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Factors Influencing Mortality and Functional Outcomes Among Patients With Stroke Admitted to a Tertiary Hospital in Eastern Nepal

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ABSTRACT

Introduction: Of all stroke-related mortality, 80% have occurred in developing countries. But there is a paucity of data regarding the mortality and functional outcome among patients with stroke after hospital discharge in the context of Nepal. Therefore, we conducted this study to determine the mortality and functional outcome in patients with stroke and factors associated with these outcomes.

Materials and methods: We conducted a longitudinal observational study for a period of one year, among patients admitted at B.P. Koirala Institute of Health Sciences who were aged ≥18 years and diagnosed with stroke. Baseline data on clinical-epidemiological profile and risk factors were obtained on admission. All the patients received usual treatment at hospital, and they were followed up at 30 days of stroke onset to determine the outcomes (mortality and functional outcomes). Barthel index was used to determine the functional outcome. Chi-square test and Mann-Whitney U test were performed to determine factors influencing the outcome measures at 30 days.

Results: Of the 107 patients, majority were males (55.1%) and had ischemic stroke (86.9%). The mean±SD age was 63±15 years. The common risk factors were smoking (64, 59.8%), hypertension (59, 55.1%) and alcohol consumption (56, 52.3%). The 30 days mortality rate was 30.8%. The factors significantly associated with mortality were age (p=0.005), atrial fibrillation (p=0.043), hypertension(p=0.029), cardiac disease (p=0.026), history of stroke (p=0.015), and modified Rankin scale score <3 (p=0.043). Of the 60 stroke survivors, 60% were independent at 30 days of stroke onset. The factors significantly associated with functional outcomes were modified Rankin scale <3 (P=0.041) and Glasgow coma scale score (p=0.014).

Conclusion: The mortality rate at 30 days of stroke onset was relatively higher than stated by earlier studies in Nepal but those who survived had higher functional independence. The factors associated with mortality were mostly modifiable, but the functional outcomes were mostly influenced by the disability due to stroke and the extent of impaired consciousness.

Keywords: Awareness, Stroke, Hypertension

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INTRODUCTION

Stroke is a leading cause of disability among adults and the second most common cause of mortality after ischemic heart disease.[1] Out of all stroke-related mortality, 80% of stroke-related mortality occurred in low to middle-income countries.[2] The in-hospital mortality of stroke in a setting with stroke unit care was 4.9%.[3] In contrast to this, the stroke-related mortality in Nepal ranges from 13% to 29%.[4–6] Stroke-related mortality has been associated with advancing age, atrial fibrillation, large vessel stroke, previous stroke and low albumin level[7] while, the poor functional outcome in stroke survivors has been linked with age, dysphagia, atrial fibrillation, urinary incontinence, and diabetes mellitus.[8]

Nepal is a low country with very few hospitals having stroke unit facilities. However, the prevalence of stroke is increasing with the rise of other non-communicable diseases in Nepal. As reported by the World Health Organisation, the country has a higher age-standardized death rate and disability rate due to non-communicable diseases than communicable diseases.[9] However, the facilities to cope with the increasing burden of stroke is limited. The stroke-related rehabilitation in Nepal is facing greater challenges due to inadequate skilled work force and stroke unit care. In this context, the functional outcome of stroke survivors may not match with the data from the facility enriched Centre.

B.P. Koirala Institute of Health Sciences is a pioneer tertiary care centre in eastern Nepal which admits 30000-40000 patients annually.[10] As a centre of choice to refer most of stroke patients from eastern Nepal, we conducted this longitudinal observational study to determine the clinic-epidemiological profile, 30 days mortality and functional outcome in patients with stroke admitted in the department of internal medicine of B.P. Koirala Institute of Health Sciences, Nepal.

MATERIALS AND METHODS

Study design: This was the longitudinal observational study conducted at the department of internal medicine in B.P. Koirala Institute of Health Sciences, Dharan, Nepal. The pioneer tertiary care center covers 16 districts of eastern Nepal and bordering districts of India. This center, however, does not have a separate neurology unit and admits the patients of stroke in the department of internal medicine and intensive care unit. This study was conducted between April 2017-2018.

Study participants: The study participants were patients who were diagnosed with stroke. Stroke was defined by focal neurological deficit persisting for more than 24 hours with evidence of ischemia or hemorrhage in CT/ MRI. Those without a CT head, with a traumatic brain injury or needing assistance from others for daily activities were excluded from the study.

Study procedure: The baseline data regarding the demographic profile, clinical symptoms, and investigation reports were recorded in the preformed proforma. This history regarding the risk factors like smoking, alcohol, diabetes mellitus, hypertension, history of stroke and cardiac disease were self-reported by patient or patient's attendant. The disability grading at the time of admission was done by a modified Rankin scale which ranges from 0 to 6 where 0: no symptoms, 1: no significant disability, 2: slight disability, 3: moderately severe disability, 5: severe disability and 6: dead. Glasgow coma scale score of the patients was recorded at baseline. The follow up was arranged at the 30 days of onset of stroke and reminded by the telephonic conversation at 25 days of onset of stroke. The status regarding the patients was inquired, the mortality was recorded and survived patients were asked for follow up. The functional outcome was assessed by the Barthel index scale score, which ranges from 0 to 100. The question was asked to patients and/or the patient's attendant. The Barthel index score was categorized into total functional dependent (0-39), partially dependent (40-59), independent (60-84), and total functional independence (85-100).

Outcome measures: The primary outcome measure was the proportion of patients with stroke who had mortality within 30 days of stroke onset. The secondary outcome measure was the proportion of patients who have an unfavorable functional outcome as defined by the Barthel Index score of < 60 at 30 days of stroke onset.

Statistical analysis: The data was collected in preformed proforma and entered in MS EXCEL 2007 and converted into SPSS 11.5 for statistical analysis. For descriptive statistics frequency, percentage, mean, standard deviation (SD), median and interquartile range (IQR) were determined. For inferential statistics Chi-square test, Independent t-test or Mann-Whitney test were used where appropriate to determine the influence of various factors on outcome measures considering $p<0.05$ as statistically significant value. The loss to follow up patients were excluded from outcome measures analysis. For the functional outcome analysis, the Barthel index score was categorized into unfavorable outcomes (less than 60) and a favorable outcome group (60 or more).

Ethics statement: The protocol of this study was approved by the Institutional review committee and research committee of the B.P. Koirala institution of health sciences, Dharan, Nepal (Acd. 946/073/074).

RESULTS

Table 1. Baseline demographic and disease characteristics of study population (n=107)

Characteristics	Mean ± SD or (n%)
Age (years), range 24-95)	63 ±15
Sex, Male	59 (55.1)
Time for hospital presentation (hrs)	37 ± 51
Alcohol consumer	56 (52.3)
Smoker	64(59.8)
Hypertension	59(55.1)
T2 Diabetes Mellitus	17(15.9)
Past history of stroke	24(22.4)
H/O Cardiac disease	25(23.4)
Type of stroke	
Ischemic	93(86.9)
Hemorrhagic	14(13.1)
Location of stroke	
Non-lacunar	72(67.3)
Lacunar	35 (32.7)
Baseline GCS	12 ± 3
Baseline mRS	4 ± 1

Abbreviation: n, frequency; SD, Standard Deviation; GCS, Glasgow Coma Scale; mRS, modified Rankin Scale

Baseline Characteristics of study population: We enrolled 107 patients of stroke in this longitudinal observational study. As illustrated in Table 1 the mean age of the study population was 63±15 years with majority males (55.1%). The mean time of hospital presentation after stroke was 37 hours. Of the 107 patients, 22.4% had a history of stroke, 52.3% were alcohol consumers and 59.8% were smokers. The prevalence of diabetes mellitus and hypertension among the study population was 15.9% and 55.1% respectively. Most of the patients (86.9%) had an ischemic stroke occurred in 86.9%. On the anatomical location, the non-lacunar stroke occurred in 67.3% of the total population. The mean baseline Glasgow Coma scale score was 12±3 and mean baseline modified Rankin Scale was 4±1.

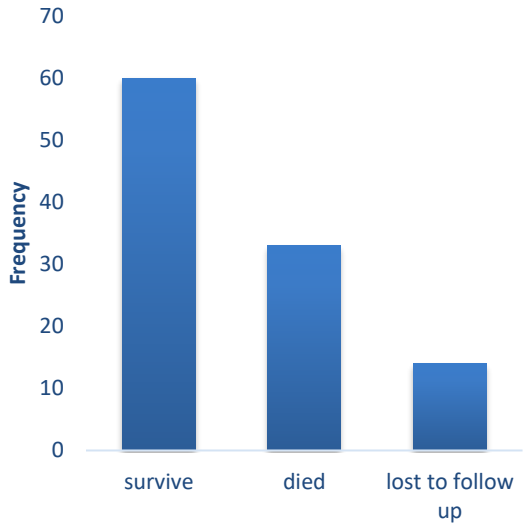

Figure 1: Outcome of study population after 1 month of stroke onset (n=107)

Outcome of the study population: As illustrated in Figure 1, of the 107 enrolled stroke patients, 14 of them were lost to follow-up at 30 days. Of the remaining 93 patients, 60 had survived while 33 died at 1 month of onset of stroke.

Functional outcome of the study population: Among 93 patients who were contacted at 30 days of stroke onset, 60 patients with stroke survived. The functional outcome of the stroke survivors in figure 2 showed that there were 8.3% total functional dependent, 31.7% partial functional dependent, 18.3% independent and total 41.7% functional independent.

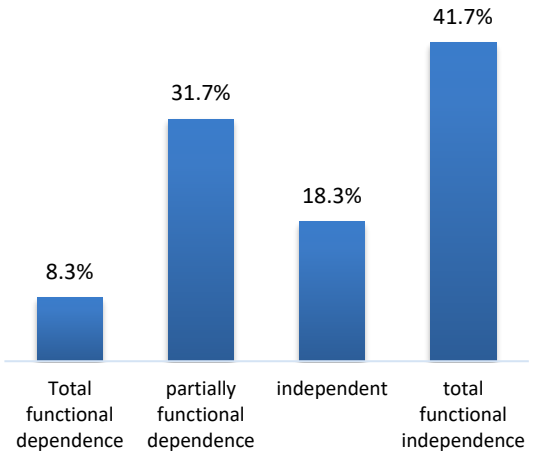

Figure 2: Functional outcome of stroke survivors after 1 month of stroke onset (n-60)

Factors influencing mortality: As illustrated in Table 2 and 3, the mortality of patients at 30 days of stroke onset was significantly and independently associated with the presence of atrial fibrillation (p=0.043), hypertension (p=0.029), cardiac disease (p=0.026), history of stroke (p=0.015). There was a significant difference in the mean age among the survival group and mortality group (59 years vs. 68 years, p =0.005). The mean GCS was significantly lower in the mortality group than in the survival group (10 vs. 13, p<0.001). There was also a significant difference in between the survival group and mortality group in terms of systolic blood pressure (142 mmHg vs.130 mmHg, p=0.045), pulse rate (84 vs. 97, p=0.011) and serum urea (27 vs. 39, p=0.007).

Table 2: Association of categorical variables influencing mortality of patients with stroke (n=93)

Characteristics	Mortality (n=33)	P-value
Male	16	0.654
Atrial fibrillation	15	0.043
Smoker	22	0.430
Alcohol consumer	18	0.399
Diabetes mellitus	4	0.335
Hypertension	12	0.029
Cardiac disease	13	0.026
Past history of stroke	13	0.015
Ischemic stroke	29	0.397
Lacunar stroke	8	0.220
mRS 3 or less	2	0.043

Abbreviations: mRS, Modified Rankin Scale

Table 3: Associated of continuous variables influencing mortality of patient with stroke (n=93)

Variables	Survived (60)	Mortality (33)	P value
Age	59 ± 15	68 ± 14	0.005
Time for hospital presentation	39 ± 60	31 ± 31	0.513
GCS score	13 ± 2	10± 3	<0.001
SBP (mmHg)	142 ± 25	130± 32	0.045
DBP (mmHg)	86 ± 12	80± 18	0.067
Respiratory rate (cycle/min)	20 ± 3	22 ± 4	0.315
Pulse rate (beat/min)	84 ± 13	97 ± 27	0.011
Hemoglobin (gm/dl)	13 ± 2	12 ± 1.5	0.073
TLC (cell/mm3)	10882 ± 10692	11133 ± 4044	0.897
Creatinine (mg/dl)	0.77 ± 0.37	0.91 ± 0.37	0.093
Urea (mg/dl)	27 ± 14	39 ± 21	0.007
Sodium (mmol/L)	139 ± 4	139 ± 4	0.463
Potassium (mmol/L)	4 ± 0.4	4 ± 0.5	0.248
Random Blood Sugar (mg/dl)	147 ± 77	149 ± 51	0.883

Abbreviations: GCS, Glasgow coma scale; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; TLC, Total leucocyte count; mmHg, millimeter of mercury; gm/dl, gram/deciliter; mm3, cubic millimeter; mmol/L, millimol/liter; mg/dl, milligram/deciliter

Factors influencing functional outcome: As illustrated in Tables 4 and 5, the mean baseline GCS was significantly low in those with unfavorable function outcome at 30 days compared to those with a favorable outcome group (14 vs. 12, p=0.014). The patients with unfavorable outcome presented with a higher grade of the modified Rankin scale than those with favorable outcome (4.2 vs. 3.8).

Table 4: Categorical variables associated with Unfavorable functional outcome of stroke survivors (n=60)

Characteristics	Unfavorable outcome (n=24)	P Value
Male	10	0.139
Atrial fibrillation	5	0..543
Smoker	13	0.593
Alcohol consumer	10	0.399
Diabetes mellitus	4	0.598
Hypertension	18	0.053
Cardiac disease	6	0.276
Past history of stroke	4	0.643
Ischemic stroke	21	0.368
Lacunar stroke	9	0.93
mRS 3 or less	2	0.041

Abbreviations: mRS, Modified Rankin Scale

DISCUSSION

In this longitudinal observational study, among the 107 patients with stroke, the mean age of the study population was 63±15 years. The majority of the patients were a smoker (59.8%), had hypertension (55.1%), were alcohol consumers (52.3%) and had an ischemic stroke (86.9%). Among the study population, 33/107 patients (30.8%) died within one-month of stroke. The factors significantly influencing the mortality in our study population were hypertension (p=0.029), cardiac disease (p=0.026), history of stroke (p=0.015), mRS score <3 (p=0.043), age (p=0.005), GCS score (p<0.001), SBP (p<0.045), pulse rate p=0.011) and serum urea (p=0.007). Of the 60 stroke survivors, 40 of them were dependent after one-month of stroke onset. The factors significantly influencing unfavorable outcome were mRS <3 (p=0.041) and GCS score (p=0.014).

In our study, the mean of the study population was 63±15 years. Our finding corroborates with the findings from previous studies in Eastern,[5] Central[11] and Western Nepal[12] where the mean age of a patient with a stroke was 66.0 years, 61.7 years and 65.98 years respectively. This suggests that stroke is usually common after the 6th decade of life in Nepalese context. However, studies from other countries have shown more older patients with stroke that those in Nepal and also South Asia.[13, 14] The relatively earlier onset of stroke in our population may be because of the high burden of the risk factors of stroke in our population.

Table 5: Continuous variables influencing unfavorable functional outcome in patients with stroke (n=60)

Variables	Favorable outcome	Unfavorable outcome	P value
Age	58 ± 15	62 ± 15	0.217
Time for hospital presentation	49 ± 72	24 ± 33	0.129
GCS score	14 ± 2	12 ± 2	0.014
SBP (mmHg)	146 ± 23	138 ± 28	0.226
DBP (mmHg)	89 ± 11	83 ± 14	0.113
Respiratory rate(cycle/min)	20 ± 3	21± 3	0.112
Pulse rate (beat/min)	83 ± 13	86± 13	0.471
Hemoglobin(gm/dl)	13 ± 2	12 ± 2	0.029
Total leucocyte count (cell/mm3)	11786 ± 13537	9527 ± 3343	0.427
Creatinine(mg/dl)	0.83 ± 0.4	0.7 ± 0.3	0.137
Urea (mg/dl)	27 ± 14	28 ± 14	0.97
Sodium (mmol/l)	1 38 ± 4.3	139± 3	0.747
Potassium (mmol/l)	3.8 ± 0.5	4 ± 0.3	0.447
Random blood sugar (mg/dl)	146 ± 77	148 ± 78	0.903
Grade of mRS	3.8 ± 1.1	4.2 ± 0.7	0.131

Abbreviations: GCS, Glasgow coma scale; SBP, Systolic blood pressure; DBP, Diastolic blood pressure; TLC, Total leucocyte count; mmHg, millimeter of mercury; gm/dl, gram/deciliter; mm3, cubic millimeter; mmol/L, millimol/liter; mg/dl, milligram/deciliter

The common risk factors in our study population were smoking (59.8%), hypertension (55.1%), alcohol consumption (52.3%), cardiac disease (23.4%), and diabetes mellitus (15.9%). These risk factors are similar to that reported from a

study in Central Nepal where smoking was present in 60.48%, alcohol in 41.43% and hypertension in 38.57% of patients with stroke.[15] In contrast to our findings, a study conducted in Pakistan showed that smoking was present only in 17% of patients with stroke.[16] Our finding showed that smoking and alcohol consumption was much higher among our study population. This may be due to a cultural practice of consuming alcohol, unchecked marketing of tobacco and alcohol, inadequate awareness of a harmful effect of alcohol and ineffective government policy to curb the smoking and alcohol consuming habit. This highlights the need for immediate intervention to mitigate the modifiable risk factors of stroke.

In our study, the 30 days mortality rate of patients with a stroke was 35%. Study from Central Nepal had reported that 30 days mortality in those with a stroke to be 18.5%.[17] This difference in mortality rate might be due to the presence of severe stroke patients in majority of enrolled patients (56.5 %). Stoke related mortalities has also been reported as 13% in Central Nepal [18], and 20.5% in Eastern Nepal.[5] This discrepancy in the mortality rate might be due to the duration of observation of the study population as the former study reported on 7-days mortality while the later reported on in-hospital mortality. Our finding on mortality rate is similar to a study from Uganda (26.8%) [19] while different to that reported from Chile (18.1%).[20] This discrepancy in mortality rate reflects the difference in the level of stroke care of our country with those of other countries. This also highlights the need for the immediate establishment of stroke unit care.

We reported significantly high proportion of hypertension in patients with stroke who did not survive (p=0.029). Literature suggest that raised blood pressure level to be associated with poor outcomes of stroke .[21,22] Castillo et al reported the U shaped effect of blood pressure on the outcome of the patients with stroke.[23] Hypertension among patients with stroke may be due to uncontrolled hypertension, as a response to raised intracranial hypertension in massive stroke, as a part of the stress response or uncontrolled pre-morbid hypertension. We also found significantly more cardiac disease in those who died due to stroke. Our data corroborate with the finding of Carter et al where they reported atrial fibrillation was predictors of mortality of stoke.[7] Our study showed that those who died due to stroke had significantly low GCS than those who survived (10 vs. 13, p<0.001). A similar finding was reported by from Eastern Nepal [5] and India[24]. Although GCS was initially developed for the prognosis of the traumatic brain injuries[25], it was found to be accepted for both traumatic as well as non-traumatic brain injuries [26]. Low GCS in stroke may be due to massive stroke, cortical stroke and brain stem stroke. Low GCS is a predictor of mortality of patients with stroke. We also observed that those who died due to stroke in our study were significantly older than those who survived (68 years vs. 59 years, p=0.005). Advancing age has been known to be a predictor of mortality of stroke[27, 28].

Of 60 stroke survivors in our study, 40% of them were dependent after one month of stroke onset. Slightly better but similar findings have been previously reported in developed countries.[19, 29]

Our study found that unfavorable outcome was significantly associated with mRS <3 (p=0.041). Stroke severity has been reported to be associated with poor functional outcome[30]. Baseline stroke severity is a predictor of an unfavorable outcome of a patient with stroke. We also reported that unfavorable outcome of stroke was significantly associated with low GCS score (p=0.014). A similar finding was reported by Nakibukka et al [19]. Low GCS in a patient with a stroke is associate with large stroke, brain stem stroke and cortical stroke. The patient with low GCS might have difficulty in the rehabilitation process thus resulting in an unfavorable outcome. ASTRAL score has low GCS as one the predictors of unfavorable outcome [31]. A low GCS score is a predictor of the unfavorable outcome of a patient with stroke. Our study being a longitudinal study, provides a realistic picture of an outcome of patients with stroke. However, there are certain limitations to our study. We did not report on the assess of the support from family members, the complication developed by the patient during a

hospital stay, causes of mortality of the patient and psychological assessment of patients. We recommend for a future study to compare the effect of medications used for the treatment and management of stroke, to develop for scoring system to prognosticate the patient with stroke and to determine the effectiveness of the structured physiotherapy versus home-based physiotherapy in a patient with stroke.

CONCLUSION

The mortality rate at 30 days of stroke onset was relatively higher than stated by earlier studies in Nepal but those who survived had higher functional independence. Several modifiable factors were associated with the mortality, but the functional outcomes were mostly influenced by the disability due to stroke and the extent of impaired consciousness.

COMPETING INTEREST

The authors declare that there is no conflict of interest regarding the publication of this paper.

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None

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