Neurol J Southeast Asia 2003; 8 : 5 – 8

Predictors of in-hospital mortality after an acute ischaemic stroke

Hamidon BASRI MD MMED, Raymond AZMAN ALI MD FRCP

Neurology unit, Department of Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

Abstract

Background and Objectives: Currently there is limited information on the mortality after an acute stroke in hospitalised patients in the region. The objective of the study was to determine the type, time after onset and predictors of mortality after stroke. *Methods:* This was a prospective study of consecutive patients with acute stroke who were admitted to Hospital Universiti Kebangsaan Malaysia from June 2000 to January 2001. A single observer, using pre-defined diagnostic criteria recorded the information of interest. *Results:* Two hundred and eighteen patients with acute stroke were enrolled in the study; 163 (74.8%) ischaemic and 55 (25.2%) haemorrhagic. The mean length of stay was 7.5 days (range=1 to 35 days). The case fatality rate for ischaemic stroke was 11.7% and for haemorrhagic stroke, 27.3%. Death occurred after a mean of 8.0 days after admission for ischaemic stroke and 3.8 days for haemorrhagic stroke. The independent risk factors for mortality for ischaemic stroke were middle cerebral artery infarct (OR 12.1; 95% CI 3.25 to 45.0), atrial fibrillation (OR 9.77; 95% CI 1.78 to 53.7), diabetes mellitus (OR 4.88; 95% CI 1.25 to 19.1), Barthel index less than 5/20 (OR 4.2; 95% CI 1.1 to 16.5), and Glasgow Coma Scale less than 9 (OR 3.9; 95% CI 1.01 to 14.6).
Conclusions: The in-hospital mortality rate of stroke in Hospital Universiti Kebangsaan Malaysia was similar to other studies. Middle cerebral artery infarct, atrial fibrillation, diabetes mellitus, very severe disability, and poor Glasgow Coma Scale had higher risk of mortality for acute ischaemic stroke.

INTRODUCTION

Stroke is one of the leading causes of death in the world. The annual incidence of stroke in the community is about 2 per 1000 population. In the United States, stroke is currently the third leading cause of death after heart disease and cancer.[1] In 1990, the World Health Organisation estimated that 2.1 million people died of stroke in Asia.[2] It has been established that stroke is among the top four leading cause of death in ASEAN countries since 1992 - number one in Indonesia, third in Philippine and Singapore, fourth in Brunei, Malaysia and Thailand.[3] The mortality of stroke in developed countries has been steadily decreasing since the 1960's.[4] The fall in mortality may be due to fall in the incidence of stroke, or its case fatality rate. The better control of risk factors such as hypertension may contribute to the reduction in incidence of stroke. Improvement in case fatality rate however, requires attention to factors that are associated with stroke mortality. There are significant differences in the subtype of stroke and the pathological distribution of vascular lesions between Asians and Caucasian patients, such as higher proportion of intracerebral hemorrhage, lacunar infarct, intracranial disease versus extracranial diseases, among Asians.[5-7] This study aims to determine the risk factors for in-patient mortality for ischaemic stroke among a cohort of Malaysian patients.

METHODS

This study was done in the Hospital Universiti Kebangsaan Malaysia, a general hospital serving mainly the population in the southern part of Kuala Lumpur. A cohort of patients was prospectively identified. They consisted of consecutive patients who were either admitted to the general medical ward, high dependency ward or the intensive care unit with a clinical diagnosis of stroke (first ever or recurrent within one week of onset of symptoms) or had suffered a stroke during an inpatient stay during the period June 2000 to January 2001. All patients assessed by the author (HB), and seen at least once by RAA.

Address correspondence to: Dr Hamidon bin Basri, Jabatan Perubatan Fakulti Perubatan, UKM, Jalan Yaacob Latiff, Bandar Tun Razak, Cheras, 56000 Kuala Lumpur, Malaysia. Tel: 03-91702306, Fax:03-91737829, E-mail: hamidon@mail.hukm.ukm.my

Acute stroke was defined as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin", according to the World Health Organisation criteria. A standardised data sheet was used to record the demographic variables including age, sex, and race; known risk factors such as history of hypertension, diabetes mellitus, hypercholesterolaemia, stroke or transient ischaemic attack, smoking, ischaemic heart disease, and valvular heart disease. The single observer, using pre-determined diagnostic criteria also recorded the type, time of onset of stroke, and death that occurred during the inpatient period. The parameters on admission, including the blood pressure, glucose levels, Glasgow Coma Scale (GCS), Barthel Index for activities of daily living (0-20), and on discharge, the length of stay and deaths were also recorded. All patients were subjected to CT scan of the brain before being admitted to the wards. Magnetic resonance imaging (MRI) of the brain was done if the stroke localization is in doubt. Middle cerebral artery infarct, lacunar and other infarcts were determined by both clinical and radiological evidence.

Univariate analysis was first performed on demographic characteristics and the risk factors for stroke, admission parameters, and type of stroke by cross-tabulations with the chi-square test. Then, a logistic multiple regression model was used and the covariates were adjusted for each independent (regression) variable. The dependent variable was determined as the presence of complication(s) or death. All probability values shown were based on the Wald test. In both univariate and multivariate analyses, odd ratios with 95% confidence interval (CI) were used to estimate the effects of each factor. All statistical analyses were performed with the SPSS 10.0 package, with statistical significance at 0.05 (2 aided).

RESULTS

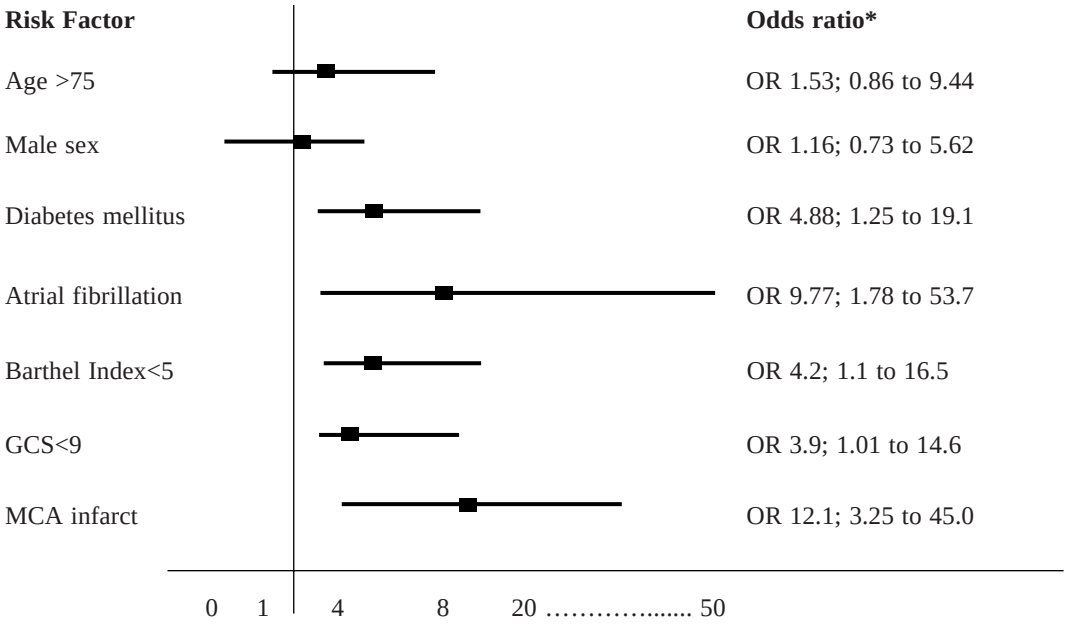
During the 8-month study period, 218 stroke patients were identified. The mean age was 62.2 years, 67 patients (30.7%) were <56 years, 122 patients (56.0%) were 56-75 years, and 29 patients (13.3%) were >75 years. One hundred and five patients (48.2%) were male and 113 patients (51.8%) were female. The ethnic composition of the patients was 117 Chinese (53.7%), 81 Malays (37.2%), 18 Indians (8.3%), and 2 others (0.9%). One hundred and sixty three patients (74.8%) had ischaemic stroke and 55 patients (25.2%) had haemorrhagic stroke. Out of the 163 patients with acute ischaemic stroke only one patient had no known risk factor; 33 (20.2%) patients had one risk factor, 55 (33.7%) had two risk factors and 74 (45.4%) had at least three risk factors. The commonest risk factor was hypertension (76.1%), followed by diabetes mellitus (55.2%), hypercholesterolaemia (31.3%), smoking (28.2%), ischaemic heart disease (15.3%), previous ischaemic stroke (15.3%), atrial fibrillation (6.1%), family history (3.7%) and others (6.1%). The types of ischaemic strokes found were middle cerebral artery (MCA) infarct (14.2%), lacunar infarct (46.8%), and others (11.4%). On admission, the mean systolic blood pressure was 170.3 mmHg, diastolic blood pressure 89.4 mmHg, random blood sugar 12.3 mmol/l, GCS 13.5 and Barthel Index 10.1/20.

The case fatality rate for ischaemic stroke was 11.7% and for haemorrhagic stroke, 27.3%. Death occurred after a mean of 8.0 days after admission for ischaemic stroke and 3.8 days for haemorrhagic stroke. The overall mean length of stay was 7.5 days (range = 1 to 35 days); 7.5 days (range = 2 to 22 days) for ischaemic and 7.8 days (range = 1 to 35 days) for haemorrhagic stroke. The relationship between risk factors, admission parameters (systolic blood pressure, diastolic blood pressure, random blood sugar, GCS score, and Barthel Index), types of ischaemic stroke and mortality were also studied. The independent risk factors for mortality were MCA infarct (OR 12.1; 95% CI 3.25 to 45.0), atrial fibrillation (OR 9.77; 95% CI 1.78 to 53.7), diabetes mellitus (OR 4.88; 95% CI 1.25 to 19.1), Barthel Index less than 5/20 (OR 4.2; 95%CI 1.1 to 16.5), and GCS less than 9 (OR 3.9; 95%CI 1.01 to 14.6). There was no significant increase in risk of mortality in the other parameters observed other than the above mentioned.

DISCUSSION

This study was hospital-based. Patients were identified using an internationally recognised definition of stroke. The mean age of patients was 62.2 years. This figure is comparable to previous Malaysian studies, where the mean age was 61.8 years by Ng et al[7], and 65 years in Penang.[8] Studies particularly from the West reported older mean age. For example, the mean age for the Austin Hospital, Melbourne was 70.4 years.[7] The lower mean age of stroke for the

Figure 1: Risk factors for mortality after the acute ischaemic stroke



*Odds ratio with 95% confidence intervals

Malaysian patients probably reflects the younger age of the Malaysian population overall. The ethnic composition consisted of 53.7% Chinese, 37.2% Malays, and 8.3% Indians. The ethnic Chinese being over represented in this study probably because our hospital is situated in an area with large Chinese population. The previous Malaysian study by Ng et al[7] showed the ethnic breakdown of stroke patients to be similar to the hospital admission. There is thus no evidence to suggest predisposition to stroke in any of the ethnic groups. The mean length of hospital stay in this study was 7.5 days. This is shorter than that reported in many other studies.[9-11] The local practice of family taking responsibility of long-term care and inadequate nursing home facilities probably accounts for the short hospital stay in this study. On the other hand, delays in provision of equipment, home adaptations, and placement in nursing homes contribute to longer hospital stay in the Western studies. The high proportion of intracranial hemorrhage and lacunar infarct are consistent with other Asian studies.[3,5,7,8] The risk factors found among our patients is also consistent with other series[7,8,12-15]

The overall mortality rate was 15.1%; 11.7% for ischaemic stroke and 27.3% for haemorrhagic stroke. This result is similar to that reported elsewhere.[12,15-17] Death occurred after a mean of 8.0 days after admission for ischaemic stroke and 3.8 days for haemorrhagic stroke. Wong[16] in reporting an Asian joint stroke mortality study involving 2403 patients, found a mean duration from admission to death of 12.9 days for ischaemic stroke and 7.3 days for hemorrhagic stroke. Early death within the first 7days has been attributed to direct effects of neurological damage, whereas death during 7-30 days were mainly from immobility.[18]

We found MCA infarct, atrial fibrillation, diabetes mellitus, Bartel Index less than 5/20, and GCS less than 9 to be significant independent risk factors for in-hospital mortality after stroke. In stroke patients with atrial fibrillation, the patients affected are usually accompanied by rather serious heart problems like dysrhythmia, ischaemic heart disease, and heart failure. Furthermore, cardio-embolic stroke tends to be more severe. In two population-based studies in Rochester and in Framingham, the odd ratios for stroke death were 1.7 and 2.0 for patients with atrial fibrillation.[19,20]

Diabetic patients are prone to infection, being less immunocompetent, and often having concurrent multiple end-organ damage that ultimately increases morbidity and mortality. The detrimental effects of diabetes on the outcome of

cerebrovascular disease are in accord with previous reports that diabetics have poorer outcome after stroke and coronary artery disease than non-diabetics.[21-23] It is not surprising that MCA infarctions, being large cerebral infarcts; low Barthel ADL score reflective of severe functional disability and poor GCS score, all indicative of immobility related to severe neurological damage, is correlated with post stroke mortality.

In conclusion, the in-hospital mortality rate in this study was relatively similar compared to other studies. The independent risk factors were atrial fibrillation, diabetes mellitus, MCA infarct, severe functional disability, and poor GCS. The limitation of this study was that the assessment was done merely during the in-patient period and hence the mortality after discharge was not included in the analysis.

REFERENCES

1. Heart and stroke statistical update. Dallas, Tex: American Heart Association 1998.
2. Murray CJL, Lopez AD. The Global Burden of Disease. Boston, Mass: Harvard University Press 1996.
3. Venketasubramanian N. The epidemiology of stroke in ASEAN countries - A review. *Neurol J Southeast Asia* 1998;3:9-14.
4. Bonita R, Beaglehold R. Explaining stroke mortality trends. *Lancet* 1993;341:1510-1
5. Huang CY, Chan FL, Yu YL, Woo E, Chin D. Cerebrovascular disease in Hong Kong Chinese. *Stroke* 1990;2:230-5
6. Leung SY, Ng THK, Yuen ST, Lauder IJ, Ho FCS. Pattern of cerebral atherosclerosis in Hong Kong Chinese. *Stroke* 1993;6:779-86
7. Ng WK, Ng WK, Goh KJ, George J, Tan CT, Baird A, Donnan A. A comparative study of stroke subtype between Asian and Caucasians in two hospital based stroke registries. *Neurol J Southeast Asia*. 1998;3:19-26
8. Ong TZ, Raymond AA. Risk factors for stroke and predictors of one-month mortality. *Singapore Med J* 2002;43:517-21
9. Van Straten A, Van Der Meulen JH, Van Den Bos GA, Limburg M. Length of hospital stay and discharge delays in stroke patients. *Stroke* 1997; 28:137-40.
10. Davenport RJ, Dennis MS, Wellwood I, Warlow CP. Complications after acute stroke. *Stroke 1996*; 27:415-20.
11. Dromerick A, Reding M. Medical and neurological complications during inpatient stroke rehabilitation. *Stroke 1994*; 25:358-61.
12. Moulin T, Tatu L, Crepin-Leblond T, Chavot D, Berges S, Rumbach T. The Besancon stroke registry: An acute stroke registry of 2500 consecutive patients. *Euro Neurol* 1997;38:10-20.
13. Baranska GM, Ryglewicz D, Lechivicz W, Mendel T, Weissbein T. Risk factors in patients with stroke. *Neurol Neurochir Pol 1993*; 27:625-32.
14. Hung TP. Changes in mortality from cerebrovascular disease and clinical pattern of stroke in Taiwan. *J Form Med Ass 1993*; 92:687-96.
15. Jeng JS, Lee TK, Chang YC, et.al. Subtype and case fatality rate of stroke: A hospital-based stroke registry in Taiwan. *J Neurol Sci 1998*; 156:220-6.
16. Wong KS. Risk factors for early death in acute ischaemic stroke and intracerebral hemorrhage: a prospective hospital-based study in Asia. *Stroke* 1999; 30:2326-30.
17. Asawavichienjinda T, Boongird P. Cerebrovascular disease in North East Thailand. *Neurol J Southeast Asia*. 1998;3:27-33
18. Bamford J, Dennis MS, Sandercock P, Burn J, Warlow C. The frequency, cause and timing of death within 30 days of a first ever stroke: The Oxfordshire Community Stroke Project. *J Neurol Neurosurg Psychiatr* 1990;53:824-9
19. Lin HJ, Wolf PA, Kelly-Hayes M, et.al. Stroke severity in atrial fibrillation: The Framingham Study. *Stroke* 1996; 27:1760-4.
20. Jorgensen HS, Nakayama H, Raaschou HO, Olsen TS. Acute stroke with atrial fibrillation: The Copenhagen Stroke Study. *Stroke* 1996;10:1765-9.
21. Jorgensen HS, Nakayama H, Raaschou HO, Olsen TS. Stroke in patients with diabetes: The Copenhagen Stroke Study. *Stroke 1994*; 25:1977-84.
22. NINDS t-PA Stroke Study Group. Generalised efficacy of t-PA for acute stroke: Subgroup analysis of the NINDS t-PA Stroke Trial. *Stroke 1997*; 28:2119-25.
23. Haffner SM, Lehto S. Mortality from coronary heart disease in subjects with type 2 diabetes and in non-diabetic subjects with and without prior myocardial infarction. *N Engl J Med 1998*; 339:229-34.