ORIGINAL ARTICLE

Risk Factors and Complications of Acute Ischaemic Stroke Patients at Hospital Universiti Kebangsaan Malaysia (HUKM)

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Summary

In Malaysia, there is limited information on the mortality and morbidity after an acute stroke in hospitalised patients. The objective of the study was to identify the type, time of onset, and frequency of medical and neurological complications following an acute ischaemic stroke. Consecutive patients with acute ischaemic stroke who were admitted to Hospital Universiti Kebangsaan Malaysia from June 2000 to January 2001 were observed. The complication rate was 20.9%. The most common individual complication was pneumonia (12.3%), followed by septicaemia (11.0%), urinary tract infection (4.3%), and upper gastrointestinal haemorrhage (3.7%). The overall mean length of stay was 7.48 days. The independent risk factors for complications were diabetes mellitus (OR 2.87; 95%CI 1.06 to 7.78), middle cerebral artery (MCA) infarcts (OR 10.0; 95%CI 4.1 to 24.3), and Glasgow coma score (GCS) less than 9(OR 3.8; 95%CI 1.03 to 14.3).

Infection was the commonest complication observed. Patients with diabetes mellitus, poor GCS and large MCA infarcts had a higher risk of developing complications.

Key Words: Ischaemic stroke, Mortality, Morbidity

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 Malaysia, stroke remains an important cause of morbidity and mortality[1]. The burden of stroke is likely to increase substantially in the future as the proportion of elderly people increases. This will have tremendous economic implications and cause devastating psychosocial problems. The cost of treatment and rehabilitation is estimated to be about USD 40 billion per year in the United States. Nonetheless, the incidence of stroke in developed countries has been steadily decreasing since the 1960's[2]. The fall in incidence has been attributed to better control of risk factors such as hypertension, diabetes, and hypercholesterolaemia. Therefore it is imperative to identify risk factors for stroke that are

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associated with stroke morbidity in order to implement more effective stroke prevention programmes. The main objective of this study was to determine the morbidity rate after an acute stroke in patients admitted to HUKM and the factors that were associated with it.

Materials and Methods

In a single hospital (HUKM), 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 ischaemic 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. Patients were recruited within 72 hours of stroke onset. 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 (WHO) criteria[3]. Hypertension was defined as a previous record of at least two blood pressure readings of >160/90 mmHg or the requirement of regular intake of anti-hypertensive drug(s). Diabetes mellitus was defined as having a fasting plasma glucose level of > 7.8 mmol/l, a random plasma glucose of > 11.1 mmol/l, or the requirement of regular hypoglycaemic drug(s). Hypercholesterolaemia was defined as having a total cholesterol of >6.5 mmol/l or the requirement of regular anti-cholesterol drug(s). A single observer, using pre-defined diagnostic criteria recorded the type, time of onset, and frequency of complications that occurred during the inpatient period. The parameters on admission, including the blood pressure, glucose levels, Glasgow coma score (GCS) and the Barthel activities of daily living (ADL) index were also recorded. The length of stay on discharge and deaths were recorded. All patients were subjected to a brain CT scan before being admitted to the wards.

Statistical Analyses

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.

Results

During the 8-month study period, 184 ischaemic stroke patients were identified. A total of 163 patients were enrolled in the study. Twenty-one patients were excluded; 2 had underlying end stage renal failure and 19 were admitted more than 72 hours after the stroke onset. The mean age was 62.2 years, and 48.2% were male. The ethnic composition of the patients was 53.7% Chinese, 37.2% Malays, 8.3% Indians and other races 0.9%. The commonest risk factor was hypertension (124 or 76.1% of patients), 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%), significant family history (3.7%) and others (6.1%). The type of ischaemic strokes found were middle cerebral artery (MCA) territory infarcts (26.4%), lacunar infarcts (62.6%), and others (11.0%). On admission, the mean systolic blood pressure (SBP) was 170.3 mmHg, diastolic blood pressure (DBP) 89.4 mmHg, random blood glucose (RBS) 12.3 mmol/l, Glasgow coma score (GCS) 13.5 and Barthel index 10.1.

During 163 hospital admissions for acute ischaemic strokes, at least one complication occurred in 34 (20.9%) patients. The frequencies of individual complications are shown in Table IV. The onset of complication after the day of

admission was also assessed. The overall mean length of stay was 7.48 days (range = 1 to 35 days). The relationship between risk factors, admission parameters (SBP, DBP, RBS, GCS score, and Barthel index), types of ischaemic stroke and complications were also studied. The independent risk factors for complications were diabetes mellitus (OR 2.87; 95%CI 1.06 to 7.78), MCA infarcts (OR 10.0; 95%CI 4.1 to 24.3), and GCS less than 9 (OR 3.8; 95%CI 1.03 to 14.3). There was no significant increase in risk of morbidity in the other parameters observed other than those mentioned above.

Table I: Patient characteristics

		Frequency	Percent (%)
Age (years)	<56	67	30.7
	56-75	122	56.0
	>75	29	13.3
Sex	Male	105	48.2
	Female	113	51.8
Race	Malay	81	37.2
	Chinese	117	53.7
	Indians	18	8.3
	Others	2	0.9
Type of ischaemic stroke	MCA infarct	31	19.0
	Lacunar infarct	102	62.6
	ACA infarct	4	2.5
	PCA infarct	21	12.9

MCA- middle cerebral artery
ACA- anterior cerebral artery
PCA- posterior cerebral artery

Table II: Risk factors for Ischaemic Stroke

		Frequency	Percent (%)
Risk Factors	Hypertension	124	76.1
	Diabetes Mellitus	90	55.2
	Hypercholesterolaemia	51	31.3
	Smoking	46	28.2
	Ischaemic heart disease	25	15.3
	Previous ischaemic stroke	25	15.3
	Atrial fibrillation	10	6.1
	Family history (stroke)	6	3.7
	Others	10	6.1

Table III: Admission parameters observed

Admission parameters	Mean	(SD)
SBP	170.3 mmHg	(37.2 mmHg)
DBP	89.4 mmHg	(25.3 mmHg))
RBS	12.3 mmol/l	(14.2 mmol/l)
GCS	13.5	(3.1)
Barthel Index	10.1	(6.5)

Table IV: Complications Observed in Patients with Ischaemic Stroke

Complication	N	Shortest onset (days)	Longest onset (days)	Mean (days)	SD
Pneumonia	20	2	7	3.6	1.5
Septicaemia	18	2	7	3.9	1.7
Urinary tract infection	7	1	15	4.6	4.8
Upper gastro-intestinal bleeding	6	1	8	4.5	2.3
Recurrent stroke	5	1	10	4.6	3.4
Depression	4	2	4	2.8	1.0
Haemorrhagic transformation	3	4	10	6.3	3.2
Bedsores	2	10	15	12.5	3.5
Deep vein thrombosis	1	4	4	4.0	-

Table V: Comparison of present study with other published data

Complications	Present Study (n=163)	Davenport et.al.[10] (n=607)	Langhorne et.al.[11] (n=311)
Total	20.9%	50.9%	85%
Chest infection	20(12.3)	70 (12)	68(22)
Septicaemia	18(11.0)	...	...
UTI	7 (4.3)	98 (16)	71(23)
Upper GI bleed	6 (3.7)	...	...
Recurrent stroke	5 (3.1)	...	28 (9)
Depression	4 (2.5)	32 (5)	50(16)
Haemorrhagic transformation	3 (1.8)	...	...
Bedsores	2 (1.2)	110(18)	...
DVT	1 (0.6)	18 (3)	6(2)

... indicates not stated. Values in parentheses are percentages.

Discussion

The limitation of this study was that the sample size was small and the subjects were only ischaemic stroke patients. Hence comparison with haemorrhagic strokes could not be done. The study design was hospital-based and thus suffered from referral bias. Patients were identified prospectively using an internationally recognised definition of stroke and were seen at least once by the consultant neurologist to ensure case ascertainment. These patients were then prospectively assessed by the single observer for complications. The accuracy of the study was enhanced by participation of the single observer in daily discussions and weekly stroke meetings with the ward doctors, nurses, physiotherapists, and relatives.

The mean age of patients was 62.2 years. This figure is comparable to a study done by Wong KS, a large hospital-based study in Asia[4] (62 years). However, other studies particularly from the West have reported different results with older mean ages[5,6]. The life expectancy of Malaysians is 69.58 years in males and 74.47 years in females[1]. The life expectancy figures in developed countries are much higher and as stroke increases with age, the mean age of stroke patients is also expected to increase in these countries. The sex distribution in this study was found to be almost equal in distribution (male to female ratio of 1:1.1). This was consistent with a study done by Ee et.al.[7] and Wong KS[4]. The ethnic composition of the patients with stroke consisted of 117 (53.7%) Chinese, 81 (37.2%) Malays, 18 (8.3%) Indians, and 2 (0.9%) other races. This composition does not reflect the national racial composition probably because HUKM is situated in Cheras, an area predominantly populated by the Chinese community.

The mean length of hospital stay in this study was 7.48 days. This is shorter than that reported in other studies which documented much longer lengths of stay such as 52 days (Dromerick et.al.[8]), 28 days (Van Straten et. al.[9]), and 37 days (Davenport et. al.[10]). Among the reasons for the longer stay cited by these studies were delays in provision of equipment and home adaptations and delays in placing patients in private nursing homes. In our country, these delays are less relevant as we have a different cultural practice. Patients are sent home to their families as the long-term care is considered the responsibility of the patient's family. Furthermore, good private nursing homes are scarce and very expensive. Most nursing homes are badly maintained and poorly equipped. Davenport et.al.[10] reported a mean length of stay of 37 days with a complication rate of 59%. Dromerick et.al.8 showed a longer mean length of stay (52 days) and an astoundingly higher complication rate (96%). Our complication rate was only 20.9%. Based on the longer length of stay from the other studies cited above, it is likely that the complications of those studies were higher compared to our present series. Our study merely recorded complications that occurred during the inpatient stay. Clearly, estimates of the frequency of complications will vary depending on the period of observation, and unfortunately, we do not know the rate of complications after discharge from hospital, as the objective of the study was to analyse only the in-hospital complications. Nonetheless, early discharge would probably reduce the more sinister complications such as nosocomial infection with multi-resistant organisms. The ideal study would prospectively observe all patients for a fixed period of time after stroke both during hospital stay and after discharge, which would help eliminate the possible bias of varying place and periods of observation.

The most common individual complication was pneumonia (20 or 12.3% of patients), followed by septicaemia (11.0%), and urinary tract infection (4.3%). The problem of infection was obviously a major problem in our hospital and could be worse if the patients were kept longer. It is clear that the frequencies of many of the complications identified in the present study are comparable to those of previous reports; in particular, infection[9,11,12]. A probable reason for the high

incidence of pneumonia was that the patients were usually fed at home before being admitted and the patient or relatives were not aware of swallowing problems or aspiration. Pneumonia is a frequent sequela of aspiration and the failure to recognise this may have made a significant contribution to the high frequency of chest infections. The onset of complications after the day of admission was also assessed. Bedsores were found to have the latest onset (12.5 days) followed by other complications (Table IV). The frequency of bedsores might be under-reported, as the patients may have developed them after discharge. However they were given strict instructions (if indicated) for the use of a ripple mattress, and frequent turning to prevent bedsores. Surprisingly, depression occurred early (mean 2.75 days). However, we suspect that the frequency of depression was higher after the patients were discharged. Patients, or family members are exposed to numerous psychosocial and possibly, financial problems especially when the patients are disabled and need extra care.

It is imperative to identify ischaemic stroke patients who have a high risk of developing complications. Several factors were examined in this study, which included age, risk factors for atherosclerosis (diabetes, hypertension, smoking, hypercholesterolaemia, etc), admission parameters (blood pressure, blood glucose, GCS, and BI score), and type of infarct. This observation may have important implications. For future estimation of the burden of stroke, it would be important to take into account the excessive morbidity and mortality rates of patients who have significant risk factors for complications and death. The independent risk factors for complications were diabetes mellitus (OR 2.87; 95%CI 1.06 to 7.78), MCA infarcts (OR 10.0; 95%CI 4.1 to 24.3), and GCS less than 9 (OR 3.8; 95%CI 1.03 to 14.3). Diabetes mellitus appears to be a risk factor for complications. These patients generally are prone to infection, less immunocompetent, and usually have concurrent multiple end-organ damage that will ultimately increase morbidity. 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-diabetics13,14,15. As expected, large cerebral infarcts (MCA territory) were a major predictor for morbidity. This is also the case for poor GCS (less than 9).

Conclusion

Infection was the most common complication encountered. The independent risk factors for the occurrence of complications were diabetes mellitus, MCA territory infarcts, and poor GCS (less than 9). Knowledge of the nature, time of onset, and frequency of complications, together with the identification of high-risk patients, is expected to influence the planning of future stroke services. The results of this study provide a rough guide to when the complications might occur. Therefore, patients who have the aforementioned risk factors should be carefully monitored for complications. The limitation of this study was that the assessment was done merely during the in-patient period and hence the morbidity rate after discharge was not known.

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