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Status epilepticus severity score (STESS): A useful tool to predict outcome of status epilepticus

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ABSTRACT

Objective: The treatment protocols for status epilepticus (SE) range from small doses of intravenous benzodiazepines to induction of coma. The pros and cons of more aggressive treatment regimen remain debatable. The importance of an index need not be overemphasized which can predict outcome of SE and guide the intensity of treatment. We tried to evaluate utility of one such index Status epilepticus severity score (STESS).

Methods: 44 consecutive patients of SE were enrolled in the study. STESS results were compared with various outcome measures: (a) mortality, (b) final neurological outcome at discharge as defined by functional independence measure (FIM) (good outcome: FIM score 5–7; bad outcome: FIM score 1–4), (c) control of SE within 1 h of start of treatment and (d) need for coma induction.

Results: A higher STESS score correlated significantly with poor neurological outcome at discharge ($p = 0.0001$), need for coma induction ($p = 0.0001$) and lack of response to treatment within 1 h ($p = 0.001$). A STESS of <3 was found to have a negative predictive value of 96.9% for mortality, 96.7% for poor neurological outcome at discharge and 96.7% for need of coma induction, while a STESS of <2 had negative predictive value of 100% for mortality, coma induction and poor neurological outcome at discharge.

Conclusion: STESS can reliably predict the outcome of status epilepticus. Further studies on STESS based treatment approach may help in designing better therapeutic regimens for SE.

1. Introduction

Status epilepticus (SE) is a common neurological emergency with substantial mortality (7–39%) and morbidity [1–3]. It is indeed surprising that despites decades of research, no uniform consensus is available for treatment of SE. The management of SE varies widely ranging from intravenous (IV) benzodiazepines alone to IV benzodiazepines and antiepileptic drugs in varying combinations to induction of coma with anaesthetic agents [4–6]. The risk benefit ratio of these various treatment protocols is unclear. Hence there appears the need for a simple prognostic score that can guide the treatment regimen.

Status epilepticus severity score (STESS) is one such score which can provide a convenient method to predict outcome of SE and may help in deciding intensity of treatment of SE. Though introduced first in 2006 and subsequently validated in 2008, it has not yet gained widespread acceptance and is sparingly used in clinical practice.

2. Aims and objectives

To determine the utility of STESS in predicting outcome of SE.

3. Patients and methods

44 consecutive patients of SE who were admitted to the emergency department of a tertiary care hospital (Post Graduate Institute of Medical Education and Research, Chandigarh, India) were enrolled in the study. SE was defined as continuous, generalized, convulsive seizure lasting >5 min, or two or more seizures during which the patient does not regain normal sensorium [9]. Written consent was obtained from relatives of the patients as the

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Table 1
Status epilepticus severity score (STESS).

Variable	Feature	Score
Level of consciousness	Alert or somnolent or confused	0
	Stuporous or comatose	1
Type of SE	Simple partial, complex partial, myoclonic, absence	0
	Generalized convulsive	1
	Non convulsive SE in coma	2
Age in years	<65	0
	≥65	2
Past history of seizures	Yes	0
	No	1
	Total	0–6

patients were in altered sensorium before inclusion in the study. Study was approved by institutional ethics committee.

Inclusion criteria:

1. Patients who fulfilled the definition of SE.
2. Patients who gave written consent for participation in the study.

Exclusion criteria:

1. Patients who received IV benzodiazepines prior to evaluation by the study team as it may interfere with mental status assessment.
2. Patients whose final outcome could not be determined [left against medical advice ($n = 3$) or withdrew consent ($n = 1$)].

STESS description (Table 1): STESS is a simple bedside assessment score (range: 0–6) [7,8,11] comprised on four clinical variables – age of the patient, past history of seizures, level of consciousness and type of SE.

Calculation of STESS: STESS was calculated in all the patients at the time of admission to the emergency by a neurologist who was not involved in therapeutic decision making. To avoid bias, the treating team was kept blinded of the value of STESS.

Description of treatment protocol for SE: The treatment protocol followed was in accordance with published guidelines [9,10]. In brief, every patient was administered IV lorazepam in a dose of 0.1 mg/kg at rate of 1 mg/min along with either one of antiepileptic drugs – phenytoin (20 mg/kg) or valproate (20 mg/kg) or levetiracetam (30 mg/kg) or phenobarbitone (20 mg/kg) (1st step). Patients whose seizures failed to control received a repeat dose (10 mg/kg) of initially used antiepileptic drug followed by an additional antiepileptic agent (2nd step). If SE persisted beyond 2 h, patient received general anaesthesia (coma induction) with either proprofol or thiopentone or midazolam (3rd step). All the patients with SE persisting after 1st step of treatment were attended in intensive care unit with facilities for ventilation and invasive monitoring. EEG monitoring was carried out in all the patients who did not recover following 2nd step as well as in patients in whom nonconvulsive SE (NCSE) was suspected.

Collection of data and outcome measures: Detailed history and meticulous general physical, systemic and neurological examination was performed in all the patients. Various outcome measures studied were (a) mortality, (b) final neurological outcome at discharge as defined by functional independence measure (FIM) (good outcome: FIM score 5–7; bad outcome: FIM score 1–4), (c) control of SE within 1 h of start of treatment and (d) need for coma induction.

4. Statistical analysis

Frequency, mean, standard deviation, median, mode, range, and percentage of study parameters were analyzed by descriptive statistics. Inferences were drawn by parametric and non-parametric tests i.e. unpaired, Chi Square test (Fisher's exact test), Mann–Whitney *U* test. Excel 2010 and SPSS Version 22 software were used for analysis of data. Sensitivity and specificity of the STESS test was analyzed by using receiver operating characteristic (ROC) curve. Online software (www.medcalc.org/calc/diagnostic_test.php) was used to analyze negative predictive and positive predictive value of the STESS test.

5. Results

Demographic profile, clinical features and laboratory results: Among the 44 patients, 40 had generalized convulsive status epilepticus (GCSE) and 4 had focal convulsive status epilepticus (FCSE). None of the patients had NCSE at presentation. The mean age of patients was 35.41 ± 16.03 years (range: 14–75 years). Mean duration of hospital stay was 4.3 days (range: 2–10 days). Study group included 25 men and 19 women. These as well as rest of the demographic features are shown in Table 2.

SE severity score (STESS): STESS was calculated in all the patients. It was zero in 4 (9.1%) patients, one in 19 (43.2%), two in 9 (20.5%), three in 10 (22.7%) and four in 2 (4.5%) patients (Table 2).

Outcome measures: 4 (9.1%) patients succumbed to their illness during hospitalization. 7 (15.9%) patients had poor neurological outcome at discharge as defined by FIM score of 1–4, while 10 (22.7%) needed coma induction for control of SE. In 16 (36.3%) patients, SE could not be controlled within 1 h of start of treatment.

Clinical features and outcome measures: Parameters associated with a significantly high mortality included longer duration of SE ($p = 0.007$) and presence of stupor or coma at admission ($p = 0.01$). Parameters associated with need of coma induction included longer duration of SE ($p = 0.0001$), lack of past history of epilepsy ($p = 0.0001$) and presence of stupor or coma at admission ($p = 0.001$).

Table 2
Demographic profile of study group.

Parameters	Study group ($n = 44$)
Age in years (mean ± SD)	35.41 ± 16.03
Duration of status epilepticus in minutes (mean ± SD)	63.98 ± 78.32 (range: 5–360)
Type of status epilepticus	Generalized – 40; partial – 4
Past history of epilepsy	31 (70.4%)
Aetiology of SE	
Idiopathic	13 (29.5%)
Acute symptomatic	18 (40.9%)
Remote symptomatic	13 (29.5%)
Laboratory abnormalities	
Hypocalcemia	6 (13.6%)
Leucocytosis	14 (31.8%)
Hypomagnesemia	1 (2.3%)
Neuroimaging	
Normal	13 (29.5%)
Abnormal (calcified granuloma – 1; neurocysticercosis – 13; chronic infarct – 4; gliotic scar – 7; viral encephalitis and tuberculomas – 2 each; hypoparathyroidism, cerebral venous sinus thrombosis and focal cortical dysplasia-1 each)	31 (70.5%)
Status epilepticus severity score (STESS)	
STESS 0	4 (9.1%)
STESS 1	19 (43.2%)
STESS 2	9 (20.5%)
STESS 3	10 (22.7%)
STESS 4	2 (4.5%)