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To Study the Clinical Profile, Risk Factors and Short-Term Outcome of Status Epilepticus of Children Admitted in Pediatric Intensive Care Unit of Tertiary Care Hospital of South Gujarat

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ABSTRACT

Introduction: The most common neurological emergency is status epilepticus (SE). The incidence of SE has a bimodal distribution, with older people and children under the age of one experiencing its highest occurrences. **AIM**: To examine the clinical-etiological characteristics and short-term outcome of status epilepticus in children admitted at tertiary care hospital. **Methodology**: This observational cross-sectional study was conducted in the Pediatric Intensive Care Unit (PICU) of New Civil Hospital, Surat, over a period of 18 months **Result**: Status epilepticus was most common in children aged 1–5 years, with fever with convulsions being the predominant presentation. Most patients required two antiepileptic drugs (mainly midazolam and phenytoin), while abnormal CRP, CSF, and MRI findings suggested CNS infections as the leading underlying cause. **Conclusion**: Status epilepticus was most common in younger children and was primarily associated with febrile seizures and central nervous system infections. Early diagnosis, antiepileptic therapy, and timely management of the underlying cause were associated with favorable outcomes and reduced morbidity.

Keywords: *Status epilepticus, Pediatric Intensive Care Unit, antiepileptic therapy.*

INTRODUCTION

The most common neurological emergency is status epilepticus (SE). The incidence of SE has a bimodal distribution, with older people and children under the age of one experiencing its highest occurrences[1].Due to the high rate of death and morbidity associated with pediatric status epilepticus (SE), it is a common serious medical and neurological emergency of the utmost concern.[2] It has been estimated that the annual prevalence of childhood convulsive SE in developed nations is between 15 and 20 per 100,000 children[3]. Population-based research is scarce on status epilepticus in India, however rates are thought to be significantly higher (80–100/100,000 children).Status epilepticus is a medical emergency characterized by prolonged seizures or a series of seizures where the person does not regain consciousness between episodes[4]. The main goal of treatment is to stop the seizures and prevent further complications. This usually involves administering antiepileptic medications such as benzodiazepines (like diazepam or lorazepam) to halt the seizure activity, followed by other medications if necessary to maintain seizure control.The most common type of SE is convulsive status epilepticus (generalized tonic, clonic, or tonic-clonic),[5] but other types do occur, including nonconvulsive status (focal with impaired awareness, absence), myoclonic status, epilepsia partialis continua, and neonatal status epilepticus.The incidence of SE ranges between 10 and 60 per 100,000 population in various studies. SE is most common in children younger than 5 yr of age, with an incidence in this age group of > 100 per 100,000 children.[6] Approximately 30% of patients presenting with SE are having their first seizure, and approximately 40% of these later develop epilepsy.Febrile status epilepticus is the most common type of SE in children. In the 1950s and 1960s, mortality rates of 6–18% were reported after SE; currently,

with the recognition of SE as a medical emergency, a lower mortality rate of 4–5% is observed, most of it secondary to the underlying etiology rather than to the seizures. About 3% of epileptics experience a SE in their lifetime. Pediatric status epilepticus is highly associated with neurological morbidity[7]. The main predictor of outcome is the underlying symptomatic etiology of SE and to a lesser degree the presence of a history of epilepsy. Duration does not seem to play a major role[8,9].The findings can inform public health policies and strategies aimed at reducing the incidence and improving the management of SE in children[10,11]. This can lead to initiatives focused on early detection, community education, and better healthcare practices.This study is crucial for improving the understanding, management, and outcomes of status epilepticus in children in South Gujarat, which can ultimately lead to better healthcare delivery and policy formulation for this vulnerable population.

AIM

To examine the clinical-etiological characteristics and short-term outcome of status epilepticus in children admitted at tertiary care hospital.

METHODOLOGY

This observational cross-sectional study was conducted over a period of 18 months, comprising 12 months of data collection followed by six months for data entry, statistical analysis, and report preparation. It was done in the Pediatric Intensive Care Unit (PICU) of New Civil Hospital Surat. Purposive sampling was used to recruit the study participants. All children aged 1 month to 12 years presenting with status epilepticus and admitted to the PICU during the study period were eligible for inclusion. Written informed consent was obtained from the parents or legal guardians before enrolment. Children whose parents or guardians were unwilling to provide consent were excluded from the study.

RESULT:

Table 1:Baseline characteristics

		Frequency	Percent
Gender	Female	27	45
	Male	33	55
Age Groups	0-5 year	29	48.3
	6-10 year	15	25.0
	>11 year	16	26.7

The table demonstrated Gender Vise distribution of all study patients.in this study male patients were more (55%) than female patients(45%).In this present study most of the patients were belong to the age between 0 to 5 year (48.3%),following 6year to 10 year (25%) and (26%) patients had age more than 11 year.

Table 2: Distribution of all patients according to their Presenting Complaints, onset of Seizure, Fever Duration and type of Seizure

		Frequency	Percent
Presenting Complaints	Fever with convulsions	26	42.6
	Convulsions	34	57.4
Duration	<24 hours	11	45%
	>24 hours	15	55%
Onset	Focal	8	13
	Generalize	52	87
Type of seizure	FOCAL	5	8.3
	GTCS	55	91.6

The above table and graph represent the distribution of all patients according to their presenting chief complaint—most of the patients presented with fever and fever with convulsion. The majority of cases took more than 24 hours, while slightly fewer were resolved in under 24 hours. mode of onset of seizure in all patients. In the majority of the patients (87%) it was almost Generalized in onset. In the majority of the patients (92%) it was Generalized tonic clonic type (GTCS).

Table 3: The Mean Value of various Investigation

investigation	Minimum	Maximum	Mean	Std. Deviation
HB	4.2	14.2	9.877	2.17
PCV	20	42	29.15	6.08
CRP	6	132	49.40	47.12
CREATININE	0.3	1.2	0.692	0.27
SODIUM	109	162	145.30	8.72
POTASSIUM	3.4	4.2	3.917	0.26
CALCIUM	4.7	11.2	10.500	0.57

RBS	28	128	93.73	30.08

The mean hemoglobin, packed cell volume, C-reactive protein, serum creatinine, sodium, potassium, calcium, and random blood sugar levels were 9.88 ± 2.17 g/dL, 29.15 ± 6.08%, 49.40 ± 47.12 mg/L, 0.69 ± 0.27 mg/dL, 145.30 ± 8.72 mEq/L, 3.92 ± 0.26 mEq/L, 10.50 ± 0.57 mg/dL, and 93.73 ± 30.08 mg/dL, respectively.The observed ranges were 4.2–14.2 g/dL for hemoglobin, 20–42% for PCV, 6–132 mg/L for CRP, 0.3–1.2 mg/dL for creatinine, 109–162 mEq/L for sodium, 3.4–4.2 mEq/L for potassium, 4.7–11.2 mg/dL for calcium, and 28–128 mg/dL for random blood sugar.

Table: 4 Distribution of blood glucose level at the time of presentation.

Variable	Frequency	Percentage
Euglycemia	54	90.5%
Hypoglycemia	6	9.5%

The above table shows Euglycemia (normal blood sugar) occurred in 5 cases, representing 8% of the total. Hypoglycemia (low blood sugar) occurred in 55 cases, accounting for 92% of the total.

The majority of cases (92%) experienced hypoglycemia, while only 8% had normal blood sugar levels.

Table 5: Findings of MRI Brain , CSF examination and EEG findings

	Variable	Frequency	Percentage
Findings	Cerebral atrophy	11	18.3
	Encephalitic changes	7	11.7
	Hypoxic encephalopathy	3	5
	Meningitis	16	26.7
	Non-commutating hydrocephalus	1	1.7
	Normal	13	21.7
	Not Done	8	13
	Puff of smoke	1	1.7
CSF Examination	Lymphocytic predominance	7	13.1
	Normal	15	24.6
	Not done	17	27.9
	Polymorphus + glucose	21	34.4
EEG	Altered	11	18
	Normal	13	22
	Not done	36	60

In the MRI findings, Meningitis was the most common finding, occurring in 16 cases (26.2%). Cerebral atrophy and normal MRI results were each observed in 11 cases (18% each). Encephalitic changes were noted in 7 cases (11.5%). Not Done applied to 8 cases (10.2%). Hypoxic encephalopathy and non-communicating hydrocephalus were each found in 3 cases (4.9% each). A puff of smoke (a rare finding) was seen in 1 case (1.2%).Meningitis and cerebral atrophy were the most frequent findings.In the CSF examination findings: Polymorphus + glucose was the most common result, observed in 21 cases (34.4%). Not done applied to 17 cases (27.9%). Normal CSF findings were present in 15 cases (24.6%). Lymphocytic predominance was seen in 7 cases (13.1%).EEG findings were altered in small groups (19.7%) of patients, and EEG was not done in most of the patients.

Table 6: Distribution of patients according to given treatment and number of AEDs required for their treatment

		Frequency	**Percent**
Treatment Given	Inj.Midazolam	16	26.7%
	Inj.midazolam + Inj Phenytoin	15	25%
	Inj .Midazolam + Inj levera	13	21.7%
	Inj Midazolam + Inj valproate	9	15%
	Inj midazolam+Inj.pheytoin + injlevera	5	8.3%
	Inj phenytoin + Inj.levera+ valproate + Inj Midazolam infusion	2	3.3%
No of AED Required	1	16	27.3

	2	37	62.4
	3	5	8.3
	4	2	3

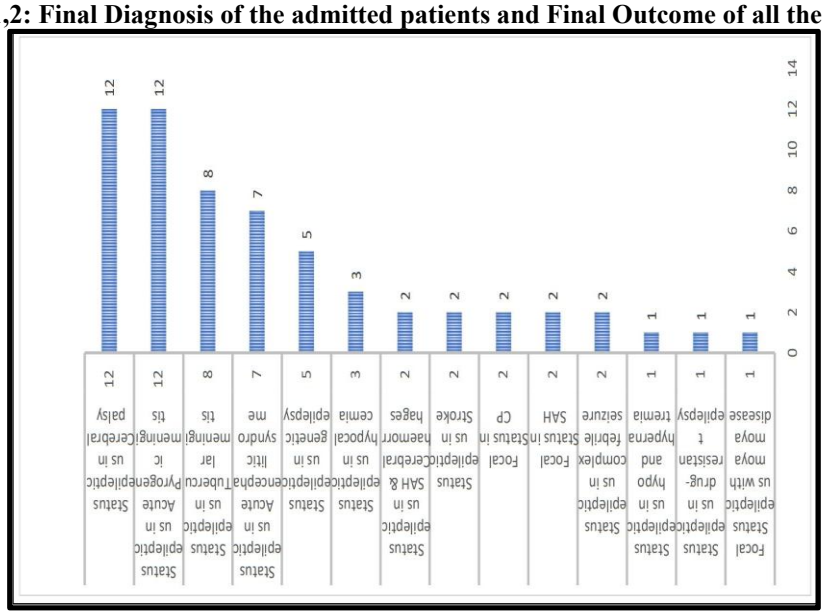
From the above table and graph,most of the patient's seizure activity is controlled by midazolam alone and with a combination of midazolam+phenytoin accounting for 27%[16] and 25%[15] respectively. Followed by midazolam+levera and midazolam abd valproate accounting for 22%[13] and 15%[9] respectively.Minority of the patients required more than 2 AED accounting for about 11%

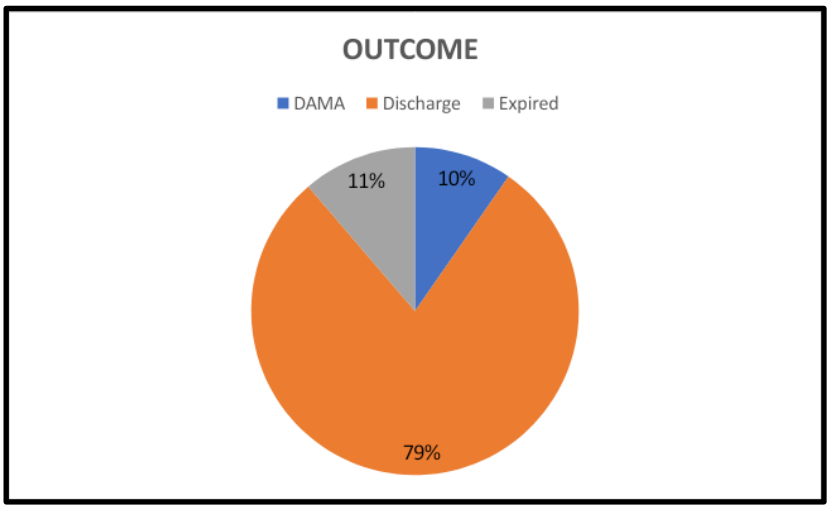
Table 7: Distribution of patients according to total hospital admission days and Outcome During Admission

		Frequency	Percentage
Hospital Days	0-5days	17	28.3
	6-15days	29	48.3
	16-25 days	9	15
	>25 days	5	8.3
Outcome During Hospital Admission	Association with Shock	15	25
	Ventilator support required	13	22
	Recurrence after control SE	5	8
	No recurrence	27	45

The majority of patients (50.9%) stayed in the hospital for 6-15 days, followed by 28% who stayed 0-5 days, and 12.5% who stayed 16-25days. Only 8.3% of patients had extended hospital stays beyond 25 days. Among them, 15 patients (25%) had an association with shock, 13 patients (22%) required ventilator support, and 5 patients (8%) experienced a recurrence after control of status epilepticus (SE). A majority, 27 patients (45%), had no recurrence. The total number of patients is 60, representing 100% of the cohort.

Figure 1,2: Final Diagnosis of the admitted patients and Final Outcome of all the patients





Status epilepticus in Acute Pyogenic Meningitis and Cerebral Palsy were the most common, each affecting 12 cases (20%). Status epilepticus in Acute Encephalitic Syndrome was diagnosed in 7 cases (11.7%), while Tubercular Meningitis was seen in 8 cases (13.3%). Other less frequent diagnoses included Hydrocephalus and Hypocalcemia, each with 3 cases (5%), and rare conditions like Moya Moya disease and drug-resistant epilepsy, with 1 case each (1.7%). Most patients were discharged (79 %), while a smaller portion left against medical advice (10%) or passed away (11 %)

Table 8: Association between Age and total number of hospital admission days

		hospital day				Total	**Chi-Square**
		0-5days	6-15days	16-25days	>25days		**P value**
Age	0-5 yr	3	1	20	5	29	55.549
	6-10yr	10	5	0	0	15	0.001
	>11yr	4	12	0	0	16	Significant
Total		17	18	20	5	60	

The P-value is less than 0.05, which indicates a statistically significant relationship between age and the length of hospital stay. The analysis shows that younger children (0-5 years) tend to stay longer in the hospital (16-25 days), while older children (6-10 years) and those aged over 11 years are more likely to have shorter hospital stays (0-15 days). This relationship between age and hospital stay is statistically significant.

DISCUSSION:

As shown in the table out of 60 patients enrolled in the study ,29 patient[48%] belongs to the age group followed by almost equal distribution in the age group 6 to 11 and 11 to 12 contributing around 15[25%] and 16 [27%].This high prevalence in this age group signifies that younger children are more susceptible to status epilepticus,mainly due to insult to developing brain and due to lowered immunity.

Additionally, the underlying cause of SE plays a significant role. Etiologies such as cerebral palsy, infections (e.g., meningitis, encephalitis), and metabolic disorders are common in younger children, while epilepsy-related SE is more frequent in older children

In this study , the most common treatments included Inj. Midazolam, either alone or in combination with other antiepileptic drugs (AEDs) like Phenytoin and Levera, indicate a preference for midazolam and phenytoin-based therapies in SE management. Combinations of drugs were frequently used to manage drug-resistant or complex SE cases.

The most frequent MRI abnormalities were meningitis-related changes (26.7%) and cerebral atrophy (18%), suggesting that infections and chronic neurological damage play a crucial role in SE presentation.

From the above table, the majority of the patients, almost 26[43%] patients present with fever with convulsion,other study data also suggests the same implicating that infectious causes are more associated with status epilepticus.

Our study reported hypoglycemia in 10% of cases, which is higher than the 5% observed in the USA study by Sanchez et al. (2018)[12]

The mean hemoglobin in our study was 10.2 g/dL, with 40% of cases showing anemia. Anemia prevalence is higher in developing countries like India and Bangladesh, as shown in Hossain et al. (2019)[13] .

Elevated CRP levels were seen in 55% of our cases, indicating the presence of inflammatory processes, possibly due to CNS infections. This is higher than in the USA study, where CNS infections are less common.

Abnormal CSF findings (pleocytosis, raised protein) were present in 47% of cases in our study, similar to Hossain et al[13] and higher than the USA study, where fewer CNS infections were reported.

The percentage of abnormal MRI findings was 65% in our study, higher to Hossain et al,but lower than studies in the USA, which reported abnormalities in 70% of cases.

EEG findings were abnormal in 18% of cases in our study, with generalized epileptiform discharges.,though the USA study showed a slightly higher rate of generalized discharges (50%), possibly due to better detection methods and early referral.

In our study, the majority of children with SE required 2 AEDs.
Midazolam and Phenytoin were the most frequently used AEDs in both our study and Diazepam use was more common in Hossain et al. (2019)[13], likely due to cost-effectiveness and availability in developing countries like Bangladesh.

In our study 12% of the patients had refractoriness in seizures which is in the same line with the studies of Hossain et al[13] .
The average length of hospital stay in our study (8 days) is shorter than studies from the USA and Bangladesh. This variability is likely due to differences in hospital protocols, the severity of cases, and healthcare resources.

In this present study, short-term outcomes varied based on the underlying cause and the timely treatment administration. Children with SE related to infections, particularly meningitis, had better outcomes with appropriate and early intervention. The mortality rate in our study is also in line with other studies from the region. However, studies from the USA report slightly better outcomes, which reflect differences in healthcare infrastructure and early intervention.

CONCLUSION:
Status epilepticus mainly affects younger children, with febrile seizures. central nervous system infections being the most common underlying etiologies. Midazolam- and phenytoin-based therapy formed the main treatment, while abnormal inflammatory markers, CSF, and MRI findings showed the significant contribution of infectious and structural brain pathologies.Early recognition and initiation of appropriate antiepileptic therapy, with timely management of the underlying cause were associated with favorable short-term outcomes. Strengthening early diagnosis and improving access to pediatric critical care further reduce morbidity and mortality in children with status epilepticus.

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