Original Article

SAGE Open Medicine

SAGE Open Medicine
Volume 11: 1–9

DOI: 10.1177/20503121221149537
journals.sagepub.com/home/smo
SAGE

In-hospital treatment outcomes of acute stroke and determinant factors in a teaching hospital in eastern Ethiopia

Fuad Adem[1], Behar Mohammed[2] and Shambel Nigussie[1]

Abstract

Objective: To assess the in-hospital mortality of acute stroke and determinant factors in a teaching hospital in eastern Ethiopia.

Method: A retrospective review of medical records of patients admitted to Hiwot Fana Specialized University Hospital was conducted. Adult patients aged 18 years and older with a diagnosis of either ischemic or hemorrhagic stroke were included. Data were analyzed using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Multiple logistic regression analysis was used to identify predictors of in-hospital mortality.

Result: A total of 112 patients with acute stroke were included in the study and 56.0% of them were of hemorrhagic stroke. The mean age was 60.32 years and 61.6% were male. The mean length of hospitalization and the mean time of presentation from symptoms onset were 4.85 days and 33.64 h, respectively. The in-hospital mortality was 36.8% for ischemic stroke and 27% for hemorrhagic stroke. Aspiration pneumonia (35.0%), cerebral edema (17%), and seizure (14.3%) were the most common complications occurring during hospitalization. Atrial fibrillation (adjusted odds ratio = 15.45, 95% confidence interval: 1.089–219.2; $p = 0.043$) was the independent predictor of in-hospital mortality.

Conclusion: Hemorrhagic stroke was predominant in the study sample. One-third of patients died in the hospital and the mortality rate was slightly higher in patients with ischemic stroke. Atrial fibrillation was the predominant risk factor for hospital mortality from acute stroke. There is a need to promote cardiovascular health, early recognition, and management of risk factors, and implement coordinated stroke care services to reduce premature death from stroke.

Keywords

Acute stroke, in-hospital mortality, eastern Ethiopia, a resource-limited setting

Date received: 05 August 2022; accepted: 19 December 2022

Introduction

A stroke is a neurological deficit resulting from an acute focal injury to the central nervous system.[1] It is the leading cause of death[2] and disability in the world.[3] The majority of stroke-related mortality and disability-adjusted life years occur in low- and middle-income countries (LMICs).[4]

Driven by a high prevalence of cardiovascular and metabolic risk factors coupled with limited access to primary and secondary prevention strategies, stroke continues to exert an enormous economic burden in LMICs. A systematic review that assessed the per-annum cost of stroke in LMIC identified that the highest estimated mean direct medical cost was $8424 US dollars in Nigeria and $416 in Senegal.[5] In South Africa, the average per-patient emergency department visit associated cost due to acute stroke ranges from $283,500 to $485,000 per year.[6,7] A prolonged hospital stay and severe stroke underlie the highest mean direct medical cost in developing countries.[5]

Stroke is a medical emergency and prompt evidence-based treatment has been shown to lower brain damage and

[1]Department of clinical pharmacy, Haramaya University, Haramaya, Oromia, Ethiopia
[2]Department of Nursing and Midwifery, Haramaya University, Haramaya, Oromia, Ethiopia

Corresponding author:
Fuad Adem, Department of clinical pharmacy, Haramaya University, Haramaya, Oromia, Ethiopia.
Email: fuadamoh2017@gmail.com

associated complications.[8] The success of an intervention relies on the time of presentation from symptom onset, early identification of stroke types, and quick initiation of effective treatment.[9–11] However, patients often present at healthcare facilities late and radiographic facilities are either not accessible or not affordable in LMIC.[10–14] These issues along with limited trained personnel in stroke management and some lifesaving drugs continue to be a challenge contributing to high stroke burden and poor patient outcomes in many resource-limited countries.

In Ethiopia, a few studies have been conducted on stroke.[15–19] However, no study has been conducted in the eastern region where the burden of stroke and cardiovascular disease risk factors could be different from other regions. Hence, this study aimed to assess in-hospital outcomes and associated factors in stroke patients admitted to Hiwot Fana Specialized University Hospital (HFSUH) in eastern Ethiopia

Methods

A retrospective cross-sectional study was conducted among consecutive patients with acute stroke hospitalized between October 2017 and October 2019 at HFSUH to assess in-hospital treatment outcomes of acute stroke and associated factors. HFSUH is a teaching hospital and is the largest referral center providing tertiary care for patients in eastern Ethiopia. The hospital is located in Harari Regional State, Harar Town, 526 KM east of Addis Ababa, the Capital of Ethiopia. The region had six hospitals (four government owned and two private), eight health centers, and 20 health posts. HFSUH provides inpatient and outpatient services for about 5.2 million people residing in the eastern part of the country. The hospital had major wards such as internal medicine, surgery, pediatrics, gynecology, and several clinics including tuberculosis, antiretroviral, ophthalmology, dermatology, and neurology clinic. HFSUH is not the only hospital where stroke cases were managed. The study was conducted at the neurology clinic of the hospital.

Adult patients aged 18 years and older with a diagnosis of either ischemic or hemorrhagic stroke were included. Patients with incomplete medical charts (incomplete treatments and outcomes), stroke-like symptoms, and transient ischemic attack were excluded from the study. The primary outcome of this study was in-hospital mortality from acute stroke. The effect of risk factors for in-hospital mortality such as age, gender, body temperature, alcohol use, and comorbidities such as hypertension, diabetes mellitus, heart diseases, and atrial fibrillation were assessed.

Sample size and sampling technique

All medical charts of adult patients with acute stroke treated at HFSUH during the last 2 years were eligible for the study. Based on the pre-defined eligibility criteria, medical charts of 112 confirmed acute stroke diagnoses (imaging or clinically) were consecutively included in the study.

Data collection

The data were collected using a structured data collection instrument. The content of the tool was reviewed by a senior consultant in internal medicine. The training was provided to data collectors and the tool was pre-tested on 5% of the medical chart. The patient medical chart was reviewed retrospectively and data on sociodemographic factors such as age, sex, education, mode of arrival to the hospital, length of time from symptom onset to admission, presenting symptoms, medical history, laboratory and diagnostic tests, medications given during hospitalization, in-hospital complications, length of hospital stay, discharge medications, and in-hospital treatment outcomes were collected. A formal letter of cooperation was submitted to the hospital administration and the neurology unit but written informed consent was waived by the ethics committee and was not obtained from the study participants as it was a retrospective study.

Statistical analyses

The collected clinical and sociodemographic information was entered and analyzed using SPSS version 21.0 (SPSS Inc., Chicago, IL, USA). Descriptive statistics were to summarize the characteristics of study participants. Bivariate analysis was done to explore factors associated with in-hospital outcomes and significant variables in bivariate analysis ($p \leqslant 0.25$) were selected for multivariable regression analysis to identify independent predictors of the in-hospital outcomes. A p value $\leqslant 0.05$ is considered significant in the multivariable regression analysis.

Result

Sociodemographic and clinical characteristics

Of the total ($n = 112$) patients included in the study, 56.0% had a hemorrhagic stroke. The mean (standard deviation (SD)) age was 60.32 (SD: 11.36) years and the time of presentation from symptom onset was 33.64 (SD: 15.7) h. The majority of the patients were male (61.6%) and 89.3% had no formal education. In all, 76 (67.9%) patients had hypertension, 42.9% had ischemic heart disease, and 33.9% had diabetes (Table 1). The common presenting symptoms were confusion ($n = 43$, 38.4%), arm paralysis ($n = 59$, 52.7%), altered speech ($n = 50$, 44.6%), headache ($n = 47$, 42%), and urinary incontinence ($n = 88$, 78.6%). In all, 25 (22.5%) patients had fecal incontinence, 43.8% had visual field defects, 10.7% had dysphagia, and 7.1% had facial palsy.

Initial assessment and investigation

The mean (SD) systolic blood pressure and diastolic blood pressure at hospitalization were 152.58 ± 24.52 mmHg and 102.31 ± 22.97 mmHg, respectively. The mean blood glucose at hospitalization was 172.22 ± 96.49 and 28.6% of the patients had elevated blood glucose (>180 mg/dl). 34.8%

Table 1. Sociodemographic and clinical characteristics of patients with acute stroke hospitalized at HFSUH, Eastern Ethiopia, 2019.

Variables		Acute ischemic stroke (*n*, %)	Acute hemorrhagic stroke (*n*, %)	Total (*n*, %)
Age (years)	<65	22 (44.9)	47 (74.6)	69 (61.6)
	⩾65	27 (55.1)	16 (25.4)	43 (38.4)
Sex	Male	26 (53.1)	43 (68.3)	69 (61.6)
	Female	23 (46.9)	20 (31.7)	43 (38.4)
Education	No formal education	41 (83.7)	59 (93.6)	100 (89.3)
	Primary education	2 (4.1)	2 (3.2)	4 (3.6)
	Secondary education	2 (4.1)	1 (1.6)	3 (2.7)
	Higher education	4 (8.2)	1 (1.6)	5 (4.5)
Mode of arrival	Ambulance	24 (48.9)	34 (54.0)	58 (51.8)
	Private car	8 (16.3)	7 (11.1)	15 (13.4)
	Taxi	17 (34.7)	22 (34.9)	39 (34.8)
GCS at hospitalization[20]	13–15	13 (26.5)	12 (19.05)	25 (22.3)
	9–12	7 (14.2)	14 (22.2)	21 (18.8)
	⩽8	29 (59.3)	37 (53.9)	66 (58.9)
Hypertension	Yes	35 (71.4)	41 (65.1)	76 (67.9)
	No	13 (26.5)	17 (27.0)	30 (26.8)
	Unknown	1 (2.0)	5 (7.9)	6 (5.4)
Ischemic heart disease	Yes	25 (51.0)	23 (36.5)	48 (42.9)
	No	6 (12.2)	20 (31.7)	26 (23.2)
	Unknown	18 (36.7)	20 (31.7)	38 (33.9)
Atrial fibrillation	Yes	8 (12.7)	3 (6.1)	11(9.8)
	No	13 (26.5)	22 (34.9)	35 (31.3)
	Unknown	28 (57.1)	38 (60.3)	66 (58.9)
Previous stroke or TIA	Yes	8 (16.3)	23 (36.5)	22 (19.6)
	No	16 (32.7)	6 (9.5)	31 (27.7)
	Unknown	25 (51.0)	34 (54.0)	59 (52.7)
Alcohol use	Yes	44 (89.8)	53 (84.1)	97 (86.6)
	No	4 (8.2)	8 (12.7)	12 (10.7)
	Unknown	1 (2.0)	2 (3.2)	3 (2.7)
Diabetes	Yes	19 (38.8)	19 (30.2)	38 (33.9)
	No	27 (55.1)	37 (58.7)	64 (57.1)
	Unknown	3 (6.1)	7 (11.1)	10 (8.9)
Family history of stroke	Yes	4 (8.2)	4 (6.3)	8 (7.1)
	No	9 (18.4)	14 (22.2)	23 (20.5)
	Unknown	36 (73.5)	45 (71.4)	81 (72.3)
History of heart failure	Yes	5 (10.2)	3 (4.8)	8 (7.1)
	No	8 (16.3)	20 (31.7)	28 (25.0)
	Unknown	36 (73.5)	40 (63.5)	76 (67.9)
HIV	Yes	2 (4.1)	4 (6.3)	6 (5.4)
	No	44 (89.8)	57 (90.5)	101 (90.2)
	Unknown	3 (6.1)	2 (3.2)	5 (4.5)
Smoking history	No smoking history	17 (37.0)	25 (37.9)	42 (37.5)
	Ex-smoker	14 (28.6)	13 (20.6)	27 (24.1)
	Current smoker	18 (39.1)	27 (40.9)	45 (40.2)
Chronic liver disease	Yes	6 (12.2)	3 (4.7)	9 (8.04)
	No	43 (87.8)	60 (95.2)	103 (92.0)
Pulmonary tuberculosis	Yes	5 (10.2)	9 (14.3)	14 (12.5)
	No	44 (89.8)	54 (85.7)	98 (87.5)

GCS, Glasgow Coma Scale; HFSUH, Hiwot Fana Specialized University Hospital; HIV, human immunodeficiency virus; TIA, transient ischemic attack.

Table 2. Initial assessment and investigation in patients with acute stroke hospitalized at HFSUH, Eastern Ethiopia, 2019.

Variables		Acute ischemic stroke (*n*, %)	Acute hemorrhagic stroke (*n*, %)	Total (*n*, %)
Systolic blood pressure (in mmHg)[21]	<120	2 (4.1)	8 (12.7)	10 (8.0)
	120–139	3 (6.1)	2 (3.2)	5 (4.5)
	140–159	10 (20.4)	22 (34.9)	32 (28.6)
	160–185	28 (57.1)	15 (24.0)	43 (68.3)
	⩾185	6 (12.2)	16 (0 .0)	22 (19.6)
Diastolic blood pressure (in mmHg)	⩽60	4 (8.0)	3 (5.0)	7 (6.0)
	61–79	4 (8.0)	6 (9.0)	10 (8.0)
	80–89	10 (20.4))	3 (4.8)	13 (12.0)
	90–99	9 (18.0)	18 (29.0)	27 (24.1)
	100–110	4 (8.0)	15 (24.0)	19 (17.0)
	⩾110	18 (36.0)	18 (29.0)	36 (32.0)
Body glucose (in mg/dl)	60–140	27 (55.0)	34 (54.0)	61 (54.5)
	140–180	5 (10.2)	14 (22.2)	19 (16.9)
	>180	17 (35.0)	15 (24.0)	32 (28.6)
Oxygen saturation (in %)	⩾90	27 (55.0)	46 (73.0)	73 (65.0)
	<90	22 (45.0)	17 (27.0)	39 (34.8)
Body temperature (in °C)	<36.5	5 (10.2)	2 (3.0)	7 (6.0)
	36.5–37.5	23 (47.0)	38 (60.3)	61 (54.5)
	>37.5	21 (43.0)	23 (36.5)	44 (39.3)
Brain imaging (CT)	Yes	49 (100.0)	63 (56.0)	112 (100.0)
	No	0 (0.0)	0 (0.0)	(0.0)
Serum troponin (in ng/dl)	⩾0.01	11 (22.0)	8 (13.0)	19 (17.0)
	<0.01	38 (78.0)	55 (87.0)	93 (83.0)
Serum creatinine (Scr) (in mg/dl)	<0.6	6 (12.0)	5 (7.9)	11 (9.8)
	0.6–12	14 (28.6)	19 (30.2)	33 (29.5)
	⩾1.2	29 (59.0)	39 (61.9)	68 (60.7)
Coagulation test				
International normalized ratio	<1	7 (14.0)	11 (17.0)	18 (16.0)
	⩾1	5 (10.0)	16 (25.0)	21 (19.0)
aPTT (in a second)	<30	4 (8.0)	3 (5.0)	7 (6.0)
	30–40	8 (16.0)	24 (38.0)	32 (28.0)
	41–60	0 (0.0)	2 (3.2)	2 (1.8)
Total cholesterol (in mg/dl)	<200	16 (33.0)	30 (48.0)	46 (41.0)
	⩾200	0 (0.0)	0 (0.0)	0 (0.0)
LDL cholesterol (in mg/dl)	<100	18 (37.0)	28 (44.0)	46 (41.0)
	⩾100	0 (0.0)	0 (0.0)	0 (0.0)
HDL cholesterol (in mg/dl)	<40	2 (4.0)	1 (2.0)	3 (2.7)
	⩾60	33 (67.0)	10 (16.0)	43 (38.0)
Triglyceride (in mg/dl)	<150	2 (4.0)	7 (11.0)	9 (8.0)
	>150	14 (29.0)	23 (36.0)	37 (33.0)

aPTT, activated partial thromboplastin time; CT, computed tomography; °C, degree Celsius; HDL, high-density lipoprotein; HFSUH, Hiwot Fana Specialized University Hospital; LDL, low-density lipoprotein; mg/dl, milligram per deciliter; mmHG, millimeter of mercury; ng/dl, nano gram per deciliter.

had low oxygen saturation (<90%) and 39.3% had elevated body temperature (>37.5°C). Baseline imaging (computed tomographic scan) was done for all patients and serum cholesterol was measured in 46 (41.15%) patients. The mean total cholesterol, low-density lipoprotein (LDL), high-density lipoprotein (HDL), and triglyceride were 178.76 (11.56 mg/dl), 87.35 ± 2.74, 60.69 ± 7.79, and 148.79 ± 22.87, respectively. In all patients, LDL was within optimum values (<100 mg/dl); a significant majority 38.0% of patients had high HDL (>60 mg/dl) and 33.0% had elevated (>150 mg/dl) triglyceride (Table 2).

In-hospital complications

The most common complication during hospitalization was aspiration pneumonia (35.0%), cerebral edema (17.0%), and seizure (14.3%). Four patients experienced ventricular tachycardia, seven encountered atrial fibrillation, and four experienced intra-cerebral hemorrhage (Table 3).

Treatment commenced during hospitalization

As a stroke unit is not available in the hospital, all patients were managed in the general medical wards. Of 49 (43.8%)

Table 3. In-hospital complications by stroke sub-types among patients hospitalized with acute stroke at HFSUH, Eastern Ethiopia, 2019.

In-hospital complication	Stroke sub-types		Total (*n*, %)
	Ischemic stroke (*n*, %)	Hemorrhagic stroke (*n*, %)	
Aspiration pneumonia	13 (26.5)	26 (41.3)	39 (35.0)
Seizure	14 (28.6)	2 (3.2)	16 (14.3)
Cerebral edema	13 (26.5)	6 (9.5)	19 (17.0)
Atrial fibrillation	2 (4.1)	5 (8.0)	7 (6.25)
Gastritis	3 (6.1)	1 (1.6)	4 (3.6)
Urinary tract infection	0 (0.0)	2 (3.2)	2 (1.8)
Intracerebral hemorrhage	1 (2.04)	3 (4.8)	4 (3.6)
Diabetic ketoacidosis	1 (2.04)	0 (0.0)	1 (0.09)
Gastrointestinal-onset sepsis	3 (5.0)	1 (1.6)	4 (3.6)
Myocardial infarction	1 (2.0)	2 (3.2)	3 (2.7)
Peptic ulcer disease	2 (4.1)	0 (0.0)	2 (1.8)
Ventricular tachycardia	2 (4.1)	2 (3.2)	4 (3.6)

HFSUH, Hiwot Fana Specialized University Hospital.

patients with acute ischemic stroke, no patient received thrombolytic therapy when indicated due to the unavailability of thrombolytics at the hospital. Thus, these patients have been prescribed a loading dose of aspirin (325 mg) followed by a maintenance dose of 81 mg once daily. Of the 49 patients who were prescribed aspirin, 38.75% started within the first 24 h at the emergency department, after intracranial bleeding has been ruled out. Three (2.7%) patients were identified to have a comorbid myocardial infarction and were prescribed a loading dose of clopidogrel (300 mg) followed by a maintenance dose of 75 mg per oral daily.

Prophylaxis for deep vein thrombosis was prescribed for 40 (35.7%) patients, and all of them received unfractionated heparin (5000 mg IM daily). Of 39 (34.80%) patients who indicated oxygen therapy (i.e., O_2Sat $< 90\%$), 33% received intra-nasal oxygen. In all, 14 (12.5%) patients received antipyretic therapy (paracetamol 1000 mg every 4 h as required). Ten patients had an indication for prophylactic anticoagulant against coronary heart disease and cerebrovascular accident and thus prescribed prophylactic warfarin. Prophylactic statin (Atorvastatin 40 mg) was prescribed for all patients with ischemic stroke (Table 4).

Of the 112 patients admitted with a diagnosis of stroke, 35 (31.2%) died in the hospital and 77 (68.8%) were discharged after surviving a stroke with some form of disability. Of 35 patients who died during hospitalization, 18 had an ischemic stroke and 17 had a hemorrhagic stroke, there was no significant difference in in-hospital mortality between the two stroke subtypes (36.7% versus 27.0%, $p = 0.25$). The mean duration of hospital stay was 4.85 ± 3.73 days and 46 (41.1%) patients were hospitalized for 4–7 days. At discharge, 42.0% of patients have been prescribed Aspirin, 44.0% were prescribed Atorvastatin, and 8.04% were prescribed Metoprolol (Table 5).

Predictors of in-hospital outcomes

In bivariate logistic regression analysis, age ⩾65 years, pre-existing diabetes, blood glucose score between 60 and 140, body temperature between 36.5 and 37.5°C, and atrial fibrillation were significantly associated with in-hospital mortality from stroke. However, in multivariable logistic regression analysis, only atrial fibrillation remains the predicting factor of in-hospital mortality from acute stroke (adjusted odds ratio = 15.5, 95% confidence interval: 1.09–219.2; $p = 0.043$) (Table 6).

Discussion

This is the first study to assess in-hospital treatment outcomes and determinant factors in patients admitted due to acute stroke in eastern Ethiopia. This study showed that the in-hospital mortality was 31.2% and 51.4% of the patients who died in the hospital were patients with ischemic stroke. It was also found that the proportion of patients who had an acute hemorrhagic stroke was higher when compared with previous studies conducted in other regions in Ethiopia[17] and some African countries.[22,23] This difference could be due to the variations in the risk factors for stroke. The in-hospital case-fatality rate in this study was slightly lower than the findings of other studies.[18,23] However, it was higher than the case fatality rate reported in the study conducted in Gondar,[16] Palestine (21%),[24] and Germany[25] but comparable with reports of a study conducted in Spain (31%).[26] In our study, the mean length of hospitalization was lower compared to reports from previous studies conducted in Ethiopia.[16,19] The variation could be attributed to the differences in clinical characteristics like comorbidity and severity of the disease among study participants.

Table 4. Treatment commenced during hospitalization among patients with acute stroke admitted at HFSUH, eastern Ethiopia, 2019.

Variables		Acute ischemic stroke (*n*, %)	Acute hemorrhagic stroke (*n*, %)	Total (*n*, %)
Antiplatelet	Aspirin	44 (89.0)	5 (8.0)	49 (44.0)
	Clopidogrel	5 (10.0)	0 (0.0)	5 (4.5)
Anticoagulant	Heparin	33 (67.0)	7 (11.0)	40 (36.0)
	Warfarin	7 (14.0)	0 (0.0)	7 (6.0)
Anti-hypertensive	Captopril	10 (20.0)	16 (25.0)	26 (23.0)
	Nifedipine	5 (10.0)	7 (11.0)	12 (11.0)
	Amlodipine	7 (14.0)	8 (13.0)	15 (13.0)
	Hydralazine	11 (22.0)	18 (28.0)	29 (26.0)
	Enalapril	1 (2.0)	3 (5.0)	4 (3.6)
Statins	Atorvastatin	34 (69.0)	0 (0.0)	34 (30.0)
Anti-pyretic medication	Paracetamol	3 (6.0)	11 (18.0)	14 (12.5)
Anti-diabetic	Regular Insulin	14 (29.0)	9 (14.0)	33 (29.0)
Anti-seizure drugs	Phenytoin	0 (0.0)	1 (2.0)	1 (0.9)
	Phenobarbitone	1 (2.0)	7 (11.0)	8 (7.0)
	Diazepam	0 (0.0)	7 (11.0)	7 (6.0)
Osmotic diuretics	Mannitol	6 (12.0)	13 (20.0)	19 (17.0)
Anti-ulcer drugs	Cimetidine	27 (55.0)	25 (39.0)	52 (46.0)
	Omeprazole	3 (6.0)	1 (2.0)	4 (3.6)
Antibiotics	Ceftriaxone and metronidazole	32 (65.0)	10 (16.0)	42 (38.0)
	Ceftazidime	3 (6.0)	1 (2.0)	4 (3.6)
	Cefepime	0 (0.0)	5 (8.0)	5 (4.5)
	Ceftriaxone	0 (0.0)	2 (3.0)	2 (2.0)
	Vancomycin	5 (10.0)	4 (6.0)	26 (23.0)
	Hydrocortisone	1 (2.0)	0 (0.0)	1 (0.9)
Other	Tramadol	18 (37.0)	19 (30.0)	37 (33.0)
	Metoprolol	9 (18.0)	0 (0.0)	9 (8.0)
	Oxygen therapy	22 (45.0)	15 (24.0)	37 (33.0)

HFSUH, Hiwot Fana Specialized University Hospital.

Table 5. Discharge medication and length of hospitalization among patients with acute stroke admitted at HFSUH, eastern Ethiopia, 2019.

Variables		Acute ischemic stroke (*n*, %)	Acute hemorrhagic stroke (*n*, %)	Total (*n*, %)
Aspirin		38 (78.0)	9 (14.0)	47 (42.0)
Clopidogrel		2 (4.0)	0 (0.0)	2 (1.8)
Warfarin		5 (10.0)	0 (0.0)	5 (4.5)
Atorvastatin		49 (39.0)	0 (0.0)	49 (44.0)
Enalapril		4 (8.0)	8 (13.0)	12 (10.7)
Metoprolol		9 (18.0)	0 (0.0)	9 (8.04)
Cimetidine		8 (16.0)	12 (19.0)	20 (17.9)
Omeprazole		3 (6.0)	1 (2.0)	4 (3.6)
Length of hospital stay	⩽3	5 (10.0)	8 (13.0)	13 (11.6)
	4–7	21 (43.0)	25 (40.0)	46 (41.1)
	7–14	29 (59.0)	21 (33.0)	50 (44.6)
	>14	2 (4.0)	1 (2.0)	3 (2.7)

HFSUH, Hiwot Fana Specialized University Hospital.

The average age at presentation was comparable with the findings of studies conducted in some African countries.[23,27–29] This is due to the fact our arteries naturally become narrower and harder as we get older. In addition, certain medical conditions that increase the risk of stroke are common in old age. The mean time of presentation from symptom onset was 33.6 (15.7) hours. This was higher than the mean time of presentation reported in the study conducted in the capital,

Table 6. Factors associated with in-hospital mortality from acute stroke in hospitalized patients with acute stroke at HFSUH, eastern Ethiopia, 2019.

Variable	In-hospital mortality		COR (95% CI)	*p* Value	AOR (95% CI)	*p* Value
	Yes	No				
Age						
<65	54	15	1		1	
⩾65	23	20	3.1 (1.37–7.17)	0.007	1.9 (0.61–5.8)	0.273
Previous stroke or TIA						
No	65	25	1		1	
Yes	12	10	2.2 (0.83–5.65)	0.114	1.2 (0.32–4.62)	0.781
Diabetes mellitus						
No	57	17	1		1	
Yes	20	18	3.0 (1.31–6.96)	0.01	4.5 (0.88–23.24)	0.07
Heart failure						
No	74	30	1		1	
Yes	3	5	4.1 (0.92–18.29)	0.063	4.1 (0.67–24.96)	0.126
Blood glucose level						
60–140	48	13	0.4 (0.14–0.88)	0.026	0.5 (0.06–4.10)	0.523
140–180	9	5	0.7 (0.20–2.61)	0.611	1.4 (0.16–12.78)	0.762
>180	18	14	1		1	
Oxygen saturation						
⩾90	53	20	1		1	
<90	24	15	1.7 (0.73–3.78)	0.231	1.5 (0.45–4.72)	0.539
Body temperature						
<36.5°C	2	5	1		1	
36.5–37.5°C	48	13	0.1 (0.02–0.62)	0.013	0.2 (0.02–1.69)	0.137
⩾37.5°C	26	16	0.3 (0.04–1.42)	0.117	0.3 (0.04–2.85)	0.305
GCS						
⩽8	21	4	0.3 (0.10–1.02)	0.053	0.8 (0.20–3.07)	0.717
9–12	15	6	0.7 (0.23–1.91)	0.440	1.7 (0.38–7.92)	0.475
13–15	41	25	1		1	
Blood glucose lowering therapy						
No	61	24	0.6 (0.23–1.41)	0.225	5.2 (0.68–39.71)	0.113
Yes	16	11	1		1	
Seizure						
No	64	32	1		1	
Yes	13	3	0.5 (0.12–1.74)	0.25	0.4 (0.07–2.26)	0.302
Atrial fibrillation						
No	76	31	1		1	
Yes	1	4	9.8 (1.05–91.27)	0.045	15.5 (1.09–219.2)	0.043

AOR, adjusted odds ratio; COR, crude odds ratio; HFSUH, Hiwot Fana Specialized University Hospital; TIA, transient ischemic attack.

Addis Ababa, but lower than the study conducted in Northern Ethiopia[16] which reported 60.42 h. The discrepancy could be due to the differences in sociodemographic characteristics among study subjects.

Arterial hypertension was the most common modifiable risk factor identified in this study and this was similar to the findings reported in studies conducted in other African countries.[23,28,30] In our study, diabetes mellitus was another common modifiable risk factor identified. In line with our result, diabetes was found to be the commonest risk factor in the studies conducted in Ghana[23] and Nigeria.[30] On the other hand, the prevalence of a previous history of stroke was slightly higher among our study participants, when compared with the findings of a study conducted in Addis Ababa, Ethiopia[27] but this was lower than reports from some African countries.[15]

The in-hospital mortality from acute stroke was affected by several factors. In this study, comorbid diabetes, blood glucose less than 140 mg/dl, Glasgow comma scale less than 8, and atrial fibrillation were predictors of in-hospital mortality in bivariate logistic regression. However, only atrial fibrillation remains the independent predictor of in-hospital mortality from acute stroke in multivariable logistic regression analyses. This is attributed to stroke patients with atrial fibrillation having cerebrovascular risk factors and more

severe stroke with more medical complications such as aspiration pneumonia and heart failure. The embolism and alteration in systemic and cerebral circulation were the proposed underlying mechanism of mortality in acute stroke patients with atrial fibrillation.[31]

The management of acute stroke in LMIC is often suboptimal[10,32]; and stroke unit care is not available.[10] On top of this, some lifesaving medicines such as thrombolytics are not available[10] and there is a limited number of stroke experts and trained personnel in neurology.[14,32] Likewise, similar to many other developing countries, neither stroke unit nor thrombolytics is available for managing stroke patients admitted to hospitals in eastern Ethiopia.

Strength and limitation

This study was the first of its kind to offer insight into in-hospital treatment outcomes of an acute stroke at HFSUH, eastern Ethiopia. Moreover, it sheds light on factors underlying the in-hospital outcomes of study participants at the setup. The study design (being cross-sectional), being limited to a single center, inability to perform power analysis for sample size calculation, inability to assess NIHSS, and the small sample size could be the possible limitation of this study.

Conclusion

Hemorrhagic stroke was predominant in the study sample. One-third of patients died in the hospital and the mortality rate was slightly higher in patients with ischemic stroke. The majority of patients were 65 years old and younger and had at least one risk factor. Atrial fibrillation was the predominant risk factor for hospital mortality from acute stroke. Increased attention to promoting cardiovascular health, early recognition and management of risk factors, and implementing a coordinated stroke care system are needed to reduce premature death due to stroke.

Acknowledgements

We acknowledge the hospital and workers at the medical record-keeping office for their cooperation.

Authors' contributions

Fuad Adem was involved in the conception and design of the study, developed data collection tools, supervised data collection, analyzed data, and draft the original document and the manuscript. All authors contributed to data analysis, drafting or revising the article, gave final approval of the version to be published, and agree to be accountable for all aspects of the work

Declaration of conflicting interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics

The study was approved by the Institutional Research Ethics Review Committee (IRERC) of Haramaya University.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Informed consent

Written informed consent was waived by the ethics committee (retrospective chart review) and not obtained from the study participants as it was a retrospective study.

Trial registration

Not applicable.

ORCID iD

Fuad Adem https://orcid.org/0000-0001-8850-0533

Data availability

The raw data used for this study were included in the manuscript.

Supplemental material

Supplemental material for this article is available online.

References

1. Sacco RL, Kasner SE, Broderick JP, et al. An updated definition of stroke of the 21st century: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2013; 44(7): 2064–2089.
2. Roth GA, Abate D, Abate KH, et al. Global, regional, and national age-sex-specific mortality for 282 causes of death in 195 countries and territories, 1980–2017: a systematic analysis of the Global Burden of Disease Study 2017. *Lancet* 2018; 392(10159): 1736–1788.
3. Kyu HH, Abate D, Abate KH, et al. Global, regional, and national disability-adjusted life-years (DALYs) for 359 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990–2017: a systematic analysis of the Global Burden of Disease Study 2017. *Lancet* 2018; 392(10159): 1859–1922.
4. Owolabi MO, Akarolo-Anthony S, Akinyemi R, et al. The burden of stroke in Africa: a glance at the present and a glimpse into the future. *Cardiovasc J Afr* 2015; 26(2): S27–S38.
5. Kaur P, Kwatra G, Kaur R, et al. Cost of stroke in low and middle-income countries: a systematic review. *Int J Stroke* 2014; 9(6): 678–682.
6. Balaka A, Tchamdja T, Djagadou KA, et al. Medical direct cost of hospital admission for cerebrovascular accident on medical recovery at the Sylvanus Olympio teaching hospital of Lomé. *Open J Intern Med* 2017; 7(4): 165–171.
7. Maredza M and Chola L. Economic burden of stroke in a rural South African setting. *eNeurologicalSci* 2016; 3: 26–32.
8. Watkins J. *Clinical Guidelines for Stroke Management 2017*. Melbourne, VIC: Stroke Foundation, 2017.

9. Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* 2019; 50(12): e344–e418.
10. Chimatiro GL and Rhoda AJ. Scoping review of acute stroke care management and rehabilitation in low and middle-income countries. *BMC Health Serv Res* 2019; 19(1): 789.
11. Lansberg MG, Bluhmki E and Thijs VN. Efficacy and safety of tissue plasminogen activator 3 to 4.5 hours after acute ischemic stroke: a metaanalysis. *Stroke* 2009; 40(7): 2438–2441.
12. Mensah GA, Roth GA, Thrift G, et al. Strategies to improve stroke care services in low- and middle-income countries: a systematic review. *Neuroepidemiology* 2017; 49: 45–61.
13. Chimatiro GL and Rhoda AJ. The challenge to providing stroke care and rehabilitation in Malawi. *J Glob Heal Rep* 2019; 3: 1–12.
14. Pandey S. Challenges in neurological practice in developing countries. *Indian J Public Health* 2012; 56(3): 227–230.
15. Fekadu G, Chelkeba L and Kebede A. Burden, clinical outcomes and predictors of time to in-hospital mortality among adult patients admitted to a stroke unit of the Jimma university medical center: a prospective cohort study. *BMC Neurol* 2019; 19(1): 213.
16. Gebreyohannes EA, Bhagavathula AS, Abebe TB, et al. In-hospital mortality among ischemic stroke patients in Gondar University Hospital: a retrospective cohort study. *Stroke Res Treat* 2019; 2019: 7275063.
17. Kefale B, Betero G, Temesgen G, et al. Management practice, and treatment outcome and its associated factors among hospitalized stroke patient at Ambo University Referral Hospital, Ethiopia: an institutional based cross-sectional study. *Res Sq* 2020: 1–22.
18. Temesgen TG, Teshome B and Njogu P. Treatment outcomes and associated factors among hospitalized stroke patients at shashemene referral hospital, Ethiopia. *Stroke Res Treat* 2018; 2018: 8079578.
19. Gedefa B, Menna T, Tesfaye B, et al. Assessment of risk factors and treatment outcome of stroke admissions at St. Paul's Teaching Hospital, Addis Ababa, Ethiopia. *J Neurol Neurophysiol* 2017; 8(3): 6–11.
20. Teasdale G and Jennett B. Assessment of coma and impaired consciousness. A practical scale. *Lancet* 1974; 2(7872): 81–84.
21. Whelton PK, Carey RM, Aronow WS, et al. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: executive summary: a report of the American college of cardiology/American Heart Association task force. *Hypertension* 2018; 71(6): 1269–1324.
22. Sagui E, M'Baye PS, Dubecq C, et al. Ischemic and hemorrhagic strokes in Dakar, Senegal: a hospital-based study. *Stroke* 2005; 36(9): 1844–1847.
23. Sarfo FS, Acheampong JW, Appiah LT, et al. The profile of risk factors and in-patient outcomes of stroke in Kumasi, Ghana. *Ghana Med J* 2014; 48(3): 127–134.
24. Sweileh WM, Sawalha AF, Al-Aqad SM, et al. Predictors of in-hospital mortality after acute stroke: impact of gender. *Int J Clin Exp Med* 2008; 2(1): 41–47.
25. Bonkhoff AK, Karch A, Weber R, et al. Sex differences in acute treatment and early outcomes of acute ischemic stroke. *Stroke* 2021; 52: 406–415.
26. Arboix A, Massons J, Eroles Lj, et al. Diabetes is an independent risk factor for in-hospital mortality from acute spontaneous intracerebral hemorrhage. *Diabetes Care* 2000; 23(10): 1527–1532.
27. Jowi JO and Mativo PM. Pathological sub-types, risk factors and outcome of a stroke at the Nairobi hospital, Kenya. *East Afr Med J* 2008; 85(12): 572–581.
28. Garbusinski JM, van der Sande MAB, Bartholome EJ, et al. Stroke presentation and outcome in developing countries a prospective study in the Gambia. *Stroke* 2005; 36: 1388–1393.
29. Assogba K. Epidemiology, risk factors, type and outcome of stroke in health care facilities of Lomé, Togo: a prospective study. *Sci J Public Heal* 2015; 3(1): 25.
30. Candelise L, Pinardi G, Morabito A, et al. Mortality in acute stroke with atrial fibrillation. *Stroke* 1991; 22: 169–174.
31. Ekeh B, Ogunniyi A, Isamade E, et al. Stroke mortality and its predictors in a Nigerian teaching hospital. *Afr Health Sci* 2015; 15(1): 74–81.
32. Ekeh BC. Challenges of the management of stroke in sub-Saharan Africa: evaluating awareness, access, and action. *J Pediatr Neurol Med* 2017; 2: 3.