

## Etiological evaluation of convulsions in children from 1 month to 14 years of age

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### ABSTRACT

**Background:** Seizures are a common problem evaluated in the pediatric emergency departments worldwide. **Objective:** The objective of the study was to study the etiology of convulsions in children aged 1 month–14 years. **Methods:** This cross-sectional study was done among 120 children admitted to the pediatric ward of a tertiary care hospital with convulsions during the period of June 2014–May 2015. Complete blood count, blood sugar, serum calcium, magnesium, and electrolytes were done for all the children. Mantoux, chest X-ray, liver biopsy, electroencephalograph, lumbar puncture and cerebrospinal fluid analysis, ultrasonography cranium, computed tomography brain, or magnetic resonance imaging brain were done based on the clinical situation. **Results:** We found that 46.7% of the children had febrile seizures, 19.2% had seizure disorder, 15% had cerebral palsy, 5.8% had viral encephalitis, 3.3% had pyogenic meningitis, 1.7% had neurocysticercosis, 0.8% had metabolic disorders, and 0.8% had traumatic brain injury, and the cause of seizures was unknown in 6.6% of the children. **Conclusion:** Children with seizures need a thorough evaluation to identify the underlying pathology causing seizures.

**Key words:** Children, Convulsions, Epilepsy, Seizures

Seizures are a common problem evaluated in the pediatric emergency departments worldwide and account for 2% of the visits to the emergency department [1]. The International League Against Epilepsy (ILAE) defined an epileptic seizure as “a transient occurrence of signs and symptoms resulting from an abnormal excessive or synchronous neuronal activity in the brain.” Seizures are the most common pediatric neurological problem; it is estimated that 4–10% of children have at least one seizure in the first 14 years of life. The incidence is highest in children <3 years of age with a decreasing frequency in older children [2-4].

As per the new updated 2017 ILAE classification of seizures [5], six recognized categories of epilepsy are: Structural, genetic, infectious, metabolic, immune, and unknown causes. Epilepsy describes a condition of susceptibility to recurrent seizures; most of the seizures in children are provoked by somatic disorders originating outside the brain such as high fever, infections, metabolic problems, head trauma, or hypoxia. Worldwide, febrile seizures are the most common type of seizures in children under 5 years of age [6,7]. Central nervous system (CNS) infections are an important cause of seizures in the developing world [8]. Less than one-third of the seizures in children are caused by epilepsy, a condition in which seizures are triggered recurrently from within the brain. Other events such as breath holding spells, syncope, and gastroesophageal reflex can cause events that simulate seizures.

The outlook for most children with symptomatic seizures or those associated with epilepsy is generally good. In some situations, seizures may signal a potentially serious underlying systemic or CNS disorder that requires a detailed investigation. Since there is still a paucity of studies on the etiological evaluation of seizures in children in India; we conducted the present study to evaluate the etiology of convulsions in children aged 1 month–14 years.

### METHODS

This prospective cross-sectional study was done during the period of June 2014–May 2015 in the pediatric ward of a tertiary care hospital. The Institutional Ethical Committee approval was obtained before starting the study. A total of 120 children, admitted with convulsions and whose parents/guardian gave consent, were included in the study. Children with toxicological causes for convulsion, seizure mimic disorders and children <1 month and children >14 years of age were excluded from the study.

Detailed history and examination of the subjects were done and recorded in the pre-structured questionnaire. Complete blood count, blood sugar, serum calcium, serum magnesium, and serum electrolytes were done for all the children. Mantoux, chest X-ray, liver biopsy, electroencephalograph (EEG), lumbar puncture and cerebrospinal fluid analysis, ultrasonography cranium, computed tomography brain, or magnetic resonance imaging (MRI) brain were done based on the clinical situation.

## RESULTS

Of 120 children included in the study, 57.5% (67) were males and 42.5% (51) were females. The largest proportion (30%) of children was in the age group of 1–2 years and the smallest proportion (9.1%) was in the age group 10–14 years; the age distribution of the study population is given in Table 1.

Regarding the type of convulsion 81.7% (98) of the children had generalized Tonic-Clonic seizures and 18.3% (22) of them had focal seizures. Atypical febrile seizures (6 children), seizure disorder (10), viral encephalitis (2), pyogenic meningitis (1), neurocysticercosis (2), and traumatic brain injury (1) were the causes of focal seizures.

Information regarding the history and family history of seizures was obtained from all the respondents. Among them, 55% (66) children had history of convulsions and 15.8% (19) children had a family history of seizures. In the present study, 80% (96) children had normal development and 20% (24) had delayed development. Cerebral palsy (11 children), seizure disorder (8), and congenital malformation of the brain (5 children) were the etiology in those presenting with developmental delay.

EEG recording was done in 79 children, and among them, 51.9% (41) had normal EEG and 48.1% (38) had an abnormal EEG recording in the form of spikes and sharp waves. MRI brain was performed in 41 children, and among them, 48.8% (20) had normal MRI and 51.2% (21) had abnormal MRI findings. The MRI findings are given in Table 2.

Regarding the etiology of convulsions, of the 120 children, 46.7% (56) had febrile seizures, 19.2% (23) had seizure disorder, 15% (18) had cerebral palsy, 5.8% (7) had viral encephalitis, 3.3% (4) had pyogenic meningitis, 1.7% (2) had neurocysticercosis, 0.8% (1) had metabolic disorder, and 0.8% (1) had traumatic brain injury and the cause of seizures was unknown in 6.6% (8) children. One child had a metabolic disorder who had glycogen storage disorder Type 1, and the diagnosis was confirmed by liver biopsy and enzyme assay.

## DISCUSSION

Seizures are the most common pediatric neurological disorder occurring in approximately 10% of children. The present study was conducted to know the various etiologies of convulsions in children aged 1 month–14 years. We have included 120 children in our study who were admitted to our hospital with convulsions over a period of 12 months. Among them, 57.5% were males and 42.5% were females.

In a study done by Gowda *et al.* in Bengaluru, 150 children from 1 month to 18 years of age were evaluated for seizures, and they found a male predominance in the ratio of 1.2:1 [9]. In the present study, the largest proportion (30%) of children was in the age group of 1–2 years and the smallest proportion (9.1%) was in the age group of 10–14 years. This is in concurrence with a study by Mamillapalli and Penchalaiah from Nellore, where they found the highest incidence of seizures in the age group of 1 month–1 year [10]. Similar observations were made in the study

**Table 1: Convulsions in the different age groups**

Age group (years)	n (%)
0–1	14 (11.7)
1–2	36 (30)
2–3	19 (15.8)
3–4	9 (7.5)
4–5	8 (6.7)
5–10	23 (19.2)
10–14	11 (9.1)
Total	120 (100)

**Table 2: MRI brain findings**

MRI findings	Number of cases (%)
Mesial temporal sclerosis	8 (38)
Focal cortical dysplasia	3 (14.3)
Cerebral atrophy with ventricular dilatation	3 (14.3)
Polymicrogyria	2 (9.5)
Schizencephaly	2 (9.5)
Calcification	2 (9.5)
Hypoplasia of corpus callosum	1 (5)
Total	21 (100)

MRI: Magnetic resonance imaging

by Ashraf *et al.* [11]. Regarding the type of convulsions, 81.7% of the children had generalized Tonic-Clonic seizures and 18.3% of them had focal seizures. Kuruvilla *et al.* conducted a study in Mangalore and reported GTCS as the most common type of seizure in children [12].

Developmental milestones should be assessed in all cases of childhood epilepsy. Prenatal/perinatal insults or CNS malformations present with seizures and developmental delay. In the present study, it was found that 20% of the children had delayed development. In a study done by Chithambaram and Ravichander in Bengaluru, it was found that 28% of children had developmental delay [13]. EEG recording was done in 79 children, and among them, 51.9% of children had a normal EEG, and 48.1% had an abnormal EEG recording. In the study done by Saravanan, it was reported that 70% of the children with seizures had abnormal EEG findings [14].

Neuroimaging is mandatory for the workup of children presenting with seizures. The MRI is the preferred modality of neuroimaging for children presenting with seizures and is increasingly being used to understand the underlying disease process [15,16]. In this study, MRI brain performed in 41 children; of them, 48.8% had normal MRI and 51.2% had abnormal MRI findings. In a study done by Chaurasia *et al.* in the Bundelkhand region of North India, 271 children presenting with epilepsy were evaluated. MRI brain done among them revealed positive findings in 70.4% of the cases [17]. Saravanan conducted a study in Kanchipuram in South India and also reported that 25% of the children with seizures had abnormal neuroimaging findings [14].

Regarding the etiology of convulsions, we found that febrile seizures, seizure disorder, cerebral palsy, viral encephalitis, pyogenic meningitis, neurocysticercosis, metabolic disorders,

and traumatic brain injury were the common causes. Similar observations were made by Adhikari *et al.* who studied the profile of 551 children admitted with seizures to a tertiary care hospital in Nepal [18]. In the present study, 46.7% of the children had febrile seizures, and this was the most common cause of seizures. Kumar *et al.* also reported febrile convulsions as the most common cause of seizure in children under than 5 years of age [19]. Similar observations were made by Sadleir and Scheffer [20]. Delpisheh *et al.* conducted a meta-analysis and found the pooled prevalence of childhood febrile seizures in Iran to be 47.9% [21].

## CONCLUSIONS

In our study, we found that febrile seizures were the most common cause of seizures, followed by seizure disorder, cerebral palsy, viral encephalitis, pyogenic meningitis, neurocysticercosis, metabolic disorders, and traumatic brain injury. Thorough evaluation including a careful history, physical examination, laboratory workup, EEG, and neuroimaging studies are required to identify the underlying pathology causing seizures.

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