Original Article

Clinical Profile and Predictors of In -Hospital Mortality in Stroke Patients a Prospective Observational Study

Archana Verma[1], Pooja Pathak[2], Alok Kumar[3], Sachin[4]

[1]Professor and Head, Department of Neurology, All India Institute of Medical Sciences Raebareli, Munshiganj, Dalmau Road, Raebareli, Uttar Pradesh, India. [2]Department of community Medicine, MVASMC Ghazipur, Uttar Pradesh, India. [3]Professor & Head, Department of Forensic Medicine & Toxicology, UP university of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India. [4]CST, M. Sc. (Neuro) EEG Technologist, Neurology Department, All India Institute of Medical Science, Munshiganj, Dalmau Road, Raebareli, Uttar Pradesh, India.

Abstract

Background: In India, the prevalence of stroke is rising. This study set out to assess the clinical characteristics, risk factors, and predictors of in-hospital death among stroke patients. **Material and Methods:** We conducted a prospective observational study on stroke patients. We collected information on the stroke subtype, demographic profile, vascular risk factors, modified Rankin Scale (mRS), and factors linked to in-hospital mortality. **Results:** 256 stroke patients were enrolled (154 males and 102 female). The mean age of the patients was 60.9 ± 13.3 years (ranging: 26–86 years). 75% of cases were of ischemic stroke. The commonest risk factors were hypertension (61.7 %), tobacco smoking (34.7%), dyslipidaemia (26.9 %), diabetes (21.5 %). History of prior stroke was present in 16%, and seizures at onset in 6% of cases. At the time of admission 80.0% had mRS 4,5 and mean GCS on admission was 13.4±2.9. In-hospital mortality was 8.9 %, and was linked to the low GCS, high mRS score, UTI, sepsis, mechanical ventilation, bed sore, chest infection. On multivariate analysis factors related with mortality were duration of onset of symptoms to arrival to hospital (in hours) [AOR =.98; C.I 95%: (0.98-9.99), $p < 0.03$], hemorrhagic stroke [AOR = 2.7; C.I 95%: (1.0–7.4), $p < 0.05$] poor GCS [C.I 95%: (.67-–0.92), $p < 0.003$; AOR =.79]. **Conclusion:** In our study the mortality was related with haemorrhagic stroke, duration of onset of symptoms and intervention and low GCS. Early and rapid intervention can reduce the mortality.

Keywords: Stroke; risk factors; In-Hospital Mortality.

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Introduction

Stroke is the leading cause of morbidity, mortality, and long-term disability worldwide, putting a huge strain on healthcare system.

Over 101 million people worldwide have had a stroke at some point in their lives. Every year, more than 12.2 million new strokes occur. One in four adults over 25 will experience a stroke at some point in their lives.[1]

The incidence is significantly higher in LMICs (low- and middle-income countries) than in HICs, accounting for approximately 70% of all cases.[2,3] In 2019, the World Bank low-income group had a 3.6 times higher age-standardized stroke-related mortality rate than the World Bank high-income group, and the low-income group had a 3.7 times higher age-standardized stroke-related disability-adjusted life-years rate than the high-income group.[4]

India is the world's largest LMIC, hence the incidence of strokes is increasing as a result of demographic shift and rising modifiable risk factors such as hypertension, diabetes, smoking, and sedentary behaviour.[5-7] In India, the estimated annual stroke incidence is between 108 and 172 cases per 100,000 people, with a one-month death rate of 18-42%, significantly higher than in affluent countries.[8]

The available data is heterogeneous and comes from just four of India's Eight Union Territories and 28 States. As a result, there is not enough high-quality data to guide planning, service delivery, and stroke policy and assessment in India. Despite this astounding burden, little is known about the clinical profile, risk factors, and predictors of stroke outcomes in India. This knowledge gap can be attributed to a variety of factors, including varying diagnostic criteria, uneven case definitions, low public awareness, and limited medical infrastructure.[9]

There is no study regarding the predictors of mortality in Uttar Pradesh which is one of most populated state of India.

Materials and Methods

A prospective cross-sectional study of stroke patients admitted to hospitals between September 2022 and September 2024 was carried out.

The study included stroke patients who were above the age of 18

Address for correspondence: Dr. Archana Verma, Professor and Head, Department of Neurology, All India Institute of Medical Sciences Raebareli, Munshiganj, Dalmau Road, Raebareli, Uttar Pradesh, India
E-mail: archanashiva2010@rediffmail.com

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and who arrived at the hospital within seven days of the commencement of symptoms, as well as those who had a recurrent stroke if the index hospitalization was brought on by a new stroke. Patients having subarchnoid hemorrhage or epidural or subdural hemorrhages were excluded.

The World Health Organization defines a stroke as the abrupt decline in brain function brought on by an interruption in the blood supply that lasts more than twenty-four hours.[9] Based on the results of the neuroimaging, clinical examination, and history, the diagnosis of stroke was made.

The stroke subtype, demographic profile, vascular risk factors such as hypertension, diabetes mellitus, dyslipidemia, history of alcohol use and cigarette smoking, history of heart disease, history of recurrent stroke, and seizures at the onset of stroke were all collected. At the arrival, GCS was evaluated. The stroke outcome was measured by using the Modified Rankin Scale (mRS).

All patients were subjected to a neuroimaging CT scan, and MRI with MRA as per the indication. Based on imaging report stroke types were identified. Laboratory tests (e.g., CBC, blood gas analysis, blood glucose, electrolyte levels, liver, renal function tests, lipid profile, serum B12, and vitamin D) and ECG and 2D echo were among the routine investigations that were conducted.

Every patient was monitored during their hospital stay, and the in-hospital death rate was noted. Mortality in hospitals was defined as stroke-related fatalities.

Results

A total of 256 stroke patients (102 women and 154 men) were enrolled. The patients' ages ranged from 26 to 86, with an average age of 60.9 ± 13.3 years. Thirty-one percent of patients were between the age group of 60 and 70 years. Ischemic stroke accounted for 75% of the cases. The most prevalent risk factors were diabetes (21.5%), dyslipidemia (26.7%), tobacco use (34.7%), and hypertension (61.7%). Tobacco smoking was more common in males. Six percent of cases experienced seizures at beginning, and sixteen percent had a history of previous stroke. Fifty percent of patients reached the hospital in less than twenty-four hours. [Table 1]

At admission, the mean GCS was 13.4±2.9 and 80.0% had mRS 4 to 5. Bed sores developed in 2% of cases, and in 3% of cases required mechanical ventilation support. Duration of hospital stay was in those who survived 9.63±11.09 vs 7.60± 9.67 days in expired patients. Maximum mortality (69.5 %) occurred within 1 week and 26% expired within one day. [Table 2]

In-hospital mortality was 8.9 %. Low GCS, high mRS score, UTI, sepsis, mechanical ventilation, bed sore, and chest infection were associated with in-hospital mortality rate. The duration of symptoms to hospital entrance (in hours) [AOR =.98; C.I 95%: (0.98-9.99), $p < 0.03$], hemorrhagic stroke [AOR = 2.7; low GCS [AOR =.79; C.I 95% range: (1.0–7.4), $p < 0.05$], and: (.67-–0.92), $p < 0.003$] were risk variables associated with mortality on multivariate analysis. [Table 3 & 4].

Table 1: Association between gender of the patients, socio-demographic profile and clinical profile of the patients (N= 256)

Variables		Female (Total= 102) n,%	Male (Total=154) n,%	p-value
Age (in Years)	20-30	03 (1.2)	04 (1.6)	0.78
	30-40	02 (0.8)	09 (3.5)	
	40-50	14 (5.5)	26 (10.2)	
	50-60	26 (10.2)	33 (12.9)	
	60-70	34 (13.4)	47 (18.4)	
	70-80	15 (5.9)	24 (9.4)	
	80-90	08 (3.1)	11 (4.3)	
Mean duration of symptoms (in days)	2.51 ± 2.7			
Mean duration of symptoms (in hours)	10.4 ± 7.6			
Symptoms onset to hospitalization	<24 hours	57 (22.3)	73 (28.5)	0.38
	1-7 days	39 (15.2)	68 (26.6)	
	>7 days	06 92.3)	13 (5.1)	
Diagnosis of stroke	Ischemic	77 (30.1)	116 (45.3)	0.51
	Hemorrhagic	25 (9.8)	36 (14.1)	
	TIA	0 (0.0)	02 (0.8)	
H/o HTN	Yes	59 (23.0)	99 (38.7)	0.18
	No	43 (16.8)	55 (21.5)	
H/o DM	Yes	29 (11.3)	26 (10.2)	0.02
	No	73 (28.5)	128 (50.0)	
H/o CAD	Yes	01 (0.4)	06 (2.3)	0.16
	No	101 (39.5)	148 (57.8)	
Dyslipidemia	Yes	24 (9.4)	45 (17.6)	0.19
	No	78 (30.5)	109 (42.6)	
H/o RHD	Yes	01 (0.4)	05 (2.0)	0.23
	No	101 (39.5)	149 (58.2)	
H/o prior episode of stroke	Yes	19 (7.4)	22 (8.6)	0.23
	No	83 (32.4)	132 (51.6)	
H/o Tobacco Smoking	Yes	24 (9.4)	65 (25.4)	0.001
	No	78 930.5)	89 (34.8)	
Seizure at stroke onset	Yes	07 (2.7)	09 (3.5)	0.47
	No	95 (37.1)	145 (56.6)	
MRS score on admission	1	0 (0.0)	05 (2.0)	0.05
	2	0 (0.0)	05 (2.0)	
	3	14 (5.5)	26 (10.2)	

	4	59 (23.0)	89 (34.8)	
	5	29 (11.3)	29 (11.3)	
GCS scoring	Mild	66 (25.8)	117 (45.7)	0.10
	Moderate	23 (9.0)	27 (10.5)	
	Severe	13 (5.1)	10 (3.9)	
UTI	Yes	01 (0.4)	01 (0.4)	0.64
	No	101 (39.5)	153 (59.8)	
Sepsis	Yes	01 (0.4)	01 (0.4)	0.64
	No	101 (39.5)	153 (59.8)	
Mechanical Ventilation	Yes	04 (1.6)	04 (1.6)	0.40
	No	98 (38.3)	150 (58.6)	
Bed sores	Yes	04 (1.6)	01 (0.4)	0.09
	No	98 (38.3)	153 (59.8)	
Chest Infection	Yes	02 (0.8)	03 (1.2)	0.66
	No	100 (39.1)	151 (59.0)	
Outcome of the patient	Alive	91 (35.5)	142 (55.5)	0.27
	dead	11 (4.3)	12 (4.7)	
chi-square test and Fisher exact test applied p-value <0.05 (significant) p-value <0.001 (highly significant)				

Table 2: Association of mortality due to stroke, socio-demographic profile and clinical profile of the patients (N= 256)

Variables		Alive (Total-233) (n,%)	Dead (total-23) (n,%)	p-value
Gender	Male	142 (55.5)	12 (4.7)	0.50
	Female	91 (35.5)	11 (4.3)	
Age (in Years)	20-30	07(2.7)	0 (0.0)	0.36
	30-40	11 (4.3)	0 (0.0)	
	40-50	37 (14.5)	03 (1.2)	
	50-60	50 (19.5)	09 (3.5)	
	60-70	76 (29.7)	05 (2.0)	
	70-80	34 (13.3)	05 (2.0)	
	80-90	18 (7.0)	01 (0.4)	
Mean age (in years)	60.9 ± 13.3			
Symptoms onset to hospitalization	<24 hours	112 (43.8)	18 (7.0)	0.02
	1-7 days	103 (40.2)	04 (1.6)	
	>7 days	18 (7.0)	01 (0.4)	
Diagnosis of stroke	Ischemic	181 (70.7)	12 (4.7)	0.02
	Hemorrhagic	50 (19.5)	11 (4.3)	
	TIA	02 (0.8)	0 (0.0)	
H/o HTN	Yes	144 (56.3)	14 (5.5)	1.00
	No	89 (34.8)	09 (3.5)	
H/o DM	Yes	49 (19.1)	06 (2.3)	0.59
	No	184 (71.9)	17 (6.6)	
H/o CAD	Yes	06 (2.3)	01 (0.4)	0.48
	No	227 (88.7)	22 (8.6)	
Dyslipidemia	Yes	58 (22.7)	11 (4.3)	0.03
	No	175 (68.4)	12 (4.7)	
H/o RHD	Yes	06 (2.3)	0 (0.0)	1.00
	No	227 (88.7)	23 (9.0)	
H/o prior episode of stroke	Yes	38 (14.8)	03 (1.2)	1.00
	No	195 (76.2)	20 (7.8)	
H/o Tobacco Smoking	Yes	82 (32.0)	07 (2.7)	0.82
	No	151 (59.0)	16 (6.3)	
Seizure at stroke onset	Yes	12 (4.7)	04 (6.3)	0.05
	No	221 (86.3)	19 (7.4)	
MRS score on admission	1	04 (1.6)	01 (0.4)	<0.001
	2	05 (2.0)	0 (0.0)	
	3	38 (14.8)	02 (0.8)	
	4	144 (56.3)	04 (1.6)	
	5	42 (16.4)	16 (6.3)	
GCS scoring	Mild	175 (68.4)	08(3.1)	<0.001
	Moderate	44 (17.2)	06 (2.3)	
	Severe	14 (5.5)	09 (3.5)	
Mean GCS Scoring	13.4 ± 2.9			
UTI	Yes	0 (0.0)	02 (0.8)	0.01
	No	233 (91.0)	21 (8.2)	
Sepsis	Yes	0 (0.0)	02 (0.8)	0.01
	No	233 (91.0)	21 (8.2)	
Mechanical Ventilation	Yes	0 (0.0)	08 (3.1)	<0.001

	No	233 (91.0)	15 (5.9)	
Bed sores	Yes	0 (0.0)	05 (2.0)	<0.001
	No	233 (91.0)	18 (7.0)	
Chest Infection	Yes	0 (0.0)	05 (2.0)	<0.001
	No	233 (91.0)	18 (7.0)	
chi-square test and Fisher exact test applied p-value <0.05 (significant) p-value <0.001 (highly significant)				

Table 3: Association of various factors to the mortality of stroke patients (N=256)

Variables	Alive (Total-233) (Mean ± S.D.)	Dead (total-23) (Mean ± S.D.)	p-value
Age (in years)	60.9 ± 13.6	61.7 ± 10.4	0.73
Duration of symptoms (in hours)	73.3 ± 65.7	44.1 ± 56.3	0.03
GCS Score	13.7 ± 2.6	10.4 ± 4.0	0.001
MRS on admission	3.9 ± 0.76	4.5 ± 0.9	0.02
Independent t-test applied p-value <0.05 (significant) p-value <0.001 (highly significant)			

Table 4: Regression analysis of various factors affecting mortality of the patients with stroke (N=256)

Variables		Unadjusted OR (OR) (CI)	Adjusted OR (OR) (CI)	p-value
Diagnosis of stroke	Ischemic	Reference	Reference	0.05
	Hemorrhagic	3.3 (1.4-7.9)	2.7 (1.0-7.4)	
Dyslipidemia	No	Reference	Reference	0.08
	Yes	2.8 (1.2-6.6)	2.4 (0.90-6.74)	
MRS on admission		3.5 (1.7-7.4)	1.4 (0.60-3.3)	0.43
GCS scoring on admission		0.76 (0.67-0.85)	0.79 (0.67-0.92)	0.003
Duration of onset of symptoms		0.99 (0.97-1.00)	0.98 (0.98-9.99)	0.03
Binary multiple logistic regression was applied. p-value <0.05 (significant). p-value <0.001 (highly significant)				

Discussion

In our study the majority of patients (79.7%) presented with ischaemic stroke. The in-hospital mortality was 8.9 %. According to multivariate logistic regression model, haemorrhagic stroke, low GCS on admission, duration of onset of symptoms to admission were the independent predictors of in-hospital mortality. Our findings are consistent with previous research, which has identified hemorrhagic stroke and an initial low GCS as independent predictors of in-hospital death.[10] Furthermore, patients with mechanical ventilation, bedsores, urinary tract infections (UTIs), sepsis, or a chest infection had poor clinical outcomes. These findings highlight the importance of complete inpatient stroke therapy, including complication prevention, early mobilisation, and infection control measures.

In our study, 6% of stroke patients presented with seizures at admission, indicating the significance of early post-stroke seizures. Xu et. al noted that early seizures are a common complication after stroke, with similar definitions and varied rates of occurrence per study.[11] Early seizures are most likely to complicate patient outcomes through contributing to higher morbidity and longer hospital lengths of stay.

Stroke prevalence was higher in males than in women, as seen in previous study. It can be ascribed to a higher prevalence of risk factors, such as smoking, in 34.7% of the population. Eapen et al. and Maskey et al also found a greater association between smoking, vascular damage, and stroke risk.[12,13]

Hypertension was identified as the most common risk factor in our study, affecting 61.7% of stroke patients. Hypertension remains a significant contributor to stroke burden, as highlighted by the SIREN and INTERSTROKE studies.[14,15]

In the current research, dyslipidemia was found in 26.7% of the patients, and this is much higher than those reported by Eapen et al. 17% and Abdu-Alrahman Sallam et al. 13.9%.[12,16] This discrepancy may be a reflection of various factors such as population characteristics, lifestyle, and access to health care. In the present study, diabetes was observed in 21.5% of patients, which is slightly higher compared to the findings of Maskey et al. (9.3%).[13]

Age is a significant nonmodifiable risk factor for stroke. The mean age of onset of stroke in our study was 60.9 ± 13.3 years, and patients ranged from 26 to 86 years. The mean age reported in Western countries is as high as 68 years in the USA and 71 years in Italy.[17,18]

Stroke patients in LMICs were significantly younger than those in HICs (63.1 years vs. 68.6 years, $p < 0.01$), with an average age of 64.4 years (95% CI: [62.9, 65.8]) across all countries.[19] Age-related risk assessment is essential for stroke patients, as observed from these findings.

In-hospital mortality and predictors of poor outcomes

In our study, in-hospital mortality was 8.9%. This is consistent with recent data from wealthy countries. In the Austrian Stroke Unit Registry in-hospital death rate was 2%,[20] and 4.9% in the German Stroke Registers cohort in acute ischemic stroke patients.[21]

Similarly, studies from Sri Lanka and Kerala India in-hospital mortality were 11.7% and 3.4% for entire cohort respectively.[10,22] These findings contrast with the relatively high in-hospital mortality of 21% reported by Shah et al. from Nepal,[23] and 27.6% from Eastern Ethiopia.[24] The different fatality rates in various regions could be explained by varying healthcare infrastructure, stroke care protocols, and availability

of novel modalities of treatment such as thrombolysis. Our investigation found that several characteristics were independently related with in-hospital mortality.

Stroke Management and Future Directions

Our findings emphasise the importance of early hospitalisation in improving stroke outcomes. Only 50% of our cohort patients presented to the hospital within 24 hours after symptom start, which is alarming given the documented benefits of early reperfusion therapy. Delayed hospital presentation was an independent predictor of in-hospital death, and public education efforts to recognise stroke symptoms and come directly to the hospital are urgently needed. Improving emergency medical services, updating stroke treatment facilities in rural locations, and launching telemedicine programs for early stroke evaluation could lessen this discrepancy.[25]

Multidisciplinary stroke care must be improved to enhance patient outcomes. Because stroke patients with infection, sepsis, and respiratory problems died more frequently, neurologists, intensivists, rehabilitation specialists, and infection control teams must work together. Long-term rehabilitation and secondary preventive techniques must also be enhanced to reduce the risk of recurrent stroke.

Conclusion

Limited access to evidence-based stroke care, such as delayed or restricted CT imaging, hindered correct diagnosis and timely treatment and thus unfavourable patient outcomes. Bridging these gaps requires specific health policies to ensure access to required diagnostic facilities and trained healthcare professionals. Subsequent studies should strive to demonstrate systemic deficiencies and introduce an exclusive stroke care system to enhance the quality of stroke management in India.

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Conflicts of interest

There are no conflicts of interest.

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