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Research Paper: Evaluating the Duration of Hospitalization and Its Related Factors Among Stroke Patients

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ABSTRACT

Background: Prolong hospitalization after a stroke is associated with increased cost, higher risk of complications, and adverse effects.

Objectives: The purpose of this study was to determine the length of stay and its related factors among stroke patients admitted to one of the educational and therapeutic centers in the north of Iran.

Materials & Methods: In this descriptive-analytic study, 253 stroke patients admitted to an academic hospital affiliated to Guilan University of Medical Sciences were enrolled during 2016-2017. Their socio-demographic characteristics and medical records associated with their admission were collected. A linear regression model was used to estimate the adjusted risk factors in predicting the duration of hospitalization in SPSS 21.

Results: The Mean±SD duration of hospitalization in stroke patients was 5.6±2.1 days (range 2-12 days). The multivariate regression model indicated that the unemployed versus the self-employed subjects (β=0.74), hemorrhagic versus the ischemic stroke (β=0.84), strokes with moderate volume (β=0.61) and large volume (β=1.22) compared to small volume, infectious complications, and certain physicians had an independent and significant association with increased duration of hospital stay.

Conclusion: Assessing the duration of hospitalization and identifying its potential predictors can be useful in the proper use of the resources and discharge of patients with stroke.

Keywords: Length of stay, Stroke

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Highlights

- Prolong hospitalization after a stroke is associated with increased cost, higher risk of complications, and adverse effects.

- Predictors are prolonged hospitalization are job (unemployed), type of stroke (hemorrhagic), stroke volume (moderate, large), physician, and infectious complications.

Plain Language Summary

Stroke is caused by obstruction of blood vessels or bleeding in the brain. Prolonged length of stay (LOS) in the hospital following stroke rises health care costs, risk of catching hospital-acquired infections, and in-hospital death which is the worse outcome. Therefore, factors affecting LOS in stroke patients should be identified to select the appropriate rehabilitation targets and plan for on-time patient's discharge. In this study, we studied 253 stroke patients admitted to an academic hospital affiliated to Guilan University of Medical Sciences. We found that some factors such as unemployment, hemorrhagic stroke, moderate and large volume stroke, infectious complications, and the responsible therapist had significant associations with longer LOS. These findings can improve planning, providing, and reducing the cost of care.

Introduction

Stroke is defined as the onset of focal neurological symptoms or decreased consciousness which takes more than 24 hours or could be fatal [1]. Stroke is the fifth cause of death after heart disease, cancer, chronic respiratory illnesses, and unpredictable injuries; it is also one of the most important causes of disability in the world [2]. Annually about 16 million new strokes occur in the world. Two-thirds of these cases occur in poor countries or in a modest economic situation [3]. Around 125000 people in the UK suffer from stroke and 40000 of them die [4]. Although stroke does not necessarily end in death, it can lead to severe neurological defects for the patient and generates a lot of expenses for treatment and rehabilitation [5].

Stroke recovery starts from the earliest days and lasts for a long time. Caring for patients with stroke has a significant financial burden [6]. Increasing the length of hospitalization can lead to increased hospital care costs, increased hospitalization complications, and higher mortality rate and adverse outcomes [7]. The desired outcome depends on the diagnosis and treatment in the acute phase, therapeutic interventions for the prevention of stroke recurrence, rehabilitation during initial stroke phase and scheduled discharge. Hospital costs for stroke patients account for a large portion of total costs over the first 12 months after stroke [8]. Therapeutic interventions are planned to reduce the Length of Stay (LOS) of the patients and reduction of the costs [9].

It is necessary to identify the factors affecting LOS in stroke patients, in order to select the appropriate rehabilitation targets and planning for discharge [8]. The average LOS may be predicted by some parameters such as demographic characteristics, severity of stroke, and associated diseases [10]. According to Martin and Smith's study, patient's demographic characteristics and hospital features are two main determinants of hospitalization [11]. In terms of demographic characteristics, patients' LOS in a hospital varies according to patient's age and type of disease [12]. Among the hospital characteristics, the hospital care service can affect the LOS of the patients [13]. Patients and their families, health care workers, hospital managers, and health care systems are increasingly interested in predicting the length of hospitalization to obtain useful information about patient's prognosis [6].

Of course, the relationship between the LOS and the quality of health care is not straight forward. Longer hospitalization is not necessarily associated with better quality care. Both quality and non-quality health care services may have the same length of stay. It is more likely that the duration of hospitalization with the quality of health care will have a "U" shape association. LOS, longer or shorter than the optimum, can reduce the quality of care. The suitable length of hospitalization in the particular circumstances has a range that depends on supply and demand factors, such as needs of each patient or the availability of related social services.

Community-based care in industrial societies has reduced the role of the hospital. The duration of hospitalization

should not be reduced without considering the appropriate care and treatment pattern. Guaranteeing appropriate care and treatment patterns for the quality of health care is very important [13]. This study was conducted to identify the effective factors on LOS in stroke patients.

Materials and Methods

This is a descriptive-analytic study and The study population were stroke patients admitted to a teaching hospital affiliated with GUMS during 2016-2017. The study inclusion criteria were confirmation of patients' stroke based on the diagnosis of neurologist and neuroimaging specialist and the completeness of their medical records in terms of the main variables of the study. Exclusion criteria were considered as patients' deaths or their personal consent for discharge.

According to a Hashemifard study [14], with standard deviation of 2.6, a precision of 0.4, and an error of 0.05, the sample size was determined as 103 patients. Considering 5 people for each of the 18 primers, the final sample size was 253 patients. A researcher-made questionnaire was used to collect information after getting informed consent from patients or their legal relatives. After reviewing the literatures, the relevant research questions were set up as a data collection form.

Variables included the length of stay and the individual-social factors of the patient such as age, gender, marital status, occupation, smoking, alcohol consumption, drug use, history of previous stroke, and underlying illness, as well as factors associated with illness and admission such as type of stroke, severity of stroke, location of ischemia, location of bleeding, lesion size, type of insurance, their physician, admission to ICU, infectious side effects, and lesion side. The severity of stroke was classified into three classes: mild (1-5), moderate (6-13), and severe (14-42) based on the score obtained from the NIHSS (National Institutes of Health Stroke Scale score) [15].

After collecting data, the information was organized and entered into SPSS 21. Normality of quantitative variables was confirmed by Kolmogorov–Smirnov test. The obtained data were described and analyzed by descriptive statistics (mean and standard deviation, percentage and frequency and related tables) and analytical statistics with t test and ANOVA. Linear regression model was used to determine the adjusted estimation of each risk factor in the prediction of hospitalization time. The significance level was considered as less than 0.05. The confidentiality of collected information and respect for trustworthiness and integrity in the use of information based on research ethical considerations were respected at all stages.

Results

In this research, the medical records of 253 patients with stroke were studied. The mean age of patients was 69 years (range 41-94 years). The Mean±SD of their LOS was 5.6±2.1 days (minimum 2 and maximum 12 days). The frequency of other demographic variables and risk factors for stroke is listed in Table 1. There was no statistically significant relationship between duration of hospitalization and variables of demographic characteristics, stroke risk factors, and past medical history (Table 1). In this study, of 253 patients suffering from stroke, the most frequent cases were arterial ischemic stroke. There was a significant correlation between type of stroke and LOS (P=0.0001).

Most strokes had moderate severity and volume. The variables of brain lesion volume and severity of stroke showed a significant relationship with the duration of hospitalization (P=0.0001). The deep arteries and basal ganglia were the most frequent site of involvement in ischemic stroke and hemorrhagic stroke, respectively. There was a significant relationship between ischemic location and duration of hospitalization (P=0.0001). LOS was significantly longer in cases of ischemic lesion in Middle Cerebral Artery (MCA) territory than other arterial territory except Posterior Cerebral Artery (PCA) artery. Involvement of PCA territory was significantly higher than deep arteries and did not differ from other types. Three percent of the patients were admitted to the ICU. There was a significant relationship between admission in ICU and LOS (P=0.0001).

In general, 25% of the patients developed infectious complications. A significant relationship between infectious complications and duration of hospitalization was observed (P=0.0001). Also, the duration of hospitalization had a significant relationship with their physicians (P=0.0001) (Table 2). A multivariate linear regression model was used to determine the predictive factors of hospitalization time and estimate the adjusted coefficients of the variables studied in the prediction of hospitalization time. The variables that had a significant level of less than 0.1 in single-variable analyzes entered the model.

The ischemic stroke location variable due to the strong linear correlation with other variables and the ICU variable because of its low frequency and the long hospitalization time that caused an uncommon increase in

Table 1. Length of stay of stroke patients in hospital in terms of demographic characteristics

Predictor		No. (%)	LOS, d Mean±SD	P
Age, y	60-40	54(21)	5.40±2.24	0.51
	60-80	151(60)	5.64±2.09	
	>80	48(19)	5.89±2.12	
Gender	Male	122(48)	5.54±2.15	0.74
	Female	131(52)	5.72±2.10	
Marital state	Married	218(86)	5.6±2.1	0.37
	Widow	35(14)	5.9±2.2	
Job	Self-employed	39(15)	5.58±2.09	0.05
	Retired	68(27)	5.19±1.92	
	Housekeeper	126(50)	5.73±2.13	
	Unemployed	18(7)	6.66±2.63	
Insurance	Rural	65(30)	5.58±1.84	0.25
	Social security	86(34)	5.48±2.23	
	Medical health	6(2)	4.33±1.21	
	Private	44(17)	6.15±2.18	
	Other	48(19)	5.66±2.26	
Smoking	Yes	77(30)	5.97±2.06	0.09
	No	174(68)	5.48±2.15	
Alcohol consumption	Yes	25(10)	6.25±2.33	0.16
	No	228(90)	5.55±2.10	
Opium addiction	Yes	64(25)	5.71±2.03	0.72
	No	187(74)	5.60±2.17	
History of stroke	Yes	65(26)	5.41±1.92	0.45
	No	188(74)	5.73±2.21	
Diabetes mellitus	Yes	149(59)	5.67±2.06	0.73
	No	104(41)	5.58±2.22	
Hypertension	Yes	63(25)	5.84±2.25	0.19
	No	190(75)	5.57±2.08	
Hyperlipidemia	Yes	202(79)	5.69±2.16	0.39
	No	251(21)	5.41±2.00	
Underlying disease	Yes	171(67)	5.59±2.02	0.63
	No	82(33)	5.73±2.33	

LOS were not included in the regression model. In the multivariate regression model, job, severity and volume of lesion, physician and infectious complications were independently associated with the duration of hospitalization. In terms of occupation, the length of admission of unemployed persons increased by an average of 0.68 day compared to those who were self-employed.

With the increase in stroke severity, according to the NIHSS index, the duration of hospitalization also increased. LOS in severe stroke was on average 1.5 days more than mild stroke. Also, the increase in stroke volume increased LOS. Regarding the responsible therapist, the physician number 2 and 3, compared to physician number 1, increased the hospitalization to 1.71 and 0.75 days, respectively. The length of hospitalization of patients with physician number 4 did not differ significantly with physician number 1. The presence of infectious complications increased LOS by 1.91 days (Table 3).

Table 2. Length of stay of stroke patients in hospital

Predictor		No. (%)	LOS, d Mean±SD	P
Type of lesion	Arterial ischemic	195(77)	5.23±1.97	0.0001
	Venous ischemic	4(2)	6±2	
	Hemorrhagic	52(21)	7.21±1.99	
Stroke severity	Mild	62(25)	3.59±1.04	0.0001
	Moderate	113(45)	5.39±1.43	
	Severe	74(30)	7.66±1.91	
Location of ischemic lesion	Trunk MCA	39(15)	7.38±1.91	0.0001
	Branches of MCA	33(13)	4.93±1.76	
	ACA	22(9)	4.86±1.80	
	PCA	7(3)	6.28±1.38	
	Deep artery (thalamic & lacunar)	64(25)	4.26±1.34	
	Cerebellar	34(14)	4.94±1.57	
Location of hemorrhagic lesion	Cortical	8(3)	6.87±1.72	0.73
	Basal ganglia	44(17)	7.15±2.20	
Stroke volume	Small	131(52)	5.29±2.25	0.0001
	Moderate	80(32)	5.30±1.46	
	Large	41(16)	7.43±1.93	
Lesion side	Right	128(50)	5.37±2.13	0.14
	Left	125(50)	5.89±2.10	
Physician	1	45(18)	4.31±1.60	0.0001
	2	79(31)	5.63±1.89	
	3	61(24)	6.62±2.02	
	4	68(27)	5.13±1.81	
ICU admission	Yes	7(3)	10.14±1.21	0.0001
	No	246(97)	5.49±2.00	
Infectious complications	Yes	65(25)	8.20±1.61	0.0001
	No	188(75)	4.73±1.45	

Table 3. Multivariate linear regression model of variables affecting on LOS

Predictor		Adjusted Beta Coefficient	95% CI		P
			Higher Bound	Lower Bound	
Job	Self-employed		Reference		
	Retired	0.02	0.48	-0.44	0.93
	Housekeeper	0.45	0.93	-0.02	0.06
	Unemployed	0.74	1.41	0.08	0.02
Smoking		0.18	0.58	-0.20	0.35
Stroke type	Ischemic		Reference		
	Hemorrhagic	0.84	1.39	0.28	0.003
Stroke severity	Mild		Reference		
	Moderate	1.02	1.43	0.61	0.0001
	Severe	1.50	2.16	0.84	0.0001
Stroke volume	Small		Reference		
	Moderate	0.61	1.01	0.20	0.003
	Large	1.22	1.86	0.58	0.0001
Physician	1		Reference		
	2	0.74	1.19	0.30	0.001
	3	1.16	1.64	0.69	0.0001
	4	0.36	0.82	-0.09	0.11
Infectious complications	Yes		Reference		
	No	1.91	2.35	1.47	0.0001

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Discussion

The prediction of LOS in patients with stroke is a complex subject in the healthcare profession [16]. In this study, the Mean±SD duration of hospitalization in patients with stroke was 5.6±2.1 days. Unemployed patients with hemorrhagic stroke, severe stroke, large lesion volume, infectious complications, and certain physician were associated with longer LOS. Also the type, severity, volume of stroke, infectious complications, as well as the physician, were the most powerful predictors of hospitalization time of stroke patients.

A study by Göz et al. in Turkey reported an average length of hospitalization of 7 days [16]. In Saxena et al. study in India, the Mean±SD duration of hospitalization was 5.6±4.3 days [3]. The average length of hospitalization in Kim et al. study in South Korea was 18.6 days [5]. Likewise, in studies in Denmark and Taiwan this time was 13 and 11 days, respectively [17, 18]. However, in our study, the mean length of stay for stroke patients was shorter than other studies. Such variation in the period of hospitalization in different countries may be due to differences in the inclusion and exclusion criteria, different diseases, the compensation system and so on [5]. It seems that in the present study, we can mention the lack of hospital space and the occupancy rate of hospital beds, which can have a significant effect on the reduction of the mean LOS.

In our study, consistent with another research, no significant correlation was found between the age of the patients and LOS which contradicts the findings reported by Lee et al. [3, 19]. Perhaps the reason for this discrepancy is the difference in the rest of the patient's variables, such as stroke severity or the infectious disease complications. The relationship between gender and LOS for stroke patients remains unclear, and various results have

been reported in various studies [16, 17]. In our study, although female subjects had longer hospital stay, there was no significant relationship between sex and duration of hospitalization. It is likely that this lack of association can be also attributed to the difference in the rest of the patient variables.

In some studies, marital status is considered as another factor affecting the average LOS in the hospital, with the duration of staying of married patients reported less than single individuals. It is probably due to the fact that married people have family support and care more than single patients [20, 21]. But in the study of Liu et al., single subjects had less hospitalization time [22]. However, in this study, the marital status did not have a significant relationship with the LOS. According to the results of some studies, there was no significant correlation between the socioeconomic status and the duration of hospitalization [3, 23]. Nonetheless, other studies suggest that housewives had a shorter stay than other occupations [24]. Our study indicate that unemployment can be associated with longer LOS. Such an outcome is likely to be attributed to the increased acceptance of the treatment process and the monitoring of this category of patients.

In some studies, alcohol and smoking could increase the risk of hospitalization and prolong LOS [25, 26]. Our study indicate that the history of drug use, alcohol and smoking did not have a significant relationship with LOS. Similar results were also observed in other study [27]. In the present study, there was no association between history of stroke and length of hospitalization. It is worth noting that similar studies in this area are few. Other disease-related features and hospitalization seem to be effective in this result. In some studies, the type of stroke was effective in predicting the duration of hospitalization [28]. In the present study, like the study of Lim et al., patients with hemorrhagic stroke had longer hospitalization than other patients [10]. However, in another study no significant relationship was found between the type of stroke and LOS [3].

In our study, patients with longer hospitalization time had greater severity of stroke than other patients. Similarly, a direct relationship was reported in a study by George et al. and Koton et al [29, 30]. It is evident that the greater severity of stroke and its association with severe neurological symptoms and disability in patients requires more hospitalization time. In addition, these patients develop more complications such as infection, bed sore, and so on, and thus increase their length of hospital stay. In the present study, in line with the study by Saxena et al., no correlation was found between the side of the stroke and the length of stay in the hospital [3]. In this study, similar to some other studies, there was a significant direct correlation between stroke location and LOS [19, 31].

In Arboix et al. study, the lacunar infarction was the only subtype that was inversely related to the LOS [27]. In another study, it has been concluded that lacunar infarcts are associated with shorter LOS but anterior or posterior circulatory infarcts with more days of hospitalization [3]. In our study, it was found that in the ischemic stroke, the location of the lesion had a significant relationship with the duration of hospitalization and the presence of a lesion in the MCA and PCA territories was accompanied by more days of hospitalization. It can be due to the feeding of wider areas of brain tissue by these arteries and more neurological manifestations, resulting in the need for more time to cure the symptoms. Moreover, the involvement of these areas in some cases is associated with a decrease in the level of consciousness and the severity of the stroke, with more disability, which requires longer LOS.

In the present study, the location of hemorrhage was not associated with the LOS, while in some studies the presence of hemorrhage in the cortical area was significantly associated with the duration of the patient's stay in the hospital [27]. The reason for such a difference in results can be due to the low proportion of hemorrhagic stroke samples studied or to other accompanying features in these patients. In our study, no association was found between underlying diseases such as hyperlipidemia, hypertension, diabetes mellitus, or cardiac disease with duration of hospitalization. Saxena et al. and Curtain et al. also did not report such a relationship [3, 32]. But in studies conducted by Spurt et al. as well as Lee et al., diabetes mellitus and hypertension were the determinants for increasing LOS [7, 19]. In some studies, the presence of underlying heart disease, such as heart failure and valvular heart disease was associated with an increase in the LOS [27, 33].

In the present study, it was determined that the physician can be considered as factors influencing the LOS. Similar studies in this area are few. The present study, in line with the study by Göz et al. and Arboix et al. indicate that LOS is associated with the occurrence of infectious complications [16, 27]. It seems that the cause and effect relationship in this case can be bilateral and creates a defective loop. Acute stroke can make patients susceptible to complications such as pneumonia, urinary tract infections, and bed sore [19]. On the other hand, the length of hospitalization can be shortened by reducing the infectious compli-

cations [34]. Early-care, patients' monitoring, and encouraging the patients to start moving can prevent a lot of these complications.

Some studies have indicated that the type of patient's insurance has a significant relationship with the average LOS in the hospital [5, 24]. While in our study, the type of insurance did not correlate with LOS. It seems that the implementation of the national plan for health system reform and the benefit of all patients from public health insurance can contribute in this finding.

Conclusion

Stroke management is an interdisciplinary expertise and no sacrifice in treatment quality is accepted. Assessing the length of hospitalization and identifying its potential predictors can be useful in proper use of the resources and discharge of patients with stroke. Certain demographic and clinical characteristics of stroke patients associated with longer LOS were identified. These findings could improve planning, organizing, and reducing the cost of care.

Ethical Considerations

Compliance with ethical guidelines

This study approved by the Ethics Committee of Guilan University of Medical Sciences (GUMS) (ethical code: IR.GUMS.REC.1396.162).

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Authors contributions

All authors contributed in preparing this article.

Conflict of interest

The authors declare no conflict of interest.

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