

A Prospective Study of Factors affecting Mortality in Acute Stroke

L. Suja¹, R. Srinivasan², G. Sowmya³, Preetam Arthur⁴

ABSTRACT

Introduction: Stroke is leading cause of death after cardiac disease and there has been a paradigm shift in the management of stroke after the advent of intravenous thrombolysis and mechanical thrombectomy. Clinicians are often challenged regarding the outcome as the morbidity and mortality are high if not managed appropriately. As there are various factors which influence the mortality in each type of stroke, our study has been designed out find the mortality rates and to identify the factors influencing in each type of stroke.

Material and methods: This prospective study was conducted at tertiary care centre for a period of one year among 190 patients who presented with acute stroke. All patients were evaluated by complete medical history, meticulous physical and neurological examination, necessary blood investigations and brain imaging. All the patients were categorized into ischemic and haemorrhagic stroke. The outcome of patients was noted in terms of mortality. Various parameters that influenced the mortality were analysed using statistical package for social sciences and compared.

Results: Out of the 190 patients, 151 had ischemic and 39 had a haemorrhagic stroke. Regarding the outcome 22.6% died. Elderly patients, patients with stress hyperglycemia and diabetes, patients with prior history of CVA, raised intracranial tension, low Glasgow coma scale, higher BP on admission, altered renal function and presence of nosocomial infections were predictors of mortality in both stroke types. Additionally in ischemic stroke we found that the involvement of more than one vascular territory of the brain and the presence of atrial fibrillation have higher mortality.

Conclusion: Considering these factors with larger sample size in both tertiary and other care centres we can evolve better criteria and guideline in the management of stroke.

Keyword: Acute Stroke, Management, Mortality in Stroke

Majority of strokes are due to ischemic cerebral infarction (68%) and the remaining is due to hemorrhage.³ Clinicians are often challenged regarding the outcome after stroke by the patients and their family.

There are various factors which influence the mortality in both types of stroke like infarct location, comorbid conditions, the age of the patient, type of stroke, presence of increased intracranial tension, nosocomial infection.⁴ Adequate perception of important factors that affect the prognosis is required for the clinician to predict the outcome of stroke. Hence our study was designed to find the mortality rate among patients with ischemic and haemorrhagic stroke and to identify the factors influencing mortality in both types of stroke.

MATERIAL AND METHODS

This prospective study was carried out in patients who were admitted with acute stroke in a tertiary care institute from 1st July 2015 To 30th June 2016. Total of 190 patients with more than 18 years of age including both sexes presented with acute stroke was included in the study. Patients with age less than 18 years, CNS tumour, vasculitic stroke, CNS infections, subdural and extradural haematoma, subarachnoid haemorrhage were excluded from the study. After obtaining informed consent from the patients or their relatives, patients were evaluated by complete medical history including diabetic status, hypertension, transient ischemic attacks, cerebrovascular accidents, ischemic heart disease, atrial fibrillation or other arrhythmias in the past. History regarding smoking and alcoholism were recorded. It was followed by a detailed neurological examination to assess the side of the stroke. Glasgow coma scale on admission, features of raised intra cranial tension and admission blood pressure were also recorded. Later they were subjected for complete haemogram, blood sugar,

INTRODUCTION

Stroke in recent years is a major concern in developing countries as there is an increase in the ageing population. Considering the mortality rates among various diseases, stroke is leading cause after cardiac disease. According to WHO about 15 million suffer a stroke every year out of which 5 million die and another 5 million are left permanently disabled.¹ A developing country like India, due to urbanization and demographic changes is facing the burden of noncommunicable disease like a stroke. The prevalence rate ranges from 84-262 per one lakh in rural areas and 334-424 per one lakh population in urban areas whereas the incidence is 119-145 per one lakh population.² The survival, recovery and ultimate outcome of stroke patients depend on various variables viz demography, coexisting comorbidities, and advancement in the treatment.

¹Assistant Professor, Department of General Medicine, Sri Ramachandra Institute of higher education and Research, ²Associate Professor, Department of General Medicine, Sri Ramachandra Institute of higher education and Research, ³Professor, Department of General Medicine, Sri Ramachandra Institute of Higher Education and Research, ⁴Professor, Department of General Medicine, Sri Ramachandra Institute of Higher Education and Research, India

Corresponding author: L. Suja, Department of General Medicine, Sri Ramachandra Institute of Higher Education and Research, No 1 Ramachandra Nagar, Porur, Chennai-600116, India

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HBA1C, renal parameters, lipid profile, electrocardiography, and brain imaging. They were then classified into patients with ischemic stroke or primary intracerebral haemorrhage on the basis of CT and MRI scan of the brain. The course in the hospital was observed till discharge and the outcome was noted in terms of recovery or death.

STATISTICAL ANALYSIS

The data collected were presented in the form of tables and analysed by social sciences (SPSS). Data were summarised using statistical package for the qualitative data. Comparisons were done using the Chi square test.

RESULTS

Incidence in terms of various factors

A total of 190 patients were enrolled in our study with a diagnosis of acute stroke after excluding the patients based on the criteria mentioned. Of these patients, 151 had an ischemic stroke and 39 patients had a hemorrhagic stroke. Among the patients who had stroke, 53.2% had right-sided stroke. The mean age of the patients with stroke was 59.4 years. The mean age of those with hemorrhagic stroke was less by 1.9 years when compared to those with ischemic stroke. Males outnumbered females in both variants of stroke (63.7% vs 33.3%). About 30% of patients with stroke were diabetic and 55.3% were hypertensives. History of smoking was present in 53.7% of all stroke patients. Prior history of the cerebrovascular accident was present in 22.1% of patients. Presence of dyslipidemia was in 45.8% of those patients with ischemic stroke (table-1).

Majority of the patients having an ischemic stroke had involvement of middle cerebral artery territory (60.9%) followed by involvement of both MCA and ACA territories in 9.2 % of patients, the involvement of PCA territory in 6.6 % and ACA territory in 3.9 % of patients. Rest of the strokes were lacunar stroke comprising 19.2% of all patients with ischemic stroke. In the haemorrhagic group, capsuloganglionic hemorrhage was the most common cause of hemorrhagic stroke comprising 82% of cases. This was followed by pontine haemorrhage in 5 % of cases and 13 % of the cases had a haemorrhage in other areas.

Raised ICT features were very common in 46.3% of patients. Stress hyperglycemia was observed in 18.9% of patients. Atrial fibrillation was present in 24.2% of the stroke patients. Altered renal parameters were seen in 21.6% of cases.

We also found that 21.6% of patients in our study group developed a nosocomial infection.

Mortality statistics

Regarding the outcome, 77.4 % survived and 22.6% succumbed to death. Of the total number of patients who died, 65.1% had an ischemic stroke and 34.9% had a hemorrhagic stroke and it was statistically significant ($p < 0.01$). Comparing the different age groups elderly patients (>70 years) have a higher mortality rate (40.9%) ($p < 0.01$). Males (25.6%) have higher mortality when compared to females (17.4%). Hypertensive stroke patients have a marginally increase in mortality when compared to those without hypertension (statistically insignificant). We have observed that stress hyperglycemia (55.6%) and diabetics (28.1%) have higher mortality than nondiabetics (7.2%) which was statistically significant ($P < 0.001$). Patients with prior CVA had a worse outcome (45.2%) than those without similar history (16.2%) which was statistically significant ($P < 0.001$). We found that in 43.2% of patients who developed features of raised ICT had a poor outcome ($P < 0.001$) there was a statistical significance ($P < 0.001$). Patients with altered renal parameters (53.7%) had higher mortality than patients with normal renal parameters (14.1%). Patients who have developed a nosocomial infection (43.9%) had a worse outcome ($P < 0.001$). It was an interesting statistically significant observation that rise in systolic blood pressure ($p < 0.001$) and rise in diastolic blood pressure ($p < 0.01$) during the course of treatment were associated with higher mortality. Patients who had low GCS had a worse outcome ($p < 0.001$). We have also analysed certain factors that do not have statistical significance in terms of mortality like the side of the lesion, the presence of coexisting ischemic heart disease, dyslipidemia and atrial fibrillation and habituations like smoking and alcoholism.

Analysis of factors influencing mortality in each type of stroke

Among the 190 patients who were admitted with acute stroke 43 patients (22.6%) died. Out of the total patients who died, 65.1% were patients with ischemic stroke and 34.9% were patients with hemorrhagic stroke. Considering the mortality among various age groups patients with ischemic stroke of age > 70 years had a higher mortality rate (40%) followed by 50-69 year age group (14.5 %) and < 49 years (7.5%). This was statistically significant ($p < 0.001$) when compared

Type of stroke	ISCHEMIC - 151	Hemorrhagic - 39	Total
Mean age	59.05 years	60.95 years	59.44 years
Males	92	29	121
Females	59	10	69
Male : female	1.6:1	2.9:1	1.8:1
Diabetes	47 (82.5%)	10 (17.5%)	62
Hypertension	82 (78.1%)	23 (21.9%)	105
Smokers	75 (73.5%)	27 (26.5%)	102
H/o cva	35 (83.3%)	7 (16.7%)	42
Dyslipidemia	66 (75.9%)	21 (24.1%)	87
Raised ict features	67 (76.1%)	21 (23.9%)	88

Table-1: Demographic variables of patients admitted with stroke

Factors		Ischemic stroke	P value	Haemorrhagic stroke	P value
Total no of cases		151		39	
Death		28(65.1 %)		15 (34.9%)	
Age in years	<50	3(7.5)	P<0.001	2(25.0%)	P=0.669
	51-70	11(14.5%)		9(40.9%)	
	>70	14(40%)		4(44.4%)	
Territory of stroke	ACA	1(16.7%)	P<0.001	-	
	MCA	11(12%)			
	PCA	4(40 %)			
	ACA + MCA	12(80.7 %)			
	Lacunar stroke	0(0%)			
Diabetic State	Non Diabetes	12(25.5%)	P<0.001	4(40%)	P <0.05
	Diabetes	5(6.1%)		2(13.3%)	
	Stress hyperglycemia	11(50 %)		9(64.3%)	
History of Recurrent CVA	Present	15(42.9%)	P<0.001	4(57.1%)	P=0.262
	Absent	13(11.2%)		11(34.4%)	
Atrial Fibrillation	Present	13(30.2%)	P<0.05	1(33.3%)	P=0.849
	Absent	15(13.9%)		14(38.9%)	
IHD	present	11(19%)	p-0.916	4(30.8%)	P=0.485
	Absent	17(18.3%)		11(42.3%)	
Smoking	Present	15(20%)	P-0.647	12(44.4%)	P=0.249
	Absent	13(17.1%)		3(25%)	
Raised ICT	Present	25(37.3%)	P<0.001	13(61.9%)	P<0.001
	Absent	3(3.6%)		2(11.1%)	
GCS of patients who	Survived	12.11	P=0.000	10.75	P<0.001
	Died	7.070		5.73	
RAISED SBP	Survived	163.64	P=0.037	171.83	P<0.001
	Died	174.86		201.33	
RAISED DBP	Survived	91.27	P=0.339	92.50	P<0.001
	Died	93.93		108	
Altered Renal Parameters	Present	13(52%)	P<0.001	9(56.3%)	P<0.05
	Absent	15(11.9%)		6(26.1%)	
Nosocomial Infection	Present	11(42.3%)	P<0.001	7(46.7%)	P=0.405
	Absent	17(13.6%)		8(33.3%)	

Table-2: Comparison of various factors influencing mortality among different types of stroke

to haemorrhagic stroke where the age of the patient did not influence the mortality (table-2).

Regarding the glycaemic status and mortality, it was found that there was statistical significance that patients with diabetes and stress hyperglycemia had higher mortality than nondiabetics in both ischemic ($p < 0.001$) and haemorrhagic stroke ($p < 0.01$). It was found that ischemic stroke patients with prior history of CVA have higher mortality than those who had the first stroke event (42.9% vs 11.2%). This was statistically significant ($p < 0.001$) when compared to patients with haemorrhagic stroke. Presence of atrial fibrillation in patients with ischemic stroke was associated with higher mortality (30.2%) and have a statistical significance of $p < 0.05$. Raised ICT was significantly associated with higher mortality (37.3%) in patients with ischemic stroke and haemorrhagic stroke (61.9%). This finding was statistically

significant ($p < 0.001$).

Glasgow coma scale scores at admission were significantly associated with the outcome of stroke. The mean GCS of those who expired in ischemic stroke was 7.07 and those who survived where 12.11. this was statistically significant ($p < 0.001$). Whereas in haemorrhagic stroke, the mean GCS of those who expired was 5.73 and those who survived was 10.75. We found that this was also statistically significant ($p < 0.001$). There was a statistical significance ($p < 0.05$) in patients who died with ischemic stroke who had significantly higher SBP (about 12 mm Hg higher SBP than that on admission) It was also found that patients who died with haemorrhagic stroke ($p < 0.001$) had significantly higher systolic blood pressure. (About 22 mm Hg higher SBP than that on admission).

Patients who died with hemorrhagic stroke had significantly

higher DBP (about 14 mm Hg higher DBP than that on admission) and this was statistically significant. ($p < 0.001$). Whereas in ischemic stroke we found that the rise in diastolic blood pressure was not associated with increased mortality. Impaired renal functions were significantly associated with higher mortality in ischemic stroke ($p < 0.001$) and also in haemorrhagic stroke ($p < 0.005$).

We also observed that nosocomial infection was significantly associated with increased mortality only in ischemic stroke ($p < 0.001$) and not in hemorrhagic stroke. UTI was the most common nosocomial infection followed by pneumonia. In the ischemic stroke group we found statistical significance ($p < 0.001$) as mortality was highest when both ACA and MCA territories were involved (85.7%) followed by PCA territory stroke (40%), ACA territory (16.7%) and MCA territory (12%). In the hemorrhagic stroke group, we observed 100% mortality in those who had pontine bleed followed by 60% mortality in cerebellum and other areas and 31.3% in the gangliocapsular bleed. There was no statistical significance in factors like the side of stroke, systemic hypertension, the presence of dyslipidemia, prior ischemic heart disease, history of smoking and alcoholism.

DISCUSSION

Among the total number of stroke cases enrolled in our study ischemic stroke contributed to 79.5% of all stroke cases and the rest 20.5% were haemorrhagic strokes. This was comparable to the study done by K.S. WONG et al.⁵ Males dominate in the prevalence of ischemic stroke 76% Vs 24% (1.6 males: 1 female) and females in hemorrhagic stroke 85.5% Vs 14.5% (2.9:1). Commonest territory involved in ischemic stroke was MCA (60.9%) and the commonest type of hemorrhagic stroke was in the capsuloganglionic region comprising 82% of cases. We have found that in many studies ischemic stroke is 10 times more frequent than hemorrhagic stroke, hence the mortality in both types of strokes could not be compared. In our study, out of the 43 patients who died 65.1% of patients belonged to the ischemic group and 34.9% were in the hemorrhagic group. This was comparable to the study done by Klaus et al.⁶

Analysis of mortality among patients with ischemic and hemorrhagic stroke

The mortality among patients with ischemic stroke was 18% when compared to those with hemorrhagic type (38.4%). This was comparable to the study done by Klaus et al.⁶ Patient's age had a significant bearing on the outcome of patients with both types of stroke. Elderly patients had higher mortality than those with lesser age groups. This could be attributed to the presence of other co morbid illness in elderly people. Comparing the mortality in ischemic stroke involving various territories patients who had involvement of both ACA and MCA territories had higher mortality (85.7%) when compared to stroke involving single territory. This could be attributed to a higher volume of the brain involved and increased chance of raised ICT in these patients.⁷ The mortality rate among PCA territory infarct was 40% which could be because of vital brain stem areas perfused in this

territory. None of the patients with lacunar stroke died. This was comparable to the studies done by Wong et al, gray CS et al.

In ischemic stroke, the mortality was highest in those with stress hyperglycemia (50%) followed by those with DM (6.1%), whereas mortality in nondiabetic patients was 25.5%. This is comparable to the study done by Bonito et al which showed 44% mortality in those with stress hyperglycemia. Similarly, the in-hospital mortality in patients with hemorrhagic stroke was highest in those with stress hyperglycemia (64.3%) followed by those with DM (13.3%), whereas mortality in nondiabetic patients was 40%. This is because stress hyperglycemia alters the vascular response, immune response and brain cell response. Hyperglycemia also causes immunosuppression inviting infections. Increased blood sugar levels cause an increase in blood pressure, natriuretic peptide levels, thereby causing adverse cardiovascular events. Acute hyperglycemia platelet hyperactivity leading to thrombotic events causing neuronal damage and brain ischemia.⁸

Of the 35 patients who had a previous history of CVA or TIA 42.9% patients expired. This shows that patients with recurrent stroke had markedly higher mortality than patients with index stroke. This observation is explained by the presence of intracranial atherosclerosis in patients who had a recurrent stroke.⁹ Among patients who had atrial fibrillation as a predisposing factor in the ischemic stroke 30.2% patients died. This is in accordance with the study done by Minna M et al which showed that patient with atrial fibrillation had higher mortality (31%), longer hospital stay and poor functional outcome.¹⁰ This could be due to the wider area of infarction in patients with atrial fibrillation due to repeated thromboembolism and also increased mortality from the cardiac disease.

Smoking did not significantly increase the mortality among male patients with ischemic stroke. This is probably because smoking is only a risk factor for stroke. Increase in intracranial tension affected the mortality in both types of stroke. In ischemic stroke patients with raised ICT had higher mortality (37.3%) and this emphasizes the need for aggressive management in these patients.¹¹ In hemorrhagic stroke patients with raised ICT had a higher mortality rate (61.9%). This emphasizes the need for decompression surgery and aggressive management in these patients. Patients who died of ischemic stroke had a mean GCS of 7.07 and those who survived had a mean GCS of 12.1. This is comparable to the study done by Shaheen et al who found higher mortality in those with GCS between 3-9/15. Patients who died of hemorrhagic stroke had a mean GCS of 5.75 and those who survived had a mean GCS of 10.75. This shows that the level of consciousness at admission was a very important factor predicting outcome in hemorrhagic stroke. This is comparable to the study which showed that mortality in ischemic stroke is 90% if the GCS level is < 8 .¹² Very high blood pressure at admission was significantly associated with higher mortality in both groups of stroke. In ischemic stroke, high blood pressure on admission and acutely elevated blood

pressure during the course is associated with greater risk of haemorrhagic transformation, recurrence of stroke and development of cerebral edema. In haemorrhagic stroke, the higher mortality has been postulated to be due to continued bleeding as the blood pressure rises.¹³

Renal impairment on admission was associated with a high mortality of 52 % in ischemic stroke and 56.3 % in haemorrhagic stroke.¹⁴ The presence of nosocomial infection also significantly increased the mortality of 42.3% in ischemic stroke and 46.7% in haemorrhagic stroke. This emphasized the need for strict aseptic precautions and preventive measures to reduce the incidence of nosocomial infections

CONCLUSION

Mortality in patients with hemorrhagic stroke was significantly higher than in patients with ischemic stroke. There was no significant difference in mortality between males and females among both types of strokes. The adverse prognostic factors in both types of stroke were found to be age > 70 yrs, the presence of stress hyperglycemia, recurrent stroke, the presence of raised ICT features, low Glasgow coma scale score, higher BP on admission, altered renal function and presence of nosocomial infections. Additionally, we found that the involvement of more than one vascular territory of the brain and presence of atrial fibrillation in ischemic stroke have higher mortality. We also recommend that in certain clinical situations like recurrent stroke the need for continuing anti thrombotic therapy as a secondary preventive measure is highly appreciated. We would like to emphasize the importance of history taking and detailed neurological evaluation will be useful in bringing out the good outcome in the management of stroke.

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