Stroke care unit on hospitalization for acute management of stroke in H. Adam Malik General Hospital

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Abstract **.** Stroke is the second leading cause of death and the third leading cause of disability-adjusted life. The care hospitalization of some ischemic stroke patients, the cost effectiveness of this very expensive treatment may vary from hospital to others hospital, because of the different practice patterns of stroke management. The mean variables contributing to the total costs of hospitalization, The mean length of stay in hospitals (MLOS) as a marker of resource utilization is highly predictive of inpatient costs. Accurate prediction of MLOS has become increasingly important for the administration of hospitals and healthcare systems. The objective of this study was to examine the relative importance of patients characteristics , clinical, and functional factors that can be assessed at the time of admission for predicting MLOS of acute care hospitalization. The respondents were male respondents were more than women (64 patients), ischemic strokes were more dominant (64 patients) and others of the respondents were treated on day care <1 week when the study was conducted. The result predictor variables were analyzed for the 64 patients. Male sex is 98 patients, corresponded to an increase in MLOS by approximately 0.088 % days (P =0.004), and smoking decreased MLOS by approximately 00.178 days (P = 0.048). The purpose of thisstudy was to identify what factors and mapping (Patient's age, gender, stroke type, stroke event, risk factors, initial stroke severity), the patients were associated with hospital length of stay. Initial stroke severity, but not age or comorbidity, was shown to be one of the significant predictors of MLOS, we may postulate the hypothesis that initially reducing stroke severity in first ever ischemic stroke patients with mild or moderately severe stroke might be a wiser way to reduce MLOS after acute care hospitalization.

1. **Introduction**

Stroke is the second leading cause of death and the third leading cause of disability adjusted life. The cost of providing acute short term and long term care, along with estimated loss of productivity costs in stroke patients, is over 8 billion pounds per year [1]. The mean length of stay in hospitals (MLOS) in acute medical care is a significant contributor to the financial implication ofcaring for stroke patients and the ability to accurately predict which patients are likely to require longerinpatient care would be desirable for both budgetary planning and healthcare provider considerations,and also in communicating with patients and families to manage expectations at a vulnerable anduncertain time [3].

Results of examination on February 4, 2019 to May 2019 inclusive: CSU-HAMGH examined 1,353 patients, including coronary heart disease and stroke, chronic respiratory

disease[3]. The purpose of thisstudy was to identify what factors and mapping (Patient's age, gender, stroke type, stroke event, risk factors, initial stroke severity), the patients were associated with hospital length of stay.

2. Literature Search

2.1 Functional improvements and neurological

Recovery spontaneous neurological recovery, as demonstrated by an improvement in impairment, is an important part of post-stroke recovery.Within the first 6 months post stroke, upper limb impairment resolves by fixed proportion [4]. Fixed proportion states that 70% of each patient's maximum possible neurological improvement in their motor impairment occurs regardless of the initial impairment (as measured by the Fugl Meyer score or 3D-kinematics) but only for those with a relatively intact corticospinal (motor) tract function [5]. Irreversible structural damage to the corticospinal tract severely limits motor recovery of the upper extremity. This holdstrue for patients across all ages and countries with different rehabilitation services [6]. Some authors have suggested that the majority of functional recovery after stroke is simply related to spontaneous natural recovery from neurological impairment[7]. Proportional resolution of upper extremity impairment appears to be minimally affected by rehabilitation therapy. 3D kinematics in subacute and chronic stroke survivors have shown that motor recovery associated with rehabilitation is driven more by adaptive (or compensatory) learning strategies.The fact that specialized stroke rehabilitation units and greater intensities of rehabilitation are associated with improved functional outcomes indicates that neurological recovery alone can not account for the degree of functional improvements seen in stroke rehabilitation. Most clinical tests used in research (Action Reaction Arm Test (ARAT) or walking speed (6 minutes walk test) only assess the patient's ability to accomplish a certain task or function; they do not measure impairment. It appears that rehabilitation promotes largely and likely entirely, adaptive or compensatory motor recovery. In terms of the expected time course of recovery following stroke [8],[15]. suggested that functional recovery is thought to reach 80% of maximum by threemonths, 95%, by six months,and 100% by 12 months. In their assessment of the relationship between impairment and disability after a stroke, [9],[12] concluded that, "although stroke0related impairment and disability are significantly correlated with each other, reduced impairment level alone does not fully explain the reduced disability that occurs during rehabilitation. Even patients without substantial impairment reduction demonstrate disability reduction during rehabilitation, suggesting that rehabilitation has an independent role in improving function beyond that explained by neurological recovery alone." Using a modified form of regression analysis estimated that time alone could explain between 16% and 42% of the observed improvement in many parameters of recovery during the first 6 to 10 weeks post stroke [10],[11].

2.2 Type of stroke units associated with improved outcomes

Specialized stroke rehabilitation units are associated with better outcomes, compared with mixed rehabilitation wards, general medicine, and mobile stroke teams: the collaborative care on the stroke unit on (CCSU) systematic review [13], [14] has described the hierarchical service organization in stroke care, moving along a continuum from more to less organised care:

- Stroke ward; Wards where a multidisciplinary teamincluding specialist nursing staff based in a discrete ward cares exclusively for stroke patients. This category included the following subdivisions:
  a) Acute stroke units; patientsare acceptedacutely but dischargedearly (usually within seven days). These units are further subcategorised into: (i) “intensive” model of care with continuous monitoring, high nurse staffing levels,and the potential for life support. (ii) “semi intensive” model of care with continuous monitoring high nurse staffing but no life support facilities. (iii) “non intensive” model of care with no high nurse staffing or life support facilities.
  b) Rehabilitation stroke units; Patients are accepted after a period of five to seven days or more, and the focus is on rehabilitation.
  c) Comprehensive stroke units (i.e. combined acute and rehabilitation) Patients are accepted acutely but are also provided with rehabilitation for at least several weeks if necessary. Both the rehabilitation unit and comprehensive unit models offer prolonged periods of rehabilitation.
- Mixed rehabilitation ward: where a multidisciplinary team including specialist nursing staff in a ward provides a generic rehabilitation service but not exclusively caring for stroke patients.
- Mobile stroke team: where a peripatetic multidisciplinary team (excluding specialist nursing staff) provides care in a variety of settings.
- General medical ward: where care is provided in an acutemedical or neurology ward without routine multidisciplinary input.

3. Subjects and method

This study used the data held in the care stroke unit (CSU) at H. Adam Malik General Hospital (HAMGH). CSU collected clinical data from sequential stroke patients admissions. Data collection was from February 2019 to May 2019 inclusive. Data capture included a 14 month follow up. This study aims to determine the number of stroke patients at (HAMGH in Medan. Patients population included both first ever stroke and recurrent stroke and all included patients were treated as per institutional practice and stroke guidelines. Relevant institutional and ethical approvals for use of these data were in place. Patients eligible for this prospective follow-up study were enrolled if they met the following criteria: (1) diagnosis with first ever ischemic stroke and identified as having no history of stroke or transient ischemic attack; and (2) diagnosis of acute stroke and identified as having the qualified ischemic stroke onset within 40 hours before admission.

All the participating investigators had completed the short0term procces and they would perform the evaluations of the National Institutes of Health Stroke Scale (NIHSS) accurately and consistently. The investigator assessed the eligible patients once per week. The discharge date was recorded as the date the patient died or was discharged to home, another hospital, a rehabilitation facility, or any place other than the Neurology in CSU-HAMGH .

The destination of disposition was made according to the condition of the patients, consideration of the families, and assessment of rehabilitation doctors, according to the practice patterns of stroke management in this area.

On the basis of evidence in the literature and clinical judgment, predictor variables were prospectively determined. Because our intention was to identify the major predictors of MLOS from the information available at admission, we evaluated only those factors that

could be assessed at the time of admission. Data collected prospectively included the patient's age and sex, stroke severity at admission, functional independence status at admission, hours after stroke onset (within 22 hours or not), comorbidity (presence or absence of history of hypertension, diabetes mellitus, or hypercholesterolemia), smoking, congestive heart failure, valvular heart disease, atrial fibrillation, history of cardiac disease (history of arrhythmia, angina pectoris, ischemic heart disease, stroke subtypes, and serum total cholesterol and triglyceride levels at admission.

The diagnosis of the subtype of ischemic stroke can be difficult in the beginning of stroke management, and the diagnosis of stroke subtypes often changes as the results of ancillary diagnostic tests become available [11]-[16],[19]. However, we chose to determine the ischemic stroke subtype according to the criteria. The logarithmic transformation of MLOS produced a more normal distribution (the Kolmogorov-Smirnov Z value changed from 4.77 to 1.71)[15]-[18].

In this study the natural logarithm of MLOS was used as the dependent variable for multiple regression analysis. The predicted First- MLOS values were then transformed back to obtain the predicted MLOS. We did not consider the potentially embedded bias of transformation. Before multiple regression analysis, we plotted First-MLOS against each continuous predictor variable to get an idea of model selection.

To avoid overfitting the data to the model, all the prespecified predictor variables were entered simultaneously. The model reliability was assessed by the split-sample approach[20],[21]. Two thirds of the patients were randomly assigned to the training group and one third to the validation group. Additionally, we performed a tougher test by splitting the data in a nonrandom way: two thirds of the patients who were admitted in time periods earlier than the remaining one third were assigned to the training group. All analyses were done with the use of regresion data analysis.

Table 1 summarizes the demographic and clinical characteristics of the 150 patients. The mean age was 45±11.5 years (median, 30 years; range, 20 to 80 years). There were 98 men (65.3%) and 62 women (34.7%) in our research study. Mean score of the NIHSS was 8.3 ± 8.1 (median, 5). Mean score of the MBI was 28.1 ± 7.2 (median, 18). MLOS was 10 days (mean, 5± 15; range, 1 to 34). Stroke subtype was qualified as cardioembolism in 29 (19%), large0artery atherosclerosis in 95 (63%), small0vessel occlusion in 25 (16%), and undetermined etiology in 3 patients (2%). Approximately four fifths 100 (34.1%) of patients had an on sett admission interval of ± 2 hours. The patients had at least 2 kind of comorbidity in 33.3 %. and patients were smokers in 12 (8 %). Patients of this observational study did not have a high prevalence rate of congestive heart failure (6.6%), valvular heart disease 5.3 (6.3%), or atrial fibrillation (3.3%). Forty percent of patients had some previous cardiac disease. Of these 150 patients, 7 % died during the acute care hospitalization, 35%) were transferred to the rehabilitation ward located in the same hospital for intensive rehabilitation, and 58% were discharged to their homes or other care facilities.

Table 1. Characteristics of the 150 Patients Included in Analysis

Characteristics	Median or No. (%)		22th-75th	MLOS	
	Mean	%	percentile		%
Demographic characteristics					
Age,y	64	34	43 – 77		
Sex, Male	98	65.3		143	95.3
Comorbidity, any*	50	33.3			
Hypertension*	60	40			

Diabetes mellitus*	30	20		110	73.3
Hypercholesterolemia*	15	10			
Smoking	12	8		57	38
Congestive heart failure	10	6.6			
Valvular heart disease	8	5.3			
Atrial fibrillation	5	3.3			
History of cardiac disease	15	10		38	25.2
Clinical characteristics					
NIHSS score at admission	8.3	5	3 – 8		
MBI score at admission	28.1	18	5 – 23		
Onset <22 h	100	66		136.4	89
Type of stroke					
Cardioembolism	29	19			
Large0artery atherosclerosis	95	63			
Small0vessel occlusion	25	16			
Undetermined etiology	3	2		152	100
Total cholesterol level, mg/dL	84	83	58 - 141		
Triglyceride level, mg/dL	69	32	16 - 48		
LOS, d	5	3	5-8		

Patients will given factor variables are expressed, if patients CSU-HAMGH registration and unavailable information was assumed to indicate absence of the symptom, is shown in Table 2. Characteristics patients with atrial fibrillation had a significantly longer MLOS. Study aim not significant association between MLOS and age (≥ 64 versus >64 years), sex, comorbidity, smoking, congestive heart failure, valvular heart disease, or history of cardiac disease was observed. Among clinical characteristics, MLOS, not surprisingly, differed significantly by initial neurological severity and by functional severity. Severity of stroke in general prolonged MLOS. However, as mentioned, the relation ship was expected to be non linear. Mean LOS was significantly longer for patients admitted to the hospital sooner (onset <22 hours). There was a strong association between mean LOS and stroke subtype. Small0vessel occlusion stroke was associated with shorter MLOS (median, 6 versus 3 days; mean, 6 versus 40). Neither serum total cholesterol level nor serum triglyceride level was significantly associated with MLOS.

If we will see a whether the record MLOS difference between stratified groups was related to stroke severity. We has compared the initial NIHSS score in these patient categories. Patients with atrial fibrillation had a significantly severe stroke, with mean NIHSS score of 40 versus 8 (P 0.001). This was also true for patients whose stroke onset was within 24 hours (5 versus 5.2; P 0.002) and for patients with other than small0vessel occlusion stroke (4 versus 5; P 0.048). In the regression model, the analysis was performed with the use of all the prespecified predictor variables, even though some of them (such as atrial fibrillation, onset 22 hours, or stroke subtype) could be identified as nonconfounders. The cubic term for the NIHSS score did not provide additional implications as opposed to the quadratic term and thus was ignored. Table 3 $R2$ is the percentage of total variance explained by the model. *The following variables, in addition to the reported (significant) variables, were entered into the model: age, comorbidity, congestive heart failure, valvular heart disease, atrial fibrillation, history of cardiac disease, onset <22 h, and serum total cholesterol and triglyceride levels at admission. Summarizes the results of multiple regression analysis. NIHSS score at admission, the uadratic term of initial NIHSS score, MBI score at admission, small0vessel occlusion stroke, sex, and smoking were the main explanatory factors for first MLOS, whereas other variables such as age (continuous), comorbidity, congestive heart failure, valvular heart

disease, atrial fibrillation, history of cardiac disease, onset <22 hours, and lipid levels (continuous) had no significant influence on first MLOS. In particular, NIHSS score at admission (along with its quadratic term) was the strongest predictor.

Table 2. Univariate Analysis of MLOS (n=150)

Characteristics	No.	%	MLOS,	d*	P
Demographic characteristics					0.004
Atrial fibrillation					
Yes	5	3.3	4	6-10	
No	58	40	9	3 - 11	
Clinical characteristics					<0.001
NIHSS score at admission					
0 - 6	60	40	6	4 - 9	
7 - 15	29	20	9	6-14	
16 - 38	40	10	10	10-20	
MBI score at admission			66		<0.001
0 - 12	65	45	5	6-11	
13 - 20	144	41	5	4-8	
Onset <22 h					0.024
Yes	100	95	2	5 - 7	
No	64	19	83	4 - 86	
Large0artery atherosclerosis					<0.001
Yes	25	62	32	4 - 36	
No	124	38	3	8 - 40	

Table 3. Regression Analysis Predicting Fisrt-MLOS* (n 150; R 2 0.265)

Characteristics	Coefficient			
	SE	%	β*	P
Demographic characteristics				
Sex, Male	0.212	0.073	00,1	0,004
Smoking	-0.178	0.088	0,696	0,048
NIHSS score at admission	0.06	0.018	-0,578	0,001
Quadratic term of NIHSS score at admission	-0.002	0.000	-0,181	0,001
MBI score at admission	-0.02	0.010	0,291	0,001
Small0vessel occlusion	-0.436	0.080	0,144	<0,001
(Contrast)	2.019	0.339		<0,004

The negative sign of the quadratic term indicated that for patients with mild or moderate stroke, first MLOS increased with increasing stroke severity, while for those who had severe strokes, first MLOS decreased with increasing stroke severity. This model explained approximately 37% of the total variance of MLOS. The reliability of the fitted model was evaluated by obtaining a “shrinkage on cross validation” of 0.1513 for random splitting. The shrinkage statistic for our nonrandom splitting approach was 0.2104. The estimate of the regression coefficients was calculated by pooling all the data (n=150).

4. Discussion

With the use of data from a prospective cohort gathered from a CSU-HAMGH, our analysis demonstrated that, among the prespecified predictor variables, initial stroke severity

measured by NIHSS was the strongest predictor of first MLOS for first0ever ischemic stroke patients. Other significant predictors of first MLOS were initial functional impairment measured by MBI, small0vessel occlusion stroke, sex, and smoking. In this study age was not significantly associated with LOS. This finding agreed with many previous related studies [11]- [16], [20]-[25].

Where, the MLOS examined in this study was the MLOS of acute care hospitalization rather than rehabilitation, which has been studied more often. In addition, only variables for which information is available at the time of admission were considered. The multiple regression analysis showed that each additional point on the NIHSS would increase the first MLOS by approximately 0.060□0.003N, where N is initial stroke severity measured by NIHSS. More specifically, for patients with mild or moderate neurological impairments (NIHSS score ≤13), a 1point increase in NIHSS score corresponded to an increase in LOS by approximately 1 day, while for patients with severe neurological impairments (NIHSS score >13), a 1point increase in NIHSS score corresponded to a decrease in MLOS by approximately 1day. Our finding of the curvilinear relationship between stroke severity and LOS was compatible with the results of the Copenhagen Stroke Study [12]-[15].

The decreased MLOS in patients with more severe stroke was largely related to the mortality rate. Without consideration of the quadratic term of the NIHSS score, the multiple regression analysis, including only patients with initial NIHSS score ≤ 13, was repeated (n=89). This analysis showed that in these patients a 1-3 point increase in NIHSS score corresponded to an increase in MLOS by approximately1day (regression coefficient 00.178, SE =0.088, P=0.048). A similar analysis including only patients with initial NIHSS score >13 showed that NIHSS score at admission had no significant influence on MLOS; small0vessel occlusion stroke was the only significant predicpredictor variable (regression coefficient = 0 0.436, SE= 0.080, P = <0.001). where, the caution is warranted when these findings are interpreted because, in this analysis, too many predictor variables were analyzed for the 64 patients. Male sex is 98 patients, corresponded to an increase in MLOS by approximately 0.088 % days (P =0.004), and smoking decreased MLOS by approximately 00.178 days (P = 0.048). It is not clear whether the influence of sex on MLOS reflects the impact of culture difference or is due to other factors.

MBI score at admission was, as expected, a significant predictor of MLOS. A 102 point decrease of MBI score corresponded to an increase in MLOS by approximately 1 day (P = 0.048). Stroke sub0type was also a strong predictor of MLOS, with small0vessel occlusion stroke associated with an approximately 107 day shorter MLOS than the other sub0types (P = 0.001). This study has some limitations is no comparison data of history of patients records . It is rather difficult for data of an observational study of this type to meet the normality assumption required for using regression models. The MLOS variable was thus transformed by a log function to improve the model. The data were obtained from a CSU-HAMGH hospital0based study. In particular, the fact that the median NIHSS score of the study patients was 10 seemingly indicated that the strokes observed in this study were minor. Consequently, whether the model is transportable to similar patients in different time periods or another location is an important consideration. Even though the shrinkage on cross validation indicated that the reliability of the model seems fairly acceptable, it is important to have the model externally validated. Nevertheless, the present study sheds some light on the practice patterns of stroke management in CSU-HAMGH. For patients with more severe stroke, the cost of stroke care might not be lower than average because of the extraordinary need of intensive care facilities[20],[23]-[25]. MLOS alone may not correctly measure the costs of

acute care hospitalization for first0ever ischemic stroke patients. Future research on this topic is expected to yield potentially fruitful results. Because initial stroke severity, but not age or comorbidity, was shown to be one of the significant predictors of MLOS, we may postulate the hypothesis that initially reducing stroke severity in first0ever ischemic stroke patients with mild or moderately severe stroke might be a wiser way to reduce MLOS after acute care hospitalization. We do not have information specifically related to hours after stroke onset. During the design stage of this study, we thought that the percentage of patients arriving at the hospital within weeks after stroke onset might be too low to make any meaningful conclusions. where, with the potential use of intravenous rtPA to treat acute stroke, further studies should address the impact of the therapy on MLOS of stroke patients. Thirty five percent of patients in this cohort were transferred to the rehabilitation ward within the same hospital. This might reflect the practice pattern of stroke management in CSU-HAMGH. Additionally, in this area the impact of the caregiver regarding the disposition destination after acute stroke care might be different. Further studies addressing the influence of different practices on MLOS are necessary.

5. Concolusion

1. Initial stroke severity, but not age or comorbidity, was shown to be one of the significant predictors of MLOS, we may postulate the hypothesis that initially reducing stroke severity in first ever ischemic stroke patients with mild or moderately severe stroke might be a wiser way to reduce MLOS after acute care hospitalization.The stroke care was consistently associated with improved outcomes, and with decreased mortality, institutionalised care,and dependency.
2. The increasing demand on health services in an aging population, it is crucial to identify the factors that hamper discharge, particularly before clinicians, patients (consumers), and policy makers can evaluate the most effective, efficient, and acceptable methods of managing patients with acute stroke.
3. Result studies of MLOS were conducted by rehabilitation specialists, and the study patients were largely undergoing postacute care. With the potential positive impacts from drugs available to treat ischemic stroke, the present study of MLOS after acute care hospitalization is valuable for further analysis of cost effectiveness.

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