

Factors Predicting Length of Hospital Stay in Acute Stroke Patients Admitted in a Rural Tertiary Care Hospital

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Abstract

Background: Cerebrovascular stroke is a global health problem. Prolonged length of hospital stay following stroke inflates health care cost, increases risk for hospital-acquired complications, in-hospital death and has been associated with worse outcome.

Methods: A hospital based prospective study was performed in acute stroke patients admitted in the department of Medicine of a rural teaching tertiary care hospital located in a town in central India. Data of all consecutive stroke inpatients related to demographic variables (age, gender, social class, education-status), co-morbid conditions, risk factors, imaging variables and various complications during hospital course was collected from patients' medical records.

The type, location, and side of the stroke lesion were noted from the CT/MRI head reports of stroke patients. Stroke assessment scales (GCS, NIHSS, mRS) were also assessed by another trained study person who was blind of the diagnosis and investigations of the patient. Results: A total of 55 stroke patients were studied. The mean age was 58.4 + 12 years; ranging from 23-86 years. Of the total 55 stroke patients, 32 (58.2%) were males and 23 (41.8%) were females.

Twenty three (41.8%) of 55 stroke patients had length of stay (LOS) in hospital ≥ 7 days. The association of location of stroke lesion (LAC/TAC/PAC/POC) and GCS score with LOS in hospital was found to be statistically significant ($P < 0.05$). During hospitalization, six patients developed pressure-sore and five patients developed sepsis, all of them had prolonged LOS in hospital (> 7 days).

Conclusion: Prolonged length of stay (> 7 days) in hospitalized stroke patients was related to location of lesions and low Glasgow coma scale scores. The complications during hospitalization esp. pressure-sores and sepsis were associated with prolonged length of stay in hospitalized stroke patients.

Keywords: Prevalence; Cerebrovascular stroke; Predictors; Length of stay; Stroke scales

Introduction

Cerebrovascular stroke (CV stroke) is a global health problem. It makes an important contribution to morbidity, mortality and disability in developed as well as developing countries [1,2]. The global incidence of stroke is 16 million new acute strokes per year, two-thirds of which occur in low-income and middle-income countries [1,3].

Of 35 million deaths attributable to chronic non-communicable diseases that occurred worldwide in 2005, stroke was responsible for 5.7 million (16.6%) deaths, the second leading cause of death worldwide [4]. The prevalence of stroke in India is 44-843/100,000 population [5,6]. CV stroke imposes direct costs (e.g. the cost of medical care) as well as indirect costs (e.g. the cost incurred due to loss of productivity).

The management of acute stroke in hospital has a variable duration, lasting from 1 week to 2 weeks on average [7,8]. Longer stays are more

common in older patients and those with more severe stroke, anterior circulation infarcts and atrial fibrillation [7-9].

Prolonged length of stay following stroke inflates health care cost, increases risk for hospital-acquired complications, in-hospital death and has been associated with worse outcome [9,10]. There is a paucity of literature from our country about the correlates of prolonged hospital stay in acute stroke patients.

The purpose of this study is to determine factors (demographic variables-age, gender, social class, education), co-morbid conditions, clinical, biochemical and imaging variables that extend the length of stay (LOS) in hospital of acute stroke patients.

A better understanding of the factors that influences LOS helps focusing our resources on patients at risk and allow stroke care units to develop better interventions to reduce prolong hospital stay and help control medical costs.

Methods

Setting

This study was conducted between April 1, 2014 and July 31, 2014 in the department of Medicine, Mahatma Gandhi Institute of Medical Sciences, Sevagram which is a 750-bedded rural teaching tertiary care hospital located in a town in central India.

Most patients visiting the hospital come from rural areas. The patients with the diagnosis CV stroke are admitted in the intensive care unit or general indoor ward of department of Medicine.

Study design

Our study was a hospital based prospective study. We collected data of stroke patients related to demographic variables, co-morbid conditions, clinical, biochemical, imaging variables and various complications during hospital course from patients' medical records.

Ethics

The study was approved by the institutional ethics committee of Mahatma Gandhi Institute of Medical Sciences (IRB00003623). We obtained a written informed consent from all study patients before enrolling them in the study.

Patients: Inclusion criteria

(1) All consecutive patients admitted with a diagnosis of acute stroke, as delineated by the World Health Organization criteria, is defined as rapidly developing clinical symptoms or signs of focal or global disturbance of cerebral function that last more than 24 hours, with no apparent non-vascular causes (primary and metastatic neoplasms, dural hematoma, head trauma, etc) with a radiological [computed tomography scan (CT) or magnetic resonance imaging (MRI) head] evidence of CV stroke. Acute stroke included acute ischemic stroke, intracerebral/intraventricular hemorrhage, and subarachnoid hemorrhage; (2) age of patient 18 years or older.

Exclusion criteria

(1) Patient having an alternate diagnosis on computed tomography (CT) brain scan like space occupying lesion (mass/tuberculoma/neurocysticercosis), anoxic-ischemic brain injury following cardiac arrest, or patients with traumatic intracranial hemorrhage (2) history of malignancy or psychiatric illness (3) patient having hepatic, uremic, toxic or metabolic encephalopathy (4) refusal to consent.

Data collection

A research assistant collected the data of acute stroke patients at admission, including demographics (age, gender, per capita income (PCI), education-status), and co-morbidities or risk factors such as hypertension (history of hypertension or anti-hypertensive drugs), diabetes mellitus (DM) (history of diabetes or anti-hyperglycemic drug), history of previous CV stroke, history of ischemic heart disease (IHD), current smokers (persons who report smoking at least 100 cigarettes in their life and who currently smoke every day or on some days), and high alcohol consumption (≥ 5 standard drink/day).

Reports of laboratory investigations like serum creatinine, sodium, potassium, blood sugar, urea and liver function tests were collected

from the patient's medical records. The radiological imaging data (type, location and size of the stroke lesion) was noted from the CT/MRI head reports.

The following variables: glasgow coma scale (GCS), national institute of health stroke scale (NIHSS) and modified rankin scale (mRS) scores were also assessed by another trained person who was blind of the diagnosis and investigations of the patient [11].

Briefly the GCS elicits information on best ocular, verbal and motor response; the score ranges between 3 and 15. The NIHSS uses 11 neurological clinical signs and is represented by a score from 0-42. Modified Rankin scale score runs from 0-6, running from perfect health without symptoms to death.

Complications during hospital stay like pneumonia or other infections (UTI etc.), acute kidney injury, acute respiratory distress syndrome, deep vein thrombosis, pressure sore, need for mechanical ventilation were noted in the data collection forms. LOS was measured in days and calculated from the date of admission until the date of discharge.

Data analysis

Data was analysed using SPSS software. Continuous variables were presented as mean \pm standard deviation (SD) for normally distributed data or median (range) for non-normally distributed data and compared using students t-test (for normally distributed data) or Wilcoxon rank sum (for non-normally distributed data).

Categorical variables were presented as proportions and compared using chi-square test. Odds ratios were calculated to determine factors associated with prolonged hospital stay. P value < 0.05 is regarded as being statistically significant.

Results

A total of 55 stroke patients were studied. The mean age was 58.4 + 12 years; ranging from 23-86 years. There were 28 (51%) stroke patients below the age of 60 years and 27 (49%) patients above the age of 60 years. Thirty two (58.2%) of 55 stroke patients had length of stay (LOS) in hospital ≤ 7 days (Table 1).

Length of Stay (LOS)	Frequency (percent)
≤ 7 days	32 (58.2%)
> 7 days	23 (41.8%)
Total	55 (100%)

Table 1: Distribution of length of stay (LOS) in hospital among all cerebrovascular stroke patients.

Of the total 55 stroke patients, 32 (58.2%) were males and 23 (41.8%) were females (Table 2). Forty five (81.8%) patients had their per capita income (PCI) below Rs. 3000 per month (Table 2). There were 13 (23.6%) illiterates, 12 (21.8%) educated up to primary-school, 22 (40%) educated up to middle-school and 8 (14.5%) educated high-school and above of the total 55 patients (Table 2).

The association of age of the patient (younger < 60 years vs. elderly ≥ 60 years), gender, per capita income (PCI) and education status with LOS in hospital was not statistically significant ($P > 0.05$) (Table 2). Of the 55 patients, 33 (60%) had hypertension, 24 (43%) had DM, and 13

(24%) had IHD. The association of co-morbidities i.e. hypertension, DM, and IHD with LOS in hospital was not statistically significant (Table 3).

There were 14 (25%) current smokers and 8 (14%) alcohol drinkers of the total 55 stroke patients. The association of LOS in hospital with either current smoking or alcohol drinking was not statistically significant (Table 3).

In the radiological imaging (CT head) of CV stroke patients, 26 (47%) patients had left-sided lesions and 26 (47%) patients had right-

sided lesions. 38 (69%) patients had cerebral infarcts and 17 (31%) had intracerebral hemorrhages (ICH).

Twenty six (47%) of 55 stroke patients had lacunar (LAC) infarcts, 12 (22%) had TAC infarcts, 14 (25%) had PAC infarcts and 3 (5%) had POC infarcts. The association of location of stroke lesion (LAC/TAC/PAC/POC) with LOS in hospital was found to be statistically significant (P<0.05).

Type of lesion (infarction/ICH) and side of lesion were not associated with LOS in hospital (P>0.05) (Table 4).

Demographic variables		LOS ≤7days (n=32)	LOS >7days (n=23)	Total (n=55)	P value
Age-groups (years)	18-59	17 (60.7%)	11 (39.3%)	28 (50.9%)	0.69
	60 and above	15 (55.6%)	12 (44.4%)	27 (49.1%)	
Gender	Female	15 (65.2%)	8 (34.8%)	23 (41.8%)	0.36
	Male	17 (53.1%)	15 (46.9%)	32 (58.2%)	
PCI quartiles	<2000	13 (56.5%)	10 (43.5%)	23 (41.8%)	0.30
	2000-3000	15 (68.2%)	7 (31.8%)	22 (40%)	
	3001-4250	4 (44.4%)	5 (55.6%)	9 (16.4%)	
	4251 and above	0	1 (100%)	1 (1.8%)	
Education	Illiterate	7 (53.8%)	6 (46.2%)	13 (23.6%)	0.49
	Primary school	7 (58.3%)	5 (41.7%)	12 (21.8%)	
	Middle school	15 (68.2%)	7 (31.8%)	22 (40%)	
	High school and above	3 (37.5%)	5 (62.5%)	8 (14.5%)	

Figures in parenthesis in column 3 and 4 represent the row percentage. Figures in parenthesis in column 5 represent the column percentage.

Table 2: Distribution of demographic variables among stroke patients with LOS in hospital.

Co-morbidities/Risk factors	LOS ≤7days (n=32)	LOS >7days (n=23)	Total (n=55)	P value
Hypertension	17 (51.5%)	16 (48.5%)	33 (60%)	0.21
Diabetes Mellitus	15 (62.5%)	9 (37.5%)	24 (43.6%)	0.56
Ischemic heart disease	8 (61.5%)	5 (38.5%)	13 (23.6%)	0.77
Current smokers	6 (42.9%)	8 (57.1%)	14 (25.5%)	0.17
Alcohol drinkers	5 (62.5%)	3 (37.5%)	8 (14.5%)	0.7

Figures in parenthesis in column 2 and 3 represent the row percentage. Figures in parenthesis in column 4 represent the column percentage.

Table 3: Distribution of comorbid diseases/Risk factors among stroke patients with LOS in hospital.

Forty one stroke patients had GCS ≤10 and 14 patients had GCS between 11 and 15. Twenty seven stroke patients had NIHSS ≤20 and 18 patients had NIHSS between 21 and 42.

Similarly, 21 stroke patients had mRscore ≤3 and 34 patients had NIHSS between 4 and 6.

Radiologic lesions		LOS ≤7days (n=32)	LOS >7days (n=23)	Total (n=55)	P value
Side lesion (laterality)	Left	16 (61.5%)	10 (38.5%)	26 (47.3%)	0.81
	Right	14 (53.8%)	12 (46.2%)	26 (47.3%)	
Type lesion	Infarct	23 (60.5%)	15 (39.5%)	38 (69.1%)	0.59
	Hemorrhage	9 (52.9%)	8 (47.1%)	17 (30.9%)	
Location of lesion	LACI	20 (76.9%)	6 (23.1%)	26 (47.3%)	0.02
	TACI	3 (25%)	9 (75%)	12 (21.8%)	
	PACI	7 (50%)	7 (50%)	14 (25.5%)	
	POCI	2 (66.7%)	1 (33.3%)	3 (5.5%)	

Figures in parenthesis in column 3 and 4 represent the row percentage. Figures in parenthesis in column 5 represent the column percentage. Location of lesion: LACI-Lacunar infarct; TACI-Total Anterior Circulation infarct; PACI-Partial Anterior Circulation infarct; POCI-Posterior Circulation infarct

Table 4: Distribution of imaging variables among stroke patients with LOS in hospital.

The association of GCS with LOS in hospital was found to be statistically significant ($P < 0.05$). NIHSS and mR scores were not associated with LOS in hospital ($P > 0.05$) (Table 5).

Stroke Scores	Severity	LOS ≤ 7 days (n=32)	LOS > 7 days (n=23)	Total (n=55)	P value
GCS ≤ 10 11-15		20 (48.8%)	21 (51.2%)	41 (74.5%)	0.01
		12 (85.7%)	2 (14.3%)	14 (25.5%)	
NIHSS ≤ 20 21-42		17 (63%)	10 (37%)	27 (49.1%)	0.48
		15 (53.6%)	13 (46.4%)	28 (50.9%)	
Modified Ranking scale ≤ 3 4-6		14 (66.7%)	7 (33.3%)	21 (38.2%)	0.31
		18 (52.9%)	16 (47.1%)	34 (61.8%)	

Figures in parenthesis in column 2 and 3 represent the row percentage. Figures in parenthesis in column 4 represent the column percentage.

Table 5: Distribution of stroke severity scores among stroke patients with LOS in hospital.

During hospitalization, six stroke patients developed pressure-sore and five stroke patients developed sepsis, all of them had prolonged LOS in hospital (> 7 days). Three stroke patients developed pneumonia during hospitalization.

Two patients developed UTI, one patient required mechanical ventilator support and six patients developed hyponatremia during their stay in hospital (Table 6).

Complications hospitalisation	during	LOS ≤ 7 days (n=32)	LOS > 7 days (n=23)	Total (n=55)
Pressure-sore		0	6	6
Pneumonia		1	2	3
Sepsis		0	5	5
UTI		2	0	2
Mechanical ventilator support		0	1	1
Hyponatremia		2	4	6

Table 6: Distribution of complications during hospitalisation among stroke patients with LOS in hospital.

Discussion

In our study, the mean LOS in hospital of stroke patients was 5.6 ± 4.3 days. Thirty two (58.2%) of 55 stroke patients had LOS in hospital ≤ 7 days and 23 (41.8%) stroke patients had LOS in hospital > 7 days. In a study done by Koton et al. a median (interquartile range) LOS observed was 6 (3-10) days in the derivation cohort (42.3% prolonged LOS) and 5 (3-8) in the validation cohort (35.7% prolonged LOS) [7]. The median LOS was 11 days (range 8-13 days) in a study done by Zhao et al. [12].

In our study, the association of age and gender with LOS in hospital was not found to be statistically significant which is in contrast to finding reported by Lee et al. [13]. Previous studies done by Kwok et al.

and Spratt et al. also reported older age as a strong predictor of prolonged hospital stay in acute stroke patients [8,9].

However, Lang et al. demonstrated that demographic variables had no influence on LOS in hospital in demented inpatients [14]. The association of patient's PCI and education status with LOS in hospital was not statistically significant in our study. Similarly, Maguire et al. reported in their study that social support was unrelated to prolonged hospital stay [15]. However, Jakovljevic et al. reported that low socioeconomic status was related to excess rate of morbidity and mortality in stroke patients [16].

In our study, the association of co-morbidities i.e. hypertension, DM, and IHD with LOS in hospital was not statistically significant. DM and increased number of co-morbidities was found to be related to prolonged hospital stay in previous studies done by Spratt et al. and Lee et al. [9,13]. The association of LOS in hospital with either current smoking or alcohol drinking was not statistically significant in our study.

The association of location of lesion (LAC/TAC/PAC/POC) with LOS in hospital was found to be statistically significant in our study. Type of lesion (infarct/ICH) and side of lesion were not associated with LOS in hospital in our study which is in contrast to findings reported by Kwok et al. and Lee et al. that indicated stroke-type was a strong independent predictor of LOS [8,13]. Venkatachalm et al. and Kotila et al. in their studies showed that the side of lesion was not related to LOS which is in line with our finding [17-19].

The association of GCS score with LOS in hospital was found to be statistically significant in our study. NIHSS and mRS scores were not associated with LOS in hospital. In previous studies done by George et al., Koton et al. and Koennecke et al. on acute stroke patients, patients with prolonged LOS had higher admission NIHSS than patients without prolonged LOS [7,20,21].

In our study, a prolonged LOS in hospital (> 7 days) was found in all the stroke patients who developed pressure-sore and sepsis during hospitalization. In a study done by George et al. on 274 ischemic stroke patients, 106 (38.7%) had prolonged LOS [20].

A larger proportion of patients with prolonged LOS developed an infection, and after adjusting for covariates, these patients had greater odds of poor short-term functional outcome. Spratt et al., Lee et al. and Koennecke et al. observed in their studies that in-hospital infections were related to prolonged hospital stay [9,13,21].

Our study has several strengths. Our patients represent typical rural Indian patients from central India. By including every consecutive stroke inpatient we avoided the selection bias. We made a blind assessment (GCS, NIHSS, mRS score assessment and data collection) of the patient.

The limitation of our study is small sample size. This is a single-hospital study, and generalizations should therefore be made with caution. If our study was done with a larger sample size having more number of patients with co-morbidities or cardiovascular risk factors (smoking or alcohol drinking), or complications during hospitalization (other than pressure-sores and sepsis) then a possible significant association between these co-morbidities/risk factors/complications and LOS (≤ 7 days vs. > 7 days) in hospital could be found.

Conclusion

Prolonged length of stay (>7 days) in hospitalized stroke patients was related to location of lesions and low Glasgow coma scale scores. The complications during hospitalization esp. pressure-sores and sepsis were associated with prolonged length of stay in hospitalized stroke patients.

Sources of support

This study was partly funded by the Indian Council of Medical Research, New Delhi, India. Khushboo Verma, a medical student, was awarded the short term studentship (2014) to conduct this study (URL: <http://www.icmr.nic.in/shorttr.htm>). The Indian Council of Medical Research had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript. No additional external funding received for this study.

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