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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

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Abstract

Background: Stroke is the second-leading global cause of death behind heart disease in 2013 and is a major cause of permanent disability. The burden of stroke in terms of mortality, morbidity and disability is increasing across the world. It is currently observed to be one of the commonest reasons of admission in many health care setups and becoming an alarming serious public health problem in our country Ethiopia. Despite the high burden of strokes globally, there is insufficient information on the current clinical profile of stroke in low and middle income countries (LMICs) including Ethiopia. So, this study was aimed to assess risk factors, clinical presentations and predictors of stroke subtypes among adult patients admitted to stroke unit of Jimma university medical center (JUMC).

Methods: Prospective observational study design was carried out at stroke unit (SU) of JUMC for 4 consecutive months from March 10–July 10, 2017. A standardized data extraction checklist and patient interview was used to collect data. Data was entered into Epi data version 3.1 and analyzed using SPSS version 20. Multivariable logistic regression was used to identify the predictors of stroke subtypes.

Result: A total of 116 eligible stroke patients were recruited during the study period. The mean age of the patients was 55.1 ± 14.0 years and males comprised 62.9%. According to world health organization (WHO) criteria of stroke diagnosis, 51.7% of patients had ischemic while 48.3% had hemorrhagic stroke. The most common risk factor identified was hypertension (75.9%) followed by family history (33.6%), alcohol intake (22.4%), smoking (17.2%) and heart failure (17.2%). The most common clinical presentation was headache complained by 75.0% of the patients followed by aphasia 60.3% and hemiparesis 53.4%. Atrial fibrillation was the independent predictor of hemorrhagic stroke (AOR: 0.08, 95% CI: 0.01–0.68).

Conclusion: The clinical characteristics of stroke in this set up were similar to other low- and middle-resource countries. As stroke is a high priority chronic disease, large-scale public health campaign should be launched focusing on public education regarding stroke risk factors and necessary interventions.

Keywords: Stroke, Risk factors, Clinical presentation, Predictors, Jimma, Ethiopia

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Background

Stroke is acute clinical event of focal or global neurological disturbance related to impairment of cerebral circulation, which lasts longer than 24 h resulting in death with no known cause other than vascular origin. Without blood to supply oxygen and to remove waste products, brain cells quickly begin to die [1–4]. Stroke is the second-leading global cause of death behind heart disease in 2013 and is a major cause of permanent disability [5–7]. Currently, the burden of stroke in terms of mortality, morbidity and disability is increasing across the world [8, 9]. Additionally, data from Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) of 2010 revealed that stroke is the leading cardiovascular disease (CVD) which causes mortality and disability in sub-Saharan Africa (SSA) and other low and middle income countries (LMICs) [10].

Risk factors for stroke can be classified as modifiable and non-modifiable. Age, sex, family history and race/ethnicity are non-modifiable risk factors; while hypertension, smoking, diet, and physical inactivity are among some of identified modifiable risk factors [11]. Different risk factors apply to an African population in the development of stroke [12]. Africa might be increasingly affected by high burden of stroke and other vascular diseases due to health transitions in line with ever-changing social, economic and demographic patterns [13]. Additionally, the poor are increasingly affected by stroke, which can be attributable to the changing population exposures to risk factors and inability to afford the high cost of stroke care [14]. Yet, only little data about context-specific risk factors for prioritizing interventions to reduce the stroke burden in sub-Saharan Africa is available [15, 16].

Compared to developed countries, the percentage of hemorrhagic stroke (HS) mortality rate was higher in SSA and other LMICs [10, 17, 18]. There have been variations in the prevalence of major risk factors among the stroke subtypes, demonstrating that knowledge of pathophysiology is crucial for the right management and care of the patients [19]. In addition to highest burden of stroke risk factors in LMICs, the racial or genetic factors also plays key roles in the pathogenesis of stroke. For example, hypertension and diabetes mellitus (DM) appear to be more prevalent among black races as compared to white races [17]. Currently even though several modifiable risk factors are becoming significant, hypertension is still the most common risk factor globally including our country [20].

Stroke is currently observed to be one of the commonest reasons of admission in many health care setups and becoming an alarming serious public health problem in our country Ethiopia [21, 22]. Under-diagnosing of hypertension and other risk factors, delayed presentation to the hospital, poor risk factors control and failure to adhere to the treatments are some of the major challenges that needs to be addressed [21, 23]. Etiologic investigation for stroke was infrequently performed due to lack of systematic cardiological examinations and brain imaging, most of the time for economic reasons and unavailability of the instruments [24]. The findings of the studies done in Ethiopia frequently changes from one another with respect to various demographic profiles, location and risk factors [21]. Most of the data's regarding stroke that used in the management, follow-up and prevention of stroke come from studies in developed countries [22]. Thus, in our country we haven't pooled data on prevalence, risk factors and outcome of the stroke.

The shortage of data specific to the Ethiopian setting limits the formulation of well-designed response and management of stroke [21]. So it is imperative that a lot has to be done to overcome the current challenges concerning the risk factors and clinical profile of stroke in Ethiopia [22]. Hence this study will generate evidences for improving the prevention strategy of stroke and guide health authorities to halt or reduce the devastating effects of stoke at different sectors of our community by having overview knowledge of clinical characteristics of stroke. This study data was part of huge study project done in stroke unit (SU) of Jimma university medical center (JUMC) with novel and extensive findings focusing on stroke. Hence, this study was aimed to assess risk factors, clinical presentations and predictors of stroke subtypes among adult patients admitted to SU of JUMC.

Methods

Since this data was part of study previously described by Fekadu etal [24], we have used similar methods. Additionally, the study participants in this finding share similarity with previously published articles of the same study project. Prospective observational study design was conducted at SU of JUMC located at south-west Ethiopia for 4 consecutive months from March 10–July 10, 2017. All adult patients (> 18 years) diagnosed to had stroke clinically or by brain imaging and admitted to SU of JUMC during the study period were included. Those not willing to give an informed consent, died before evaluation, changed diagnosis of stroke, transformed stroke and with hematomas were excluded [23, 24].

Data collection tool and procedure

Data collection was carried out by two trained nurses and one internal medicine resident. Data collectors collect data using interviewer administered questionnaire and standardized data extraction form from the case records of the patients. Data collection tool (Additional file 1) was developed based on the previous study findings done at different sites and using the WHO step wise approach to stroke surveillance [25]. The necessary history used for

the study was taken from the patient and/or caregivers by the language they understood. To ensure quality of data, the data abstraction tool was developed in English, translated to local language (Amharic and Afan Oromo) and back translated into English to check its consistency. The data collection form was used to collect data on the sociodemographic characteristics, clinical characteristics of patients such as risk factors, clinical presentation and subtypes of stroke.

Data processing and analysis

The data was entered to Epidata version 3.1 and analyzed using statistical package for the social sciences (SPSS) version 20. Descriptive statistics such as proportions, means, standard deviations, medians and interquartile ranges were calculated to describe the independent variables. During candidate selection because of adequate significant variables were obtained at $P < 0.05$, it was considered as cut off point for candidate selection for multivariable logistic regression analysis model with backward stepwise approach to identify the independent predictors of stroke subtypes. The data was summarized using odds ratio (OR) and 95% confidence interval. Confidence interval which doesn't contain 1 and predictor variables with p value less than 0.05 was considered statistically significant.

Operational definition

Alcohol abuse/ consumption

On average ≥ 2 drinks/day for males and ≥ 1 drinks for females (previous drinker: ex drinker for more than 1 year) [26].

Diabetes mellitus

If the patient was previously on oral hypoglycemic agents/ insulin treatment or had the diagnosis of any type of DM or FBS ≥ 126 mg/dl or had a documented RBS ≥ 200 mg/ dl or glycosylated hemoglobin of ≥6.5% [7, 27–29].

Dyslipidemia or hyperlipidemia

Previous had history of hyperlipidemia or using lipid lowering medication or total cholesterol ≥200 mg/dl, LDL cholesterol ≥100 mg/dl, and HDL-cholesterol < 40 mg/dl for men or < 50 mg/dl for women, and/or serum triglyceride level ≥ 150 mg/dl [27, 30].

Hypertension

Previously receiving antihypertensive medication or when the patient was previously diagnosed with hypertension or detecting blood pressure of ≥ 140/90 mm/Hg for two measurements [7, 27–29].

Obesity

According to the WHO, Body Mass Index (BMI) ≥ 30 kg/m ^{2} [28].

- Central obesity: Waist circumference greater than 102 cm in men and 88 cm in women [28].

Smoker

On average 2 cigarettes per day in men and 1 per day in women

- Former smoker: who abstained from smoking for greater than 1 years [31].
- Current smoker: smoking within 1 year ago [31].

Result

One hundred twenty five patients were admitted to SU of JUMC with suspected diagnosis of stroke and 9 patients were excluded from the study during the study period. From 116 study participants included in the study; history was obtained solely from 11 patients (9.5%), from the patient and caregiver in 50 cases (43.1%), and solely from caregivers in 55 cases (47.4%). According to WHO criteria 51.7% patients had ischemic type of stroke (IS) while 48.3% had hemorrhagic stroke (HS). Of the total 116 patients, 61 patients evaluated with CT scan of the brain and the rest 55 patients were evaluated clinically to have stroke [24].

Patient characteristics

The mean age of the patients was 55.1 ± 14.0 years and 65 (56.0%) were in age of group of 45–65 years. Males comprised of 73 (62.9%) with male: female ratio of 1.70: 1. Majority of the participants (42.2%) had informal education and 85.3% of patients were independent at home during pre-stroke. Majority of the patients had normal mean body mass index (BMI) (63.8%) and 15.5% of the patients were overweight [23]. Regarding the food habit of the patients during the pre-stroke, 81.9% were mixed diet users (Table 1).

Risk factors for stroke subtypes

Risk factors were identified in 114 (98.3%) patients; 59 (98.3%) of IS and 55 (98.2%) of HS patients. The most common risk factor identified was hypertension in 88 (75.9%) patients followed by family history in 39 (33.6%), alcohol intake 26 (22.4%) and smoking 20 (17.2%). Thirty six patients (83.7%) of IS and 34 (75.6%) of HS patients had a pre-stroke knowledge of being hypertensive. Twenty eight patients (24.1%) had no current and previous history of hypertension [17 (28.3%) of IS and 11(19.6%) of HS patients] (Table 2).

About 18 (20.5%) of the patients had no prior knowledge of being hypertensive, but diagnosed in hospital during admission for stroke. From 46 patients with no previous history of hypertension including newly diagnosed, 19 (41.3%) were never had their blood pressure

Table 1 Patient characteristics among adult stroke patients admitted to stroke unit of JUMC from March 10–July 10, 2017

Patient characteristics		Total patients (n = 116)	Ischemic stroke (n = 60)	Hemorrhagic stroke (n = 56)
Age (years)	< 45	26 (22.4%)	10 (16.7%)	16 (28.6%)
	45–65	65 (56.0%)	34 (56.7%)	31 (55.4%)
	> 65	25 (21.6%)	16 (26.7%)	9 (16.1%)
Sex	Male	73 (62.9%)	38 (63.3%	35 (62.5%
	Female	43 (37.1%)	22 (36.7%)	21(37.5%)
Residence	Rural	84 (72.4%)	43 (71.7%)	41 (73.2%)
	Urban	32 (27.6%	17 (28.3%)	15 (26.8%)
Marital status	Married	104 (89.7%)	54 (90.0%)	50 (89.3%)
	Widow	11 (9.5%)	5 (8.3%)	6 (10.7%)
	Divorced	1 (0.9%)	1 (1.7%)	0 (0%)
Religion	Muslim	71 (61.2%)	40 (66.7%)	31 (55.4%
	Orthodox	35(30.2%)	15 (25.0%)	20 (35.7%)
	Protestant	9 (7.8%)	4 (6.7%)	5 (8.9%)
	Traditional belief	1(0.9%)	1 (1.7%)	0 (0%)
Education status	Unable to read and write	42 (36.2%)	20 (33.3%)	22 (39.3%)
	Able to read and write, informal education	49 (42.2%)	28 (46.7%)	21 (37.5%)
	Elementary school (1–8)	17 (14.7%)	10 (16.7%)	7 (12.5%)
	Secondary school (9–12)	3 (2.6%)	1 (1.7%)	2 (3.6%)
	College/university or above	5 (4.3%)	1 (1.7%)	4 (7.1%)
Occupational status (over the last 1 year)	Agriculture / farmer	44 (37.9%)	27 (45.0%)	17(30.4%)
	Homemaker/ housewives	41 (35.3%	20 (33.3%)	21 (37.5%)
	Merchant	11 (9.5%)	7 (11.7)	4 (7.1%)
	Retired	6 (5.2%	2 (3.3%)	4 (7.1%)
	Government employee	5 (4.3%)	1 (1.7%)	4 (7.1%)
	Other own business work	5 (4.3%)	2 (3.3%)	3 (5.4%)
	Skilled/unskilled manual labor/ daily worker	4 (3.4%)	1 (1.7%)	3 (5.4%)
Body mass index (BMI) (kg/m^2)	Mean + standard deviation	21.2 ± 3.4	21.4 ± 3.7	21.1 ± 3.0
	< 18.5 (underweight)	24 (20.7%	13 (21.7%)	11 (19.6%)
	18.6–24.9 (normal)	74 (63.8%)	34 (56.7%)	40 (71.4%)
	25.0–29.9 (overweight)	18 (15.5%)	13 (21.7%)	5 (8.9%)
Living situation of the patients during pre-stroke	Independent at home	99 (85.3%)	47 (78.3%)	52 (92.9%)
	Dependent at home	14 (12.1%)	10 (16.7%)	4 (7.1%)
	Hospital/ health center	3 (2.6%)	3 (5.0%)	0 (0%)
Feeding habits	Mixed diet	95 (81.9%)	47 (78.3%)	48 (85.7%)
	Non vegetarian	15 (12.9%)	10 (16.7%)	5(8.9%)
	Vegetarian	6 (5.2%)	3 (5.0%	3 (5.4%)

measured and the remaining measured but was in normal range.

Among the patients with recorded history of hypertension, the median duration of hypertension prior to stroke diagnosis was 3 years (ranged 0.04 to 25 years). Of 70 patients with pre-existing hypertension, 27 (38.6%) were on anti-hypertensive medications, 24 (34.3%) of the patients were discontinued their antihypertensive medication and 19 (27.1%) hadn't started antihypertensive medication before stroke occurrence. From 51 patients previously started antihypertensive medication the median duration since the medication started was 3 years.

Table 2 Risk factors of stroke subtypes among adult patients admitted to stroke unit of JUMC from March10–July 10, 2017

Stroke risk factors		Total patients (n = 114)	Ischemic stroke (n = 59)	Hemorrhagic stroke (n = 55)	OR (P value)
Hypertension	New diagnosis	18 (20.5%)	7 (16.3%)	11 (24.4%)	1.00
	Previous history	70 (79.5%)	36 (83.7%)	34 (75.6%)	0.345
Family history (n = 39)	Hypertension	21 (53.8%)	12 (60.0%)	9 (47.4%)	0.584
	Sudden death	15 (38.5%)	7 (35.0%)	8 (42.1%)	0.675
	Diabetes mellitus	10 (25.6%)	6 (30%)	4 (21.1%)	0.585
	Ischemic heart disease	5 (12.8%)	2 (10%)	3 (15.8%)	0.595
	Stroke	2 (5.1%)	2 (10%)	0 (0%)	0.999
Alcohol intake	Former drinker	22 (84.6%	10 (100%)	12 (75.0%)	1.00
	Current alcohol use	4 (15.4%)	0 (0%)	4 (25.0%)	0.999
Smoking	Current smoker	10 (50.0%)	1 (16.7%)	9 (64.3%)	0.074
	Former smoker	10 (50.0%)	5 (83.3%	5 (35.7%)	1.00
Heart failure		20 (17.2%)	16 (26.7%)	4 (7.1%)	0.009
Atrial fibrillation		19 (16.4%)	15 (25.0%)	4 (7.1%)	0.014
Overweight/central obesity		18 (15.5%)	13 (21.7%)	5 (8.9%)	0.066
Hematological disorders (n = 17)	Polycythemia	7 (41.2%)	5 (45.5%)	2 (33.3%)	0.407
	Anemia	6 (35.3%)	4 (36.4%)	2 (33.3%)	0.459
	Thrombocytopenia	5 (29.4%)	3 (27.3%)	2 (33.3%)	0.706
	Thrombocytosis	1 (5.9%)	1 (9.1%)	0 (0%)	–
Diet (low fruit and vegetable)		15 (12.9%)	10 (16.7%)	5 (8.9%)	0.221
Coronary disease (CHD, IHD)		14 (12.1%)	11 (18.3%)	3 (5.4%)	0.043
Hypertensive heart disease (HHD)		13 (11.2%)	10 (16.7%)	3 (5.4%)	0.066
Physical inactivity/sedentary life		13 (11.2%)	9 (15.0%)	4 (7.1%)	0.189
Migraine or headache		12 (10.3%)	2 (3.3%)	10 (17.9%)	0.021
Psychosocial stress		10 (8.6%)	2 (3.3%)	8 (14.3%)	0.053
Traumatic brain /head injury		9 (7.8%)	2 (3.3%)	7 (12.5%)	0.085
Previous stroke		9 (7.8%)	8 (13.3%)	1 (1.9%)	0.048
Diabetes mellitus	Newly diagnosed	4 (50%	1 (25%)	3 (75%)	1.00
	Previous history	4 (50%)	3 (75%)	1 (25%)	0.178
Contraceptive drug use		8 (6.9%)	5 (8.3%)	3 (5.4%)	0.530
Hyperlipidemia (all newly diagnosed)		6 (5.2%)	5 (8.3%)	1 (1.8%)	0.148
Infective meningitis (TB / bacterial meningitis)		5 (4.3%)	1 (1.7%)	4 (7.1%)	0.182
Oral anticoagulant		5 (4.3%)	5 (8.3%)	0 (0%)	0.999
Nephrotic syndrome (Chronic kidney diseases)		4 (3.4%)	3 (5.0%)	1 (1.8%)	0.364
Epilepsy/seizure		3 (2.6%)	2 (3.3%)	1 (1.8%)	0.527
Other Malignancy/ history of other cancer		3 (2.6%)	1 (1.7%)	2 (3.6%)	0.528
Preeclampsia-eclampsia		3 (2.6%)	2 (3.3%)	1 (1.8%)	0.605
Other cardiovascular diseases such as DCM		3 (2.6%	3 (5.0%)	0 (0%)	0.999
VTE (hypercoagulable state)		2 (1.7%)	1 (1.7%)	1 (1.8%)	0.961
Hyperuricemia		1 (0.9%)	1 (1.7%)	0 (0%)	–
Thyrotoxicosis		1 (0.9%)	1 (1.7%)	0 (0%)	–
Chronic obstructive pulmonary disease (COPD)		1 (0.9%)	1 (1.7%)	0 (0%)	–
Valvular heart disease		1 (0.9%)	1 (1.7%)	0 (0%)	–
HIV		1(0.9%)	1 (1.7%	0 (0%)	–
Other comorbidities		3 (2.6%)	3 (5%)	0 (0%)	0.999

CHD Coronary Heart Disease, *DCM* Dilated Cardiomyopathy, *HIV* Human Immune Virus, *IHD* Ischemic Heart Disease, *OR* Odds ratio, *TB* Tuberculosis, *VTE* Venous thromboembolism

From the 27 patients that were on antihypertensive medication during hospital arrival, 19 (70.4%) of the patients' blood pressure was not controlled. The median month since discontinuation of their antihypertensive medications before onset of stroke was 2.5 months (ranged 0.5 to 48 months).

Diabetes Mellitus was identified as co-morbidity in 8 patients (4 of them previously diagnosed). It was more prevalent in males and in middle age group, but there was no statistically significant difference between stroke subtypes ($p = 0.178$). Among the patients with previous history of diabetes, the mean duration of diabetes prior to stroke was 5.3 years (ranged 3 to 9 years). Although all previously diagnosed patients were on anti-diabetics, only 1 patient's blood glucose was controlled (RBS < 200 mg/dl) during hospital arrival.

Physical inactivity/ sedentary life was detected in 13 (11.2%) patients, the remaining patients had habit of physical activity. Of those who had physical activity, 101 (98.1%) had work related aerobic physical activity and 2 (1.9%) had aerobic/planned physical activity. From nine patients (7.8%) who gave a history of previous stroke, eight of them were ischemic stroke patients. From those patients who had previous history of stroke, one patient had history of hypertension for 25 years.

Alcohol consumption and cigarette smoking was less prevalent in IS than HS patients, which was statistically significant among smokers ($p = 0.038$). Majority of the patients who used alcohol were former drinker before 1 year (84.6%), but no difference in smoking status of the patients between the current and previous smokers. Seventy stoke patients (83.6%) had two or more risk factors for stroke, while 17 (14.7%) had one identified risk factor. In addition 17 (14.7%) patients had more than five identified risk factors. With this, the average risk factor for the patient was 3.38 (ranged 0 to 9) risk factors.

Clinical presentation of stroke patients

The most common clinical presentation was headache complained by 87 (75.0%) patients followed by aphasia 70 (60.3%) and hemiparesis 62 (53.4%). Most of ischemic stroke patients presented with headache (71.7%), aphasia (60.0%) and facial palsy (58.3%). Similarly, the common clinical presentations among hemorrhagic stroke patients was headache (78.6%) followed by aphasia (60.7%) and vomiting (57.1%) (Table 3).

Hemorrhagic stroke patients were more likely to be presented with coma ($P = 0.033$), vomiting ($P = 0.028$) and neck stiffness ($p = 0.015$), but ischemic stroke patients were more likely presented with chest pain ($p = 0.016$). In other clinical presentations there was no statistical significant difference between stroke subtypes. The average clinical presentation per patient was 6 (ranged from 2 to 12).

Predictors of stroke subtypes

Using $P < 0.05$ for candidate variable selection for predictors of stroke subtypes on binary logistic regression; atrial fibrillation, heart failure, previous stroke, coronary disease, smoking, migraine/headache and previous situation of hypertension management were selected to be included in multivariable logistic regression. Up on multivariable logistic regression only atrial fibrillation (AOR: 0.08; 95% CI: 0.01–0.68, P: 0.021) was the independent predictor for hemorrhagic stroke. Patients having atrial fibrillation were 0.08 times less likely experience hemorrhagic stroke than ischemic stroke (Table 4).

Discussion

This study data was drawn from the huge study project done on stroke in SU of JUMC. The study populations participated in this finding share similarity with previously published articles of the same project [23, 24]. Even though this study share similarity and textual overlap in the method and the socio-demographic part with previous findings, this finding provides advance and unique contribution over the previous published studies by exploring the risk factors and clinical presentation of stroke.

The mean age of the patients (55.1 ± 14.0 years), was in line with other studies carried out in developing countries including Ethiopia [29, 32–36], but lower compared to studies by Tirschwell et al. and Sagui et al. [37, 38]. In developing countries like Ethiopia, stroke occurs a few years earlier as compared to developed countries. This disagreement may be due to liability of hospital based studies to selection bias, demographic differences (differences in birth rates and survival into old age) and poor risk factor control. Thus community based studies are required to clearly find out and compare incidence as well as prevalence of stroke by age in our area. Young stroke (< 45 Years) comprised of more than one fifth (22.4%) of all patients similar to study in other part of Ethiopia [36], but higher than study in Gujarat, Nigeria and other parts of Ethiopia [21, 22, 32, 39].

The higher percentage of stroke in male patients over females was in line with other previous studies [14, 17, 29, 30, 39]. The possible reason may be increased risk factors such as cigarette smoking and alcohol consumption among males. In addition, there is no vascular protection of endogenous estrogens in males. This was unlike to some studies where female patients were dominant [13, 22]; may be due high use of contraception, pregnancy related disorders and migraine causing stroke among females in those studies. In our study finding majority of the patients were rural residents. Contrary to this, findings by Gebremariam et al. [21] and Greffie et al. [22] showed that majority of the patients were from urban areas. It is clear that hospital-based cohorts differ in the type of persons that

Table 3 Clinical presentations of stroke subtypes among adult patients admitted to stroke unit of JUMC from March 10–July 10, 2017

Clinical presentations	Total patients (*N* = 116)	Ischemic stroke (*n* = 60)	Hemorrhagic stroke (*n* = 56)	OR (*P* value)
Headache	87 (75.0%)	43 (71.7%)	44 (78.6%)	0.392
Aphasia/ dysphasia	70 (60.3%)	36 (60.0%)	34 (60.7%)	0.937
Hemiparesis	62 (53.4%)	31 (51.7%)	31 (55.4%)	0.691
Facial palsy	60 (51.7%)	35 (58.3%	25 (44.6%)	0.142
Vomiting	54 (46.6%)	22 (36.7%)	32 (57.1%)	0.028
Bladder/ urinary incontinence	44 (37.9%)	21 (35.0%)	23 (41.1%)	0.501
Decreased LOC	43 (37.1%	21 (35.0%)	22 (39.3%)	0.633
Hemiplegia	38 (32.8%)	31 (51.7%)	31 (55.4%)	0.589
Swallowing difficulty / dysphagia	26 (22.4%)	13 (21.7%)	13 (23.2%)	0.842
Dysarthria / slurred speech	24 (20.7%)	10 (16.7%)	14 (25.0%)	0.271
Blurred vision	23 (19.8%)	9 (15.0%)	14 (25.0%)	0.181
Ataxia/ gait abnormality	21 (18.1%)	14 (23.3%)	7 (12.5%)	0.135
Loss of memory	18 (15.5%)	10 (16.7%)	8 (14.3%)	0.724
Vertigo/ dizziness	16 (13.8%)	8 (13.3%)	8 (14.3%)	0.882
Neck stiffness	15 (12.8%)	3 (5.0%)	12 (21.4%)	0.015
Asphyxia	14 (12.1%)	6 (10.0%)	8 (14.3%)	0.481
Chest pain	14 (12.1%)	12 (20.0%)	2 (3.6%)	0.016
Forced gaze (conjugate deviation)	12 (10.3%)	6 (10.0%)	6 (10.7%)	0.900
Coma	11 (9.5%)	2 (3.3%)	9 (16.1%)	0.033
Altered sensorium	9 (7.8%)	6 (10.0%)	3 (5.4%)	0.358
Convulsion/ seizure /ABM	8 (6.9%)	5 (8.3%)	3 (5.4%)	0.530
Visual field defect	7 (6.0%)	4 (6.7%)	3 (5.4%)	0.768
Trismus (lock jaw)	5 (4.3%)	2 (3.3%)	3 (5.4%)	0.228
Diplopia	5 (4.3%)	2 (3.3%)	3 (5.4%)	0.595
Monoparesis/plegia	2(1.7%)	0 (0%)	2 (3.6%)	0.999

ABM Abnormal body movement, *LOC* Level of consciousness, *OR* Odds ratio

come to the hospital. The location and catchment area of the hospital determines category of patients visiting the hospital. Additionally, cities and rural regions may differ in age constituencies. The high burden of stroke in rural population may also be due to reduced awareness and poor control of risk factors.

Majority of the patients were farmers (37.9%) and housewives (35.3%), which correlates with the study in Nigeria [40], but contrary to studies in Zambia and Vietnam [37, 41]. Lack of information, ignorance of the risk factors and inability to manage such risk factors might be responsible to this effect. Even when the patients understand the risk factors, they may not accept them to be the cause for stroke nor be able to afford the cost of medications. Additionally, since managing risk factors of stroke require longer period or may be life time; most patients failed to adhere and follow it properly. The above causes might have contributed in many directions to the high prevalence of stroke among peoples with lower education level including housewives and farmers.

In this study majority of the patients (63.8%) had normal BMI and only 15.5% of the patients were overweight. Majority of the patients in developing countries had low or normal BMI because of low economic status and have increased labor related physical activities. Compared to normal weight patients, obese and overweight patients are susceptible to develop a stroke. This may be associated with increased risk factors, insulin resistance, pro-thrombotic state, excessive secretion of free fatty acids, release of excitatory amino acids and sympathetic nervous system activation. This directly or indirectly related to thrombotic and coagulation adverse events thereby reducing the functional outcome and may result in catabolic imbalance. At the same time, immobilization in obese patients can impair the post stroke recovery and outcome.

The most common risk factor identified was hypertension in 75.9%, consistent with other findings as uncontrolled hypertension is the most important risk factor for stroke both in developing and developed countries [12, 13, 29, 30, 32, 36, 37]. This trend may

Table 4 Predictors of hemorrhagic stroke compared to ischemic stroke patients admitted to stroke unit of JUMC

Variables		HS	IS	COR 95% CI	P value	AOR 95% CI	P value
Atrial fibrillation	Yes	4	15	0.231 (0.71–0.75)	0.014	0.08 (0.01–0.68)	0.021*
	No	51	45	1.00		1.00	
Heart failure	yes	4	16	0.21 (0.07–0.68)	0.009		
	no	52	44	1.00			
Previous stroke	yes	1	8	0.12 (0.01–0.98)	0.048	0.18 (0.02–1.66)	0.130
	no	55	52	1.00		1.00	
Smoking (current/previous)	yes	14	6	3.00 (1.06–8.47)	0.038		
	no	52	54	1.00			
Coronary disease (CHD, IHD)	yes	3	11	0.25 (0.67–0.98)	0.043		
	no	53	49	1.00			
Migraine/ headache history	yes	10	2	6.30 (1.32–30.20)	0.021	14.54 (0.85–249.98)	0.065
	no	46	58	1.00		1.00	
situation of previous HTN management	Medication discontinued	15	9	3.33 (1.06–10.53)	0.04		
	Not start medication	10	9	2.22 (0.67–7.41)	0.194		
	On medication	9	18	1.00			

AOR Adjusted odds ratio, CHD Coronary Heart Disease, COR Crude odds ratio, IHD Ischemic Heart Disease, HTN Hypertension
*stastistically significant at $p < 0.05$

reflect poor community awareness, health practices and access to healthcare including different patient related factors. Even when blacks are treated for hypertension, they are less likely than white races to be adhere with treatments given for them. This leads us to believe that hypertension is underdiagnosed and less treated in our study community due to lack of an active screening program, failure to take routine blood pressure measurements, poor medical history taking and poor follow up of the patients. Additionally, adherence with long-term treatment is a great challenge to achieve the optimum outcome as uncomplicated hypertension is usually asymptomatic and denial of the disease is common.

In this study, 79.5% of the hypertensive patients had a pre-stroke knowledge of being hypertensive and 27(38.6%) were on anti-hypertensive medication prior to the stroke occurrence. This was in line with study by Gebremariam et al. in which 20 (37.0%) of the patients had prescribed anti-hypertensive medication prior to the stroke occurrence [21]. But it was in contrary to study by Watila et al. [32] in which more than half of the patients had no prior knowledge of being hypertensive and only small proportion of patients had treatment for hypertension prior to having a stroke. The median duration of hypertension prior to stroke was 3 years, in line with previous study in Ethiopia by Gebremariam et al. [21].

From patients who were on antihypertensive medication during hospital arrival, in majority of the patients' blood pressure was not controlled (> 140/90 mmHg). Poor control of blood pressure is associated with adherence problem, lack of frequent monitoring, cost issue for medications and transportation for follow up. The proportion

of patients that never had their blood pressure measured was lower than finding by Walker etal [33]. Most patients discontinued their antihypertensive medications by convincing themselves as they were cured or improved, because hypertension is asymptomatic disease until organ damage is evident.

Diabetes mellitus is one of the major risk factor for the development of atherosclerosis and the excess risk of stroke. It was diagnosed as co-morbidity in 8 patients, without statistically significant difference between stroke subtypes. According to study by Alemayehu et al. infarction is the most common type of stroke events in diabetic individuals (57.7%) [13]. In our study the prevalence of DM was lower compared to study by Sarkar et al. (25.9%) [34], 46.8% by De Carvalho etal [42], 23.8% by Desalu etal [43], 19.5% by Owolabi etal [17] and 10.1% by Watila etal [32]. But was closely similar with study by Deresse et al. in Ethiopia which was identified in 7.8% of stroke patients [29]. This discrepancy could be due to our small sample size, referral bias and single hospital-based design of our study. We recommend well designed multi-centered studies to quantify the risk of diabetes in Ethiopian stroke patients. The mean duration of diabetes prior to stroke was 5.3 year, that was closely correlates with study by Gebremariam etal [21].

Habituation of alcohol (22.4%) and smoking (17.2%) was higher compared to other previous studies [14, 17, 32, 39, 43]. This was mostly associated with the community in catchment area of our hospital were highly abuser of social drugs. The majority of smokers develop stroke due to smoking may predispose blood vessels to thrombosis and facilitates platelets aggregation possibly

by causing an imbalance between brain vascular coagulation and abnormal fibrinolysis. This might alter the function of blood brain barrier and disrupt normal endothelial cell function. The relation between alcoholism and risk factor of stroke is more susceptible to aggravating effect which causes cardio embolism and hypertension thereby increases the risk of ischemic stroke.

In this study 12.9% of patients were previous user of diet containing low fruit and vegetable. The relation between risk of stroke and diet may be associated with increased daily total fat intake that greatly increases risk of stroke. But vegetable foods have low saturated fat and are protective for our health and organ function. Similar to previous study by Tirschwell et al. [37] cardiac disease like atrial fibrillation, coronary disease and heart failure were commonly associated with ischemic stroke than hemorrhagic strokes. Atrial fibrillation which is great source of cardioembolic stroke was diagnosed in 16.4% that was consistent with study by De Carvalho etal 14.95% [42] and Sagui etal 14.7% [38].

Up on multivariate logistic regression, atrial fibrillation was the independent predictor for hemorrhagic stroke. Patients having atrial fibrillation were less likely experience hemorrhagic stroke than ischemic stroke. From the pathophysiology of the stroke, atrial fibrillation is the most common reason for cardioembolic stroke that occludes cerebral arteries which favors ischemic stroke over hemorrhagic stroke. This finding complies with study by Atadzhanov etal in Zambia [16, 41].

At the onset of stroke, the most common clinical presentation was headache (75.0%) followed by aphasia (60.3%) and hemiparesis (53.4%), similar finding was reported on study by Walker et al. in Gambia [33]. This finding was unlike to other studies where motor symptoms (hemiplegia/hemiparesis) were the most common clinical presentation among stroke patients [13, 14, 22, 35, 39, 42]. The difference could be due to two major reasons. Primarily we have collected data on motor symptoms separately; hemiparesis and hemiplegia. Thus if we had collected as one category the result complies with those other previous studies, as 82.6% of patients manifest either hemiplegia/hemiparesis. Secondly even though the severity varies in degrees due to the nature of the disease most patients may complain the headache as the study was prospective with face to face interview. Initial presentation of urinary incontinence was higher (37.9%) as compared to other study by Greffie et al. [22]. Aphasia was one common presentation in this study which was less presentation as compared to other previous studies [14, 22, 39]. Similar to our finding, study by Kuriakose etal [7] reported that vomiting favors hemorrhagic stroke. This may be one indicator of stroke diagnosis based on clinical where brain imaging is not available. In general average clinical presentation for the patient was 6, which was higher than study in India by Kuriakose et al. in which majority of the patients had 3–4 clinical manifestation during admission [7].

Strength and limitations of the study

This study attempted to identify different risk factors related to stroke with a prospective clinical follow-up that focused on the need of preventive strategy and improvement of patient care. To ensure a uniform data collection, we ascertained consistently ascertainable risk factor identification and obtained more or less reliable information to achieve the goals of our study. More generable case ascertainment than in earlier studies, in-person health care professional assessment to verify eligibility for inclusion was addressed.

The study was associated with some limitations and drawbacks. First, this study was a hospital-based study rather than longitudinal community based study. Hence it may be subjected to referral bias, as most of the acute stroke patients' visit our hospital only from the south western part of Ethiopia. These referral bias as well as convenience sampling approach used might not reflect the true prevalence of the stroke in the community. Even though the study was hospital based, having only one referral center might probably reflect the actual magnitude of stroke in our country.

Secondly, about half of the patients were diagnosed clinically alone to have stroke based on clinical presentations, risk profiles, disease course and other supportive investigations. Clinical way of diagnosis based on clinician judgment rather than biological may distort accuracy and reliability of the data. This may cause unintended false positive and false negative association between different variables of the study. Thus caution should be taken for the generalization of the finding for large community.

Thirdly, in our study protocol, the risk factor status was not refined sufficiently enough especially for ischemic stroke patients with cardiac cases. Even simple and inexpensive diagnostic tests like electrocardiograms (ECG) were not routinely performed. Poor risk factor identification and diagnosis may underestimate or overestimates some factors. Finally, the sample size was small hampering the analysis of some prognostic indicators due to the short recruitment period. In addition, we counted on patient reports of some of their risk factors and other patient related histories, which may introduce recall bias.

Conclusion

Majority of the patients were males, middle aged, rural residents, uneducated and farmers with low socioeconomic status. The increasing burden of stroke in LMICs countries like Ethiopia poses a challenge to the health care system and the community as a whole. The most common risk factor identified was hypertension and the level of poor blood pressure control in hypertensive patients we

observed in this study was alarming. The most common clinical presentation was headache and motor symptoms (hemiplegia/hemiparesis). Hemorrhagic stroke patients were more likely to have coma, vomiting and neck stiffness but ischemic stroke patients were more likely presented with chest pain.

As stroke is a high priority chronic global case, large-scale community health campaign should be launched focusing on community education regarding risk factors of stroke as well as recognition of stroke-related symptoms, prognosis and outcomes. The importance of early recognition and treatment may help to improve outcomes, facilitate consistent and continuous follow up as well as with available treatment options disability can be minimized. Educational programs for front-line health-care providers, focusing on simple supportive interventions, could improve outcomes in settings where advanced diagnostics and treatment of stroke remain limited.

In addition, there should be influential contribution from every social media and political level of the country with the goal of increasing the awareness of risk factors and making the community to understand the challenging effect of the stroke on human health and economy of the country. Thus, policy makers should put strategies for screening and management of common risk factors like hypertension.

Additional file

Additional file 1: Data abstraction tool. (DOCX 24 kb)

Abbreviations
AF: Atrial fibrillation; BMI: Body Mass Index; DM: Diabetes Mellitus; GBD: Global Burden of Diseases; HS: Hemorrhagic stroke; IHD: Ischemic heart Disease; IS: Ischemic stroke; JUMC: Jimma university medical center; LMICs: Low and middle income countries; SSA: Sub Saharan Africa; SU: Stroke unit; WHO: World Health Organization

Authors' contributions
GF contributes in the design of the study, analysis, interpretation and write up of the manuscript. AK made the data analysis and interpretation of the data. LC contributed to the design of the study and edition of the manuscript. All authors critically revised the manuscript and have approved the final manuscript.

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

Ethics approval and consent to participate
Ethical clearance was obtained from the Institutional Review Board (IRB) of Jimma University, Institute of health with reference number of IHRPGC/107/207. Permission was obtained from responsible bodies of the JUMC and stroke unit prior to the interview and review of the patient data. At hospital written informed consent was obtained from the study participants. All patients got the right to opt out of the research. For patients who were not of sound mind to consent; those of altered level of consciousness or severe aphasias, one of the family members or caregivers was given the written consent. This was done by explaining the objective and importance of the study as it is beneficial for patient's quality service delivery for future encounters. The data from the case records and interview was handled with strong confidentiality. Neither the case records nor the data extracted was used for any other purpose. The confidentiality and privacy of patients was assured throughout by removing identifiers from data collection tools using different codes [23, 24].

Consent for publication
Not applicable. No individual person's personal details, images or videos are being used in this study.

Competing interests
The authors declare that they have no competing interests.

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