Factors Associated with Functional Outcome Improvement in Hospitalized-Ischemic Stroke Patients

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Abstract: Aim: to identify factors associated with the improvement of functional outcome among hospitalized ischemic stroke patients who had received rehabilitation program. Methods: A retrospective study of stroke patient's medical records. Functional outcome improvement was measured by evaluating the Barthel Index (BI) score on the first day of rehabilitation treatment and the last day in the hospital. Factors that were thought to associate with BI changes were analyzed using SPSS 23, including door-to-rehabilitation time, length of hospital stay, hemiparetic side, aphasia, and spasticity. Results: A total of 208 medical records, 121 data were included. Subjects were 52.1% male with a mean age was 57.36 (SD=11.03). There were 33.1% of subjects who had at least one comorbidity. Most of the subjects experienced paresis unilateral (90.3%). Stroke-related complications were spasticity (19.8%), dysarthria (19%), aphasia (14.9%) and others. The median time of door-to-rehabilitation treatment and length of stay was 2 days and 9 days. The increase of the BI score was ranging between 5 to 70. Among the factors analyzed with BI score improvement, only spasticity that was statistically significant (p=0.002). Conclusion: Spasticity was significantly associated with functional outcome improvement after stroke rehabilitation program in hospitalized-ischemic stroke patients.

1 INTRODUCTION

Stroke is a global health problem and a major cause of long-term disability in Indonesia. The clinical syndrome of stroke is characterized by an acute loss of focal brain function lasting more than 24 hours and in some cases, may lead to death. In Indonesia, data in 2011 showed that 250.000 (2,5%) people died due to stroke and the rest (97,5%) had mild to severe disabilities (Yayasan Stroke Indonesia, 2011). The prevalence of stroke in Indonesia mostly occurs in people aged over 45 years and increases according to the patient's age. That incidence of stroke has increased gradually according to Riskesdas (Riset Kesehatan Dasar) from 2007 to 2013 (Depkes RI, 2013). Therefore, considering the increase in stroke prevalence, the burden of post-stroke disability has garnered greater importance to public health. Most stroke survivors living with long-term physical and functional disorders such as disruption of the activity of daily living (ADL).

The World Health Organization (WHO) divides the burden due to stroke into 3 such as impairment, disability and handicap (WHO, 2011). A rehabilitation program is considered one of the key factors to improve functional outcome in post-stroke patients. Post-stroke outcomes vary widely, between and within world regions depending on multiple factors including demographic profile, stroke type, severity and immediate and long-term post-stroke care (Mweshi M et al, 2016). Previous studies have explained various factors that can affect functional outcomes in ischemic stroke patients. However, there are no studies that assess the factor that affects functional outcomes in ischemic stroke patients who had received rehabilitation programs in Indonesia. This study aims to identify factors associated with the improvement of functional outcomes among

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hospitalized ischemic stroke patients who had received a rehabilitation program.

2 MATERIALS AND METHOD

2.1 Study Population

This was a retrospective, cross-sectional study, carried out at Dr. Soetomo General Academic Hospital, Universitas Airlangga, which is a referral hospital for eastern Indonesia, located in Surabaya, East Java. Data were retrieved from medical records of ischemic stroke patients who were admitted to the neurology ward and consulted to the Physical Medicine and Rehabilitation department from January till December 2018, consecutively. The diagnosis of ischemic stroke was made by neurologists. The following information was obtained from the patient medical records: age; sex; risk factors (hypertension, diabetes, dyslipidemia, smoking history, current history of stroke, cardiovascular disease); presence of comorbid disease; paresis side, stroke-related complication; Barthel index score; door-to-rehabilitation time; length of hospital stay and other relevant data. Patients were excluded if the diagnosis was not an ischemic stroke (e.g., hemorrhagic, embolic, transient ischemic attack [TIA], brain injury), there was no improvement of BI (remain BI or death) at last day of admission and medical records data was incomplete. This study already had ethical clearance from the institutional ethical board.

2.2 Diagnosis Categories

All data were obtained from the patient's medical record. All patients underwent standardized supporting examination, including laboratory examination (hematology, coagulation, and others), chest X-ray, electrocardiography (ECG) and CT-scan. Diagnose of hypertension, diabetes mellitus, dyslipidemia, cardiovascular disease (myocardial infarction and atrial fibrillation), and comorbid diseases were obtained from medical records, which were diagnosed by a related specialist doctor (neurologist, cardiologist, pulmonologist and internist). Paresis side and other stroke-related complications were defined from physical and neurological examination result in the patient's medical records. Door-to-rehabilitation time was defined as a time difference between patient first-day admission in the hospital with a first-day stroke rehabilitation program started. Barthel index score was assessed on the first day of the rehabilitation program started and the last day of hospital admission to evaluate if there any improvement of the BI score. Only door-to-rehabilitation time, length of hospital stay, hemiplegic side, spasticity, and aphasia were evaluated as the factors that were predicted influence BI score changes.

2.3 Statistical Analysis

Categorical data were presented as number (%) and continuous data were presented as mean and standard deviation if normally distributed. Statistically, the analysis was done using SPSS for Windows version 23. Continuous variables were analyzed with the Mann-Whitney test, Wilcoxon test and Spearman test. A probability level of $p<0.05$ was considered significant.

3 RESULTS

Of all 208 ischemic stroke patient's data, there were 121 ischemic stroke patients enrolled in this study. The age distribution was 19 to 88 years old with the proportion of males across all groups was 63 (52.1%). Most of the risk factors were hypertension (87.6%), type-2 diabetes mellitus (47.1%) and previous history of stroke (30.6%), see Table 1.

About forty (33.1%) patients had comorbid diseases with the most prevalent was the presence of other diseases (10.7%), consist of cardiovascular and kidney disease; and infection (9.9%) including pulmonary infection (pneumonia, bronchitis, pulmonary tuberculosis) and sepsis. Notably, the majority experienced hemiparesis (91.7%) with 54% of them had left hemiparesis. The most frequent stroke-related complication was spasticity, dysarthria, and aphasia with 19.8%; 19% and 14.9%, respectively. The average length of hospital stay was varied between 5 to 30 days. Meanwhile, door-to-rehabilitation time was also varied from zero to 11 days.

Table 1: Characteristics of the subjects (n=121)

Characteristic	n (%)	Mean ± SD / Median (min-max)
Demographics		
Male	63 (52.1)	
Female	58 (47.9)	
Age (years old)		57.36 ± 11.03
Risk factors		
∑ of risk factors		2 (0-4)
Hypertension	106 (87.6)	
Diabetes mellitus	57 (47.1)	
Smoking	20 (16.5)	
Hyperlipidemia	20 (16.5)	
History of stroke	37 (30.6)	
Cardiovascular disease	7 (5.8)	
Comorbidities		
∑ of comorbidities		0 (0-5)
Seizure / Epilepsy post-stroke	5 (4.1)	
Pressure ulcer	3 (2.5)	
Infection	12 (9.9)	
Overweight & obesity	11 (9.1)	
Other diseases	13 (10.7)	
Paresis side		
Unilateral	111 (91.7)	
Bilateral	10 (8.3)	
Other stroke-related complication		
Dysphagia	6 (5)	
Dysarthria	23 (19)	
Aphasia	18 (14.9)	
Motoric	7 (5.8)	
Sensory	1 (0.8)	
Global	10 (8.3)	
Spasticity	24 (19.8)	
Clonus	4 (3.3)	
Ambulation function		
Bedridden	7 (5.8)	
Wheelchair	29 (24)	
Walking aid	1 (0.8)	
Barthel Index (BI) score		
First-day rehabilitation		30 (0-90)
Last day hospitalization		60 (5-100)

BI score changes were statistically significant ($p<0.001$) with a range of BI scores improvement was 5 to 70. Among factors that were predicted to affect the increase of the BI score, only the spasticity was statistically significant with $p=0.002$. However, although door-to-rehabilitation time and length of hospital stay were not statistically significant, each variable was negatively correlated with BI score improvement with $r= -0.09$ ($p=0.35$) and $r= -0.103$ ($p=0.26$), respectively (see Table 2.).

Table 2: Bivariate analysis of variables that could influence the Barthel index (BI) score improvement (n=121)

Variable	Median (min-max)	*Spearman's correlation value*	*p-value*
Door-to-rehabilitation time (day)	2 (0-11)	- 0.09	0.35[a]
Length of stay (day)	9 (5-30)	- 0.103	0.26[a]
Hemiparetic side (categorical)	N/A	N/A	0.18[b]
Aphasia (categorical)	N/A	N/A	0.09[b]
Spasticity (categorical)	N/A	N/A	0.002[b]

[a] = Spearman correlation test, [b] = Man-Whitney test

4 DISCUSSIONS

Previous studies have shown different results regarding factors associated with the functional score changing after the stroke rehabilitation program. This study used the Barthel Index (BI)score to measure the activity of daily living (ADL). However, generally, numerous variables that associated with functional outcome based on prior studies are age, gender, prior stroke, diabetes, severity of stroke, stroke subtype, paresis side, and neurological complications (McNaughton H et al, 2001; Weimar C et al, 2002; Pei L et al, 2016; Langhammer B et al, 2017). Besides, a neurological complication that has been suggested affects independence were limb paresis, trunk ataxia and dysphagia (Weimer C et al, 2016). Different from the previous study, our study only correlates door-to-rehabilitation time, length of stay, hemiparetic side, aphasia and spasticity with functional outcome improvement. Meanwhile, other suggested factors as in the previous study only analyze descriptively.

In our study, the overall changes in functional scores demonstrated a significant improvement. Surprisingly, door-to-rehabilitation time, length of stay, hemiparetic side and aphasia had no influence on the functional outcome after stroke rehabilitation during hospitalization. Consistent with the study by Joseph et al, the length of hospital stay showed no clear effect with the functional outcome of patients with stroke following rehabilitation (Joseph C and Rhoda A, 2013). On the contrary, Langhammer et al (2017) suggested that time to rehabilitation admission and length of hospital stay associated with activities of daily living after stroke rehabilitation. However, Langhammer et al (2017) study had a bigger sample size and a better study design.

Along with dysarthria, aphasia also has been reported as a factor associated with functional status (Kim G et al, 2016; Kongsawasdi S et al, 2018). In the present study, aphasia had no significant effect on the BI score improvement. Also, congruent with Park SY et al (2011), the hemiparetic side did not contribute to the functional outcome of stroke patients receiving rehabilitation programs (Park SY et al, 2011). Only spasticity showed a significant association with BI score improvement after the stroke rehabilitation program. Another study suggested that stroke patients with spasticity had a lower BI (Wissel et al, 2010). Rate of patient dependency on ADL according to BI also higher in patients with spasticity (Lundström E et al, 2008; Cacho RO et al, 2017). Other factors that suggested associated with functional outcome improvement by Langhammer et al. were the number of various therapies per day and hours of therapy provided per day, which were not assessed in the present study (Langhammer B et al, 2017).

As a nature of the retrospective study, the major limitation was the certainty of BI score evaluation because it was only obtained as a total score, we can not evaluate each component of daily living activities in Barthel Index. Besides, the evaluation of the BI score was not done in the same evaluation time frame. Risk factors analyzed in this study were limited, even though other risk factors should be accounted for as in the prior studies. Our study design also does not allow follow up, therefore, the further large and multicenter prospective study design is needed to better understand factors associated with functional outcome improvement of stroke rehabilitation in Indonesia.

5 CONCLUSIONS

Improvement of the BI score represented significant functional outcome improvement. Spasticity showed a significant effect on functional outcome

improvement. Further study with better study design is required to evaluate prognostic factors of functional improvement after stroke rehabilitation programs in the Indonesian population.

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