

Predictors of 6-Month Functional Outcome in First Ever Stroke Patient: Malaysian Perspective

Afiza Hanun A.H.¹, Azidah A.K.^{1*}, Monniaty M.²

¹ Department of Family Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kubang Kerian, 16150, Kelantan, Malaysia

² Department of Medicine, Hospital Raja Perempuan Zainab II, Kota Bharu, Kelantan, Malaysia

* **Corresponding Author:** Assoc Prof. Dr. Azidah Abdul Kadir
Department of Family Medicine, School of Medical Sciences
Universiti Sains Malaysia, 16150, Kubang Kerina, Kelantan, Malaysia
Tel: Office: 6097676608 | Mobile: 6012-9286006 | Fax: 609-7676611
Email: azidah@kb.usm.my

Abstract

Objective: The purpose of this study is to determine the predictors of good functional outcome in post stroke patients 6 months post stroke.

Design: This is a prospective cohort study. The study included all stroke patients who were admitted to a tertiary centre in Malaysia from December 2009 to December 2010. Patients were interviewed and examined within 72-hours of admission. The socio-demographic data and medical history were taken. Then, clinical examinations were done to assess the stroke severity using Scandinavian Stroke Scale (SSS) and functional status based on Modified Barthel Index (MBI). The clinical data and investigations results upon admission were gathered from the medical records. Patients were reassessed at six months post stroke on the rehabilitation service, carer availability and functional status (MBI).

Result: A total of 101 patients were recruited and 8 patients passed away before completing the study. They were 52 men and 41 women with mean age of 63.7 (10.3) years. On admission 34.4% had good functional status and at six month, 84.9% had good functional status. SSS score ($p < 0.05$) and age ($p < 0.05$) significantly predict good functional outcome.

Conclusion: Higher SSS score and younger age at occurrence of stroke significantly predict good functional outcome.

Keywords: stroke, predictors, functional outcome, outcome, cerebral infarction, cerebrovascular accident

Short title: *Predictors of Functional Outcome in Stroke Survivors, Malaysia*

Introduction

Stroke is a health problem worldwide and a leading cause of adult disability.¹ Annually, 15 million people worldwide suffer a stroke. Of these, 5 million died and another 5 million are left permanently disabled.^{1,2} It is anticipated that by 2020, stroke would have moved from the 6th to the 4th leading cause of lost disability adjusted life years (DALY's).³ In Malaysia, stroke is one of the top five leading causes of death.⁴ In Malaysia, the number of DALYs lost per 1000 population for non-communicable diseases including stroke was 101.8.⁴

The objective for stroke survival is to achieve their full potential and level of functional independence. Prediction of the functional outcome of stroke survival is useful especially in planning more appropriate short-term and long-term goals for the stroke survivors.⁵ Discharge plan and long term placement may be decided based on the predictors of functional outcome to optimize the efficiency of any services available.

Evidence on the predictors for ambulation and activities of daily living (ADL) is still lacking.⁵ A systematic review found that only one prognostic factor (incontinence for urine) for ADL identified in three level A studies (good level of scientific evidence according to the methodological score).⁶ Recommendation has been suggested to look at evidence based prediction of ADL in the sub acute stage of stroke with the assessment done within two weeks post stroke. Thus, the objective of this study is to determine the predictors of 6-month good functional outcome in post stroke patients.

Subject and Methods

The study was conducted from 1st December 2009 until 31st December 2010. It was a prospective cohort of 101 stroke patients with acute stroke admitted to medical wards in a tertiary hospital (Hospital Raja Perempuan Zainab II) in North East of Peninsular Malaysia

In this study, stroke is defined as clinical syndromes characterized by rapidly developing clinical symptoms and/or signs of focal (or at times global) loss of cerebral function of sudden onset and lasting for more than 24 hours (or leading to death) with no apparent cause rather than vascular in origin.¹ Brain CT scan description was used to divide patients into infarction or haemorrhage.

The study included all patients aged above 18 years old with clinical diagnosis of first ever stroke and did not require intensive care. Pre-morbidly bedridden, pregnant women, patient with pre-existing neuron / motor disorder, patient with mental illness and patient with CT brain findings showed other than vascular in origin were excluded.

All stroke patients who were admitted and fulfilled the inclusion criteria were included in the study. Informed consents were obtained from the subjects or caregivers for the participation into the study after the study protocol was explained to them.

Within 72 hours of admission, socio-demographic data of the patients were obtained. The patients were then assessed clinically by the study investigator using The Scandinavian Stroke Scale (SSS) score.⁷ Then the patients' functional status were assessed using the Modified Barthel

Index (MBI)⁸ by the study investigator and/or allocated physiotherapist when they were discharged. Patients' data on admission were obtained from medical records, which consists of Glasgow Coma Scale (GCS) level, blood pressure (BP) measurements, random blood sugar, ECG tracing and CT Brain result.

During the follow up at 6 months, the patients were interviewed on attendance to rehabilitation programme and availability of carer during stroke recovery. The functional status of the patients then was reassessed using the MBI score.

The Scandinavian Stroke Scale (SSS) was used to assess stroke severity upon admission.⁷ The SSS evaluated the level of consciousness, eye movement, motor power in arm, hand and leg, orientation, aphasia, facial paresis, and gait on total score of 0 to 58.⁷ The higher the score means the lesser neurological impairment.

The Modified Barthel Index (MBI) was used to measure the ability to complete 10 basic activities of daily living except that the scoring system was modified to be more sensitive by including coding for help required: from 0 (unable) to 5 (independent).⁸ The total score is 100. For the purpose of this study, a cut-off point of 50 for the MBI score was chosen arbitrarily to dichotomize the variable. The samples were later stratified into 2 groups: 1) those who had good functional outcome (i.e. MBI scores > 50 points) and 2) those who had poor functional outcome (i.e. MBI scores ≤ 50 points).

Data Entry and Statistical Analysis

The sample size calculations were done using Power and Sample Size Calculation software.⁹ Calculations were done for all possible variables and the biggest sample size was chosen. Using the power of 80%, σ of 30 and δ of 20 (based on systolic blood pressure) the calculated sample size was 92 including 10% dropout rate.

All data was entered and analyzed using Statistical Program for Social Sciences (SPSS) version 12.0. Simple logistic regression was used as a screening in selection of variables for further analysis. All variables with P value less than 0.25 and clinically relevant variables were included in the multiple logistic regression analysis. The method that was used for variable selection was backward and forward stepwise procedure. All possible 2 way interactions were checked and those significant variables were included in the model. The independent variables were fitted into multiple logistic regression and multicollinearity was checked. Fitness of model was tested by Hosmer Lemeshow Goodness of Fit test, the classification table and receiver operator characteristic curve.

Approval by the research and ethics committee

The protocol was approved by the Research and Ethical Committee, School of Medical Sciences, Universiti Sains Malaysia (ref: USMKK/PPP/JEPeM [215.3 (03)]).

Results

A total of 101 patients were recruited during the study period. However, eight had passed away due to other medical causes (i.e. 3 patients died due to acute myocardial infarction, 2 died due to acute renal failure, 2 died because of sepsis and another died due to recurrent stroke) before completing the study leaving a total of 93 patients who completed the study. Thus, the response rate of the study was 92%. Table 1 shows the demographic and clinical characteristics of the study participants. Types of strokes were predominantly ischaemic in origin (81.7%).

Table 2 showed the clinical parameters on admission. Majority of study samples admitted with mean (SD) GCS of 14.0 ± 1.6 . The mean SBP on admission was 165.3 ± 28.2 and mean DBP was 90.6 ± 14.9 . All of the study samples were afebrile on admission. The BP monitoring over 24-hours showed mean daytime BP was $150.5 \pm 19.4 / 83.8 \pm 12.3$ mmHg and mean night time BP was $151.9 \pm 18.2 / 84.7 \pm 10.1$ mmHg.

Figure 1 showed the percentage of the outcome of study samples on admission and after 6 months. The functional outcome was based on the scoring by MBI. 84.9% had good functional outcome at 6-month compared to 34.4% on admission.

Simple logistic regression analysis showed that GCS on admission (p value < 0.05), SSS score on admission (p value < 0.05), age ($p < 0.05$) and educational level ($p < 0.05$) significantly predict good functional outcome at 6-month post stroke. However, multiple logistic regression analysis showed that the significant predictors of good functional outcome were age (OR, 0.93; 95% CI: 0.86 to 0.99; $p = 0.027$) and stroke severity on admission (OR, 1.12 ; 95% CI: 1.04 to 1.21; $p = 0.002$).

Fitness of Multiple Logistic Regression Model

Hosmer-Lemeshow goodness of fit statistic showed that the model was fit. ROC curve analysis indicated that age and SSS score may accurately predict patients with favourable functional outcome at 6 months post stroke (area under curve, AUC = 85.5%).

Discussion

The functional outcome assessment at 6-months showed significant improvement in functional outcome. Eighty-four point nine percent have good functional outcome compared to only 34.4% on admission. Jorgensen *et al.* report that functional recovery occurs mainly within the first 6 months after stroke.¹⁰ Their study showed that functional recovery was completed within 3 months from stroke onset in 95% of patients and best ADL function was reached within 8.5 weeks in patients with mild strokes, within 13 weeks in patients with moderate strokes, within 20 weeks in patients with severe strokes and within 20 weeks in patients with very severe strokes.¹⁰ Thus, it appears that time itself is one of the most important factors although neglected determinants in relation to spontaneous recovery.¹¹

Finding from this study indicates that majority of the patients achieved good functional outcome at 6-month, although only 19.4% had rehabilitation. The rehabilitation services in this country mainly focus at tertiary hospital thus that is why the usage of rehabilitation is low. Functional recovery in stroke patients was significantly higher and more rapid in stroke rehabilitation unit compared to general wards despite similar therapy input.¹² However, majority of the patients lived with carer which means they had good social support. Study shows that people who have good social support after a stroke positively associated with good functional status.¹³ However, availability of carer is not significant predictors in this study because majority of the patients (96.8%) lived with spouse or children.

In this study, younger age significantly predict good functional outcome. The result is similar to few other studies^{14,15,16,17} on effects of age and functional outcome in stroke. Age has been shown as the main factor in predicting functional outcome regardless of mean age of the stroke population, severity of strokes, stroke subtypes or ethnicity.^{18,19} This relation is most likely to be due to age-linked reduced ability for functional compensation.²⁰

Stroke severity is an important predictor of outcome.^{21,22} Several stroke severity scales have been developed to predict the outcome. The Scandinavian stroke scale is one of the stroke scale that is reliable in measuring stroke severity.⁷ Our data showed better neurological deficit on admission independently predict good functional outcome. The result supports other studies^{14,21,22} on prognostic factor of stroke.

A study among most severe stroke patients did show that initial stroke severity was an important predictor of functional outcome.²⁰ The severity on stroke onset was also found to be one of the important factors in predicting functional outcome in a study conducted in Denmark among very old stroke patients.²⁰ Another study on ICU-admitted stroke patients demonstrates that initial stroke severity score at emergency department was an independent predictor for functional status at discharge.²³

The findings in this study are also similar with another study done in diabetic patients.²¹ In that study age, dementia, initial stroke severity scoring based on national Institutes of Health Strokes Scale (NIHSS) score, systolic blood pressure on admission, proteinuria, stroke subtype and prior use of angiotensin receptor blocker (ARB) were significantly related to outcome at 3 months after onset of stroke.²² However in this study our data of BP within 24 hours and stroke subtype did not predict functional outcome.

The present study has several limitations. The study did not include the patients who were admitted to intensive care due to the difficulty in assessing their functional status, in view that they were sedated for treatment purposes. This study also did not evaluate the disease effects on the stroke recovery and outcome such as controlled of blood pressure or blood sugar till 6 months or compliance to medication because it needs regular follow-up at different interval that may not be feasible to conduct for the purpose of this study. Majority of the stroke patients in this study had mild to moderate stroke severity, so the results of predictors of good functional outcome might not be generalized to all stroke patients.

Conclusion

In conclusion, younger age and less severe neurological impairment significantly predict good functional status at 6-month. In future, we proposed further validation of these models in a larger multi-centred study. We also recommend that future studies also look into the higher cognitive functions and also ability to perform instrumental activities of daily living.

Acknowledgement

We would like to acknowledge Universiti Sains Malaysia for the grants given to do this study. Ref: (304/PPSP/6139074). We also gratefully acknowledge the cooperation of all staffs involved in this study.

Conflict of interest statement

We declare there is no financial and personal relationship with other people or organizations that could inappropriately influence the research

Funding: This study was funded by the short term grant from Universiti Sains Malaysia (USM) (304/PPSP/6139074).

References

1. *Clinical Practice Guidelines : Management of Ischaemic Stroke*. In: MOH Malaysia, Malaysia: Malaysia Ministry of Health; 2006. p. 1.
2. WHO Report 2003. http://www.who.int/cardiovascular_diseases/en/cvd_atlas_15_burden_stroke.pdf. assessed May 2012.
3. Murray JL. *The Global Burden of Disease: A Comprehensive Assessment of Mortality and Disability from Diseases, Injuries and Risk Factors in 1990 and Projected to 2020*. Harvard University Press; 1996.
4. Loo KW and Gan SW. Burden of stroke in Malaysia. *International Stroke Journal* 2012;7:165-167.
5. Kollen B, Kwakkel G and lindeman E. Functional recovery after stroke: A review of current developments in stroke rehabilitation research. *Reviews on Recent Clinical trials* 2006;1:75-80.
6. Meijer R, Ihnenfeldt DS, de Groot IJ, van Limbeek J, Vermeulen M, de Haan RJ. Prognostic factors for ambulation and activities of daily living in the subacute phase after stroke. A systematic review of the literature. *Clin Rehabil* 2003;17(2):119-29.

7. Christensen H, Boysen G, Truelsen T. The Scandinavian stroke scale predicts outcome in patients with mild ischemic stroke. *Cerebrovasc Dis*. 2005;20(1):46-8.
8. Mahoney FI, Barthel DW. *Functional Evaluation: The Barthel Index*. Md State Med J. 1965 Feb;14:61-5.
9. W. D. Dupont and W. D. Plummer. PS power and sample size program available for free on the internet. *Controlled clinical trials*, vol. 18, no. 3, pp. 274, 1997.
10. Jorgensen HS, Nakayama H, Raaschou HO, Vive-Larsen J, Stoier M, Olsen TS. Outcome and time course of recovery in stroke. Part I: Outcome. The Copenhagen Stroke Study. *Arch Phys Med Rehabil* 1995;76(5):399-405.
11. Kollen B, Kwakkel G, Lindemann E. Functional Recovery After Stroke : A Review of Current Developments in Stroke Rehabilitation Research. *Reviews on Recent Clinical Trials* 2006;1:75-80.
12. Kalra L. The influence of stroke unit rehabilitation on functional recovery from stroke. *Stroke*. 1994 Apr;25(4):821-5.
13. Glass TA, Matchar DB, Belyea M, Feussner JR. Impact of social support on outcome in first stroke. *Stroke*. 1993 Jan;24(1):64-70.
14. Sharma VK, Tsivgoulis G, Teoh HL, Ong BK, Chan BP. Stroke Risk Factors and Outcomes Among Various Asian Ethnic Groups in Singapore. *J Stroke Cerebrovasc Dis* 2010:424-430.
15. Jeng JS, Huang SJ, Tang SC, Yip PK. Predictors of survival and functional outcome in acute stroke patients admitted to the stroke intensive care unit. *J Neurol Sci* 2008;270(1-2):60-6.
16. Andersen KK, Olsen TS. One-month to 10-year survival in the copenhagen stroke study: interactions between stroke severity and other prognostic indicators. *J Stroke Cerebrovasc Dis* 2011;20(2):117-23.
17. Liu X, Lv Y, Wang B, Zhao G, Yan Y, Xu D. Prediction of functional outcome of ischemic stroke patients in northwest China. *Clin Neurol Neurosurg*. 2007;109(7):571-7.
18. Jorgensen HS, Reith J, Nakayama H, Kammersgaard LP, Raaschou HO, Olsen TS. What determines good recovery in patients with the most severe strokes? The Copenhagen Stroke Study. *Stroke*. 1999;30(10):2008-12.
19. Di Carlo A, Lamassa M, Pracucci G, Basile AM, Trefoloni G, Vanni P, et al. Stroke in the very old : clinical presentation and determinants of 3-month functional outcome: A European perspective. European BIOMED Study of Stroke Care Group. *Stroke*. 1999;30(11):2313-9.

20. Kammersgaard LP, Jorgensen HS, Reith J, Nakayama H, Pedersen PM, Olsen TS. Short- and long-term prognosis for very old stroke patients. The Copenhagen Stroke Study. *Age Ageing* 2004;33(2):149-54.
21. Kuwashiro T, Kamouchi M, Ago T, Hata J, Sugimori H and Kitazono T. The factors associated with a functional outcome after ischemic stroke in diabetic patients: The Fukuoka Registry. *J Neurol Sci.* 2011;313:110-114.
22. Wozniak MA, Kittner SJ, Price TR, Hebel JR, Sloan MA, Gardner JF. Stroke location is not associated with return to work after first ischemic stroke. *Stroke.* 1999;30(12):2568-73.
23. Jeng JS, Huang SJ, Tang SC, Yip PK. Predictors of survival and functional outcome in acute stroke patients admitted to the stroke intensive care unit. *J Neurol Sci.* 2008;270(1-2):60-6.

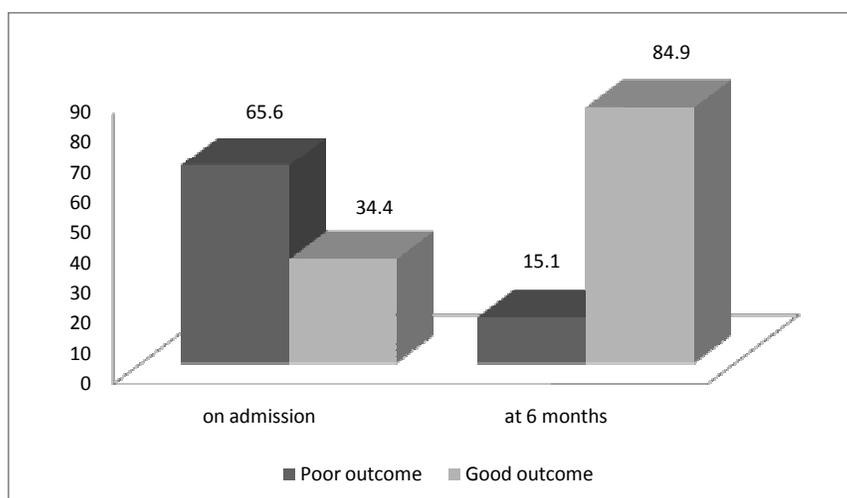
Table 1: Socio-demographic and medical characteristic of study patients

Variables	Total n(%)	Good outcome n(%)	Poor outcome n(%)
Age	63.7(10.3) ^a	62.5(10.0) ^a	70.2(9.2) ^a
Sex			
Men	52(55.9)	45(57.0)	7(50.0)
Women	41(44.1)	34(43.0)	7(50.0)
Marital status			
Married	73(78.5)	63(79.7)	10(71.4)
Single	20(21.5)	16(20.3)	4(28.6)
Income	1120.8(1048.1) ^a	1071.26(932.70) ^a	1400.00(1567.08) ^a
Smoking			
Never smoke	56(60.2)	48(60.8)	8(57.1)
Ever smoke	37(39.8)	31(39.2)	6(42.9)
Carer			
Together	90(96.8)	77(97.5)	13(92.9)
Apart	3(3.2)	2(2.5)	1(7.1)
Rehabilitation			
No	75(80.6)	63(79.7)	12(85.7)
Yes	18(19.4)	16(20.3)	2(14.3)
Diabetes	28(30.1)	25(31.6)	3(21.4)
Hypertension	57(61.3)	47(59.5)	10(71.4)
CAD	12(12.9)	10(12.7)	2(14.3)
CT Brain			
Haemorrhage	17 (18.3)	13(16.5)	4(28.6)
Ischemic	76 (81.7)	66(83.5)	10(71.4)

^a Data is expressed in mean (standard deviation, SD)

Table 2: Clinical parameters on admission

Variables	Total Mean (SD)	Good outcome, Mean (SD)	Poor outcome, mean (SD)
GCS	14.0 (1.6)	14.3(1.5)	12.6(1.8)
SBP	165.3(28.2)	164.1(28.0)	172.1(23.6)
DBP	90.6 (14.9)	90.6(15.2)	89.8(13.7)
RBS	8.2(3.7)	8.4(3.8)	7.0(2.9)
SSS score	56.0 (34.1)	36.0(11.3)	22.9(8.7)
Mean SBP (day)	150.5(19.4)	149.6(19.4)	155.6(19.4)
Mean DBP (day)	83.8 (12.3)	84.3(12.4)	81.6(12.1)
Mean SBP (night)	151.9(18.2)	151.1(18.4)	156.6(17.2)
Mean DBP (night)	84.7 (10.1)	84.8(10.2)	84.3(10.0)

**Figure 1:** Prevalence of functional outcome on admission and at 6 months (%)