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The Care And Cost of Acute Ischemic Stroke in a Stroke Unit of a Tertiary Care Hospital in Mumbai

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Abstract

Aim: To evaluate the current status of care and cost of acute ischemic stroke in Mumbai. The hospital based analysis at a tertiary emergency care hospital with a 24 hour neurology team and stroke care unit.

Methods: During 9 month period of May 2016 to January 2017, consecutively hospitalized 72 patients with acute ischemic stroke data were collected. We examined the demographic data, in- hospital care, length of stay, outcome at discharge and hospital costs. The medical cost data were collected from official hospital medical accounts department, which calculated direct medical costs for beds, staff, radiological and blood examination, medications and rehabilitation.

Results: The mean age was 60.81 years, and 81.12% were male. The mean National institutes of health stroke scale score (NIHSS) was 8.07 points on admission. All patients underwent MRI angiography of brain on admission. All Patients were treated with ischemic protocol (Antiplatelet, Neuroprotector, LMWH and Statin and treatment of co morbidity) in Stroke unit. 52.72% patients were admitted to neurological intensive care unit. Overall, 100% patients received in-hospital rehabilitation; mean length of stay was 10.77days. In hospital mortality rate was 1.38%. The mean hospital cost per patient was 89,610 INR (8320.3INR/day). The mean ICU cost per patient was 13,495INR per day. Of which 41% was attributed to the cost for beds, doctor and staff, 8% for medicine, 3% for rehabilitation and 15%for imaging , 11% surcharge and 22% for laboratory examination. National institutes of health stroke scale score on discharge were 4.07 points.

Conclusion: Despite the single Hospital- Based analysis, this study provided the current precise data on short-term inpatient care and costs of acute ischemic stroke in a tertiary care hospital in Mumbai. We can conclude that early effective and proper management of stroke leads to a better and cost effective outcome.

Introduction

Stroke was defined by the World Health Organization (WHO) more than 40 years ago as “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin” [1].

Over time the definition has been changed and improved as follows, Ischemic stroke has been defined as an episode of neurological dysfunction caused by focal cerebral, spinal, or retinal infarction by American Heart Association in 2013 [2].

Globally, stroke is the second leading cause of death, first being Heart disease [3]. Stroke is becoming an important cause of premature death and disability in low-income and middle-income countries like India, largely driven by demographic changes and enhanced by the increasing prevalence of the key modifiable risk factors. As a result developing countries are exposed to a double burden of both communicable and non-communicable diseases [4]. The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and, most tragically, not being able to afford the high cost for stroke care. Majority of stroke survivors continue to live with disabilities, and the costs of on-going rehabilitation and long term-care are largely undertaken by family members, which impoverish their families [5].

The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population based studies. There is also a wide variation in case fatality rates with the highest being 42% in Kolkata. Stroke units are predominantly available in urban areas that too in private hospitals [6].

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India's per capita income (nominal) was $1670 in 2016, ranked at 112th out of 164 countries by the World Bank [7], while its per capita income on purchasing power parity (PPP) basis was US$5,350, and ranked 106th [8].

Stroke remains the most common cause of permanent disability in adults. To save stroke victims from death and disability, the establishment of effective stroke management is of urgent importance. Although pharmacological therapies such as tissue plasminogen activator and aspirin are effective in selected patients with acute ischemic stroke, studies have addressed the role of patient care in stroke units in Western communities. Early intervention would be the key factor in reducing the morbidity and cost of care in a stroke unit.

The health care system in India is different from other countries, Government hospitals are available but Majority of Recent and advanced health care is provided by the private hospitals. Little is known about the cost and economic impact of stroke in India. Hence we conducted this study to understand the cost of care of stroke in a territory care hospital, and also found out the factors responsible for an increase cost of care as this might differ from other regions of the world.

Methodology

This study was carried out during the 9 month period between May 2017 and January 2018 at Bombay Hospital and Research Center Mumbai, India. The Institutional Review Board approved this study without assessment because the study design maintained patient anonymity and did not affect human rights.

Subjects

During the study period, a total of 72 patients with a final diagnosis of acute ischemic stroke (n=72) were seen within 7 days of symptom onset were admitted to Stroke unit for treatment and evaluation. Of the72 patients, 67 patients had been treated conservatively for acute ischemic stroke and 2 Succumbed and 3 patients required thrombolytic intervention.

Hospital characteristics

Our hospital with 700+ beds is a 24-hour–service tertiary emergency hospital for acute cardiovascular and cerebrovascular diseases situated in Mumbai, which has a population of 18.41 million and an area of 603.4 km2 [9,10]. Our hospital covers Mumbai and surrounding smaller cities and towns. The 24-hour neurology-neurosurgery-interventional neurologist team consisted of neurologist and neurosurgeons with access to stroke unit. In-hospital rehabilitation included physiotherapy and speech therapy. Neurologist and neurosurgeons are on duty and on call outside working hours. Neuro-radiological facilities were available 24 hours.

Stroke severity

Stroke severity on admission was assessed by an attending neurologist using the National Institutes of Health Stroke Scale (NIHSS), ranging from 0 (asymptomatic) to 42 points (maximum score) and Functional independence measure (FIM), ranging from 18 points (Total Assistance) to 126 points (Complete independence)

In-hospital care

Measures of hospital care included delayed time from hospital arrival to initial diagnostic brain CT, type of wards that the patient was admitted to in the intensive stroke care unit or the neurology-neurosurgery wards, medications, rehabilitation programs, and length of hospital stay. For patients with acute ischemic stroke on the initial CT/MRI antithrombotic medications were initiated as early as possible, unless antithrombotic medications were contraindicated. The anticoagulant medications included intravenous unfractionated heparin, LMWH, and Tab warfarin. The antiplatelet medications included aspirin, and clopidogrel. In-hospital rehabilitation was given according to the patient's neurological deficit. In calculations of the length of hospital stay for patients who were subsequently transferred to other in-hospital wards, the stay in wards included.

Outcomes at discharge

Functional outcomes at discharge were evaluated by NIHSS scale and FIM scale, Patients were discharged when they required minimal to no assistance for daily activities.

Hospital costs

Data on hospital cost were collected from the official hospital accounts department. These charts calculated direct medical costs for beds, staff, examinations, medications & rehabilitation. Costs for meals were included. Costs for intensive care beds, ward beds, and staff were officially fixed according to the hospital category. Based on the hospital class, the costs for laboratory examinations, imaging studies, and medications were also officially fixed. Rehabilitation costs were pre determined. Physician fees were fixed according to hospital class. As in other studies, the costs calculated in the India Rupees were then converted to the US dollar by use of an exchange rate of 1$= 67.7 INR as on 13th June 2018.

Results

A total of 72 patients were studied. 81.12% were male. Mean age was 60.81 years, range 34.0–79.0 years, 52.1% were aged more than 65 years. Mean length of stay (LOS) was days 10.77 days, range 4–38 days. In-patient mortality was 0.03%. There was no statistical difference in mean age or LOS of male versus female patients, or of those who died or survived. There was no statistical difference in LOS of patients aged above or below 65 years (Table 1). The Patients had an Average score of 8.07 points on NIHSS and 77.48 on FIM scale on Admission and 4.07 points and 108.3 on discharge respectively. The distribution of the cost of stroke care is shown in Figure 1. The mean cost was 89,610 INR (1,323.63 USD), range 51,212 INR (756.45 USD) to 2, 49,129 INR (3679.89 USD). The data are sharply skewed to the right due to the small number of patients with very high costs. There are many components contributing to the costs of hospital care. Of which 44.03% was attributable to the costs for beds, doctor and staff, 9% for medicine, 3% for rehabilitation, 16% for imaging studies, 12% surcharge and 24% for laboratory examinations. The cost was highly correlated with LOS, r2 = 0.83, p = 0.01. It was not correlated with age, or associated with sex or status at discharge. Based on clinical and neuroimaging criteria, 61.11% had MCA territory stroke, 25% had ACA territory Stroke and 13.8% had PCA territory Stroke. 69.23% had Hypertension, 44.23% had Diabetes Mellitus and 17.3% had Ischemic Heart Disease. 15.38% had previous history of Cerebro-vascular accident length of stay correlated with the number of co morbidities present and hence increased the Cost of stroke care as well. 52.72% patients required admission to Neurological Intensive care unit. The Mean neurological ICU cost Per Patient was 13,495 INR per day. The additional cost of thrombolytic procedure for patients was 39,300 INR hence the variation in the range of stroke care cost (Figure 2).

	Sex		Age	
	Male	Female	<65 years	>65years
Number	58	14	41	31
Mean Age	62.5	59.12	-	-
Length of stay	10.93	10.61	10.73	10.74
Total cost	90,940.87 INR	88,278.83 INR	89,276.82 INR	89,360.02 INR

Table 1: Patient Characteristic and Stroke Costs

Discussion

Stroke is a significant economic and health burden in many countries, both in the developed and developing world. It exacts a heavy toll from the patient, family and society. Factors driving the economics of stroke include the epidemiology of stroke, treatment settings, and social and behavioral factors. Hospital costs comprise the largest single component of direct costs in the acute phase of stroke treatment. This study is an analysis of the costs of stroke care for an unselected stroke population admitted to the stroke service

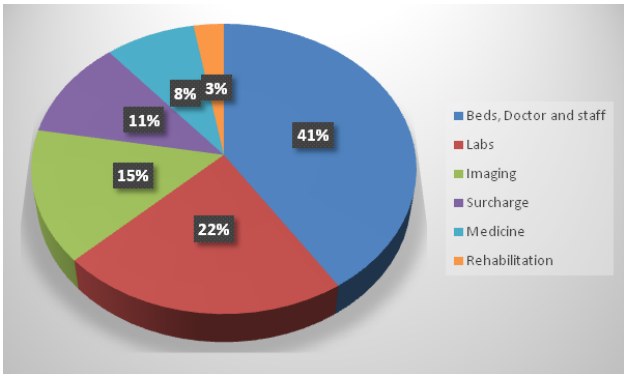

Figure 1: Breakup of Stroke Care

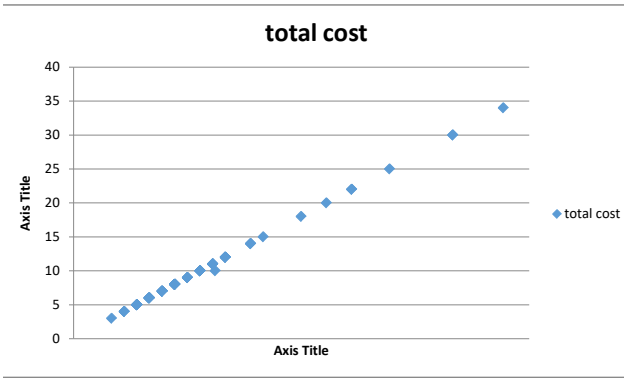

Figure 2: Stroke cost and length of stay of 72 patients

of a large Indian hospital. The mean hospital cost in our study was 1323.63 USD and mean length of stay being 10.77 days. This was strongly correlated with the length of hospital stay, which was contrary to another large North American study [11].

The length of stay was longer in our study as compared to USA (8.7days) [11], shorter than that for japan (33 days) [12]and Singapore (17 days) [13]and on par with a study conducted in china (11days) [14]. The cost of stroke care in India was 1323.63 USD according to our study it was less when compared with USA (19,836USD) [11] and Japan (6916.1USD) [12], it was more when compared with china (900.9USD) [14].

The length of hospital stay in India was longer owing to the intensive ongoing in-hospital rehabilitation program and the patients being discharged when they are minimally dependent or independent in activities of daily living.

There is no significant correlation between age and sex and the cost of hospital stay in our study, this has been seen in other studies as well where cost of stroke was calculated [15,16].

In another study, while costs did not correlate with increasing age, costs were reportedly higher for younger patients. Our mean per-day cost was 122.89 USD. This did not correlate with age or sex, similar to another study. This may indicate that the cerebrovascular syndrome is the principal component of the pattern of hospital care; once the patient is admitted, the hospital course is independent of the age or sex. However, per-day costs were higher among those who had a poor functional rating on admission and required intensive care, supporting previous studies [17].

Breakup of costs have been reported in previous studies, in the study of Smurawska LT, Alexandrov AV et al. [18] in Toronto Canada, nursing accounted for 42%, doctors' fees 6%, tests 8%, therapy 6%, pharmacy 4% on the contrary the study Dennis M, Wellwood L et al in United kingdom, Nursing accounted for 81%, doctors fees 1%, tests 2% therapy 1.8% and 0.3% for Pharmacy. In our study, 44.03% was attributable to the costs for beds, doctor and staff, 24% for laboratory examinations, 16% for imaging studies, 12% surcharge, 9% for medicine, & 3% for rehabilitation. The difference noted in these country wise studies is probably due to differences in the definition of the components as well as different practices in various countries. The most striking point noted is that doctor fees and rehabilitative therapy don't comprise a major part of the costs of acute stroke care. These difference between these cost changes are might be due to the completely different costing system available in India. The patient in India is need to pay from pocket and as such there is no fixed cost base system for any particular lab test, bed or any other parameter.

The efficient use of resources, avoidance of intensive care management unless indicated, and early discharge planning may have contributed to the stabilisation in costs. Stroke units have clearly been shown to reduce stroke mortality and the cost of stroke care. This may be due to the use of protocols provide by American Heart association and American Stroke association. Costs may also be reduced by the use of home physiotherapy rather than inpatient therapy. There have been concerns that stroke care costs are higher in academic centres than in community hospitals. Costs may actually be less if managed by a neurologist [17].

However, our study does have some limitations. It does not include pre- or posthospital costs, or the indirect costs of loss of earnings by the patient and family, pain and suffering, or other quality of life aspects – however, this was not the aim of the study. The study was performed in a single hospital. The health system in metropolitan city of Mumbai is so structured that a patient is brought by ambulance to the nearest hospital – such hospitals are strategically situated to adequately cover the city. Coupling this with the fact that neurologists have now become the principal physicians for most stroke patients in Mumbai, it is likely that the patterns and costs in our hospital would differ significantly from those in the other public hospitals. No conclusion can be reached about those who did not come to hospital but opted to stay at home. The costs of care in our study cannot be compared directly to costs in developed countries, where health care costs and stroke subtypes may differ from our own. This study suggests that the hospital cost of stroke care is independent of the age or sex of the patient. It is more likely related to the number Co-Morbidities present. It is important to recognize these facts so as to provide costeffective quality care to the stroke patient. With the high economic impact of stroke, the costs of providing such care need to be adequately appreciated by doctors, hospitals, third-party payers and governments. The results of this study could be used to model the cost-benefits of other methods for the prevention and treatment of stroke[18].

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