



# Study of Status Epilepticus in Children: Etiology, Associated Risk Factors and Outcome

<sup>1</sup>Dr. Kamesh Patel, <sup>2</sup>Dr. Halak Vasavada, <sup>3</sup>Param Patel, <sup>4</sup>Dr. Chirag Patel, <sup>4</sup>Dr. Piyush Dholakiya,  
<sup>5</sup>Dr. Shraddha Prakashbhai Merja, <sup>6</sup>Dr. Darshan Jethva

<sup>1</sup>Senior Resident, Department of Pediatrics, Narendra Modi Medical College and LG Hospital, Maninagar, Ahmedabad, Gujarat, India

<sup>2</sup>Professor, Department of Pediatrics, Narendra Modi Medical College and LG Hospital, Maninagar, Ahmedabad, Gujarat, India

<sup>3</sup>Second Year MBBS Student, GMERS Medical College and Hospital, Sola, Ahmedabad, Gujarat, India

<sup>4,5,7</sup>Junior Resident, Department of Pediatrics, Narendra Modi Medical College and LG Hospital, Maninagar, Ahmedabad, Gujarat, India

<sup>6</sup>Junior Resident, Department of Pediatrics, SMIMER Medical College and Hospital, Surat, Gujarat, India

## Abstract:

This study was conducted to analyse the clinical characteristics of status Epilepticus in pediatric age groups and know etiology, risk factors and outcomes. Clinical details of all hospitalized children with status Epilepticus were recorded and cases were analyzed further. Total 60 cases were admitted out of which 38(63.3%) were males and 22(36.6%) were females, out of which 15(25%) was < 1 year, 29(48.3%) was between 1-5 years while 16(26.6%) were > 5 years. The most common etiology seen was acute symptomatic seizure 20(33.3%), followed by febrile seizure 13, epilepsy syndrome 11, and lastly remote seizures with 7 cases. In 14(23.4%) cases which had multiple seizures before hospitalization, out of them 6 were had re admitted. It has been found that there if there was altered levels of sodium then it had higher mortality. In terms of outcomes 43(71.6%) were discharged, while 14 (23.3%) of them re admitted and 3 (5%) of them died.

**Keywords:** Status Epilepticus, Pediatric Seizures, Etiology and Risk Factors, Clinical Characteristics

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## 1. Introduction

The 2015 International League Against Epilepsy defines status Epilepticus as “A condition resulting either from the failure of the mechanisms responsible for seizure termination or from the initiation of mechanisms which lead to abnormally prolonged seizures (after time point t1). It is a condition that can have long-term consequences (after time point t2), including neuronal death, neuronal injury, and alteration of neuronal networks, depending on the type and duration of seizures” [1]. Despite substantial research and treatment advancements over the last two decades, SE continues to be associated with substantial morbidity and mortality. Either convulsive or non-convulsive SE affects children and is sometimes associated with high morbidity and

mortality, particularly in infants varying from 4% to 39% in different studies [2-6]. The overall incidence of SE is 9.9 to 41 per 100,000/year, with peaks in children and the elderly. The neonatal period shows the highest incidence which declines roughly by about five years of age. Estimates in the first year of life are approximately 135–150 per 100,000 people, with higher incidence in vulnerable populations with acute or chronic neurologic conditions. Through the pediatric age group, the comprehensive estimates of the incidence of status Epilepticus have been found to be between 17 and 23 per 100,000 children [5]. Unique features pertaining to the pediatric population include a much higher rate of recurrence of status Epilepticus, more repeated infectious or remote symptomatic causes, and more likely occurrence in children without a diagnosis of



epilepsy. In about 75% of cases, status Epilepticus may be the first presenting seizure of life, and these children only have a 30% risk of a later diagnosis of epilepsy [7]. In spite of the higher incidence of status Epilepticus in children as compared with adults, the overall mortality of status Epilepticus is lower in children than adults [8]. The etiology is the major determinant of mortality. Though many studies in status Epilepticus have been done, studies on pediatric population in our geographical area are few. Hence this study was undertaken to delineate the clinic-demographic profile of status Epilepticus in children.

**MATERIALS AND METHODS:**

The study was a hospital based prospective observational study done in pediatric set up of a tertiary medical college hospital for a period of 18 months that is from September 2020 to March 2022. During the study period with age group of 1 months to 12 years presenting with status Epilepticus to Pediatric Intensive Care Unit or Pediatric Ward were included and Child with repeat episode of status which is already included in study was excluded. However, the requirement of repeat admission during study period at our hospital was noted in the outcome. All consecutive cases of Status Epilepticus admitted to PICU or Pediatric ward of our hospital were included in the study by

**Observations:**

**Table 1:** Distribution of children in study group according to the Age & gender:

Age (In Years)	Male		Female		Total	
	No. of Patient	%age	No of Patients	%age	No.of Patients	%age
<1Year	11	18.33%	4	6.66%	15	25%
1-5 Year	17	28.33%	12	20%	29	48.33%
>5Year	10	16.66%	6	10%	16	26.66%
Total	38	63.33%	22	36.66%	60	100%

Table no.1 shows age & gender wise distribution of the patients included in present study. In present study it was seen that 29 children (49.33%) were between the age group of 1-5 years, 15 children

“Universal sampling method”. Children who presented to hospital with more than 5 minutes of on-going-seizures were included in the study. Duration was noted from start of seizure as per informant and time taken for travel was also accounted for. Parental consent was taken before enrollment of the patient in the study. The patients’ data was collected and documented in following categories using a case record form and recorded as follows: Demographic data including age and gender. Clinical data including medical history, neurological and other physical examinations, type of seizure, duration of SE, different types of treatments used and outcome of treatment. At presentation, the child was evaluated in emergency room by Pediatric Advanced Life Support (PALS) assessment. Clinical examination including a detailed neurological evaluation and features suggesting a syndrome was specifically looked for. Blood and specific investigations done such as serum glucose, complete blood count, blood gas, calcium, and were noted. Some patients required additional diagnostic testing including lumbar puncture, neuro-imaging, and other blood work (liver function tests, coagulation panel, serum or urine drug screen, inborn errors of metabolism screen), done as per the protocol were entered in the case record forms.

(25%) were less than 1 year of age while 16 children (26.6%) were above 5 years of age. In present study it was seen that 63.3% children (38) were male while 36.6% (22) were female.

**Table 2:** Distribution of children in study group according to the Etiology

Etiology	Age (In Years)			Total No. & Percentage
	<1	1-5	>5	
A) Prolonged Febrile Seizure	2	6	5	13(21.6%)
B) Epilepsy Syndrome	2	5	4	11(18.3%)
C) Remote Symptomatic Epilepsy	1	6	0	7(11.6%)
D) Acute Symptomatic seizure	8	8	4	20(33.3%)
1) Hypocalcemic Seizure	2	0	0	2
2) Hyponatremic Seizure	1	1	0	2
3) Hypoglycaemic Seizure	2	3	0	5
4) TB Meningitis	00	1	1	2



5) viral Meningitis	0	1	0	1
6) Bacterial Meningitis	2	0	0	2
7) ADEM.	0	0	2	2
8) Hyponatremia	1	0	0	1
9) Metabolic encephalitis	0	1	0	1
10) Non haemorrhagic infarct	0	1	0	1
11) PRES syndrome	0	0	1	1
E)Unknown Cause First Episode	3	2	1	6(10%)
F)Unknown Cause Repeat Episode	1	1	1	3(5%)
Total	25	36	19	60

Table no 2 shows the distribution of children in study group as per etiology of status Epilepticus. The most common etiology seen in present study was acute symptomatic seizure which was seen in 20 children (33.3%). Other etiologies seen in decreasing order of frequency were prolonged febrile seizure seen in 13 children, epilepsy syndrome in 11 children, remote symptomatic seizure in 7 children,

1<sup>st</sup> attack of unprovoked seizure in 6 children and repeat attack of unprovoked seizure in 3 children. In acute symptomatic seizure hypoglycemic seizures being most common and seen in 5 patient, followed by tubercular meningitis and bacterial meningitis in 2 children, hyponatremic and hypocalcemic seizure in 2 children, ADEM in 2 children as well followed by viral meningitis which was seen in 1 children.

**Table 3:** Distribution of children in study group according to outcome

Outcome	No. of Children (n=60)	Percent
Discharge (with no readmission during the study period)	43	71.66%
Readmission (For status epilepticus during the study period)	14	23.33%
Death	3	5%
Total	60	100%

In present study, in terms of outcome 43 children (71.66%) discharge, 14 children (23.33%) require

readmission during our study period (2years), 3 children (5%) died during hospital stay.

**Table 4:** Association between Number of Seizures before child presented to Hospital and Outcome

Seizure Episodes in last 24 hrs.	Readmission (For status epilepticus during the study period)	Discharge	Death	Total
One (including the present episode)	8	35	3	46
Multiple	6	8	0	14
Chi squareX <sup>2</sup> : 4.433668, p value: 0.21 non-significant				

Table no. 4 shows association between no. of seizure episode in last 24 hour before child presented to hospital and outcome. Total 46 children had single episode in last 24 hour, out of which 35 patients were discharged, 8 children required readmission and 3 children died. 14 children

(23.4%) had multiple attacks in last 24 hour. In which 8 children discharged and 6 children readmitted. In present study 3 children died who had single attack in last 24 hour before presented to hospital. There is no association between increase no. of attack in last 24 hour and mortality.

**Table 5:** Association between Sodium and Outcome

Sodium levels(Na+)	Readmission For status epilepticus during the study period	Discharge	Death	Total
Low Sodium (Hyponatremia)	4(26.6%)	9(60%)	2(13%)	15(100%)
Normal Sodium	8(20%)	32(80%)	0	40(100%)
Hyponatremia	2(40%)	2(40%)	1(10%)	5(100%)
Chi-Square Test, P Value 0.018, Significant				



Table 5 shows association between Sodium level and outcome. Out of 60 patient 40 patients had normal sodium level out of which 32 children discharged and 8 children required readmission. 15 children had presented with hyponatremia. Out of which 9 children discharged, 4 required readmission, and 2 died. 5 children presented with Hypernatremia on presentation, out of which 2 get discharged, 2 required readmission, and 1 died

### Discussion

There is a predominance of SE in younger children, the reason for this predominance is not known. Probably, mechanisms for control of seizure activity are fragile in younger children and may get disrupted with minimal abnormalities in neuro-function. These findings are similar to study conducted by Shinnar et al. It was found that most cases of status Epilepticus occurred in children less than 2 years of age [9]. In similar studies Gulati S, Kalra V et al. And Prakash AT et al. conducted at Indian center's, which also suggests that the incidence is more in children less than 5 years of age [10, 11]. In study conducted by Arun PT et al. 60% were in the age group were less than 5 years, 22% were between 6-10 years, 14% were between 11-15 years and 4% were above 16 yrs [12].

Of the acute symptomatic etiology, cerebrovascular disease is the predominant cause in developed countries [13,14], whereas in developing countries CNS infections accounted for 28-67% of etiological spectrum and this was much more in the pediatric age group [15,16] in study done by Mritunjay Kumar et al, acute symptomatic etiology accounted for 47% of the etiology [17]. Similar high frequency of acute symptomatic etiology was reported in the hospital-based series in developing countries like Maharaj N et al. study [18]. In another study by Chin et al., 266 children were enrolled for the ascertainment of etiology of SE. Ninety-eight children (56%) was previously neurologically healthy individuals. Acute symptomatic SE occurred in 30 cases (17%). Most children with acute symptomatic SE (17%) had either a metabolic derangement (electrolyte imbalance, hypoglycemia, hypocalcaemia or hypomagnesaemia) or an acute CNS infection (12% bacterial meningitis versus, 8% viral CNS infection). Remote symptomatic and cryptogenic accounted for 16% and 12% of SE cases, respectively [16].

In recent studies there is a decrease in mortality rate, this may be probably because of usage of newer anticonvulsants and of mechanical ventilators. In present study lower mortality is probably due to early presentation and early

termination of seizure (being a PICU of tertiary care centre), so less chance to be refractory and 2<sup>nd</sup> reason could be the usage of newer anticonvulsant. Mortality in the present study is 5%, which is almost similar with Arun PT et al study, having mortality of 4%. In study done by Gulati the mortality 30%. Judith found that overall mortality is 6%. Kwong KL had a mortality of 11% [10,12,19].

In present study it is suggested that altered level of sodium is associated with significant mortality. Thus it was seen that sodium levels had a significant association with outcome. Although sodium derangements are also considered an important etiology of status epilepticus [20,21,22]; they also play a role in pathogenesis. Sodium channels play an important role in development of refractory seizures [23], which has formed the basis of certain antiepileptic like lacosamide and Phenytoin.

### Conclusion

Status epilepticus is a common childhood medical neurological emergency and is associated with significant morbidity and mortality. The present study shows a male preponderance with 1-5 years being commonest age of presentation. Acute symptomatic seizure was the commonest etiological factors and fever was commonest association. Hypo and hypernatremia were associated with poor outcomes. Sodium channels play an important role in development of refractory seizures, which has formed the basis of certain anti-epileptic like lacosamide and phenytoin. The duration of seizures was found to be associated with high mortality outcomes as compared to the number of seizure episodes. Awareness in the society about the timely usage of Midazolam could possibly help in reducing duration of seizures and hence the mortality outcomes.

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