF glucose was seen in 25% of cases and was normal in 75%.

Computed tomography (CT) scan

CT scan was performed in 65 cases in which abnormalities included cerebral edema (11.5%), hydrocephalus (6.5%), basal exudates (4.5%) infarct (1.5%). 8.5% of cases had other findings like cerebral atrophy. The presence of trauma, intracranial hypertension, persisting disturbances of consciousness or associated focal sign necessitates urgent neuroimaging. In a 1 year retrospective study in 66 patients who presented with new onset of seizures to the emergency department, 52 patients (78.8%) had normal CT results and 14 patients (21.2%) had abnormal CT results. None of the 13 patients with complex febrile seizures had abnormal CT scan.¹¹

Electroencephalograph (EEG)

EEG was done in 16 cases of which 14 (7%) had recordings suggestive of grand mal epilepsy while 2 (1%) had petit mal type. EEG is important for confirming the epileptic nature of seizures and if possible for making a precise diagnosis of epilepsy syndrome. However, epilepsy being a clinical disorder, its diagnosis does not depend primarily on EEG findings. In about 10% of patients with epilepsy, EEG with routine stimulations and short sleep recording was negative.

Etiology of convulsions

In our study, hypocalcemic seizures, febrile seizures, bacterial meningitis were the major causes between 1 month to 1 year. Febrile seizures, viral encephalitis and bacterial meningitis had high incidence between 1 to 2 years, while febrile seizures and viral encephalitis were predominant causes between 2 to 5 years. Age specific incidence was highest in the group aged 1-12 months. Intracranial hemorrhage, bacterial meningitis and metabolic disturbances were the major causes of acute symptomatic seizures in children aged 1 to 12 months. In our study, febrile seizures were the most common cause for convulsions accounting for 34.5% of all our cases. The Yelandur survey estimated the prevalence to be 3.28-5.571 per 1000 whilst the more recent uttarakhand survey found a prevalence of 2.27 per 1000 population.¹²

Viral encephalitis

In present study of 200 cases, 40 (20%) cases of viral encephalitis were identified. In a study conducted in a hospital in New Delhi between 2004 and 2005, 57 cases out of 151 with encephalopathy were suspected as viral encephalitis. The two most common clinical features in these cases were generalized convulsions (70.17%) and meningeal signs (59.64%). Of the 57 cases, etiological diagnosis was reached in 41 cases. The most common etiological agent identified in the study was enterovirus 71 in 20 patients (35.1%). The other viruses identified were mumps in 6 (10.5%), Japanese encephalitis in 5 (8.7%) and measles in 4 (7%) cases.

Metabolic causes hypocalcemic seizures

The next cause of convulsions in the present study was hypocalcemic seizures (13%), predominantly occurring between 1 month to 1 year of age. In a study done in an urban reference hospital in a developing country, hypocalcemia due to rickets was the leading cause (25.6%) of afebrile seizures.¹³

Hypoglycemic seizures

Hypoglycemic seizures, which is one of the commonest cause of convulsions in neonates, also occurs in infants. In our study 4(2%) cases in the age group of 1 month were due to hypoglycemia i.e. serum glucose <40mg/dl.

Bacterial meningitis

In this current study 22 cases were suspected clinically to have bacterial meningitis. All 22 (11%) presented with seizures and the incidence was highest in the age group between 1 month and 1 year. Various incidences have been quoted for the occurrence of seizures with bacterial meningitis. Two recently published reviews reported that only 0.4-1.2% of children who have a seizure with fever had unexpected acute bacterial meningitis. In another study of 187 patents with bacterial meningitis, seizures were a manifestation in 25 (13%).¹⁴

Tuberculous meningitis (TBM)

In the present study, TBM was seen in 8.5% cases. Focal or generalized seizures occur in 10-15 percent children of TBM. In a study done over a period of 20 years in London on 38 children with CNS tuberculosis, seizures were observed in 20 patients (53%).

Epilepsy

5.5% of the cases in present study included infants and children with cerebral palsy or mental retardation syndromes with developmental delay and epilepsy. Cerebral palsy (CP) is the most common neurologic disorder associated with epilepsy. The frequency of epilepsy in CP varies from between 15% and 60% of patients. The onset of epilepsy in patients with CP is usually early and the course of epilepsy in these patients also tends to be severe. Epilepsy associated with CP considerably aggravates the total disability of these patients. Both neurologic difficulties and mental retardation tend to be more severe when seizures are present.

CONCLUSION

This was a hospital based study of 200 cases to the know the etiology of convulsions in children between 1 month to 5 years of age. The incidence of convulsions was highest in the age group of 1 month to 1 year (84%). The occurrence of seizures was high in males, 61% when

compared to females, 39%. The commonest type of seizure was generalized tonic clonic (93%). Focal seizures constituted 7%. Fever (77%), altered sensorium (41.5%) and vomiting (29%) were the common presenting symptoms associated with convulsions. Other symptoms included cough (21.5%), loose stools (15.5%), irritability (18%), lethargy (11%), headache (7.5%) and ear discharge (6.5%) in our patients. Only 23% had a past history of convulsions and 9% had a family history of convulsions. Developmental history was normal in 95% cases. The common neurological signs were altered sensorium (44.5%), meningeal irritation (27%) and neurological deficit (3.5%). Metabolic abnormalities like hypoglycemia and hypocalcemia was seen in 1.5% and 14% cases respectively. CSF analysis was performed in all 200 cases. CSF sugar was low in 25% cases, CSF proteins were elevated in 57% cases while pleocytosis was seen in 30.5% cases.

CT scan done in 65 cases detected abnormalities like cerebral edema (11.5%), cerebral atrophy (8.5%), hydrocephalus (6.5%), basal exudates (4.5%), infarcts (1.5%). 16 patients underwent EEG of which 7% recordings were suggestive of grand mal epilepsy while 1% had those of petit mal type. In present study, the most common cause of convulsion was febrile seizures (34.5%). Of the 69 cases of febrile seizures, 22% had a family history of febrile seizures. The other causes included viral encephalitis (20%), hypocalcemic seizures (13%), pyogenic meningitis (11%), TB meningitis (8.5%), epilepsy (8%). Of the 40 cases of viral encephalitis, dengue serology was positive in 55% cases and Japanese encephalitis serology in 7.5%. 5.5% included cases had mental retardation or cerebral palsy with epilepsy. Few other causes were hypoglycemia (2%), neurocysticercosis (1%), head injury (1%) and late hemorrhagic disease of newborn (0.5%).

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Pal DK. Epilepsy control in the 21st century: leave no child behind. *Epilepsia*. 2003;44(3):273-5.
2. Fisher RS, Acevedo C, Arzimanoglou A, Bogacz A, Cross JH, Elger CE et al. ILAE official report: a practical clinical definition of epilepsy. *Epilepsia*. 2014;55(4):475-82.
3. Gadgil P, Udani V. Pediatric epilepsy: the Indian experience. *J Pediatr Neurosci*. 2011;6(Suppl1):S126.
4. Udani V. Pediatric epilepsy-an Indian perspective. *Indian J Pediatr*. 2005;72(4):309-13.
5. Bhat BV, Verma IC, Puri RK, Srinivasan S, Nalini P. A profile of pyogenic meningitis in children. *J Indian Med Assoc*. 1991;89(8):224-7.
6. Arzimanoglou A, Guerrini R, Aicardi J. Aicardi's epilepsy in children. 3rd ed. Lippincott Williams & Wilkins; 2004:38-50.
7. Varma RR. Febrile seizures. *Indian J Pediatr*. 2002;69(8):697-700.
8. Friedman MJ, Sharieff GQ. Seizures in children. *Pediatr Clin North Am*. 2006;53(2):257-77.
9. Lorber J, Sunderland R. Lumbar puncture in children with convulsions associated with fever. *Lancet*. 1980;315(8172):785-6.
10. Kliegman RM, Behrman RE, Jenson HB, Stanton BMD. *Nelson textbook of pediatrics*: Elsevier Health Sciences; 2007.
11. Maytal J, Krauss JM, Novak G, Nagelberg J, Patel M. The role of brain computed tomography in evaluating children with new onset of seizures in the emergency department. *Epilepsia*. 2000;41(8):950-4.
12. Goel D, Agarwal A, Dhanai JS, Semval VD, Mehrotra V, Saxena V et al. Comprehensive rural epilepsy surveillance programme in Uttarakhand state of India. *Neurol India*. 2009;57(3):355.
13. Çetinkaya F, Sennaroglu E, Comu S. Etiologies of seizures in young children admitted to an inner city hospital in a developing country. *Pediatr Emergency Care*. 2008;24(11):761-3.
14. Chin RFM, Neville BGR, Scott RC. Meningitis is a common cause of convulsive status epilepticus with fever. *Arch Dis childhood*. 2005;90(1):66-9.

Cite this article as: Bharathi M, Penchalaiah A. Etiological evaluation of convulsions in children between 1 month to 5 years of age. *Int J Contemp Pediatr* 2017;4:1811-6.