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Clinical pattern and predictors of stroke treatment outcome among hospitalized stroke patients at Felege Hiwot Comprehensive Specialized Hospital, North-west Ethiopia

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Abstract

Background: Stroke is one of the most common causes of morbidity and mortality in sub-Saharan African countries including, Ethiopia in the 21st century. Hence, this study aimed to assess the clinical pattern and predictors of stroke treatment outcome among hospitalized patients in Felege Hiwot comprehensive specialized hospital in north-west Ethiopia.

Methods: A retrospective cross-sectional study was conducted among 597 stroke patients, who had been admitted to the medical ward of Felege Hiwot Comprehensive Specialized Hospital (FHCSH) from 2015–2019. Multiple stepwise backward logistic regression analysis was done for a P value of < 0.25 to identify the independent predictors of treatment outcome. Statistical significance was set at $p < 0.05$.

Result: In the present study, 317 (53.1%) were males and the mean age of the study participants was 61.08 ± 13.76. About two-thirds of patients (392, 65.7%) were diagnosed with ischemic stroke. Regarding clinical pattern, about 203 (34.0%) of patients complained of right-side body weakness, and the major co-morbid condition identified was hypertension (216, 64.9%). Overall, 276 (46.2%) of them had poor treatment outcomes, and 101 (16.9%) of them died. Patients who cannot read and write (AOR=42.89, 95% CI: 13.23-111.28, p<0.001), attend primary school (AOR=22.11, 95% CI: 6.98-55.99, p<0.001) and secondary school (AOR=4.20, 95% CI: 1.42-12.51, p<0.001), diagnosed with hemorrhagic stroke (AOR=2.68, 95% CI: 1.62-4.43, p<0.001) and delayed hospital arrival more than 24 hours (AOR= 2.92, 95% CI: 1.83-4.66, p=0.001) were the independent predictors of poor treatment outcome.

Conclusion: Approximately, half of the stroke patients had poor treatment outcomes. Ischemic stroke was the most predominantly diagnosed stroke type. Education status, types of stroke, and the median time from onset of symptoms to hospitalization were the predictors of treatment outcome. Therefore, an appropriate prevention method should be designed to reduce stroke complications and mortality.

Strengths and limitations of this study

- This study has provided a real insight into the current treatment outcome and clinical pattern among hospitalized stroke patients in northwest Ethiopia.
- Around 600 patients were included in this study which allowed us to identify the potential predictors of stroke treatment outcome.
- As this study was based on a retrospective chart review, the data obtained might be affected by the documentation culture of the hospital and the health care providers.
- In this study a significant number of patients discharged against medical advice, some stroke victims may die before reaching the hospital, and the study was done in a single setting, which may affect the generalizability of the data to the entire population.
- Therefore, a prospective study in a multicenter setting would be better to accurately describe the clinical pattern and treatment outcome of stroke in Ethiopia.

Keywords: Neurology, stroke, stroke medicine.

1. Background

Stroke is one of the most common causes of morbidity and mortality in both developing and developed countries in the 21st century. Despite geographical variation in the lifetime risk of stroke, one in four persons whose age is 25 years and above develops stroke during his or her lifetime (1). Currently, central nervous system infarction is defined as the brain, spinal cord, or retinal cell death attributable to ischemia in a specified vascular territory, based on neuropathological, neuroimaging, and/or clinical evidence of ischemic injury with symptoms persisting lasting 24 hours or longer after exclusion of other etiologies (2, 3). It is associated with a severe medical conditions with high complications that are caused by reduced blood flow to the brain (4, 5). According to the American Heart Association (AHA) report, stroke can be generally classified into either ischemic due to blood clot in the artery that supplies the brain or hemorrhagic due to intracranial bleeding (6, 7). Various studies showed that ischemic stroke (52.5% - 87%) is the most frequently diagnosed type of stroke as compared to hemorrhagic stroke (8, 9). Ischemic stroke is significantly less fatal than a hemorrhagic type of stroke, with 30-day case-fatality rates of 46.5% for hemorrhagic stroke compared to 9% to 23% in ischemic stroke (7). Worldwide, it is the second leading cause of mortality, accounting for 10% of all deaths, and killing 5.5million people each year (4, 10, 11). According to the 2016 report of the

World Health Organization (WHO) and The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), there were 33 million people with stroke with an incidence of 15 million and 5 million stroke deaths and 116.4 million disability-adjusted life-years (12, 13), and the stroke burden will be doubled if the trend continues by the year 2030 (14).

In western countries, it is the third most common cause of morbidity and mortality next to cancer and coronary artery disease with mortality rates of 17% - 34% in the first month of post-stroke days and 25% - 40% in the first 12 months (15, 16). Despite a 35% reduction in stroke mortality between 2001 and 2011, a stroke occurred in the United States at a rate of almost 800,000 per year and resulted in 128,932 deaths in 2011 (17). In developing countries, the incidence of stroke is rapidly increasing due to the high prevalence of hypertension, diabetes, obesity, smoking and other non-communicable diseases (6, 18, 19), and 86% of all stroke associated deaths globally were occurred in low and middle-income countries (20). In Africa, the incidence of stroke-related morbidity and mortality is increasing due to the high prevalence of various risk factors such as hypertension , diabetes mellitus, smoking, older age and alcohol(4, 16, 21-23).

A recent community survey undertaken in African countries showed stroke prevalence was between 200 and 300 per 100,000 populations (24), and its prevalence is increasing compared to the previous African stroke report (58–68 per 100,000) (25). In eastern sub-Saharan African countries, the estimated lifetime risk of developing stroke was 11.8% (26). Further, despite comprehensive data regarding stroke burden in Ethiopia are scarce, observational studies showed that it is one of the commonest reasons for hospital admission (8, 27) and its incidence is increasing annually(28).

As per the WHO stroke mortality report, stroke mortality was estimated to be 122–153.8 per 100,000 people in Ethiopia (29). As patients usually present late, and the standard of care is poor as compared to developed countries, the mortality rate among hospitalized stroke patients is expected to be higher despite the lack of comprehensive studies. Most of the information regarding stroke mortality and its determinants that we use in the management of stroke comes from studies in developed countries. Therefore, it is imperative that a lot has to be done to address the issues concerning the burden of stroke, risk factors, and mortality in Ethiopia (5). Hence, the present study was aimed to assess the clinical pattern and predictors of stroke treatment outcome among hospitalized stroke patients at the medical ward of FHSCH.

2. Methods

2.1. Study design and period

A retrospective cross-sectional study was conducted at Felege Hiwot Comprehensive Specialized Hospital, Bahir Dar town, which is located 665km from North-west of Addis Ababa. The hospital provides different clinical services for 12 million populations in the catchment area and serves as a referral for other primary and general hospitals as well as a teaching hospital for Bahir Dar University. The data were collected from January to February 2020. Five hundred ninety-seven (597) stroke patients were included based on the eligibility criteria.

2.2. Eligibility criteria

All adult (≥18 years) stroke patients who had been admitted to the medical ward of FHSCH during 2015-2019 were included in the study. However, patients with incomplete medical records (i.e., incomplete treatment regimen and the status of the patients after treatment) were excluded in the study.

2.3. Data collection instrument and procedure

Data abstraction format was adapted from various relevant literature, and further modified based on the pretest result, which was undertaken in 5% of hospitalized stroke patients' medical card. The format contained socio-demographic patient characteristics, clinically related information, previous, current and discharge medications used, and co-morbidities, complications, time from onset of symptoms to hospitalization, length of hospital stay, type of stroke, and treatment outcome status. These data were collected from the patients' medical records. Six trained clinical pharmacists were participated in the data collection.

2.4. Data analysis

The collected data were entered and analyzed using SPSS version 25.0 statistical software. Descriptive statistics such as frequency, percentage, and mean with standard deviations were used to describe the independent variables. Multiple stepwise backward logistic regression analysis was done for a P value of < 0.25 to identify the independent predictors of treatment outcome. Statistical significance was set at $p<0.05$.

2.5. Ethical Consideration

The study was approved by the Ethical review board of Debre Tabor University, College of Health Sciences (DTU/RE/1/170/12). Patients' personnel information and clinical information were recorded by ensuring patient confidentiality.

2.6. Patient and public involvement

Patients were not involved in the design and conduction of this study. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

2.7. Operational Definition

Undetermined type of stroke: A type of stroke neither ischemic nor hemorrhagic, not clearly identified.

Improved or good outcome: If the patient is discharged without complication or if patient discharge with improvement.

Poor outcome: If the patient is discharged with complication, or referred to higher health facility, or left against medical advice or death.

3. Results

3.1 Socio demographic characteristics of patients

In the present study, a total of 597 study participants were included. Males were accounted for 317 (53.1%). Mean age of the study participants was 61.08 ± 13.76, with the age range of 25 - 98 years. Approximately, 252 (42.2%) of the patients were in the age range of 56–70 years. In addition, 191 (33.0%) and 152 (25.5%) of study participants attended primary and higher education, respectively. Occupationally, the majority 225 (37.7%) of participants in the study, were farmers. (Table 1).

Table 1: Socio-demographic characteristics of stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, North west Ethiopia, 2020.

Variables	Categories	Frequency (%)			
		Ischemic stroke	Hemorrhagic stroke	Undetermined	Total
Sex	Male	217 (55.4)	89 (47.3)	11 (64.7)	317 (53.1)
	Female	175 (44.6)	99 (52.7)	6 (35.3)	280 (46.9)
Age	<40	20 (5.1)	27 (14.4)	2 (11.8)	49 (8.2)
	41-55	100 (25.5)	44 (23.4)	2 (11.8)	146 (24.5)
	56-70	168 (42.9)	81(43.1)	3 (17.6)	252 (42.2)
	>70	104 (26.5)	36 (19.1)	10 (58.8)	150 (25.1)
Occupation	Farmer	150 (38.3)	67(35.6)	8 (47.1)	225 (37.7)
	Employed	76 (19.4)	35 (18.6)	2 (11.8)	113 (18.9)
	Unemployed	34 (8.7)	20 (10.6)	1 (5.9)	55 (9.2)
	Housewife	85 (21.7)	58 (30.9)	4 (23.5)	147 (24.6)
	Retired	47 (12)	8 (4.3)	2 (11.8)	57 (9.5)
Educational status	Cannot read & write	93 (23.7)	53 (28.2)	6 (35.3)	152 (25.5)
	Primary	70 (17.9)	44 (23.4)	3 (17.6)	117 (19.6)
	Secondary	92 (23.5)	42 (22.3)	3 (17.6)	137 (22.9)
	Higher education	137 (34.9)	49 (26.1)	5 (29.4)	191 (32.0)
Residence	Urban	206 (52.6)	65 (34.6)	7 (41.2)	278 (46.6)
	Rural	186 (47.4)	123 (65.4)	10 (58.8)	319 (53.4)

3.2. Clinical characteristics of stroke patients

About two-thirds of the participants in this study (392, 65.7%) were diagnosed with ischemic stroke while 188 (31.5%) of patients had a hemorrhagic stroke. The mean time from the onset of symptoms until arrival at the hospital was 23.67 hours. In addition, the median length of hospital stay was 5.55 ±3.29 days, and more than half of the patients (345, 57.8 %) remained in the hospital for five or fewer days.

Approximately, one-third of the study participants complained about body weakness on the right side (203, 34.0 %), followed by body weakness on the left side 194 (32.5%). Moreover, more than half of stroke patients 333 (55.8%) had at least one comorbid condition, of which the most

common comorbid conditions were hypertension 219 (64.9%), atrial fibrillation 114 (34.2%), and diabetes mellitus 83 (24.9%).

Hypertension was primarily prevalent in hemorrhagic stroke 158 (84 %) compared with patients with ischemic stroke 175 (44.6%). The most common complications of stroke were aspiration pneumonia (125, 64.4%) and elevated intracranial pressure (57, 29.4%) (Table 2).

Table 2: Clinical characteristics of stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, North west Ethiopia, 2020.

Variables	Category	Frequency (%)
Clinical presentation	Right side body weakness	203 (34.0)
	Left side body weakness	194 (32.5)
	Loss of consciousness	103 (17.3)
	Aphasia	97 (16.2)
Types of stroke	Ischemic stroke	392 (65.7)
	Hemorrhagic stroke	188 (31.5)
	Undetermined	17 (2.8)
Co-morbid status	Absent	264 (44.2)
	Present	333 (55.8)
Specific co-morbid conditions	Hypertension	216 (64.9)
	Atrial fibrillation	114 (34.2)
	Diabetes mellitus	83 (24.9)
	Congestive heart failure	37 (11.1)
	Epilepsy	33 (9.9)
	Hyperlipidemia	22 (6.6)
	Others*	31 (9.3)
Complication status	Absent	403 (67.5)
	Present	194 (32.5)
Specific complications	Aspiration pneumonia	125 (64.4)
	Increased ICP	57 (29.4)
	Septic shock	29 (14.9)
	Bed sore	23 (11.9)

	Others*	17 (8.8)
Time from onset to hospitalization	<12 hours	117(19.6)
	12-24 hours	204 (34.2)
	25-48hours	130 (21.8)
	>48hours	146 (24.5)
Length of hospital stay	≤ 5days	345 (57.8)
	> 5days	252 (42.2)
	Mean day	5.55 ±3.29 days

¥(Urinary tract infection, HIV/AIDs, lipoma, asthma, glaucoma, breast cancer), *(seizure, acute renal failure, diabetic ketoacidosis, hypokalemia, eclampsia), ICP: intracranial pressure

3.3. Management pattern of stroke patients

About half of patients with stroke (333, 55.8 %) had a history of medication. During admission, 12.2% and 9.0% of patients were used enalapril and nifedipine, respectively. In addition, 352 (59 %) stroke patients used combinations of acetylsalicylic acid and atorvastatin, while 103 (17.3%) patients received support/physiotherapy during hospitalization. Cimetidine (154, 25.8%) and a combination of metronidazole, ceftriaxone, and cimetidine 110 (18.4%) were the major concomitantly administered medications. Besides, acetylsalicylic acid 321 (53.8%), and acetylsalicylic acid and atorvastatin combination (97, 16.2%) were the frequent discharge medications, while nifedipine (147, 24.6%) was the most commonly concomitantly prescribed drug upon discharge. 227 (38.0%) stroke patients were prescribed non-fractionated heparin for the prevention of deep venous thrombosis during hospitalization (Table 3).

Table 3: Management pattern among stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, North west Ethiopia, 2020

Management practice	Categories	Frequency (n)	Percentage (%)
Past medication history	Enalapril	73	12.2
	Oral hypoglycemic	45	7.5
	Nifedipine	54	9.0
	Hydrochlorothiazide	38	6.4
	Nifedipine + hydrochlorothiazide	32	5.4
	Atorvastatin	27	4.5

	Phenytoin	24	4.0
	Insulin	15	2.5
	Others*	25	4.2
	None	264	44.2
Medications used to treat stroke during hospitalization	ASA + Atorvastatin	352	59.0
	Supportive therapy/physiotherapy	103	17.3
	ASA	54	9.0
	Atorvastatin	52	8.7
	ASA+ Atorvastatin + physiotherapy	36	6.0
Concomitantly administered drugs for hospitalized stroke patients	Cimetidine	154	25.8
	Ceftriaxone + metronidazole + Cimetidine	110	18.4
	Heparin	71	11.9
	Ceftriaxone + metronidazole	52	8.7
	Mannitol	52	8.7
	Bisacodyl	43	7.2
	Metoprolol	34	5.7
	Warfarin	30	5.0
	Mannitol +Ranitidine	32	5.4
	Ceftriaxone + Cimetidine	19	3.2
Medications give at discharge for treatment of stroke	ASA	321	53.8
	ASA + Atorvastatin	97	16.2
	Atorvastatin	78	13.1
Concurrently prescribed drug prescribed during discharge	Nifedipine	147	24.6
	Metoprolol	91	15.2
	Ranitidine	89	14.9
	Enalapril	82	13.7
	Omeprazole	41	6.9
	Phenytoin	28	4.7
	Digoxin	18	3.0

*(HAART, salbutamol, antibiotics and anticancer), ASA: acetylsalicylic acid (aspirin)

3.3. Treatment outcome and associated factors

As shown in Figure 1, more than half of the stroke patients (321, 53.8%) were discharged with improvement. Contrastingly, 97 (16.2%) and 78 (78%) patients were referred to other facilities and left against medical advice upon self and family requests, respectively. In addition, 101 (16.9%) patients have died (figure 1).

Figure 1: Distribution of stroke patients by their outcomes.

More than half (57, 56.4%) of patients with death outcome had greater than 1-week hospital stay, and 119 (30.1%), 36 (46.2%) and 36 (36.1%) of patients with an outcome of improved, left against medical advice and referred to other health facility had 4-5 days' hospital stay (figure 2).

Figure 2: Distribution of patient outcomes by duration of hospital stay

The present study showed that the majority of patients (63, 62.4%) with a hemorrhagic stroke had fatal outcomes. On the other hand, more patients with ischemic stroke have been improved, referred to other healthcare facilities, and left to medical advice than hemorrhagic stroke cases (Table 4).

Table 4: Distribution of patients' outcomes by stroke types

Patient outcomes	**Types of stroke**			**Total**
	Ischemic stroke	Hemorrhagic stroke	Undetermined	
Improved	238 (74.1%)	74 (23.1%)	9 (3.8%)	321 (53.8%
Referred to other health facility	65 (67%)	31 (32%)	1 (1%)	97 (16.2%)
Left against medical advice on self and family requests	57 (73.1%)	20 (25.6%)	1 (1.3%)	78 (13.1%)
Death	32 (31.7%)	63 (62.4%)	6 (5.9%)	101 (16.9%)
Total	392 (65.7%)	188 (31.5%)	17 (2.8%)	597 (100%)

The multivariate logistic regression model showed that educational status, types of stroke, and the median time from onset of symptoms to hospitalization were significant predictors of stroke treatment outcome.

Accordingly, patients who cannot read and write, attend primary and secondary school were about forty-three (AOR=42.89, 95% CI: 13.23-111.28, p<0.001), twenty-two (AOR=22.11, 95% CI: 6.98-55.99, p<0.001) and four (AOR=4.20, 95% CI: 1.42-12.51, p<0.001) times more likely to have a risk of poor treatment outcome, respectively. Besides, patients diagnosed with a hemorrhagic type of stroke were three (AOR=2.68, 95% CI: 1.62-4.43, p<0.001) times more likely to have poor treatment outcomes than ischemic stroke patients. Further, patients with a median time from symptom onset to hospitalization greater than 24 hours were three (AOR= 2.92, 95% CI: 1.83-4.66, p=0.001) times more likely to have poor treatment outcomes as compared to their counterparts (Table 5).

Table 5: Univariate and multivariate binary logistic regression analysis of predictors of treatment outcome

Variables	Categories	Treatment outcome		Univariate analysis	Multivariate analysis	
		Good	Poor	COR (95% CI)	AOR (95% CI)	P-Value
Sex	Male	162	155	1	1	
	Female	159	121	0.78 (0.58 - 1.01) *	0.86 (0.42 - 1.75)	0.679
Age	<40	12	37	1.73 (0.84 - 3.60) *	2.23 (0.79 - 6.31)	0.130
	41-55	98	48	0.28 (0.17 - 0.45) *	0.53 (0.16 - 0.69)	0.071
	57-70	157	95	0.34 (0.22 - 0.52) *	0.31 (0.16 - 0.61)	0.068
	>70	54	96	1	1	
Educational status	Cannot read & write	30	122	36.81 (19.81 - 68.42) *	42.89 (13.23 - 111.28)	<0.001
	Primary	33	84	23.04 (12.37 - 42.91) *	22.11(6.98-55.99)	<0.001
	Secondary	86	55	5.37 (2.99 - 9.66) *	4.20 (1.42 - 12.51)	<0.001
	Higher education	172	19	1	1	
Occupation	Farmer	82	143	4.88 (2.55 - 9.35) *	0.52 (0.14 - 1.94)	0.330
	Employed	102	11	0.30 (0.13 - 0.71) *	0.85 (0.27 - 2.72)	0.789
	Unemployed	30	25	2.33 (1.06 - 5.16) *	0.56 (0.14 - 2.28)	0.417

	House wife	65	82	3.53 (1.80 - 6.93) *	0.55 (0.14 - 2.06)	0.362
	Retired	42	15	1	1	
Types of stroke	Ischemic stroke	238	154	1	1	
	Hemorrhagic stroke	74	114	2.38 (1.67 - 3.40) *	2.68 (1.62 - 4.43)	<0.001
	Undetermined	9	8	1.37 (0.52 - 3.64)	0.35 (0.09 - 1.43)	0.143
Length of hospital stay	≤ 5days	207	138	1	1	
	> 5days	114	138	1.82 (1.31 - 2.52) *	1.70 (1.04 - 2.79)	0.056
Median time from onset of symptom to hospitalization	≤24hrs	207	114	1	1	
	>24hr	114	162	2.58 (1.85 - 3.59) *	2.92 (1.83 - 4.66)	0.001
Co-morbidity status	Absence	166	178	1	1	
	Present	155	175	1.95 (1.40 - 2.71) *	1.38 (0.85 - 2.22)	0.192

Note: AOR: Adjusted Odds ratio; COR: Crudes Odds ratio; CI: Confidence interval.
* Shows statistically significant at p value < 0.25 during univariate analysis.

4. Discussion

A five-year retrospective cross-sectional study was conducted to describe the clinical patterns and treatment outcome of patients with stroke admitted to the medical ward of FHSCH. The mean age of patients in this study was 63.2±12.6 years, which is consistent with other previous hospital-based studies in Ethiopia where the mean age of stroke patients ranged from 56-66 years (8, 9, 22). The existence of multiple co-morbidities such as hypertension, heart disease, and diabetes may be due to the high prevalence of stroke in the elderly. This is, however, lower than studies carried out in Iran (16) and USA (30), and higher than other studies conducted in Ethiopia (27, 29, 31), Sri Lanka (31) and India (32). This disparity may be due to differences in socio-demographic factors, sample size, and the method used in the studies. The prevalence of stroke in males was significantly higher than in females that are consistent with other cross-sectional studies in Ethiopia (9, 22, 33), Nigeria (34, 35), Kenya (19), Zambia (36), India(32, 37), Iran (16) and Sri Lanka(31). The high prevalence of stroke in males may be attributed to the increased habit of drinking alcohol and smoking cigarettes. Other studies performed by Greffie,

et al., and Connor, *et al.* (24, 38) showed, however, that stroke is mainly diagnosed in females. This might be explained by the presence of different risk factors such as pregnancy-related disorders and the frequent use of contraceptives in females in those studies.

The finding of this study also revealed that ischemic stroke was predominant in 65.7% of total stroke victims. Previously related research found more prevalence of ischemic stroke as opposed to hemorrhagic stroke (6, 8, 22, 31, 38, 39). Contrastingly, hemorrhagic stroke was the most common in studies conducted at St. Paul's Teaching Hospital (61.3%) (40), Jimma (64.3%) (41) and Rwanda (65%) (42). This disparity could probably due to the difference in the study area, socioeconomic status, study design, and the prevalence of risk factors and co-morbidities, especially cardiovascular risk factors in St. Paul's Teaching Hospital, Jimma, and Rwanda. Moreover, 55.8% of the study participants had one or more co-morbid conditions before hospital admission due to stroke. Hypertension was the most prevalent co-morbid disease, which was diagnosed in nearly two-thirds of the study participants with co-morbid conditions. This is consistent with other studies in Ethiopia (40, 43), Tanzania and Sri Lanka (31, 44), which reported that hypertension was the most common co-morbid condition in patients with stroke. Furthermore, research performed by Fekadu *et al*. (9), Gebremariam & Yang (22), and Rymer (45), showed that high blood pressure and aging blood vessels constituted a major risk factor for stroke development. The likely explanation for the high prevalence of hypertension could be poor life style & public awareness and inaccessible of health facilities in developing countries. This study showed that almost one-third of the stroke patients complained about the weakness of the body on the right-side during admission. Previous studies in Ethiopia and Gambia have also shown that left side body weakness is the most frequently reported clinical presentation (9, 18). On the other hand, studies conducted by Greffie, *et al.(38),* Gedefa *et al*.(40), Masood *et al(46)*, and Patne *et al(37)* reported that patients with stroke had a motor symptom and focal neurological deficit at admission. The disparities probably could be the anatomic involvement, prior history of co-morbidities, and development of complications.

In FHSCH, Enalapril, nifedipine, and hydrochlorothiazide were the most frequently used past medication regimens in the management of co-morbidities. This finding is in line with various studies conducted on the management of hypertension with stroke (9).

ACE inhibitor-based regimens are widely used for the treatment of high blood pressure, which is the major modifiable risk factor for stroke. Reducing blood pressure, therefore, improves

outcomes for patients with stroke. Various epidemiological studies done by Lawes *et al*. (47), Elliott (48), Beckett *et al*. (49) revealed that showed that screening and lowering of both systolic blood pressure and diastolic blood pressure was the most effective goal for reducing cardiovascular disease and for preventing recurrence and stroke mortality. In our setting, the mean length of hospitalization was found to be 5.55 days which is comparable with other studies conducted by Temesgen *et al*. (6.7 days) (8) and Desita *et al*. (6 days) (33). Conversely, the mean length of hospital stay at FHSCH was shorter than the studies performed by Gedefa *et al.*(40), Gebreyohannes *et al*.(50), de Carvalho *et al. (51)*, and Walker *et al*. (44) which were 11.14, 11.55, 15.4 and19 days, respectively.

In this study setting, a significant proportion of stroke patients were died, referred to other health facilities, and discharged left against medical advice upon self and family requests rapidly. These disparities could be explained in various ways, such as availability of rehabilitation centers and other referral sites, treatment set up, costs for medication and beds, and quality of health care. In terms of management pattern, the combinations of acetylsalicylic acid and atorvastatin (65%) were used primarily in the ischemic stroke care in the study setting during hospitalization. This finding is in agreement with previous studies, which indicated that antiplatelet and dyslipidemias medications were frequently prescribed (8, 16, 52). The frequent usage might be due to the superior pharmacological effects of statins in reducing cardiovascular risks relative to other lipid-lowering agents, and antiplatelet is the most well-studied medications for the treatment of ischemic stroke (8, 53). However, this result contrasts with numerous studies performed by Bernheisel *et al.* (54) and Adams *et al.* (55), which stated that tissue plasminogen activator intravenous injection was primarily used in ischemic stroke treatment. This will possibly be attributed to the financial constraints and inaccessibility of tissue plasminogen activator in the study setting.

In 44.7% of hemorrhagic stroke patients, mannitol was used to reduce cerebral edema. Despite the effectiveness of mannitol in hemorrhagic stroke needs further investigations, different clinical trials done by Wang *et al*. (56), and Aminmansour *et al.* (57) reported that the initial use of mannitol seemed safe but might not reduce hemorrhage size. Cimetidine alone and the combinations of ceftriaxone, metronidazole, and cimetidine were the most widely used medications in the treatment of hospital-acquired infections and the prevention of stress-induced ulcer during hospitalization.

Regarding the treament outcome of stroke patients, the mortality rate was recorded in 16.9% of patients. The mortality rate in the study setting is relatively higher as compared to other studies by Gebremariam *et al.* (22), Kassaw (43), Greffie *et al.* (38), Temesgen *et al.* (8), Gebremariam *et al.* (22), and de Carvalho *et al.* (51). However, it is lower compared to studies at St. Paul'sTeaching Hospital (30.1%) (40) and Jimma University Hospital (37.87%) (41). This disparity could have been due to the high prevalence of hemorrhagic stroke, the difference in approach to treatment at St. Paul's Teaching Hospital and the Jimma University Hospital. In general, in our study, 53.8% of patients had good outcomes while, 46.2% had poor outcome (left with complication, referred to other facilities and died). The finding is in line with previous studies where 54.8% and 59.2% of patients with stroke had good outcome (8, 40).

Although respiratory failure secondary to aspiration pneumonia has not been significantly associated with treatment outcomes, it was a frequent contributor to death in our study setting. It is consistent with other hospital-based studies conducted at Gondar University Teaching Hospital (22) and China (52). Contrastingly, a study conducted in Rwanda found that initial presentation with severe stroke was the leading cause of death among patients with stroke (42).

The binary logistic regression model analysis found that the treatment outcome was significantly associated with educational status, the mean time from onset of symptoms to hospitalization, and types of stroke. This contrasts with the study in the Shashemene Referral Hospital, which showed that none of the independent variables were significantly associated with the outcome (8). This variation may be attributed to the small sample size (73 patients with stroke) in that study. The current research found that stroke patients with a high educational level have a better treatment outcome than patients with a low educational level. This result is similar to other previous research carried out at Nekemte Referral Hospital, which found that study participants with higher educational level have better treatment outcome (9). Educated participants may likely have improved access to information about their health status, better economic situation, better awareness about detecting and managing risk factors of stroke, and higher capacity to evaluate stressful events. Stroke patients with a low level of education are often believed to disregard self-management behavior and adherence to their medications. Consequently, the low educational status can contribute to the poor outcome of stroke patients.

The study showed that the meantime, from the onset of symptoms to hospitalization, was found to be 23.67 hours. This is in line with other studies conducted by Temesgen *et al.* (23.5 hours)

(8) and Fekadu *et al.* (24 hours) (9). Contrary to this finding, it was shorter than the studies conducted by Sagui, *et al.* (48 hours) (58) and Gebreyohannes, *et al.* (69.42 hours) (50), whereas it was delayed compared to other studies conducted by He Q *et al.* (8 hours) (52) and de Carvalho *et al.* (12.9 hours) (51). The difference might be due to the availability of transportation and nearby health facilities and knowledge of the patient for the clinical presentations of stroke. Patients who were delayed to come to the hospital had a poor treatment outcome compared to their counterparts. This finding is inconsistent with previous studies in Africa (22, 35, 59). It is advisable that hospital arrival within 3 hours of symptom onset to receive thrombolytic medications such as tissue plasminogen activator, to prevent disabilities and mortality from stroke (30). Delayed hospital admission creates difficulties in managing stroke and preventing complications in developing countries, including Ethiopia since early hours are crucial to delaying poor prognosis. Due to this reason, the majority of stroke patients in this study were not candidates for tissue plasminogen activators. Moreover, patients diagnosed with hemorrhagic stroke (AOR=2,68, 95% CI: 1,62-4,43, p<0,001) were found to have poor treatment outcome relative to ischemic stroke. This is in line with study done in Ethiopia and other African countries, which revealed hemorrhagic stroke was significantly more lethal than ischemic stroke (19, 34, 38, 60, 61).

Even though the presence of co-morbid conditions and development of complications were found to be significantly associated with poor treatment outcome in different studies (9) , it was not significantly associated with our finding. The difference could be attributed to the difference in sample size, the design of the study, and the sampling technique used to predict a significant association between poor treatment outcomes and contributing factors.

5. Limitation of the study

As this study was based on a retrospective chart review, the data obtained might be affected by the documentation culture of the hospital and the health care providers. Besides, a significant number of patients discharged against medical advice, some stroke victims may die before reaching the hospital, and the study was done in a single setting, which may affect the generalizability of the data to the entire population. Therefore, a prospective study in a multicenter setting would be better to accurately describe the clinical pattern and treatment outcome of stroke in Ethiopia.

6. Conclusion

Approximately half of the stroke patients had poor treatment outcomes. The most prevalently observed form of stroke in the study setting was ischemic stroke. Moreover, more than half of patients with stroke were suffering from co-morbid hypertension. During hospitalization, acetylsalicylic acid, and atorvastatin combination regimens were commonly used in stroke treatment. Further, education status, types of stroke, and the meantime from the onset of symptoms to admission were the predictors of treatment outcome. Therefore, early identification of stroke types and increasing patient awareness about stroke symptoms to lessen the delay of hospitalization beyond 24 hours are essential strategies to overcome stroke complications and mortality.

Abbreviations

FHSCH Felege Hiwot Specialized Comprehensive Hospital

RR Rate ratio

WHO World health organization

SPSS Statistical Package for the social sciences

AHA American heart association

Declarations

Ethical approval and consent to participate

Approval and permission were sought from Ethical Board of Debre Tabor University, College of Health Sciences.

Consent for Publication

Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have declared that no competing interests exist.

Author's contribution

BK contributes in developing idea, design of the study, statistical analysis and interpretation of the data and write up the proposal and manuscript. AE and MM were involved in proposal development, design of the study, and manuscript writing. AD and GTT contributed to the design of the study and edition of the manuscript. All authors approved the submitted version of the manuscript critically.

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References

1. Group GBoDSE. Global, regional, and country-specific lifetime risks of stroke, 1990 and 2016. *New England Journal of Medicine*. 2018;379(25):2429-37.
2. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. *Circulation research*. 2017;120(3):439-48.
3. Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors J, Culebras A, *et al*. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2013;44(7):2064-89.
4. Feigin VL, Krishnamurthi R, Bhattacharjee R, Parmar P, Theadom A, Hussein T, et al. New strategy to reduce the global burden of stroke. *Stroke*. 2015;46(6):1740-7.
5. Fekadu G, Chelkeba L, Kebede A. Burden, clinical outcomes and predictors of time to in hospital mortality among adult patients admitted to stroke unit of Jimma university medical center: a prospective cohort study. *BMC neurology*. 2019;19(1):213.
6. Mulat B, Mohammed J, Yeseni M, Alamirew M, Dermello M, Asemahagn MA. Magnitude of stroke and associated factors among patients who attended the medical ward of

Felege Hiwot Referral Hospital, Bahir Dar town, Northwest Ethiopia. *Ethiopian Journal of Health Development*. 2016;30(3):129-34.

7. Godoy DA, Piñero GR, Koller P, Masotti L, Di Napoli M. Steps to consider in the approach and management of critically ill patient with spontaneous intracerebral hemorrhage. World journal of critical care medicine. 2015;4(3):213.

8. Temesgen TG, Teshome B, Njogu P. Treatment outcomes and associated factors among hospitalized stroke patients at Shashemene Referral Hospital, Ethiopia. *Stroke research and treatment.* 2018;2018.

9. Fekadu G, Adola B, Mosisa G, Shibiru T, Chelkeba L. Clinical characteristics and treatment outcomes among stroke patients hospitalized to Nekemte referral hospital, western Ethiopia. *Journal of Clinical Neuroscience*. 2020;71:170-6.

10. Berkowitz AL. Stroke and the noncommunicable diseases: A global burden in need of global advocacy. *Neurology.* 2015;84(21):2183-4.

11. Chen X, Zhou L, Zhang Y, Yi D, Liu L, Rao W, et al. Risk factors of stroke in Western and Asian countries: a systematic review and meta-analysis of prospective cohort studies. *BMC public health*. 2014;14(1):776.

12. Katan M, Luft A, editors. Global burden of stroke. Seminars in neurology; 2018: Thieme Medical Publishers.

13. Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, et al. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet Neurology*. 2016;15(9):913-24.

14. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *The lancet.* 2012;380(9859):2197-223.

15. Feigin VL, Lawes CM, Bennett DA, Anderson CS. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. *The Lancet Neurology*. 2003;2(1):43-53.

16. Abbasi V, Amani F, Aslanian R, Hoseinkhani A, Zakeri A, Masoumi R. Epidemiological Study of Stroke in Ardabil, Iran: a Hospital Based-Study. *J Neurol Disord Stroke.* 2017;5(3):1128.

17. Mozaffarian D, Benjamin E, Go A, Arnett D, Blaha M, Cushman M, et al. Heart disease and stroke statistics-2016 update: a report from the American Heart Association. *Circulation*. 2016;133(4):e38.

18. Garbusinski JM, van der Sande MA, Bartholome EJ, Dramaix Ml, Gaye A, Coleman R, et al. Stroke presentation and outcome in developing countries: a prospective study in the Gambia. *Stroke.* 2005;36(7):1388-93.

19. Jowi J, Mativo P. Pathological sub-types, risk factors and outcome of stroke at the Nairobi hospital, Kenya. *East African medical journal*. 2008;85(12).

20. Owolabi MO, Arulogun O, Melikam S, Adeoye AM, Akarolo-Anthony S, Akinyemi R, et al. The burden of stroke in Africa: a glance at the present and a glimpse into the future. *Cardiovascular journal of Africa*. 2015;26(2 H3Africa Suppl):S27.

21. Al Khathaami AM, Al Bdah B, Alnosair A, Alturki A, Alrebdi R, Alwayili S, et al. Characteristics and Outcomes of Younger Adults with Embolic Stroke of Undetermined Source (ESUS): A Retrospective Study. *Stroke Research and Treatment*. 2019;2019.

22. Gebremariam SA, Yang HS. Types, risk profiles, and outcomes of stroke patients in a tertiary teaching hospital in northern Ethiopia. *eNeurologicalSci*. 2016;3:41-7.

23. Karthik L, Kumar G, Keswani T, Bhattacharyya A, Chandar SS, Rao KB. Protease inhibitors from marine actinobacteria as a potential source for antimalarial compound. *PloS one*. 2014;9(3).

24. Connor M, Thorogood M, Casserly B, Dobson C, Warlow C. Prevalence of stroke survivors in rural South Africa: results from the Southern Africa Stroke Prevention Initiative (SASPI) Agincourt field site. *Stroke.* 2004;35(3):627-32.

25. Bazaldua OV, Davidson DA, Kripalani S. eChapter 1. Health Literacy and Medication Use. In: DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, editors. Pharmacotherapy: A Pathophysiologic Approach, 9e. New York, NY: *The McGraw-Hill Companies*; 2014.

26. Collaborators GLRoS. Global, regional, and country-specific lifetime risks of stroke, 1990 and 2016. *New England Journal of Medicine*. 2018;379(25):2429-37.

27. Zenebe G, Alemayehu M, Asmera J. Characteristics and outcomes of stroke at Tikur Anbessa Teaching Hospital, Ethiopia. *Ethiopian medical journal*. 2005;43(4):251-9.

28. Girum T, Mesfin D, Bedewi J, Shewangizaw M. The Burden of Noncommunicable Diseases in Ethiopia, 2000–2016: Analysis of Evidence from Global Burden of Disease Study 2016 and Global Health Estimates 2016. *International Journal of Chronic Diseases*. 2020;2020.

29. Alemayehu B, Oli K. Stroke admission to Tikur Anbassa Teaching Hospital: with emphasis on stroke in the young. *Ethiopian Journal of Health Development*. 2002;16(3):309-15.

30. Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC, et al. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2015;46(10):3020-35.

31. Chang T, Gajasinghe S, Arambepola C. Prevalence of stroke and its risk factors in urban Sri Lanka: population-based study. *Stroke*. 2015;46(10):2965-8.

32. Chhabra M, Sharma A, Ajay KR, Rathore MS. Assessment of risk factors, cost of treatment, and therapy outcome in stroke patients: evidence from cross-sectional study. *Expert review of pharmacoeconomics & outcomes research.* 2019;19(5):575-80.

33. Desita ZT, Zewdu WM. CT scan patterns of stroke at the University of Gondar Hospital, North West Ethiopia. *Journal of Advances in Medicine and Medical Research*. 2015:882-8.

34. Alkali NH, Bwala SA, Akano AO, Osi-Ogbu O, Alabi P, Ayeni OA. Stroke risk factors, subtypes, and 30-day case fatality in Abuja, Nigeria. Nigerian medical journal: *journal of the Nigeria Medical Association.* 2013;54(2):129.

35. Komolafe MA, Komolafe EO, Fatoye F, Asaleye C, Famurewa O, Mosaku S, et al. Profile of stroke in Nigerians: a prospective clinical study. 2007.

36. Atadzhanov M, N Mukomena P, Lakhi S, A Ross O, F Meschia J. Stroke characteristics and outcomes of adult patients admitted to the University Teaching Hospital, Lusaka, Zambia. *The Open General and Internal Medicine Journal.* 2012;5(1).

37. Patne SV, Chintale KN. Study of clinical profile of stroke patients in rural tertiary health care Centre. *Int J Adv Med*. 2016;3(3):666-70.

38. Greffie ES, Mitiku T, Getahun S. Risk factors, clinical pattern and outcome of stroke in a referral hospital, Northwest Ethiopia. *Clin Med Res*. 2015;4(6):182-8.

39. Zhang F-L, Guo Z-N, Wu Y-H, Liu H-Y, Luo Y, Sun M-S, et al. Prevalence of stroke and associated risk factors: a population based cross sectional study from northeast China. *BMJ open*. 2017;7(9):e015758.

40. Gedefa B, Menna T, Berhe T, Abera H. Assessment of risk factors and treatment outcome of stroke admissions at St. Paul's teaching hospital, Addis Ababa, Ethiopia. *Journal of Neurology & Neurophysiology*. 2017;8(3):1-6.

41. Beyene HADT. A Two Year Retrospective Cross-Sectional Study on Prevalence, associated Factors and Treatment outcome among Patients admitted to Medical Ward (Stroke Unit) at Jimma University Medical Center, Jimma, South West, Ethiopia, 2018. 2018.

42. Nkusi AE, Muneza S, Nshuti S, Hakizimana D, Munyemana P, Nkeshimana M, et al. Stroke burden in Rwanda: A multicenter study of stroke management and outcome. *World neurosurgery*. 2017;106:462-9.

43. Kassaw A. Prevalence, nursing managements and patients‟ outcomes among stroke patients admitted to Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia, 2018: Addis Ababa Universty; 2018.

44. Walker RW, Rolfe M, Kelly PJ, George MO, James OF. Mortality and recovery after stroke in the Gambia. *Stroke.* 2003;34(7):1604-9.

45. Rymer MM. Hemorrhagic stroke: intracerebral hemorrhage. Mo Med. 2011;108(1):50-4.

46. Masood CT, Hussain M, Abbasi S. Clinical presentation, risk factors and outcome of stroke at a district level teaching hospital. *Journal of Ayub Medical College Abbottabad.* 2013;25(1-2):49-51.

47. Lawes CM, Bennett DA, Feigin VL, Rodgers A. Blood pressure and stroke: an overview of published reviews. *Stroke*. 2004;35(3):776-85.

48. Elliott WJ. Systemic hypertension. Current problems in cardiology. 2007;32(4):201-59.

49. Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, et al. Treatment of hypertension in patients 80 years of age or older. *New England Journal of Medicine*. 2008;358(18):1887-98.

50. Gebreyohannes EA, Bhagavathula AS, Abebe TB, Seid MA, Haile KT. In-hospital mortality among ischemic stroke patients in Gondar University Hospital: a retrospective cohort study. *Stroke Research and Treatment.* 2019;2019.

51. de Carvalho JJF, Alves MB, Viana GÁA, Machado CB, dos Santos BFC, Kanamura AH, et al. Stroke epidemiology, patterns of management, and outcomes in Fortaleza, Brazil: a hospital-based multicenter prospective study. *Stroke*. 2011;42(12):3341-6.

52. He Q, Wu C, Luo H, Wang Z-Y, Ma X-Q, Zhao Y-F, et al. Trends in in-hospital mortality among patients with stroke in China. *PloS one.* 2014;9(3).

53. Tirschwell DL, Ton TG, Ly KA, Van Ngo Q, Vo TT, Pham CH, et al. A prospective cohort study of stroke characteristics, care, and mortality in a hospital stroke registry in Vietnam. *BMC neurology*. 2012;12(1):150.

54. Bernheisel CR, Schlaudecker JD, Leopold K. Subacute management of ischemic stroke. American family physician. 2011;84(12).

55. Adams H, Adams R, Del Zoppo G, Goldstein LB. Guidelines for the early management of patients with ischemic stroke: 2005 guidelines update a scientific statement from the Stroke Council of the American Heart Association/American Stroke Association. *Stroke.* 2005;36(4):916-23.

56. Wang X, Arima H, Yang J, Zhang S, Wu G, Woodward M, et al. Mannitol and outcome in intracerebral hemorrhage: propensity score and multivariable intensive blood pressure reduction in acute cerebral hemorrhage trial 2 results. *Stroke.* 2015;46(10):2762-7.

57. Aminmansour B, Tabesh H, Rezvani M, Poorjafari H. Effects of Mannitol 20% on Outcomes in Nontraumatic Intracerebral Hemorrhage. *Adv Biomed Res*. 2017;6:75-.

58. Sagui E, M'Baye PS, Dubecq C, Ba Fall K, Niang A, Gning S, et al. Ischemic and hemorrhagic strokes in Dakar, Senegal: a hospital-based study. *Stroke*. 2005;36(9):1844-7.

59. Alemayehu CM, Birhanesilasie SK. Assessment of stoke patients: occurrence of unusually high number of haemorrhagic stroke cases in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. *Clin Med Res*. 2013;2(5):94-100.

60. Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. *The Lancet Neurology*. 2007;6(3):269-78.

61. Asefa G, Meseret S. CT and clinical correlation of stroke diagnosis, pattern and clinical outcome among stroke patients visting Tikur Anbessa Hospital. *Ethiopian medical journal*. 2010;48(2):117-22.

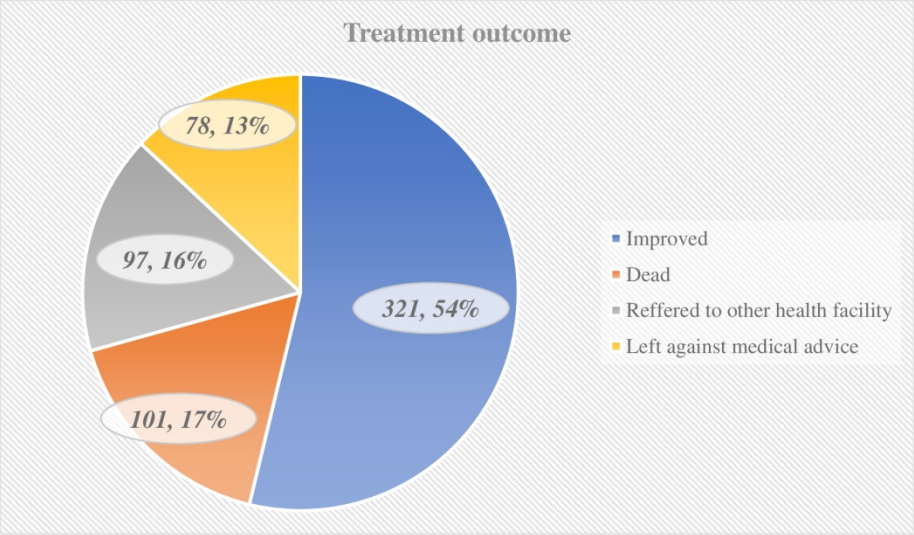
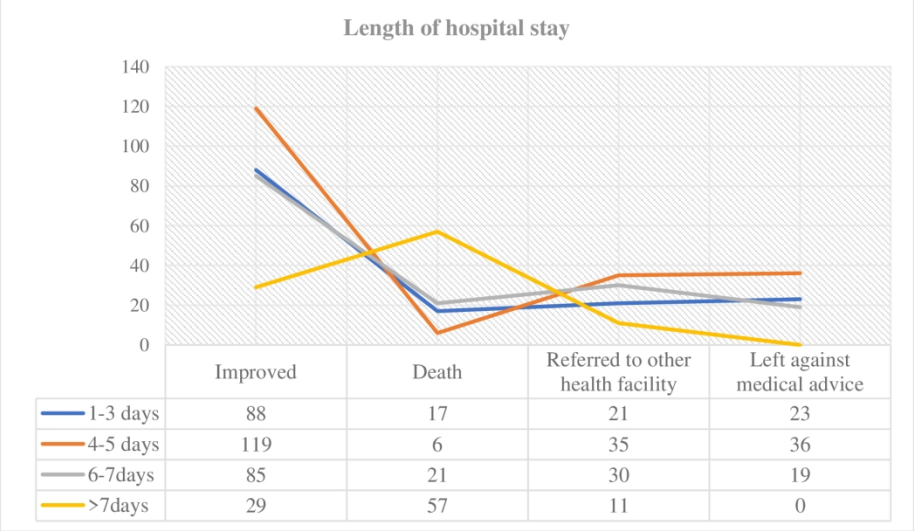


Figure 1: Distribution of stroke patients by their outcomes.



	Improved	Death	Referred to other health facility	Left against medical advice
1-3 days	88	17	21	23
4-5 days	119	6	35	36
6-7days	85	21	30	19
>7days	29	57	11	0

Figure 2: Distribution of patient outcomes by duration of hospital stay

152x199mm (300 x 300 DPI)

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Clinical pattern and predictors of stroke treatment outcome among hospitalized stroke patients at Felege Hiwot Comprehensive Specialized Hospital, North-west Ethiopia: A retrospective cross-sectional study

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Abstract

Objectives: This study aimed to assess the clinical pattern and predictors of stroke treatment outcomes among hospitalized patients in Felege Hiwot comprehensive specialized hospital (FHCSH) in northwest Ethiopia.

Design: A retrospective cross-sectional study

Setting: The study was conducted medical ward of FHCSH.

Participants: The medical records of 597 adult stroke patients were included in the study. All adult (≥18 years) stroke patients who had been admitted to the medical ward of FHSCH during 2015-2019 were included in the study. However, patients with incomplete medical records (i.e., incomplete treatment regimen and the status of the patients after treatment) were excluded in the study.

Results: In the present study, 317 (53.1%) were males, and the mean age of the study participants was 61.08 ± 13.76. About two-thirds of patients (392, 65.7%) were diagnosed with ischemic stroke. Regarding clinical pattern, about 203 (34.0%) of patients complained of right-side body weakness, and the major comorbid condition identified was hypertension (216, 64.9%). Overall, 276 (46.2%) of them had poor treatment outcomes, and 101 (16.9%) of them died. Patients who cannot read and write (AOR=42.89, 95% CI: 13.23-111.28, p<0.001), attend primary school (AOR=22.11, 95% CI: 6.98-55.99, p<0.001) and secondary school (AOR=4.20, 95% CI: 1.42-12.51, p<0.001), diagnosed with hemorrhagic stroke (AOR=2.68, 95% CI: 1.62-4.43, p<0.001) and delayed hospital arrival more than 24 hours (AOR= 2.92, 95% CI: 1.83-4.66, p=0.001) were the independent predictors of poor treatment outcome.

Conclusions: Approximately half of the stroke patients had poor treatment outcomes. Ischemic stroke was the most predominantly diagnosed stroke type. Education status, types of stroke, and the median time from onset of symptoms to hospitalization were the predictors of treatment outcome. Health education should be given to patients regarding clinical symptoms of stroke. In addition, local healthcare providers need to consider the above risk factors while managing stroke.

Strengths and limitations of this study

- This study has provided a real insight into the current treatment outcome and clinical pattern among hospitalized stroke patients in northwest Ethiopia.
- The study was conducted with a larger sample size, which can enhance the generalizability of the findings.
- Due to the retrospective nature, the data obtained might be affected by the documentation culture of the hospital and the health care providers.
- The study was done in a single setting, which may affect the generalizability of the data to the entire population.
- A prospective study in a multicenter setting would be better to accurately describe the clinical pattern and treatment outcome of stroke in Ethiopia.

Introduction

Stroke is one of the most common causes of morbidity and mortality in developing and developed countries in the 21st century. Despite geographical variation in the lifetime risk of stroke, one in four persons whose age is 25 years and above develops stroke during their lifetime (1). Currently, central nervous system infarction is defined as the brain, spinal cord, or retinal cell death attributable to ischemia in a specified vascular territory, based on neuropathological, neuroimaging, and clinical evidence of ischemic injury with symptoms persisting lasting 24 hours or longer after exclusion of other etiologies (2, 3). It is associated with severe medical conditions with high complications caused by reduced blood flow to the brain (4, 5). According to the 2016 report of the World Health Organization (WHO) and The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD), there were 33 million people with stroke with an incidence of 15 million and 5 million stroke deaths and 116.4 million disability-adjusted life-years (6, 7). The stroke burden will be doubled if the trend continues by the year 2030 (8). According to the American Heart Association (AHA) report, stroke can be classified into either ischemic due to blood clot in the artery that supplies the brain or hemorrhagic due to intracranial bleeding (9, 10). Various studies showed that ischemic stroke (52.5% - 87%) is the most frequently diagnosed type of stroke compared to hemorrhagic stroke (11, 12). Ischemic stroke is significantly less fatal than a hemorrhagic type of stroke, with 30-day case-fatality rates of 46.5% for hemorrhagic stroke compared to 9% to 23% in ischemic stroke (10). Worldwide, it is the second leading cause of mortality, accounting for 10% of all deaths, and killing 5.5million people each year (4, 13, 14).

In western countries, stroke is the third most common cause of morbidity and mortality next to cancer and coronary artery disease, with mortality rates of 17% - 34% in the first month of post-stroke days and 25% - 40% in the first 12 months (15, 16). Despite a 35% reduction in stroke mortality between 2001 and 2011, a stroke occurred in the United States at a rate of almost 800,000 per year and resulted in 128,932 deaths in 2011 (17). In developing countries, the incidence of stroke is rapidly increasing due to the high prevalence of hypertension, diabetes, obesity, smoking, and other non-communicable diseases (9, 18, 19), and 86% of all stroke associated deaths globally were occurred in low and middle-income countries (20). In Africa, the incidence of stroke-related morbidity and mortality is increasing due to the high prevalence of various risk factors such as hypertension, diabetes mellitus, smoking, older age, and alcohol (4, 16, 21-24).

A recent community survey undertaken in African countries showed stroke prevalence was between 200 and 300 per 100,000 populations (25), and its prevalence is increasing compared to the previous African stroke report (58–68 per 100,000) (26). In sub-Sahara African countries, the estimated lifetime risk of developing stroke was 11.8% (27). Further, despite comprehensive data regarding stroke burden in Ethiopia are scarce, observational studies showed that it is one of the commonest reasons for hospital admission (11, 28), and its incidence is increasing annually (29). As per the WHO stroke mortality report, stroke mortality was estimated to be 122–153.8 per 100,000 people in Ethiopia (30). Patients usually present late, and the standard of care is poor compared to developed countries; hence, rate of mortality is expected to be higher. However, data is scarce on clinical pattern and treatment outcome among stroke patients in North-west Ethiopia. Therefore, it is imperative that a lot has to be done to address the burden of stroke, risk factors, and mortality in Ethiopia (5, 24). Hence, the present study was aimed to assess the clinical pattern and predictors of stroke treatment outcomes among hospitalized stroke patients at the medical ward of FHSCH.

Methods

Study design and period

A retrospective cross-sectional study was conducted at FHSCH, Bahir Dar town, located 665 km from the North-west of Addis Ababa. The hospital provides different clinical services for 12 million population in the catchment area. It serves as a referral center for surrounding primary and general hospitals as well as a teaching hospital for Bahir Dar University. The data were collected from January to February 2020.

Eligibility criteria

All adult (≥18 years) stroke patients diagnosed to had stroke by Magnetic resonance imaging (MRI) or clinically and admitted to the medical ward of FHSCH during 2015-2019 were included in the study. However, patients with incomplete medical records (i.e., incomplete treatment regimen and treatment outcome) were excluded from the study.

Sample size and sampling techniques

All medical records of adult stroke patients who had been treated at FHSCH during 2015-2019 were eligible to the study. Based on the above eligibility criteria, 597 medial records with a confirmed stroke diagnosis (with a MRI or clinically) were included in the study. Since all eligible medical records of stroke patients were involved in the study, a consecutive sampling technique was employed.

Data collection instrument and procedure

Data abstraction format was adapted from various relevant literature and further modified based on the pretest result, undertaken in 5% of hospitalized stroke patients' medical cards. The format contained socio-demographic patient characteristics, clinically related information, previous, current, and discharge medications used, comorbidities, complications, time from onset of symptoms to hospitalization, length of hospital stay, type of stroke, and treatment outcome status. These data were collected from the patients' medical records. Six trained clinical pharmacists participated for the data collection.

Study variables

The treatment outcome was the outcome variable of the study, which could be influenced by the following independent variables. These are: age, sex, occupational status, types of stroke, length of hospital stay, the median time from onset of symptom to hospitalization and comorbidity status were the main independent variables of the study.

Data analysis

The collected data were entered and analyzed using SPSS version 25.0 statistical software. Descriptive statistics such as frequency, percentage, and mean with standard deviations were used to describe the independent variables. Multiple stepwise backward logistic regression analysis was done for a P value of < 0.25 to identify the independent predictors of treatment outcome. Statistical significance was set at $p < 0.05$.

Patient and public involvement

Patients were not involved in the design and conduction of this study. In addition, they were not invited to comment on the study design and consulted to develop patient relevant outcomes or

interpret the results. Further, they were not invited to contribute to the writing or editing of this document for readability or accuracy.

Operational Definition

Undetermined type of stroke: A type of stroke neither ischemic nor hemorrhagic, not clearly identified.

Improved or good treatment outcome: If the patient is discharged without complication or if patient discharge with improvement.

Poor treatment outcome: If the patient is discharged with complication, or referred to higher health facility, or left against medical advice or death.

Results

Socio-demographic characteristics of patients

In the present study, a total of 597 stroke patients' medical record were reviewed. Males were accounted for 317 (53.1%). The mean age of the study participants was 61.08 ± 13.76, with the age range of 25 - 98 years. Approximately, 252 (42.2%) patients were in the age range of 56–70 years. In addition, 191 (33.0%) and 152 (25.5%) patients attended primary and higher education, respectively. Regarding occupation, the majority (225, 37.7%) of them were farmers (Table 1).

Table 1: Socio-demographic characteristics of stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, North west Ethiopia

Variables	Categories	Frequency (%)			
		Ischemic stroke	Hemorrhagic stroke	Undetermined	Total
Sex	Male	217 (55.4)	89 (47.3)	11 (64.7)	317 (53.1)
	Female	175 (44.6)	99 (52.7)	6 (35.3)	280 (46.9)
Age	<40	20 (5.1)	27 (14.4)	2 (11.8)	49 (8.2)
	41-55	100 (25.5)	44 (23.4)	2 (11.8)	146 (24.5)
	56-70	168 (42.9)	81(43.1)	3 (17.6)	252 (42.2)
	>70	104 (26.5)	36 (19.1)	10 (58.8)	150 (25.1)
Occupation	Farmer	150 (38.3)	67(35.6)	8 (47.1)	225 (37.7)
	Employed	76 (19.4)	35 (18.6)	2 (11.8)	113 (18.9)
	Unemployed	34 (8.7)	20 (10.6)	1 (5.9)	55 (9.2)
	Housewife	85 (21.7)	58 (30.9)	4 (23.5)	147 (24.6)
	Retired	47 (12)	8 (4.3)	2 (11.8)	57 (9.5)
Educational status	Cannot read & write	93 (23.7)	53 (28.2)	6 (35.3)	152 (25.5)
	Primary	70 (17.9)	44 (23.4)	3 (17.6)	117 (19.6)
	Secondary	92 (23.5)	42 (22.3)	3 (17.6)	137 (22.9)
	Higher education	137 (34.9)	49 (26.1)	5 (29.4)	191 (32.0)
Residence	Urban	206 (52.6)	65 (34.6)	7 (41.2)	278 (46.6)
	Rural	186(7.4)	123 (5.4)	10 (58.8)	319 (53.4)

Clinical characteristics of stroke patients

About two-thirds of the patients (392, 65.7%) were diagnosed with ischemic stroke, while 188 (31.5%) had a hemorrhagic stroke. The mean time from the onset of symptoms until arrival at the hospital was 23.67 hours. In addition, the median length of hospital stay was 5.55 ±3.29 days, and more than half of the patients (345, 57.8 %) remained in the hospital for five or fewer days. Approximately, one-third of stroke patients complained right sided body weakness (203, 34.0 %), followed by left side body weakness (194, 32.5%). Moreover, more than half of them (333, 55.8%) had at least one comorbid condition, of which the most common comorbid conditions was hypertension (219, 64.9%), atrial fibrillation (114, 34.2%), and diabetes mellitus (83, 24.9%).

Hypertension was primarily prevalent in hemorrhagic stroke (158, 84 %) compared with patients with ischemic stroke (175, 44.6%). The most common complications of stroke were aspiration pneumonia (125, 64.4%) and elevated intracranial pressure (57, 29.4%) (Table 2).

Table 2: Clinical characteristics of stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, North west Ethiopia, 2020.

Variables	Category	Frequency (%)
Clinical presentation	Right side body weakness	203 (34.0)
	Left side body weakness	194 (32.5)
	Loss of consciousness	103 (17.3)
	Aphasia	97 (16.2)
Types of stroke	Ischemic stroke	392 (65.7)
	Hemorrhagic stroke	188 (31.5)
	Undetermined	17 (2.8)
Co-morbid status	Absent	264 (44.2)
	Present	333 (55.8)
Specific co-morbid conditions	Hypertension	216 (64.9)
	Atrial fibrillation	114 (34.2)
	Diabetes mellitus	83 (24.9)
	Congestive heart failure	37 (11.1)
	Epilepsy	33 (9.9)
	Hyperlipidemia	22 (6.6)
	Others*	31 (9.3)
Complication status	Absent	403 (67.5)
	Present	194 (32.5)
Specific complications	Aspiration pneumonia	125 (64.4)
	Increased ICP	57 (29.4)
	Septic shock	29 (14.9)
	Bed sore	23 (11.9)
	Others*	17 (8.8)
Time from onset to	<12 hours	117(19.6)

hospitalization	12-24 hours	204 (34.2)
	25-48hours	130 (21.8)
	>48hours	146 (24.5)
Length of hospital stay	≤ 5days	345 (57.8)
	> 5days	252 (42.2)
	Mean day	5.55 ±3.29 days

¥(Urinary tract infection, HIV/AIDs, lipoma, asthma, glaucoma, breast cancer), *(seizure, acute renal failure, diabetic ketoacidosis, hypokalemia, eclampsia), ICP: intracranial pressure

Management pattern of stroke patients

About half of patients with stroke (333, 55.8%) had a history of medication. During admission, 12.2% and 9.0% of patients were used enalapril and nifedipine, respectively. In addition, 352 (59%) stroke patients used combinations of acetylsalicylic acid and atorvastatin, while 103 (17.3%) patients received support/physiotherapy during hospitalization. Cimetidine (154, 25.8%) and a combination of metronidazole, ceftriaxone, and cimetidine 110 (18.4%) were the major concomitantly administered medications. Besides, acetylsalicylic acid 321 (53.8%), and acetylsalicylic acid and atorvastatin combination (97, 16.2%) were the frequent discharge medications, while nifedipine (147, 24.6%) was the most commonly concomitantly prescribed drug upon discharge. Further, 227 (38.0%) stroke patients were prescribed non-fractionated heparin for the prevention of deep venous thrombosis during hospitalization (Table 3).

Table 3: Management pattern among stroke patients hospitalized at Felege Hiwot Comprehensive Specialized Hospital, Northwest Ethiopia

Management practice	Categories	Frequency (N)	Percentage (%)
Past medication history	Enalapril	73	12.2
	Oral hypoglycemic	45	7.5
	Nifedipine	54	9.0
	Hydrochlorothiazide	38	6.4
	Nifedipine + hydrochlorothiazide	32	5.4
	Atorvastatin	27	4.5
	Phenytoin	24	4.0
	Insulin	15	2.5

	Others*	25	4.2
	None	264	44.2
Medications used to treat stroke during hospitalization	ASA + atorvastatin	352	59.0
	Supportive therapy/physiotherapy	103	17.3
	ASA	54	9.0
	Atorvastatin	52	8.7
	ASA+ atorvastatin + physiotherapy	36	6.0
Concomitantly administered drugs for hospitalized stroke patients	Cimetidine	154	25.8
	Ceftriaxone + metronidazole + cimetidine	110	18.4
	Heparin	71	11.9
	Ceftriaxone + metronidazole	52	8.7
	Mannitol	52	8.7
	Bisacodyl	43	7.2
	Metoprolol	34	5.7
	Warfarin	30	5.0
	Mannitol +ranitidine	32	5.4
	Ceftriaxone + cimetidine	19	3.2
Medications give at discharge for treatment of stroke	ASA	321	53.8
	ASA + atorvastatin	97	16.2
	Atorvastatin	78	13.1
Concurrently prescribed drug prescribed during discharge	Nifedipine	147	24.6
	Metoprolol	91	15.2
	Ranitidine	89	14.9
	Enalapril	82	13.7
	Omeprazole	41	6.9
	Phenytoin	28	4.7
	Digoxin	18	3.0

*(HAART, salbutamol, antibiotics and anticancer), ASA: acetylsalicylic acid (aspirin)

Treatment outcome and associated factors

As shown in Figure 1, more than half of the stroke patients (321, 53.8%) were discharged with good treatment outcome. Contrastingly, poor treatment outcome was observed in 276 (46.2%) patients. Of patients with poor treatment outcome, 16.9% were died.

Figure 1: Distribution of stroke patients by their outcomes.

More than half (57, 56.4%) of patients who died stayed more than seven days in the hospital. One hundred nineteen (30.1%), 36 (46.2%) and 36 (36.1%) good treatment outcome were left with medical advice and referred to other health facility and stayed 4-5 days in the hospital, respectively (Figure 2).

Figure 2: Distribution of patient outcomes by duration of hospital stay

The present study showed that the majority of patients (63, 62.4%) with a hemorrhagic stroke had fatal outcomes. On the other hand, more patients with ischemic stroke have been improved, referred to other healthcare facilities, and left to medical advice than patients with hemorrhagic stroke (Table 4).

Table 4: Distribution of 'patients' outcomes by stroke types

Patient outcomes	**Types of stroke**			**Total**
	Ischemic stroke	Hemorrhagic stroke	Undetermined	
Improved	238 (74.1%)	74 (23.1%)	9 (3.8%)	321 (53.8%
Referred to other health facility	65 (67%)	31 (32%)	1 (1%)	97 (16.2%)
Left against medical advice on self and family requests	57 (73.1%)	20 (25.6%)	1 (1.3%)	78 (13.1%)
Death	32 (31.7%)	63 (62.4%)	6 (5.9%)	101 (16.9%)
Total	392 (65.7%)	188 (31.5%)	17 (2.8%)	597 (100%)

The multivariate logistic regression model showed that educational status, types of stroke, and time from onset of symptoms to hospitalization were significant predictors of stroke treatment outcome.

Accordingly, patients who cannot read and write, attend primary and secondary school were about forty-three (AOR=42.89, 95% CI: 13.23-111.28, p<0.001), twenty-two (AOR=22.11, 95% CI: 6.98-55.99, p<0.001) and four (AOR=4.20, 95% CI: 1.42-12.51, p<0.001) times more likely to have a risk of poor treatment outcome, respectively. Besides, patients diagnosed with a hemorrhagic type of stroke were three (AOR=2.68, 95% CI: 1.62-4.43, p<0.001) times more likely to have poor treatment outcomes than ischemic stroke patients. Further, patients with time from symptom onset to hospitalization greater than 24 hours were three (AOR= 2.92, 95% CI: 1.83-4.66, p=0.001) times more likely to have poor treatment outcomes as compared to their counterparts (Table 5).

Table 5: Univariate and multivariate binary logistic regression analysis of predictors of treatment outcome

Variables	Categories	Treatment outcome		Univariate analysis	Multivariate analysis	
		Good	Poor	COR (95% CI)	AOR (95% CI)	P-Value
Sex	Male	162	155	1	1	
	Female	159	121	0.78 (0.58 - 1.01) *	0.86 (0.42 - 1.75)	0.679
Age	<40	12	37	1.73 (0.84 - 3.60) *	2.23 (0.79 - 6.31)	0.130
	41-55	98	48	0.28 (0.17 - 0.45) *	0.53 (0.16 - 0.69)	0.071
	57-70	157	95	0.34 (0.22 - 0.52) *	0.31 (0.16 - 0.61)	0.068
	>70	54	96	1	1	
Educational status	Cannot read & write	30	122	36.81 (19.81 - 68.42) *	42.89 (13.23 - 111.28)	<0.001
	Primary	33	84	23.04 (12.37 - 42.91) *	22.11(6.98-55.99)	<0.001
	Secondary	86	55	5.37 (2.99 - 9.66) *	4.20 (1.42 - 12.51)	<0.001
	Higher education	172	19	1	1	
Occupation	Farmer	82	143	4.88 (2.55 - 9.35) *	0.52 (0.14 - 1.94)	0.330
	Employed	102	11	0.30 (0.13 - 0.71) *	0.85 (0.27 - 2.72)	0.789

	Unemployed	30	25	2.33 (1.06 - 5.16) *	0.56 (0.14 - 2.28)	0.417
	House wife	65	82	3.53 (1.80 - 6.93) *	0.55 (0.14 - 2.06)	0.362
	Retired	42	15	1	1	
Types of stroke	Ischemic stroke	238	154	1	1	
	Hemorrhagic stroke	74	114	2.38 (1.67 - 3.40) *	2.68 (1.62 - 4.43)	<0.001
	Undetermined	9	8	1.37 (0.52 - 3.64)	0.35 (0.09 - 1.43)	0.143
Length of hospital stay	≤ 5days	207	138	1	1	
	> 5days	114	138	1.82 (1.31 - 2.52) *	1.70 (1.04 - 2.79)	0.056
Median time from onset of symptom to hospitalization	≤24hrs	207	114	1	1	
	>24hr	114	162	2.58 (1.85 - 3.59) *	2.92 (1.83 - 4.66)	0.001
Comorbidity status	Absence	166	178	1	1	
	Present	155	175	1.95 (1.40 - 2.71) *	1.38 (0.85 - 2.22)	0.192

AOR: Adjusted Odds ratio; COR: Crudes Odds ratio; CI: Confidence interval.
*Shows statistically significant at p-value < 0.25 during univariate analysis.

Discussion

A five-year retrospective cross-sectional study was conducted to describe the clinical patterns and treatment outcome of patients with stroke admitted to the medical ward of FHSCH. The mean age of patients in this study was 63.2±12.6 years, which is consistent with other previous hospital-based studies in Ethiopia where the mean age of stroke patients ranged from 56-66 years (11, 12, 22). The existence of multiple comorbidities such as hypertension, heart disease, and diabetes may be due to the high prevalence of stroke in the elderly. This is, however, lower than studies carried out in Iran (16) and USA (31) and higher than other studies conducted in Ethiopia (28, 30, 32), Sri Lanka (32), and India (33). This disparity may be due to differences in socio-demographic factors, sample size, and the method used in the studies. The prevalence of stroke in males was significantly higher than in females that are consistent with other cross-sectional studies in Ethiopia (12, 22, 34), Nigeria (35, 36), Kenya (19), Zambia (37), India(33, 38), Iran (16) and Sri Lanka (32). The high prevalence of stroke in males may be attributed to the increased habit of

drinking alcohol and smoking cigarettes. Other studies performed by Greffie *et al*. and Connor *et al.* (25, 39) showed that stroke is mainly diagnosed in females. This might be explained by the presence of different risk factors such as pregnancy-related disorders and the frequent use of contraceptives in females in those studies.

The finding of this study also revealed that ischemic stroke was predominant (65.7%). Previously related research found more prevalence of ischemic stroke as opposed to hemorrhagic stroke (9, 11, 22, 32, 39, 40). Contrastingly, hemorrhagic stroke was predominant in studies conducted at St. Paul's Teaching Hospital (61.3%) (41), Jimma (64.3%) (42), and Rwanda (65%) (43). This disparity could probably due to the difference in pattern of cardiovascular risk factors, and co-morbidities, especially cardiovascular risk factors in St. Paul's Teaching Hospital, Jimma, and Rwanda. Moreover, 55.8% of the study participants had one or more comorbid conditions, of which, hypertension was the most prevalent comorbid disease. This is consistent with other studies in Ethiopia (24, 41, 44), Tanzania, and Sri Lanka (32, 45), which reported that hypertension was the most common comorbid condition in patients with stroke. Furthermore, research performed by Fekadu *et al*. (12), Gebremariam & Yang (22), and Rymer (46), showed that high blood pressure and aging blood vessels constituted a major risk factor for stroke development. The likely explanation for the high prevalence of hypertension could be poor lifestyle & public awareness and inaccessible health facilities in developing countries. This study showed that almost one-third of the stroke patients complained right-sided body weakness. Previous studies in Ethiopia and Gambia have also shown that left side body weakness is the most frequently reported clinical presentation (12, 18). On the other hand, studies conducted by Greffie *et al* (39), Gedefa *et al* (41), Masood *et al* (47), and Patne *et al* (38) reported that patients with stroke had motor-related symptom and focal neurological deficit. This disparity probably could be due to different site of infarction.

In FHSCH, enalapril, nifedipine, and hydrochlorothiazide were the most frequently used past medication before patients admitted to the hospital. This finding is in line with various studies conducted on the management of hypertension with stroke (12).

ACE inhibitor and diuretics are widely used for the treatment of high blood pressure, which is the major modifiable risk factor for stroke. Reducing blood pressure, therefore, improves outcomes for patients with stroke. Various epidemiological studies done by Lawes *et al* (48), Elliott (49), Beckett *et al* (50) revealed that screening and lowering of both systolic blood pressure and diastolic

blood pressure was the most effective goal for reducing cardiovascular disease and for preventing recurrence and stroke mortality. In our setting, the mean length of hospitalization was found to be 5.6 days, which is comparable with other studies conducted by Temesgen *et al* (6.7 days) (11) and Desita *et al* (6 days) (34). Conversely, the mean length of hospital stay at FHSCH was shorter than the studies performed by Gedefa *et al* (41), Gebreyohannes *et al* (51), de Carvalho *et al* (52), and Walker *et al* (45), which were 11.14, 11.55, 15.4 and 19 days, respectively.

In this study setting, a significant proportion of stroke patients were died, referred to other health facilities, and discharged left against medical advice upon self and family requests rapidly. These disparities could be explained in various ways, such as availability of rehabilitation centres and other referral sites, treatment set up, costs for medication and beds, and quality of health care. In terms of management pattern, the combinations of acetylsalicylic acid and atorvastatin (65%) were used primarily in the ischemic stroke care in the study setting during hospitalization. This finding is in agreement with previous studies, which indicated that antiplatelet and dyslipidemias medications were frequently prescribed (11, 16, 53). The frequent usage might be due to the superior pharmacological effects of statins in reducing cardiovascular risks relative to other lipid-lowering agents, and antiplatelet is the most well-studied medications for the treatment of ischemic stroke (11, 54). However, this result contrasts with numerous studies performed by Bernheisel *et al* (55) and Adams *et al* (56), which stated that tissue plasminogen activator intravenous injection was primarily used in ischemic stroke treatment. This will possibly be attributed to the financial constraints and inaccessibility of tissue plasminogen activator in the study setting.

Although the effectiveness of mannitol in hemorrhagic stroke needs further investigations, 44.7% of hemorrhagic stroke patients used mannitol to reduce cerebral edema. In 44.7% of hemorrhagic stroke patients, mannitol was used to reduce cerebral edema. This is inline with different clinical trials done by Wang *et al* (57) and Aminmansour *et al* (58) which reported that the initial use of mannitol at early stage seemed safe but might not reduce haemorrhage size. Cimetidine alone and the combinations of ceftriaxone, metronidazole, and cimetidine were the most widely used medications in the treatment of hospital-acquired infections and the prevention of stress-induced ulcer during hospitalization.

Regarding the treatment outcome of stroke patients, the mortality rate was 16.9%. The rate is relatively higher than studies by Gebremariam *et al* (22), Kassaw (44), Greffie *et al* (39), Temesgen *et al* (11), Gebremariam *et al* (22), and de Carvalho *et al* (52). However, it is lower compared to

studies conducted at St. Paul'sTeaching Hospital (30.1%) (41) and Jimma University Hospital (37.87%) (42). This disparity could be due to the different rate of hemorrhagic stroke condition, treatment pattern and comorbid conditions. In general, in our study, 53.8% of stroke patients had good outcomes while 46.2% had poor outcome (left with complication and died). The finding is in line with previous studies, where 54.8% and 59.2% of stroke patients had good outcome (11, 41).

Although respiratory failure secondary to aspiration pneumonia has not been significantly associated with treatment outcomes, it was a frequent contributor to death in our study setting. It is consistent with other hospital-based studies conducted at Gondar University Teaching Hospital (22) and China (53). Contrastingly, a study conducted in Rwanda found that initial presentation with severe stroke was the leading cause of death among patients with stroke (43).

The binary logistic regression model analysis found that the treatment outcome was significantly associated with educational status, the time from the onset of symptoms to hospitalization, and types of stroke. This contrasts with the study in the Shashemene Referral Hospital, which showed that none of the independent variables was significantly associated with the outcome (11). This variation may be attributed to the small sample size (73 patients with stroke) in that study. The current research found that stroke patients with a high educational level have a better treatment outcome than patients with a low educational level. This result is similar to other previous research carried out at Nekemte Referral Hospital, which found that study participants with higher educational levels have better treatment outcomes (12). Educated participants may likely have improved access to information about their health status, better economic situation, better awareness about detecting and managing risk factors of stroke, and higher capacity to evaluate stressful events. Stroke patients with a low level of education are often believed to disregard self-management behavior and adherence to their medications. Consequently, the low educational status can contribute to the poor outcome of stroke patients.

The study showed that the meantime, from the onset of symptoms to hospitalization, was found to be 23.67 hours. This is in line with other studies conducted by Temesgen *et al* (23.5 hours) (11) and Fekadu *et al* (24 hours) (12). Contrary to this finding, it was shorter than the studies conducted by Sagui *et al* (48 hours) (59) and Gebreyohannes *et al* (69.42 hours) (51). In contrast, it was delayed compared to other studies conducted by He Q *et al* (8 hours) (53) and de Carvalho *et al* (12.9 hours) (52). The difference might be due to the availability of transportation and nearby

health facilities and knowledge of the patient for the clinical presentations of stroke. Patients who were delayed to come to the hospital had a poor treatment outcome compared to their counterparts. This finding is inconsistent with previous studies in Africa (22, 36, 60). It is advisable that hospital arrival within 3 hours of symptom onset to receive thrombolytic medications such as tissue plasminogen activator, to prevent disabilities and mortality from stroke (31). Delayed hospital admission creates difficulties in managing stroke and preventing complications in developing countries, including Ethiopia since early hours are crucial to delaying poor prognosis. Due to this reason, the majority of stroke patients in this study were not candidates for tissue plasminogen activators. Moreover, patients diagnosed with hemorrhagic stroke (AOR=2,68, 95% CI: 1,62-4,43, p<0,001) were found to have poor treatment outcome relative to ischemic stroke. This is in line with study done in Ethiopia and other African countries, which revealed hemorrhagic stroke was significantly more lethal than ischemic stroke (19, 35, 39, 61, 62).

Even though the presence of comorbid conditions and the development of complications were found to be significantly associated with poor treatment outcome in another study (12), our study did not show this finding. The difference could be attributed to the difference pattern of comorbid conditions.

Conclusion and recommendations

Approximately half of the stroke patients had poor treatment outcome. The most common stroke type was ischemic stroke. In addition, more than half of the patients had comorbid hypertension condition. During hospitalization, acetylsalicylic acid and atorvastatin combination agents were commonly used in stroke treatment. Further, education status, types of stroke, and the time from the onset of symptoms to admission were predictors of treatment outcome. Early identification of stroke type, risk factors and increasing patient awareness about stroke symptoms are vital to overcome stroke complications and mortality. Therefore, comprehensive health education on stroke should be given to the general public and specifically to stroke patients, while local healthcare providers should consider the above risk factors while managing stroke patients.

Abbreviations

AHA American heart association

FHSCH Felege Hiwot Specialized Comprehensive Hospital

RR Rate ratio

SPSS Statistical Package for the social sciences

WHO World health organization

Ethical approval

The study was approved by the Ethical review board of Debre Tabor University, College of Health Sciences (Ref. No: DTU/RE/1/170/12). In addition, patient consent was waived by the Ethics Committee since the data was collected from medical records retrospectively. Patients' personnel information and clinical information were recorded by ensuring patient confidentiality. The study was conducted in accordance with the principles stated in the Declaration of Helsinki.

Consent for Publication: Not required

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors have declared that no competing interests exist.

Author's contribution

BK contributes in developing the idea, design of the study, statistical analysis, and interpretation of the data and write up the proposal and manuscript. AE and MM were involved in proposal development, design of the study, and manuscript writing. AD and GTT contributed to the design of the study and edition of the manuscript. All authors approved the submitted version of the manuscript critically.

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References

1. Group GBoDSE. Global, regional, and country-specific lifetime risks of stroke, 1990 and 2016. New England Journal of Medicine. 2018;379(25):2429-37.
2. Feigin VL, Norrving B, Mensah GA. Global burden of stroke. Circulation research. 2017;120(3):439-48.
3. Sacco RL, Kasner SE, Broderick JP, Caplan LR, Connors J, Culebras A, et al. An updated definition of stroke for the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(7):2064-89.
4. Feigin VL, Krishnamurthi R, Bhattacharjee R, Parmar P, Theadom A, Hussein T, et al. New strategy to reduce the global burden of stroke. Stroke. 2015;46(6):1740-7.
5. Fekadu G, Chelkeba L, Kebede A. Burden, clinical outcomes and predictors of time to in hospital mortality among adult patients admitted to stroke unit of Jimma university medical center: a prospective cohort study. BMC neurology. 2019;19(1):213.
6. Katan M, Luft A, editors. Global burden of stroke. Seminars in neurology; 2018: Thieme Medical Publishers.
7. Feigin VL, Roth GA, Naghavi M, Parmar P, Krishnamurthi R, Chugh S, et al. Global burden of stroke and risk factors in 188 countries, during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet Neurology. 2016;15(9):913-24.
8. Murray CJ, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, et al. Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. The lancet. 2012;380(9859):2197-223.
9. Mulat B, Mohammed J, Yeseni M, Alamirew M, Dermello M, Asemahagn MA. Magnitude of stroke and associated factors among patients who attended the medical ward of Felege Hiwot Referral Hospital, Bahir Dar town, Northwest Ethiopia. Ethiopian Journal of Health Development. 2016;30(3):129-34.
10. Godoy DA, Piñero GR, Koller P, Masotti L, Di Napoli M. Steps to consider in the approach and management of critically ill patient with spontaneous intracerebral hemorrhage. World journal of critical care medicine. 2015;4(3):213.
11. Temesgen TG, Teshome B, Njogu P. Treatment outcomes and associated factors among hospitalized stroke patients at Shashemene Referral Hospital, Ethiopia. Stroke research and treatment. 2018;2018.

12. Fekadu G, Adola B, Mosisa G, Shibiru T, Chelkeba L. Clinical characteristics and treatment outcomes among stroke patients hospitalized to Nekemte referral hospital, western Ethiopia. Journal of Clinical Neuroscience. 2020;71:170-6.

13. Berkowitz AL. Stroke and the noncommunicable diseases: A global burden in need of global advocacy. Neurology. 2015;84(21):2183-4.

14. Chen X, Zhou L, Zhang Y, Yi D, Liu L, Rao W, et al. Risk factors of stroke in Western and Asian countries: a systematic review and meta-analysis of prospective cohort studies. BMC public health. 2014;14(1):776.

15. Feigin VL, Lawes CM, Bennett DA, Anderson CS. Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. The Lancet Neurology. 2003;2(1):43-53.

16. Abbasi V, Amani F, Aslanian R, Hoseinkhani A, Zakeri A, Masoumi R. Epidemiological Study of Stroke in Ardabil, Iran: a Hospital Based-Study. J Neurol Disord Stroke. 2017;5(3):1128.

17. Mozaffarian D, Benjamin E, Go A, Arnett D, Blaha M, Cushman M, et al. Heart disease and stroke statistics-2016 update: a report from the American Heart Association. Circulation. 2016;133(4):e38.

18. Garbusinski JM, van der Sande MA, Bartholome EJ, Dramaix Ml, Gaye A, Coleman R, et al. Stroke presentation and outcome in developing countries: a prospective study in the Gambia. Stroke. 2005;36(7):1388-93.

19. Jowi J, Mativo P. Pathological sub-types, risk factors and outcome of stroke at the Nairobi hospital, Kenya. East African medical journal. 2008;85(12).

20. Owolabi MO, Arulogun O, Melikam S, Adeoye AM, Akarolo-Anthony S, Akinyemi R, et al. The burden of stroke in Africa: a glance at the present and a glimpse into the future. Cardiovascular journal of Africa. 2015;26(2 H3Africa Suppl):S27.

21. Al Khathaami AM, Al Bdah B, Alnosair A, Alturki A, Alrebdi R, Alwayili S, et al. Characteristics and Outcomes of Younger Adults with Embolic Stroke of Undetermined Source (ESUS): A Retrospective Study. Stroke Research and Treatment. 2019;2019.

22. Gebremariam SA, Yang HS. Types, risk profiles, and outcomes of stroke patients in a tertiary teaching hospital in northern Ethiopia. eNeurologicalSci. 2016;3:41-7.

23. Karthik L, Kumar G, Keswani T, Bhattacharyya A, Chandar SS, Rao KB. Protease inhibitors from marine actinobacteria as a potential source for antimalarial compound. PloS one. 2014;9(3).

24. Fekadu G, Chelkeba L, Kebede A. Risk factors, clinical presentations and predictors of stroke among adult patients admitted to stroke unit of Jimma university medical center, south west Ethiopia: prospective observational study. BMC neurology. 2019;19(1):1-11.

25. Connor M, Thorogood M, Casserly B, Dobson C, Warlow C. Prevalence of stroke survivors in rural South Africa: results from the Southern Africa Stroke Prevention Initiative (SASPI) Agincourt field site. Stroke. 2004;35(3):627-32.

26. Bazaldua OV, Davidson DA, Kripalani S. eChapter 1. Health Literacy and Medication Use. In: DiPiro JT, Talbert RL, Yee GC, Matzke GR, Wells BG, Posey LM, editors. Pharmacotherapy: A Pathophysiologic Approach, 9e. New York, NY: The McGraw-Hill Companies; 2014.

27. Collaborators GLRoS. Global, regional, and country-specific lifetime risks of stroke, 1990 and 2016. New England Journal of Medicine. 2018;379(25):2429-37.

28. Zenebe G, Alemayehu M, Asmera J. Characteristics and outcomes of stroke at Tikur Anbessa Teaching Hospital, Ethiopia. Ethiopian medical journal. 2005;43(4):251-9.

29. Girum T, Mesfin D, Bedewi J, Shewangizaw M. The Burden of Noncommunicable Diseases in Ethiopia, 2000–2016: Analysis of Evidence from Global Burden of Disease Study 2016 and Global Health Estimates 2016. International Journal of Chronic Diseases. 2020;2020.

30. Alemayehu B, Oli K. Stroke admission to Tikur Anbassa Teaching Hospital: with emphasis on stroke in the young. Ethiopian Journal of Health Development. 2002;16(3):309-15.

31. Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC, et al. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2015;46(10):3020-35.

32. Chang T, Gajasinghe S, Arambepola C. Prevalence of stroke and its risk factors in urban Sri Lanka: population-based study. Stroke. 2015;46(10):2965-8.

33. Chhabra M, Sharma A, Ajay KR, Rathore MS. Assessment of risk factors, cost of treatment, and therapy outcome in stroke patients: evidence from cross-sectional study. Expert review of pharmacoeconomics & outcomes research. 2019;19(5):575-80.

34. Desita ZT, Zewdu WM. CT scan patterns of stroke at the University of Gondar Hospital, North West Ethiopia. Journal of Advances in Medicine and Medical Research. 2015:882-8.

35. Alkali NH, Bwala SA, Akano AO, Osi-Ogbu O, Alabi P, Ayeni OA. Stroke risk factors, subtypes, and 30-day case fatality in Abuja, Nigeria. Nigerian medical journal: journal of the Nigeria Medical Association. 2013;54(2):129.

36. Komolafe MA, Komolafe EO, Fatoye F, Asaleye C, Famurewa O, Mosaku S, et al. Profile of stroke in Nigerians: a prospective clinical study. 2007.

37. Atadzhanov M, N Mukomena P, Lakhi S, A Ross O, F Meschia J. Stroke characteristics and outcomes of adult patients admitted to the University Teaching Hospital, Lusaka, Zambia. The Open General and Internal Medicine Journal. 2012;5(1).

38. Patne SV, Chintale KN. Study of clinical profile of stroke patients in rural tertiary health care Centre. Int J Adv Med. 2016;3(3):666-70.

39. Greffie ES, Mitiku T, Getahun S. Risk factors, clinical pattern and outcome of stroke in a referral hospital, Northwest Ethiopia. Clin Med Res. 2015;4(6):182-8.

40. Zhang F-L, Guo Z-N, Wu Y-H, Liu H-Y, Luo Y, Sun M-S, et al. Prevalence of stroke and associated risk factors: a population based cross sectional study from northeast China. BMJ open. 2017;7(9):e015758.

41. Gedefa B, Menna T, Berhe T, Abera H. Assessment of risk factors and treatment outcome of stroke admissions at St. Paul's teaching hospital, Addis Ababa, Ethiopia. Journal of Neurology & Neurophysiology. 2017;8(3):1-6.

42. Beyene HADT. A Two Year Retrospective Cross-Sectional Study on Prevalence, associated Factors and Treatment outcome among Patients admitted to Medical Ward (Stroke Unit) at Jimma University Medical Center, Jimma, South West, Ethiopia, 2018. 2018.

43. Nkusi AE, Muneza S, Nshuti S, Hakizimana D, Munyemana P, Nkeshimana M, et al. Stroke burden in Rwanda: A multicenter study of stroke management and outcome. World neurosurgery. 2017;106:462-9.

44. Kassaw A. Prevalence, nursing managements and patients‟ outcomes among stroke patients admitted to Tikur Anbessa specialized hospital, Addis Ababa, Ethiopia, 2018: Addis Ababa Universty; 2018.

45. Walker RW, Rolfe M, Kelly PJ, George MO, James OF. Mortality and recovery after stroke in the Gambia. Stroke. 2003;34(7):1604-9.

46. Rymer MM. Hemorrhagic stroke: intracerebral hemorrhage. Mo Med. 2011;108(1):50-4.

47. Masood CT, Hussain M, Abbasi S. Clinical presentation, risk factors and outcome of stroke at a district level teaching hospital. Journal of Ayub Medical College Abbottabad. 2013;25(1-2):49-51.

48. Lawes CM, Bennett DA, Feigin VL, Rodgers A. Blood pressure and stroke: an overview of published reviews. Stroke. 2004;35(3):776-85.

49. Elliott WJ. Systemic hypertension. Current problems in cardiology. 2007;32(4):201-59.

50. Beckett NS, Peters R, Fletcher AE, Staessen JA, Liu L, Dumitrascu D, et al. Treatment of hypertension in patients 80 years of age or older. New England Journal of Medicine. 2008;358(18):1887-98.

51. Gebreyohannes EA, Bhagavathula AS, Abebe TB, Seid MA, Haile KT. In-hospital mortality among ischemic stroke patients in Gondar University Hospital: a retrospective cohort study. Stroke Research and Treatment. 2019;2019.

52. de Carvalho JJF, Alves MB, Viana GÁA, Machado CB, dos Santos BFC, Kanamura AH, et al. Stroke epidemiology, patterns of management, and outcomes in Fortaleza, Brazil: a hospital-based multicenter prospective study. Stroke. 2011;42(12):3341-6.

53. He Q, Wu C, Luo H, Wang Z-Y, Ma X-Q, Zhao Y-F, et al. Trends in in-hospital mortality among patients with stroke in China. PloS one. 2014;9(3).

54. Tirschwell DL, Ton TG, Ly KA, Van Ngo Q, Vo TT, Pham CH, et al. A prospective cohort study of stroke characteristics, care, and mortality in a hospital stroke registry in Vietnam. BMC neurology. 2012;12(1):150.

55. Bernheisel CR, Schlaudecker JD, Leopold K. Subacute management of ischemic stroke. American family physician. 2011;84(12).

56. Adams H, Adams R, Del Zoppo G, Goldstein LB. Guidelines for the early management of patients with ischemic stroke: 2005 guidelines update a scientific statement from the Stroke Council of the American Heart Association/American Stroke Association. Stroke. 2005;36(4):916-23.

57. Wang X, Arima H, Yang J, Zhang S, Wu G, Woodward M, et al. Mannitol and outcome in intracerebral hemorrhage: propensity score and multivariable intensive blood pressure reduction in acute cerebral hemorrhage trial 2 results. Stroke. 2015;46(10):2762-7.

58. Aminmansour B, Tabesh H, Rezvani M, Poorjafari H. Effects of Mannitol 20% on Outcomes in Nontraumatic Intracerebral Hemorrhage. Adv Biomed Res. 2017;6:75-.

59. Sagui E, M'Baye PS, Dubecq C, Ba Fall K, Niang A, Gning S, et al. Ischemic and hemorrhagic strokes in Dakar, Senegal: a hospital-based study. Stroke. 2005;36(9):1844-7.

60. Alemayehu CM, Birhanesilasie SK. Assessment of stoke patients: occurrence of unusually high number of haemorrhagic stroke cases in Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia. Clin Med Res. 2013;2(5):94-100.

61. Connor MD, Walker R, Modi G, Warlow CP. Burden of stroke in black populations in sub-Saharan Africa. The Lancet Neurology. 2007;6(3):269-78.

62. Asefa G, Meseret S. CT and clinical correlation of stroke diagnosis, pattern and clinical outcome among stroke patients visting Tikur Anbessa Hospital. Ethiopian medical journal. 2010;48(2):117-22.

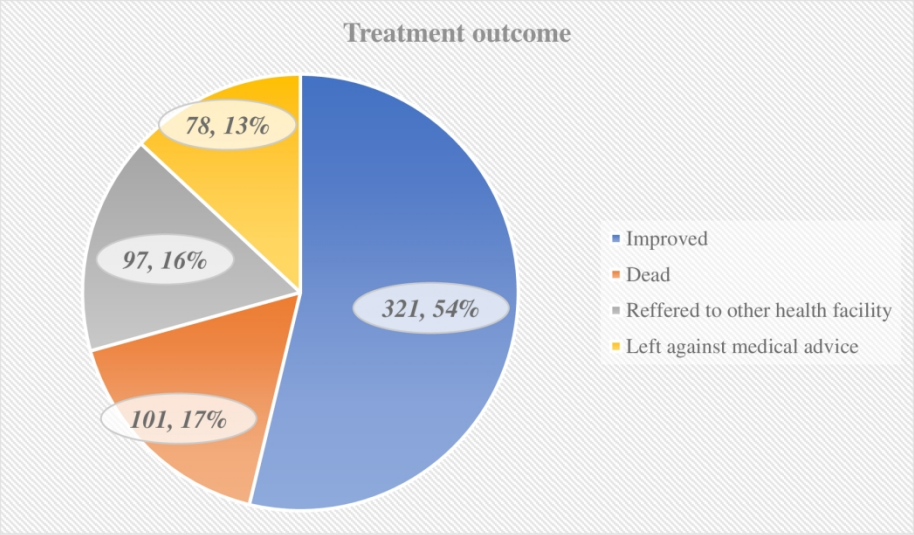
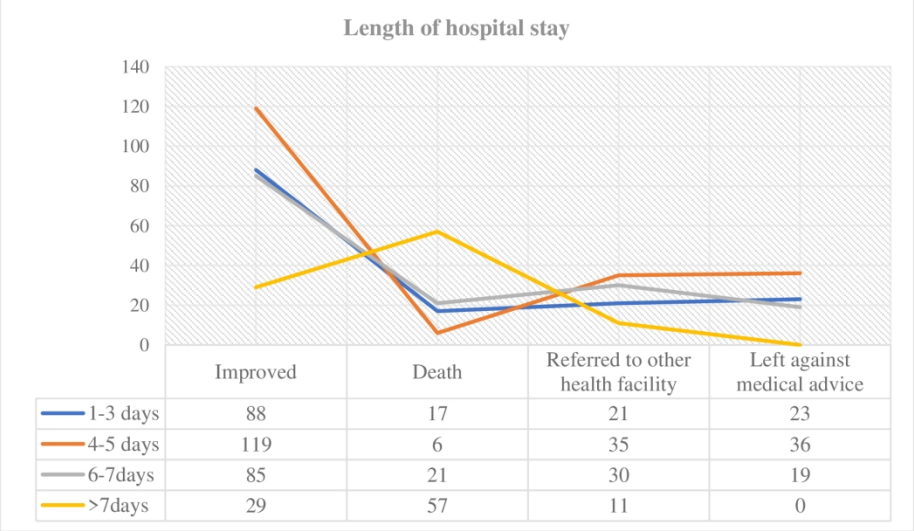


Figure 1: Distribution of stroke patients by their outcomes.



	Improved	Death	Referred to other health facility	Left against medical advice
1-3 days	88	17	21	23
4-5 days	119	6	35	36
6-7days	85	21	30	19
>7days	29	57	11	0

Figure 2: Distribution of patient outcomes by duration of hospital stay

152x199mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of cross-sectional studies

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			**1**
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1-4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	4
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	4
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	4
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	NA
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	NA
Bias	9	Describe any efforts to address potential sources of bias	*NA*
Study size	10	Explain how the study size was arrived at	5
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	5
		(*b*) Describe any methods used to examine subgroups and interactions	5
		(*c*) Explain how missing data were addressed	NA
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	NA
		(*e*) Describe any sensitivity analyses	NA
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	NA
		(c) Consider use of a flow diagram	NA
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	6
		(b) Indicate number of participants with missing data for each variable of interest	7
Outcome data	15*	Report numbers of outcome events or summary measures	11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	NA
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	NA
Discussion			13-17
Key results	18	Summarise key results with reference to study objectives	17
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	17
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	NA
Generalisability	21	Discuss the generalisability (external validity) of the study results	NA
Other information			17-18
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	18

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.