

30 DAY MORTALITY AMONG PATIENTS WITH ACUTE STROKE (ISCHEMIC AND HEMORRHAGIC) IN A TERTIARY CARE HOSPITAL

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Abstract

Objective: To compare 30-day mortality and prognostic factors in acute haemorrhagic and ischemic stroke patients

Study Design: Prospective observational cohort study

Place and Duration of Study: General Medicine and Neurology Department, Pak Emirates Military Hospital, Rawalpindi, January 2024-December 2024

Methodology: Patients from both genders aged 18 years or more with ischemic stroke or haemorrhagic stroke were included. Data were collected from patients within 24 hours of admission and weekly for 30 days after discharge. Any reported mortality was recorded. The initial data collection included age, gender, comorbid conditions, smoking history, alcohol intake, random blood glucose, and other relevant laboratory investigations as ordered by the treating physician. Logistic regression analysis was used to assess the predictors of mortality.

Results: Among the 200 patients, 151 (75.50%) had ischemic stroke, and 49 (24.50%) had haemorrhagic stroke. The mean age in ischemic stroke (IS) was 52.03 ± 13.53 years, while it was somewhat higher, 57.20 ± 12.50 years, in haemorrhagic stroke (HS). Hypertensive patients were more in IS group (59.60% vs 46.94%). Age, gender, hypertension, smoking status, dyslipidaemia, hyperglycaemia, marital status, and stroke subtype were not significantly associated with mortality on univariate analysis. After adjustment for confounders, diabetes mellitus (AOR 0.391, 95% CI 0.160–0.954, $p=0.039$), alcohol intake (AOR 0.093, 95% CI 0.015–0.589, $p=0.012$), and ECG abnormalities (AOR 0.350, 95% CI 0.144–0.854, $p=0.021$) remained independent and strong predictors of mortality

Conclusion: The frequency of mortality was 26 (13.0%) in stroke patients. Diabetes mellitus, alcohol intake, and electrocardiographic abnormalities remained independent predictors of mortality

INTRODUCTION

Acute strokes, either ischemic or haemorrhagic, have been one of the most common emergencies in medical accident and emergency departments, with somewhat avoidable mortality and morbidity in certain scenarios.¹ Stroke has been defined as a neurological deficit solely occurring

due to vascular abnormality (vessel wall rupture or acute disruption of blood supply due to vascular defect) leading to brain tissue death in the absence of any other cause and has been labelled as one of the highest mortality causes.² As compared to ischemic stroke, haemorrhagic

stroke has more associated mortality and morbidity.³

There are many factors and predictors that contribute to mortality and morbidity in these stroke types. A study published by Andersen et al. showed that ischemic stroke was favoured by many factors, including diabetes mellitus, past history of cardio- and neuro-vascular events, and atrial fibrillation; however, haemorrhagic stroke was favoured by lifestyle factors like smoking history and alcohol consumption.⁴ A few demographic factors were not associated with any of the other two stroke types. Similarly, the haemorrhagic stroke has higher mortality and morbidity. A study conducted in the United States showed a substantial increase in stroke events, 13% for ischemic events and 39.8% for haemorrhagic events.⁵ In contrast, a study conducted in Pakistan showed a raised mortality in ischemic stroke compared to haemorrhagic strokes (15.3% vs 6.5%).⁶ A review showed that ischemic stroke had lower mortality rates compared to haemorrhagic strokes because the latter type of stroke involves more serious damage to brain tissue.⁷ This review comprised 341 primary studies and 170,501 patients.

As discussed above, there are multiple overlapping factors that contribute to mortality and morbidity in stroke subtypes, and studies have reported variable mortality. This study was done to further explore the frequency of associated mortality and factors predicting mortality. This study will help clinicians to tailor the treatment and management of affected individuals and prevent further cerebrovascular incidents

METHODOLOGY

This observational cross-sectional study was conducted between January 2024 to December 2024, following approval from the Ethical Review Board at the Department of General Medicine and Neurology, Combined Military Hospital, Lahore. The research was done in accordance with regional guidelines for human research. The Sample size was calculated using the mortality prevalence of 15.3% for strokes, a 95% confidence interval, and a 5% margin of error. The sample comprised 200 stroke cases.⁶ Consent was obtained from patients and caregivers, as applicable, before inclusion in the

study. The non-probability convenience sampling technique was used for enrolment.

Inclusion Criteria: Patients from both genders aged 18 years or more with a diagnosis of ischemic stroke or haemorrhagic stroke on a non-contrast computed tomography scan of the brain were included in the study.

Exclusion Criteria: Patients with a history of recurrent strokes, transient ischemic strokes, haemorrhagic transformations, previous brain surgeries, in-situ intraventricular shunts, malignancies, metastatic tumours, and re-admission due to strokes were excluded. Moreover, pregnant females and patients with an undetermined nature of strokes were also excluded.

The data were collected from patients within 24 hours of admission during indoor treatment. The mobile numbers of patients and their next of kin were taken. Those who were discharged from the hospital were contacted weekly for 30 days to provide updates on the patient's condition. Any reported mortality was recorded. Those who were not able to maintain contact or did not respond by the end of 30 days were excluded. The initial data collection included age, gender, comorbid conditions, smoking history, alcohol intake, random blood glucose, and other relevant laboratory investigations as ordered by the treating physician. Mortality was defined as death before or at the 30th day of cerebrovascular incident. Patients who died before and at 30 days after having either type of stroke were referred to as deceased, and the rest were referred to as survivors.

Descriptive statistics were used to represent variables in the Statistical Package for the Social Sciences Version 25.0. The categorical variables, such as gender, hypertension, diabetes mellitus, smoking history, alcohol intake, and mortality, have been shown using frequencies and percentages. Continuous variables, such as age and random blood sugar, were summarized using median and interquartile range. Chi-square, independent sample t-test, and Mann-Whitney U-Test were used for the determination of association and differences between the groups. A p-value < 0.05 was taken as significant.

RESULTS

The study included two hundred patients with ischemic and haemorrhagic stroke. Among these 200 patients, 151 (75.50%) were ischemic stroke patients and 49 (24.50%) were haemorrhagic stroke patients. The mean age in ischemic stroke (IS) was 52.03 ± 13.53 years while it was somewhat higher 57.20 ± 12.50 years in haemorrhagic stroke (HS). However, the median

random blood glucose was comparable (136.00 mg/dl vs 139.00 mg/dl), respectively. There were 87 (57.62%) males in IS while 26 (53.06%) in HS. Hypertensive patients were more in IS group (59.60% vs 46.94%). Dyslipidaemia was seen in 56 (37.09%) IS patients and 17 (34.69%) HS patients. Details of clinical and demographic characteristics of HS and IS patients are given in Table-I.

Table-I: Demographics and clinical features of the included population with groupwise comparison (n=200)

Characteristics	Total Participants (n=200)	Groups	
		IS Group (n=151)	HS group (n=49)
Age, years	53.30 ± 13.44	52.03 ± 13.53	57.20 ± 12.50
Blood Glucose Random, mg/dl	137.00 (111.00-165.00)	136.00 (109.00-163.00)	139.00 (114.00-182.50)
Gender			
Male	113 (56.50%)	87 (57.62%)	26 (53.06%)
Female	87 (43.50%)	64 (42.38%)	23 (46.94%)
Comorbid Conditions			
Hypertension	113 (56.50%)	90 (59.60%)	23 (46.94%)
Diabetes Mellitus	57 (28.50%)	39 (25.83%)	18 (36.76%)
Dyslipidaemia	73 (36.50%)	56 (37.09%)	17 (34.69%)
Smoking	85 (42.50%)	70 (46.36%)	15 (30.61%)
Alcohol Intake	6 (3.00%)	6 (4.00%)	-
Marital Status	183 (91.50%)	138 (91.39%)	45 (91.84%)
ECG Abnormality	57 (28.50%)	40 (26.49%)	17 (34.69%)
Hyperglycaemia	43 (21.50%)	29 (19.21%)	14 (28.57%)
Mortality	26 (13.00%)	9 (18.37%)	17 (11.26%)

IS: Ischemic stroke; HS: Haemorrhagic stroke; ECG: Electrocardiography

Age, gender, hypertension, smoking status, dyslipidaemia, hyperglycaemia, marital status, and stroke subtype were not significantly associated with mortality on univariate analysis. However, on univariate logistic regression analysis, diabetes mellitus (OR 0.338, 95% CI 0.146-0.785, $p=0.012$), alcohol intake (OR 0.064, 95% CI 0.011-0.370, $p=0.002$), and ECG abnormalities (OR 0.281, 95% CI 0.121-0.655, $p=0.003$), were significantly associated with mortality (Table-II).

Variables with $p < 0.05$ were considered for a multivariate logistic regression analysis. After adjustment for confounders, diabetes mellitus (AOR 0.391, 95% CI 0.160-0.954, $p=0.039$), alcohol intake (AOR 0.093, 95% CI 0.015-0.589, $p=0.012$), and ECG abnormalities (AOR 0.350, 95% CI 0.144-0.854, $p=0.021$) remained independent and strong predictors of mortality as shown in Table-II.

Table II: Combined predictors of mortality in ischemic and haemorrhagic stroke patients (n=26)

Characteristics	Univariate Analysis			Multivariate Analysis		
	Exp(B)	95%CI	p-value	Exp(B)	95%CI	p-value
Age, years	0.972	0.941-1.004	0.088	-	-	-
Gender						
Male	0.740	0.324-1.689	0.475	-	-	-

Female						
Hypertension	0.787	0.338-1.833	0.579	-	-	-
Diabetes	0.338	0.146-0.785	0.012	0.391	0.160-0.954	0.039
Dyslipidaemia	0.440	0.191-0.011	0.053	-	-	-
Smoker	0.591	0.258-1.353	0.213	-	-	-
Alcohol Intake	0.064	0.011-0.370	0.002	0.093	0.015-0.589	0.012
Marital Status	2.252	0.674-7.521	0.187	-	-	-
ECG Abnormality	0.281	0.121-0.655	0.003	0.350	0.144-0.854	0.021
Hyperglycaemia	1.589	0.517-4.886	0.419	-	-	-
Stroke Type Ischemic Haemorrhagic	0.564	0.233-1.362	0.203	-	-	-

ECG: Electrocardiography

In a univariate logistic regression analysis for determinants of mortality in IS patients, the predictors like age, diabetes mellitus, alcohol consumption, marital status, and electrocardiographic abnormalities were associated with mortality. However, factors like gender, hypertension, dyslipidaemia, smoking

history, and hyperglycaemia were not associated with mortality in IS patients. After adjustments, multivariate analysis, only alcohol intake (AOR 0.051, 95% CI 0.007-0.360, $p=0.003$) was able to predict mortality, remaining factors lost the association as depicted in Table-III.

Table-III: Predictors of 30-day mortality in ischemic stroke patients (n=17)

Characteristics	Univariate Analysis			Multivariate Analysis*		
	Exp(B)	95%CI	p-value	Exp(B)	95%CI	p-value
Age, years	0.957	0.917-0.999	0.047	0.977	0.927-1.030	0.382
Gender						
Male	1.238	0.450-3.407	0.679	-	-	-
Female						
Hypertension	0.783	0.273-2.245	0.650	-	-	-
Diabetes	0.339	0.120-0.952	0.040	0.478	0.147-1.552	0.219
Dyslipidaemia	0.480	0.174-1.327	0.157	-	-	-
Smoker	0.743	0.270-2.042	0.564	-	-	-
Alcohol Intake	0.049	0.008-0.295	0.001	0.051	0.007-0.360	0.003
Marital Status	4.274	1.154-15.822	0.030	3.238	0.554-18.946	0.192
ECG Abnormality	0.353	0.126-0.990	0.048	0.540	0.164-1.778	0.311
Hyperglycaemia	1.123	0.301-4.199	0.863	-	-	-

ECG: Electrocardiography;

*For multivariate logistic regression analysis, predictors with $p<0.100$ were included to avoid missing important confounders

In a univariate logistic regression analysis of predictors of haemorrhagic stroke, the ECG abnormality showed a strong association (OR 0.190, 95% CI 0.040-0.894, $p=0.036$). The smoking history also showed a weak prediction for mortality. On multivariate analysis, both

ECG abnormality (AOR 0.114, 95% CI 0.018-0.713, $p=0.020$) and smoking history (AOR 0.148, 95% CI 0.024-0.919, $p=0.040$) were able to predict mortality after adjustments for confounders.

Table-IV: Predictors of 30-day mortality in haemorrhagic stroke patients (n=9)

Characteristics	Univariate Analysis			Multivariate Analysis*		
	Exp(B)	95%CI	p-value	Exp(B)	95%CI	p-value
Age, years	0.984	0.929-1.043	0.596	-	-	-
Gender	1.528	0.357-6.545	0.568	-	-	-
Male						
Female						
Hypertension	0.655	0.153-2.804	0.568	-	-	-
Diabetes	0.385	0.088-1.678	0.204	-	-	-
Dyslipidaemia	0.343	0.078-1.504	0.156	-	-	-
Smoker	0.267	0.060-1.191	0.084	0.148	0.024-0.919	0.040
Alcohol Intake	-	-	-	-	-	-
Marital Status	0.000	0.000	0.999	-	-	-
ECG	0.190	0.040-0.894	0.036	0.114	0.018-0.713	0.020
Abnormality						
Hyperglycaemia	3.852	0.435-34.130	0.226	-	-	-

ECG: Electrocardiography;

*For multivariate logistic regression analysis, predictors with $p < 0.100$ were included to avoid missing important confounders

DISCUSSION

This study was done to see 30-day mortality and associated predictors in haemorrhagic and ischemic stroke patients. There were 151 (75.50%) ischemic stroke patients and 49 (24.50%) were haemorrhagic stroke patients.

This follows global trends in stroke prevalence, IS being the commonest type.^{8,9} Among the 200 patients, 26 (13.00%) patients died. Only 9 (18.37%) died in the HS group, and 17 (11.26%) patients died in the IS group. mortality was reported between 11% to 22.3%.^{10, 11} Another study reported, 13.3% mortality in stroke patients.¹² These differences in mortality can be attributed to differences in population demographics, treatment facility as tertiary care in our case, case selection, and time of reporting to the hospital after stroke. When seen individually for ischemic strokes, the age, diabetes mellitus, alcohol, marital status, and ECG abnormality showed association in univariate analysis; however, only alcohol intake showed association when adjusted for confounders. In comparison, for haemorrhagic strokes, ECG abnormality and smoking history had predictive values that were enhanced further in multivariate logistic regression analysis. When factors for overall mortality were examined, only a few of the studied factors, such as diabetes mellitus, alcohol intake, and ECG abnormality,

showed an association, and this association persisted after adjustment for confounders. This discussion shows that factors vary across stroke types. The ECG abnormalities (ischemic changes, arrhythmias) remained a strong independent predictor of mortality in both cases. This suggests the impact of cardiac events on outcomes in these patients.

Increasing age, atrial fibrillation, and hypertension were reported as prognostic factors in patients with HS.¹³ Similar results were reported for age and hypertension, along with complications, as predictors of early mortality in stroke patients in another study.¹⁴ In this research, neither hypertension nor age predicted mortality, except in IS patients, where age was statistically significant, and this association was lost after confounders were adjusted for in multivariate regression analysis. These differences may be due to variability in study population characteristics; this research population is comparatively younger. ECG abnormalities (adjusted hazard ratio: 2.28) were associated with increased mortality in stroke patients.¹⁵ A Pakistani study conducted in Rawalpindi also showed atrial fibrillation was associated with poor outcomes.¹⁶ In this study, too, we found that ECG changes were associated with poor outcomes across stroke types and had cumulative predictive value for mortality.

In a study by Panthi et al., alcohol use was associated with increased risk of mortality, and a similar result was found in this cohort.¹⁷ A meta-analysis and systematic review concluded that this increased amount of alcohol consumption is associated with poor outcomes in stroke patients.¹⁸ For hemorrhagic strokes, the relationship was dose-response, and for ischemic strokes, it was a curvilinear relationship. Our research showed that alcohol had a prognostic value for ischemic strokes and cumulative representation. No case of haemorrhagic stroke in alcoholic patients was reported. A study reported diabetes mellitus as a weak prognostic factor for mortality in stroke patients.¹⁹ While another study found no association of diabetes mellitus with mortality in stroke patients.²⁰ In this research, diabetes mellitus had a strong predictive value for mortality in the stroke patients; however, subgroup regression analysis revealed no such association. The difference can be attributed underlying atherosclerotic mechanism induced by hyperglycaemia, years of diabetes, and metabolic injury during acute stroke due to hyperglycaemia.

LIMITATIONS

This study has certain limitations. Firstly, it is a single-centre study with a modest sample size. Secondly, it is a prospective cohort study; the effect and type of intervention were not recorded, post-discharge surveillance was entirely dependent on next of kin, and patients were followed up for a shorter duration. The consideration of these factors in future research will provide better and broader insight into the relationship and prognostic factors.

CONCLUSION

The mortality rate was 26 (13.00%), with only 9 (18.37%) dying in the hemorrhagic stroke group, and 17 (11.26%) dying in the ischemic stroke group. The predictors of mortality were variable among the stroke subtypes, with diabetes mellitus, ECG abnormalities, and alcohol intake as the strongest predictors for early death in stroke patients.

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