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Cost of status epilepticus in a tertiary care hospital in India

Usha K Misra *, Jayantee Kalita, Sanjeev K. Bhoi, Deepanshu Dubey

Department of Neurology Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, India

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ABSTRACT

Purpose: Status epilepticus (SE) is one of the most important neurological emergencies. The present study evaluated both direct cost of SE and predictors of cost in an Indian tertiary care teaching hospital in Lucknow India.

Methods: SE was defined as continuous seizure for ≥5 min or recurrent seizures without regaining consciousness. Etiologies of SE were categorized as acute central nervous system (CNS) pathology, acute non-CNS pathology, chronic CNS pathology, congenital disorders and others. Patients requiring mechanical ventilation (MV) received ventilators free of cost. Mortality and disability on discharge were noted.

Results: Fifty-five patients aged 8–90 years were included (males, 33). Fifty (89.3%) patients had generalized convulsive SE. The severity of SE as assessed by Status Epilepticus Scoring Scale was unfavorable (score, 3–6) in 41 (74.5%) patients. The etiology of SE was categorized as acute CNS pathology in 28 (51%) patients, non-CNS and chronic CNS pathology in 11 (19.6%) patients each, remote congenital pathology in 2 (3.6%), and others in 3 (5.6%). Thirty (53.6%) patients had comorbidities. Median duration of hospitalization was 7 (range, 1–72) days.Twenty six patients were hospitalized for >7 days. SE was controlled by 2 drugs in 47 (85.5%) patients and refractory to 2 intravenous antiepileptic drugs in 8 (14.5%). Nineteen (34.5%) patients died, and 29 (51.8%) showed favorable outcomes on discharge. Median hospital expenditure per case was INR 19,900 ($309.87; range, INR 1600–574,000). On multivariate analysis, SE hospitalization costs were determined by refractoriness of SE and mechanical ventilation (MV). Hospitalization cost of SE was lower than those of stroke.

Conclusion: Acute non-CNS pathology is largely responsible for the high cost of SE, particularly refractory SE requiring mechanical ventilation.

1. Introduction

Status epilepticus (SE) is a well-known neurological emergency and one of the most common reasons for admission to a neurological emergency department, second only to stroke. The prevalence of SE in the US has been estimated as 18.3–41.0 per 100,000 population [1,2]. Considering the greater prevalence of central nervous system (CNS) infections and infestations in developing countries, the incidence of SE is likely to be higher in such countries than in developed countries [3]. In addition, infections and infestations are the most common etiologies of SE in developing countries compared with developed countries, where stroke and drug withdrawal are the most common etiologies [3,4]. There are regional differences in the treatment protocol as well. In developed countries, SE is managed in the intensive care unit (ICU), whereas in developing countries, it is managed in general ward due to paucity of ICU.

The cost of SE is determined by multiple factors such as drugs, invasive and noninvasive monitoring, investigations, supporting infrastructure, and specialized manpower. There have been few studies especially from developing countries calculating the cause of SE. A US study estimated an annual direct cost of $4 billion for SE and found that the direct inpatient cost was higher than the direct cost of acute myocardial infarction or congestive heart failure [5]. According to another study from Germany, acute treatment of SE was responsible for the high proportion of hospital costs associated with epilepsy. Healthcare systems are likely to encounter a higher incidence of SE and its associated costs owing to the high incidence of SE in the elderly population, thus emphasizing the need to further assess the burden and optimize the treatment of SE [6]. A systematic review confirmed SE as a cost-intensive disorder and emphasized the urgent need for detailed and comprehensive cost of illness studies [7]. However, no such

* Corresponding author. Tel.: +91 522 2494167; fax: +91 0522 2668017.
E-mail addresses: drukmisra@rediffmail.com, drukmisra@gmail.com (U.K. Misra).

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studies have been conducted in developing countries, where cost of treatment is a critical determinant of disease management. In this review, we report the direct cost of SE during hospitalization as well as the predictors of cost.

2. Subjects and methods

SE patients admitted during September 2013 to January 2015 were retrospectively analyzed.

2.1. Inclusion criteria

- Patients with SE, defined as continuous convulsions for ≥5 min or recurrent seizures without recovery of consciousness to baseline between the attacks
- Patients with subtle SE, defined as the presence of coma and ictal discharges on electroencephalogram (EEG), along with subtle convulsive movements [8]
- Patients whose expenditure during hospitalization could be retrieved from the computerized hospital information system

2.2. Exclusion criteria

- Patients whose expenditure during hospitalization could not be retrieved from the computerized hospital information system

3. Management

Patients were initially treated with lorazepam (LOR), which was repeated if the seizures were not controlled within 2 min of the first dose. Second-line antiepileptic drugs such as phenytoin (PHT), sodium valproate (SVA), or levetiracetam (LEV) were prescribed if the SE continued after the second dose of LOR. Patients were managed in the ICU until their condition was stabilized and the underlying cause of seizures was managed. Outcome was defined as cessation of seizures for 24 h, death, or discharge from the hospital.

Etiologies of SE were categorized into the following groups: [5]

- Acute CNS pathology such as stroke, encephalitis, and meningitis
- Acute non-CNS pathology such as pneumonia, renal failure, liver failure, metabolic disturbances, and malignancies
- Chronic CNS pathology such as calcific granuloma, old stroke, and old head injury
- Congenital pathology
- Others (hypoxia after cardiopulmonary resuscitation, old CNS causes precipitated by recent illness, and alcohol withdrawal)

The severity of Status Epilepticus was defined by status epilepticus Severity Score (STESS) which was calculated using the level of consciousness (0, alert; 1, stupor or coma), seizure type (1, generalized; 2,nonconvulsive in coma; 0, others), age (0, <65 years; 1,≥65years), and history of previous seizures (0, present; 1, absent or unknown). Scores ranged from 0 to 6: 0–2 was considered favorable and 3–6 was considered unfavorable [9].

Direct cost was calculated by retrieving the cost incurred during hospitalization. The informal out-of-pocket expenses, including cost of transportation, supervision, cost incurred in the referring hospital and wages lost by caregivers or patients, were not included in this study. The modified Rankin's scale (mRS) was used to assess disability at discharge: a score of 0–2 indicated favorable outcome [10].

Fifty-five age-matched patients with stroke, (36 ischemic, 14 hemorrhagic, and 5 venous strokes) without SE admitted during the same period were randomly selected and their direct cost, morbidity and mortality were recorded and compared with those of patients with SE.

For comparison with international cost, we used the exchange rates on May 12, 2015:$1 = Indian Rupees (INR) 64.22 and €1 = INR 72.11.

4. Statistical analysis

The etiology of SE was compared with demographic, clinical, STESS, and direct cost of SE by using the parametric test for categorical and analysis of variance (ANOVA) for continuous variables. The cost predictors of SE management were evaluated using univariate regression analysis, followed by multivariate regression analysis, including the variables with a two-tailed p value of <0.1. Moreover, the outcome and cost of SE in different age groups were evaluated using the chi-square test for categorical and ANOVA for continuous variables. A two-tailed p value of <0.05 was considered significant. Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS; version 16) software. GraphPad prism 5 was used for graphical presentation.

5. Results

Of the 56 patients with SE, 1 was excluded due to incomplete data. The median age of the patients was 40 (range, 8–90) years, and 33 (58.9%) patients were males. A majority of patients (50 [89.3%]) had generalized tonic clonic seizures. One (1.8%) patient had epilepsia partialis continua, and 4 (7.1%) had nonconvulsive SE. The STESS score was unfavorable in 41 (74.5%) patients.

The etiology of SE was acute CNS pathology in 28 (50%) patients: acute stroke in 9, encephalitis in 14, meningitis in 4, and inflammatory granuloma in 1 patient. In addition, the etiology was acute non-CNS pathology in 11 (19.6%) patients: acute renal failure in 3, chronic renal failure in 3, hyponatremia in 2, liver failure in 1, and sepsis in 2 patients. Moreover, the etiology was chronic CNS pathology in 11 (19.6%), remote congenital pathology in 2 (3.6%), and others in 3 (5.4%) patients. The median duration of SE before treatment initiation was 1 h (range, 0.08–240 min). Comorbidities such as diabetes, hypertension, uremia, liver disease, and malignancy were present in 30 (53.6%) patients, and 12 (21.4%) patients had more than one comorbidities. Twenty-seven (48.2%) patients required mechanical ventilation (MV). The median duration of hospitalization was 7 (range 1–72) days, and 26 patients required >7 days of hospitalization. SE was controlled within 1 h in 47 (85.5%) patients, and 8 (14.5%) patients had refractory SE (resistant to two intravenous antiepileptic drugs). Thirty-six (65.5%) patients were discharged from the hospital, of whom, 29 (51.8%) had favorable outcomes (Table 1); the median mRS score was 3. Nineteen (34.5%) patients died; the cause of death in all patients was not directly related to SE but due to underlying conditions.

The direct cost of SE ranged between INR 1600 and 574,000 (median, INR 19,900, US $309.87, or €275.96; Fig. 1). Univariate analysis revealed an association between death and hospitalization for <7 days ($p = 0.024$), STESS score ($p = 0.012$), comorbidities ($p = 0.008$), multiple comorbidities ($p = 0.07$), and MV ($p = 0.00$). The predictors of direct SE cost >INR 20,000 were hospitalization for > 7 days ($p = 0.01$), duration of SE >1 h ($p = 0.04$), and MV ($p = 0.01$) (Table 2). Patients aged 18–60 years incurred the lowest costs ($p = 0.05$, Table 3). On multivariate analysis, MV ($p = 0.002$) and hospitalization for <7 days were determined as predictors of death. In addition, disability was related to MV, and these patients incurred higher costs ($p = 0.001$).

Direct cost of the 55 age-matched stroke patients during the study period ranged between INR 3028 and 181,539(median: INR