Magnitude of Stroke Subtypes and Associated Risk Factors Among Patients Admitted to Hawassa University Compressive Specialized Hospital

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Abstract: Stroke is becoming increasingly common problem in LMIC including Ethiopia exerting great impact on morbidity, mortality and economic burden. It is second leading global cause of death just behind heart disease. Various clinical conditions have been investigated as risks factors of stroke. *Objective*: To determine the magnitude of stroke subtypes and the associated risk factors among stroke patients in the in-patient department of internal medicine at HUSCH. *Methodology:* A retrospective review of all patients admitted to medical ward with the diagnosis of stroke at Hawassa university comprehensive specialized hospital from September 2017 to august 2018 was conducted. Socio-demographic information, risk factors, and treatment outcomes of patients were obtained by using a structured check list. Data analysis was done using SPSS version 23.0 software. *Results:* Out of the 224-stroke patients who were admitted to medical ward of HUCSH, majority (57.6%) were men. The median age was 55 (IQR: 44.4-66.2). Hemorrhagic stroke and Ischemic stroke accounted for 132 (58.9%) and 86 (38.4%) of patients respectively. Among patients with Hemorrhagic stroke, 117 (88.6%) patients had ICH and 15 (11.3%) patients had SAH. Hypertension followed by cardiac disease were the commonest risk factors occurring in 52.2% and 8.8% of stroke patients respectively. The inpatient mortality of stroke was 16.5%. *Conclusion:* In this study, hemorrhagic stroke was the most common type of stroke. Hypertension and cardiac disease were the commonest risk factor identified. Aspiration pneumonia and raised ICP were the main factors associated with poor outcome.

Keywords: Hemorrhagic Stroke, In-Patient, Stroke

1. Introduction

1.1. Background

Stroke is classically characterized as a neurological deficit attributed to an acute focal injury of the central nervous system (CNS) by a vascular cause, including cerebral infarction, intracerebral hemorrhage (ICH), and subarachnoid hemorrhage (SAH). There is significant rise of stroke burden in the world over the last two and half decades. About 795,000 people experience stroke each year. Among these approximately 610,000 and 185,000 are first ever and recurrent attacks respectively. As compared to other causes of DALYs in the world, stroke ranked as the second largest contributor globally

and in developing countries, and the third largest contributor to DALYs in developed countries [1-4].

Stroke is second leading global cause of death behind heart disease accounting for 11.8% of total deaths worldwide in 2015. In China Stroke is leading cause of death and the major cause of disability in adolescent, with around half of all stroke survivors becoming unable to be independent and seeking long term health care. Stroke, which was once used to be a common problem in developed countries as compared to third world countries in the past, it is now an increasing problem in low- and middle-income countries, where 86% of all stroke deaths occur [4-6].

Subgroups of stroke consist of ischemic strokes, intracerebral hemorrhages (ICH) and subarachnoid hemorrhages (SAH). Globally there is large variation in stroke subtype distributions between populations. The majority of stroke is ischemic, which account for 87% of all stroke cases and 13% of stroke is of a hemorrhagic type [7, 8].

Most studies in Africa show that the incidence of stroke in Africa is among the highest in the world with a very high incidence rate and a higher prevalence of ischemic stroke as compared to hemorrhagic stroke. In two hospitals in Nigeria, the prevalence of hemorrhagic and ischemic stroke was 29.5% and 54.7% respectively. A hospital based data in Senegal identified 70% of strokes as ischemic stroke and hypertension was the major risk factor in 68% followed by diabetes mellitus in 37.3% of cases. In contrast to this, a hospital-based study done in southern Ethiopia showed an almost similar rates of ischemic and hemorrhagic stroke each accounting for 50.3% and 49.7% of stroke cases respectively. And another recent study identified ischemic stroke as the commonest subtype accounting for 69.4% of cases [5, 9-11].

Stroke is preventable, but knowledge of its risk factors is low in the general population. Globally, more than 90% of the burden of stroke (as measured in DALYs) was due to the modifiable risk factors. The most common are high blood pressure, high cholesterol, smoking, obesity/diet, atrial fibrillation, and diabetes. In most countries worldwide, stroke burden from all these risk factors combined varied between 80% and 97%; however, in majority of African countries, it varied between 72% and 79%. Self-reported history of hypertension was the strongest risk factor for stroke, and was stronger for intracerebral hemorrhagic stroke than for ischemic stroke. Hypertension and cardiac diseases were the commonest risk factors of stroke in southern Ethiopia accounting for 50.9% and 16.6% respectively [11-14].

1.2. Statement of the Problem

As other non-communicable disease (NCD), stroke is also becoming a big health challenge since the last few decades. Globally, 16.9 million new cases of stroke and 5.9 million deaths occur each year. It is a leading cause of long-term disability and second leading global cause of death accounting for 11.8% of total deaths worldwide in 2015 [2, 13, 15].

The exact number of people affected by stroke has been rising yearly since 1990, along with the numbers of disabled stroke survivors and deaths related to stroke. If current trends continue, by 2030 there will be 20 million yearly stroke deaths and 70 million stroke survivors globally. As a result of socio-demographic and lifestyle changes, African countries are undergoing an epidemiological transition. Consequently, the incidence of stroke, the most common complication of hypertension, appears to be increasing in Africa and other low- and middle-income country (LMIC) [5, 16].

Greater than 80% of stroke burden and 86% of all stroke deaths around the world occurs in Africa and other low- and middle-income country (LMIC). But there are limitations on availability of accurate data on stroke epidemiology, especially on its incidence and morbidity. This paucity of data is an important gap because Epidemiological data is mandatory to better understand trends, and to create appropriate cost-effective, prevention and treatment strategies [5, 17].

Even though stroke is the commonest problem that we face in our medical practice in HUCSH, there is only one prospective study from (2013 to 2014) was done in the subject. The rapidity with which stroke is raising makes our knowledge on its current magnitude and risk factor insufficient. On top of this, the magnitude of the subtypes of stroke is different from hospital to hospital and there is a shift in the trend from time to time in the same hospital. For example, a study done in TASH on patients admitted to the hospital from 2010 to 2014 showed a higher rates of ischemic stroke accounting for 53.8% of stroke patients [18]. Whereas another recent study done on patients admitted to the same hospital from 2015 to 2016 showed a higher rate of hemorrhagic stroke accounting for 56% of stroke patients [19]. This shows the dynamic nature of stroke and its risk factors and therefore accurate, up-to-date information on stroke burden is invaluable for the creating effective preventative, acute care and rehabilitation programs for stroke patients.

1.3. Statement of the Problem

Stroke is not only an increasingly common but also dynamic public health problem in Ethiopia, with a shift in its trend across time and space, and the shortage of update data specific to the Ethiopian setting is hampering the formulation of an appropriate response. The main purpose of this study is to determine the magnitude of stroke including its subtype and identifying the common associated factors in HUCSH. This study will be helpful in providing valuable and current information regarding the magnitude, subtype and the common risk factors of stroke in the study area which can help the stakeholders in the hospitals, region and nation levels in developing effective and evidence-based strategies for acute care, chronic rehabilitation and prevention of stroke.

2. Methods

2.1. Study Area and Period

The study was conducted from September 2017 to August 2018, at Hawassa university comprehensive specialized hospital, Hawassa Ethiopia. Hawassa, capital city of SNNPR, is located 273km south of capital Addis Ababa. There are 4 private and 2 governmental hospitals in the city. HUCSH serves for more than

18 million populations from Southern Nations Nationalities & Peoples Region (SNNPR) & neighboring Oromia region. The hospital provides services in major departments (Internal medicine, Surgery, Pediatrics, Gynecology & Obstetrics), Ophthalmology, dermatology, ENT, Radiology, Laboratory & pharmacy. Internal medicine serves in emergency, outpatient department, MRC, ICU & medical wards. Over all there are 48 beds in medical ward distributed among the female ward, male ward, female private wing and male private wing. HUCSH is the only hospital in the region providing service for patients with neurologic diseases by a neurologist.

2.2. Study Design, Source Population, Study Population and Sample Size

A retrospective Descriptive cross-sectional study of patients admitted to medical ward with the diagnosis of stroke was conducted from September 2017 to August 2018 to assess the magnitude and risk factors of stroke. The data was used to assess the magnitude of stroke, potential associated risk factors and to compare the types and frequencies of these potential risk factors among patients admitted to HUCSH with a diagnosis of stroke. All patients who had been admitted with a diagnosis of stroke and had a brain CT scan were included.

The source population were all patients admitted to medical ward, HUCSH, during the study period. A study population were all patients admitted with the diagnosis of stroke to medical ward of HUCSH during the study period.

All medical records/charts/ of patients who were admitted to HUCSH medical ward with the diagnosis of stroke during the study period were included in the study.

2.3. Data Collection and Quality Control

Data was collected by the authors using a check list sheet from the medical records of those patients who had been admitted to the medical ward with a diagnosis of stroke over the specified time period. sociodemographic data, HIV status, type of stroke, common risk factors and possible treatment outcomes of patients were included in the check. The data collection process was supervised by the principal investigator the data was checked for completeness and accuracy on daily base.

2.4. Data Analysis

Data were first cleaned, coded and entered into SPSS version 23.0 for analysis. Descriptive statistics were used to calculate mean, medians and proportions. Cross tabulation analysis was done to compare different variables and subjected to Chi-square test to assess various relationships. The significance level was set at $p<0.05$. The data analysis and correlation were done based on the selected variables for addressing all specific objectives adequately. Finally, the results were assessed and presented by using charts, tables and paragraphs.

3. Operational Definition

1) Low- and middle-income countries – based on the yearly World Bank classification, these are countries whose gross national income (GNI) per capital is less than $12,700.
2) Medical ward- A unit in the department of internal medicine where patients are admitted to receive medical care.
3) Stroke in the young- stroke occurs in the age of 18 to 49 [23].

4. Result

There were a total of 1383 admissions to HUCSH medical ward during the study period. From these 303 charts were retrieved based on the HMIS diagnosis including all cases labeled on the HMIS as hemiplegia and/or coma. Over all, stroke accounted for 224 (16.1%) of inpatient admission of the medical ward. The remaining 52 (3.7%) and 25 (1.8) were cases other than stroke and absent charts respectively.

4.1. Demographic Characteristics and Types of Stroke

Of the total stroke patients, majority of them were found to be men accounting for 57.6%. The median age of the patients was 55 (IQR: 44.4-66.2) years with range between the age of 16 and 100 years. The most affected age group were patients between 50-59 years 62 (27.7%) followed by those >70 years 51 (22.7%). 'Stroke in the young', defined as stroke occurs in the age of 18 to 49, accounted for 73 (32.2%) of patients. Among stroke subtypes, Hemorrhagic stroke accounted for the majority 132 (58.9%) of the cases and Ischemic stroke account for 86 (38.4%). SAH was found in 15 (11.4%) of the patients with hemorrhagic stroke. Most 28 (32.5%) of the ischemic stroke cases were observed among patients above the age of 70 years (p. value: 0.02).

Table 1. Age and Gender distribution of stroke subtypes in stroke patients at HUCSH.

parameters		Stroke subtypes				Overall
		Ischemic	Hemorrhagic stroke	TIA	SOU	224 (100%)
		86 (38.4%)	132 (58.9%)	1 (0.4%)	5 (2.2%)	
Age	<40	13 (15.1)	19 (14.4)	-	0	32 (14.3)
	40-49	13 (15.1)	26 (19.7)	-	2 (40)	41 (18.3)
	50-59	16 (18.6)	42 (31.8)	1 (100)	3 (60)	62 (27.7)
	60-69	16 (18.6)	22 (16.7)	0	-	38 (17.0)
	>70	28 (32.5)	23 (17.4)	0	-	51 (22.7)
Gender	Male	51 (59.3)	76 (57.6)		2 (40)	129 (57.6)
	Female	35 (40.7)	56 (42.4)	1 (100)	3 (60)	95 (43.4)

4.2. Risk Factors

History of hypertension was the most common risk factor identified in 117 (52.2%) of patients. Cardiac disease and DM which accounted for 20 (8.9%) and 11 (4.9%) respectively. Hypertension was found in 79 (59.8%) and 37 (43.0%) of patients with hemorrhagic and ischemic strokes respectively (p. value: 0.027). Among patients with history of hypertension, 27.3% of patients had never been on any antihypertensive medication. Over all history of cardiac disease was present in 22.1% and 0.8% of ischemic stroke and hemorrhagic stroke respectively (p-value=0.001). History of substance use was not documented for majority of patients although ten (4.5%) and four (1.8%) of patients had history of drinking alcohol and cigarette smoking respectively.
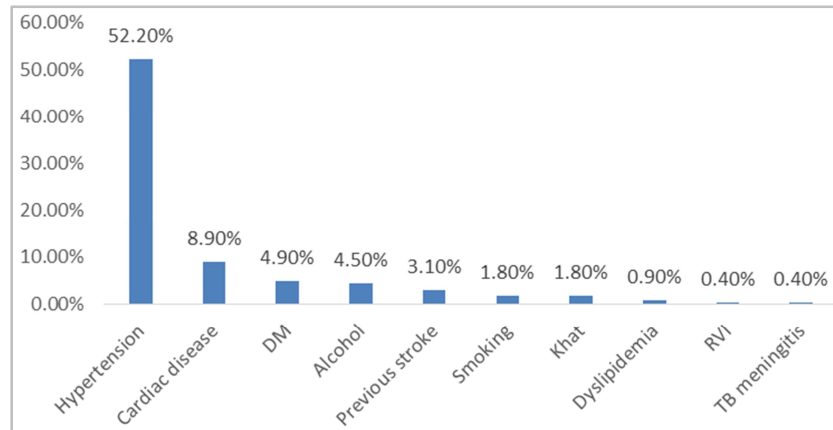

Figure 1. The distribution of the different risk factors among patients with stroke.

Table 2. The distribution of risk factors among the subtypes of stroke.

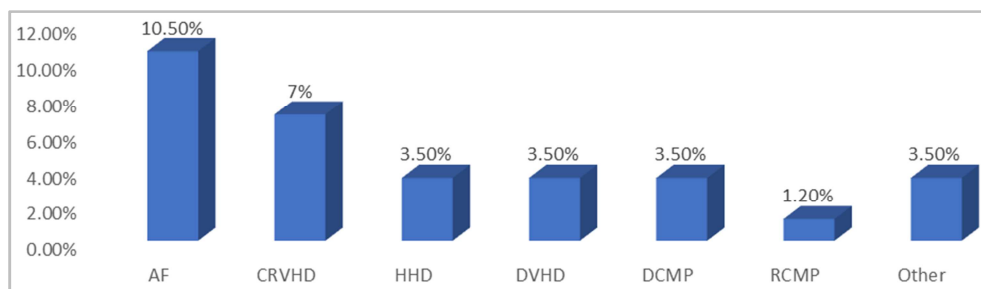| Risk factors		Stroke subtypes n (%)		P. value
		Ischemic stroke	Haemorrhagic stroke	
Hypertension		37 (43.0)	79 (59.8)	0.027
Cardiac disease		19 (22.1)	1 (0.8)	0.001
DM		6 (7.1)	5 (3.8)	0.69
Alcohol		2 (2.3)	8 (6.0)	0.58
Previous stroke		4 (4.7)	3 (2.3)	0.83
Khat		1 (1.2)	2 (1.5)	0.92
Cigarette smoking		3 (3.5)	1 (0.8)	0.50
Dyslipidaemia		2 (2.3)	0	0.36
RVI		1 (1.2)	0	0.66
Gender	M	51 (59.3)	76 (57.6)	0.55
	F	35 (40.7)	56 (42.4)	

Figure 2. Distribution of cardiac disease among patients with Ischemic stroke.

AF and CRVHD found in 9 (10.5%) and 6 (7%) of patients with Ischemic stroke whereas none of patients with Hemorrhagic stroke had AF or CRVHD with respective p-value of 0.005 and 0.042.

4.3. Clinical Presentations

Focal neurologic deficit was the major presentation occurring in 173 (77.3%) of the patients followed by speech disturbance 72 (32.1%) and altered mentation 38 (17.0%). Nearly 90% patients with Ischemic stroke and 68.9% of patients with Hemorrhagic stroke had body weakness (p. value: 0.005). Over all Seizure was identified in 14 (6.3%) of patients.

Hemiplegia was most common neurologic examination finding accounting for 114 (50.9%) of patient followed by CN

palsy 107 (41.8%) and hemiparesis 49 (21.9%). Hemiparesis is more common in patients with Ischemic stroke than

hemorrhagic stroke (26.7% vs 18.9%) with p. value of 0.07. Aphasia was identified in 41 (18.4%) of patients.
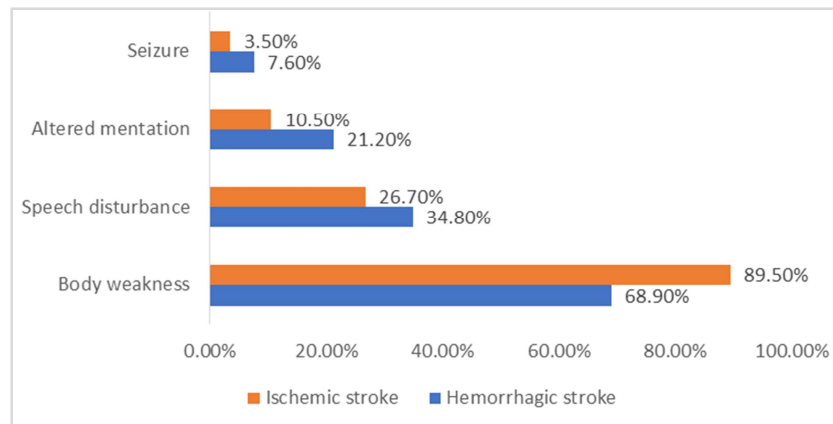

Figure 3. *Clinical presentations among the different subtypes of stroke in stroke patients at HUCSH.*
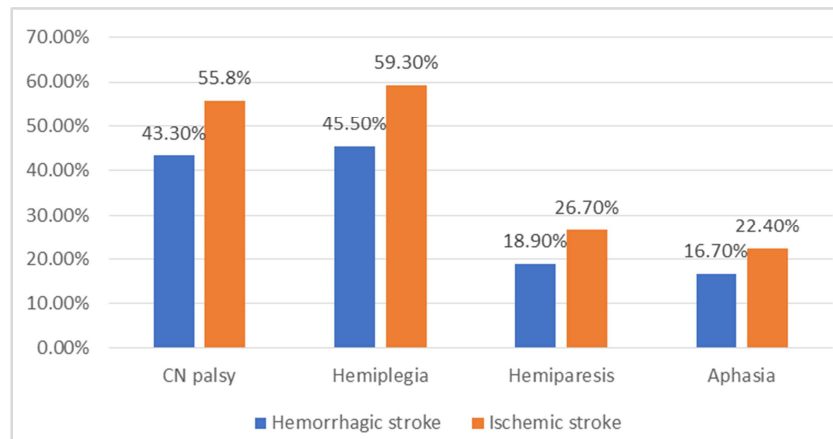

Figure 4. *Neurologic examination findings among the subtypes of stroke patients' in HUCSH.*

4.4. Investigations

Brain imaging was done for all patients. Among these 211 (94.2%) had Brain CT-scan, 9 (4.0%) had Brain MRI and 3 (1.3%) had both Brain MRI and Brain CT-scan. One patient with SAH had brain MRA which was unremarkable and Brain CT-scan. Out of the 12 patients for whom Brain MRI

was done, 3 (25%) patients turn out to have ICH (one lobar and one basal ganglia) and 7 (75%) had Ischemic stroke (one basal ganglia, one cerebellar and five lobar infarction).

Among patients with Ischemic stroke 46 (53.5%) identified to have Lobar infarction on brain CT-scan. Basal ganglia hemorrhage was the most common brain CT-scan finding occurring in 69 (52.2%) of patients with hemorrhagic stroke.

Table 3. *Brain CT- scan results of patients with stroke in HUCSH.*

Ischemic stroke CT-scan result	N (%)	Hemorrhagic stroke CT-scan result	N (%)
Normal	9 (10.5%)	BG hemorrhage	69 (52.2%)
BG infarction	16 (18.6%)	Lobar hemorrhage	24 (18.2%)
		SAH	15 (11.4%)
Lobar infarction	46 (53.5%)	Thalamic hemorrhage	11 (8.3%)
Cerebellar infarction	1 (1.2%)	Brainstem hemorrhage	3 (2.2%)
		Cerebellar hemorrhage	2 (1.5%)
Other	8 (9.3%)	Other	5 (3.8%)
No Brain CT scan	6 (7.0%)	No Brain CT-Scan	3 (2.2%)

Among the 224 stroke patients with half (50.9%) of patients had ECG and only 96 (42.9%) patients had Echocardiography. Among these LVH was the commonest ECG (23.2%) and Echocardiography (24.6%) finding.

Nearly one third (30.2%) of patients with Ischemic Stroke had Carotid Doppler. Out of these 12 (14.0%), 11 (12.8%) and 3 (3.5%) of patients had normal, atherosclerotic plaque and thrombosis respectively on carotid Doppler study.
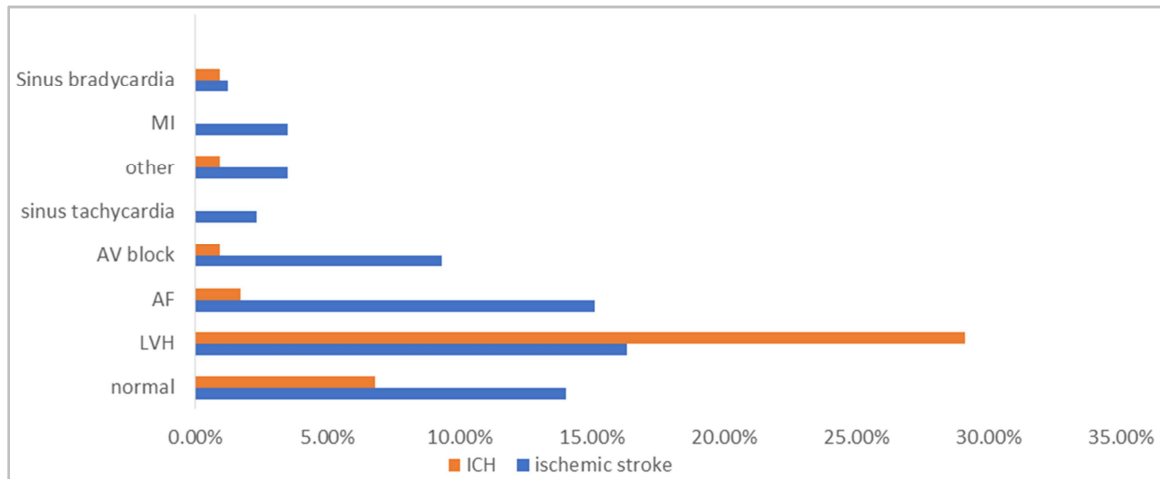
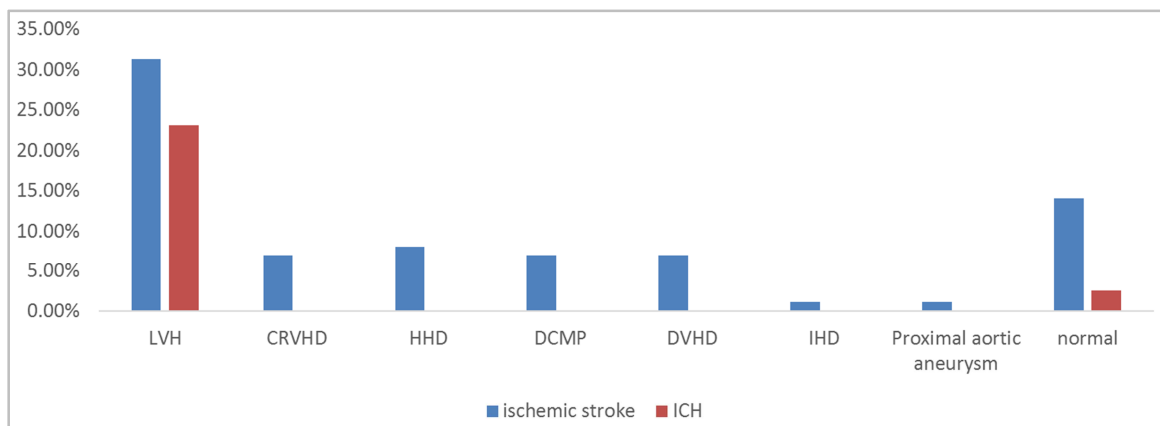*Figure 5. ECG findings among stroke patients in HUCSH.*

Figure 6. Echocardiography findings among patients with stroke in HUCSH.

4.5. Inpatient Complication and Outcome

Out of 224 stroke patients 68 (30.4%) of patients had raised ICP and 58 (25.9%) had Aspiration pneumonia. None of the patient had DVT. Aspiration pneumonia was significantly higher in patients with Hemorrhagic stroke than in patients with Ischemic stroke (31.8% Vs 16.3%) with p. value of 0.001. Raised ICP was identified in 57 (43.2%) of patients with hemorrhagic stroke, which is higher than that of patients with Ischemic stroke (p. value: 0.001). Over-all in-patient mortality of stroke was found to be 16.5%. Death occurred in 26 (19.7%) and 10 (11.6%) of patient with Hemorrhagic stroke and Ischemic stroke respectively (p. value: 0.036). The duration of hospital stay ranges from 3 to 72 days with median duration of 7 days (IQR: 5-10).
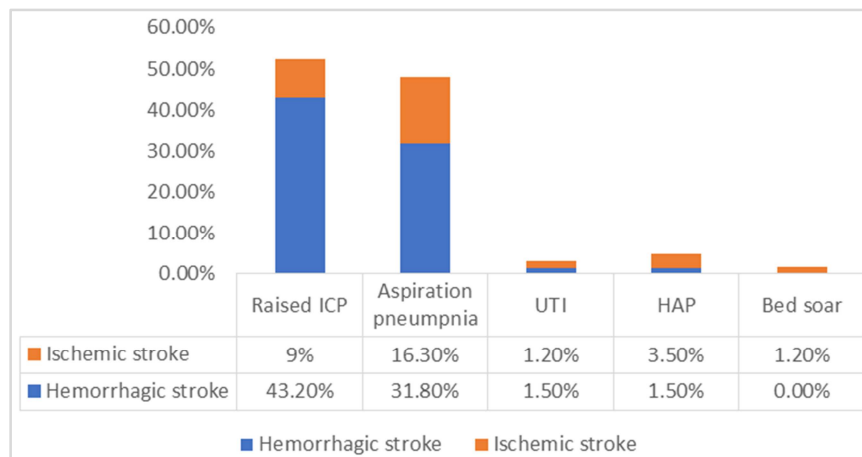

	Raised ICP	Aspiration pneumpnia	UTI	HAP	Bed soar
Ischemic stroke	9%	16.30%	1.20%	3.50%	1.20%
Hemorrhagic stroke	43.20%	31.80%	1.50%	1.50%	0.00%

Figure 7. Inpatient complications with in the stroke subtype in stroke patients in HUCSH.
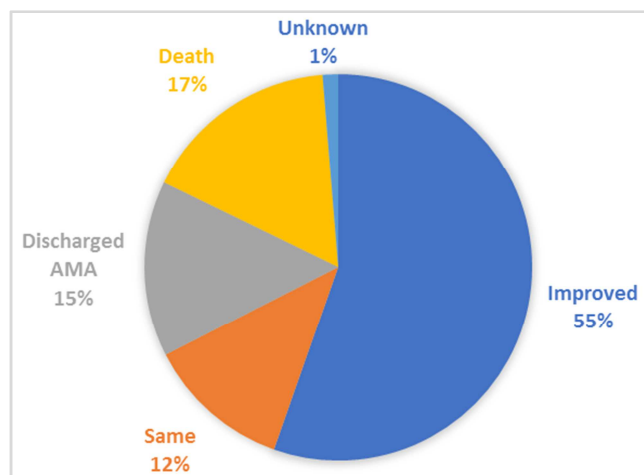
Figure 8. Summary of outcomes of patients with stroke patients in HUCSH.

5. Discussion

This hospital based retrospective cross sectional study identified that, out of the 224 patients in the study there 129 (56.7%) were male. The male predominance with M: F ratio of 1.3:1. These findings were consistent with results of hospital-based studies conducted in other parts of Ethiopia [10, 11, 18]. The median age of the patients was 55 years (IQR: 45-65). This is in line with findings in a study done in Tikur Anbessa Specialized Hospital and some African countries (18, 24). The higher rate of rate of hypertension in younger age group of patients in our study, 70 (59.8%) of patients with hypertension were below the age of 60 years. Stroke was found to be the common complication of hypertension in hypertensive patients affecting younger patients [22].

There are reports from other studies in Ethiopia that showed higher median age compared to our finding [25, 26]. This can be due to the higher rate of Ischemic stroke in those studies which is associated old age. Among stroke subtype, ischemic stroke was found to be significantly associated with age occurring in higher rate among patients >70 years of age (p. value: 0.02). Studies from Tikur Anbesa hospital and Gondar showed comparable result [9, 18]. Other studies from elsewhere also showed results consistent with our findings [20, 21, 24, 27].

Several researches done in Ethiopia showed a higher rate of ischemic stroke with the rate of hemorrhagic stroke greater than those observed in western countries [11, 25, 26]. In this study we found that hemorrhagic stroke is more common than ischemic stroke accounting for 59.8% of the cases. This result was supported by a study done in St. Paul's Teaching Hospital [10]. However, a recent hospital-based study from Shashemene Referral showed contrastingly different result with hemorrhagic stroke and Ischemic stroke accounting for 65.8% and 21.5 of patients in the study [26]. This discrepancy could be in part explained by the lack of a population studies that can more precisely reveal the true prevalence and age distribution of the subtypes of stroke. The

difference in the characteristics of the study population can also be another reason. For example, the mean age of patients in our study is 55 years where as in the study done in Shashemene hospital, it is 63 years.

When looking at the risk factors, hypertension was the most common risk factor identified in 117 (52.2%). This study also showed that hypertension is significantly associated (p. value: 0.001) with hemorrhagic stroke which in turn is the commonest stroke subtype identified. This is consistent with the previous studies done in this hospital and in other hospital based studies elsewhere in Ethiopia and African countries [11, 24-26, 28]. The reason for this could be the increase in hypertension the Ethiopian population [29]. Hypertension is a well-recognized risk factor for stroke and treatment of hypertension was shown to be effective strategy for stroke prevention [30]. Our study highlighted a window of opportunity for preventing stroke.

The other significant (p. value: 0.001) identified risk in this study is cardiac disease occurring in 20 (8.9%) of patients. AF was found to be more associated with Ischemic stroke than hemorrhagic stroke identified in 9 (10.5%) and none (0%) respectively (p. value: 0.005). This is similar with results from other studies [9, 11, 14]. It is known that patients with AF fibrillation are at increased risk of cardiovascular events [31]. It is worth noting that Out of the 9 the patients who had AF prior to the development of stroke, only 1 (10%) patient and None were taking any Aspirin and warfarin respectively. Institution of antithrombotic therapy is associated with a significant reduction in stroke among patients with AF [32].

We found that out of 110 patients for whom ECG was done 16 (14.5%) of patients had AF. This is consistent with results of a study done St. Paul's Teaching Hospital [10]. It is also worth noting out of the 16 patients who was found to have AF on ECG, 10 (62.2%) were diagnosed after stroke has already been diagnosed. Summed up our study point outs opportunity for tackling stroke by focusing on screening of risk factors and taking appropriate measure.

The in-hospital mortality rate of stroke in our study was found to be 16.5%. this result is higher than results from hospital-based studies in Gondar and Ayder hospital. It is also higher than previous study done in our setting 5 years ago which was 14.7% but it is much lower than what was identified in St. Paul's Teaching Hospital [9, 11, 25].

Research done in Pakistan showed similar result with our study [33]. This could be due to the higher rate (58.9%) of hemorrhagic stroke which accounted for most 26 (70.2%) of the in-hospital death in our study. For example, hemorrhagic stroke was found in only 38% and 30.6% of patients the done in the above-mentioned Gondar and Ayder hospital studies respectively.

Aspiration pneumonia and raised ICP were associated with worse in hospital outcome (p. value: 0.001) which is consistent with a study in Gondar [9]. The median duration of hospital stay was found to be 7 days (IQR: 5-10 days). This is in line with findings of other studies [9, 11].

6. Conclusion

In this study, Hemorrhagic stroke is the commonest stroke subtype. Hypertension and cardiac disease were the commonest modifiable risk factors associated with stroke. Aspiration pneumonia and Raised ICP were associated with poor in patient outcome.

7. Recommendation

Knowledge of the true magnitude and socio-demographic characteristics of stroke and the associated factors has indispensable importance in addressing the mortality and morbidity of stroke. For this a prospective community-based study is mandatory. Ways for screening and management of hypertension, structural heart disease and atrial fibrillation should be given priority as these are the most common risk factors identified. A better care of complications associated with stroke, hence reduction of mortality associated with it can be achieved by having a stroke unit.

Authors Contribution

This work was carried out in collaboration among all authors. All the authors played a key role in carrying out the study to a fruitful outcome. They also contributed significantly to the work that was published, whether it be in the ideation, study design, execution, data collection, analysis, and interpretation, or in each of these areas.

Conflict of Interests

All the authors do not have any possible conflicts of interest.

Abbreviations

AF	Atrial Fibrillation
CT	Computed Tomography
CNCD	Chronic Non-Communicable Disease
CRVHD	Chronic Rheumatic Heart Disease
DALYs	Disability Adjusted Life Years
DM	Diabetes Mellitus
ENT	Ear, Nose and Throat
GP	General Practitioner
HIMS	Hospital's Health Management Information System
HTN	Hypertension
HUCSH	Hawassa University Comprehensive Specialized Hospital
ICH	Intracranial Hemorrhage
ICU	Intensive Care Unit
LMIC	Low- and Middle-Income Countries
MRC	Medical Referral Clinic
MRI	Magnetic Resonance Imaging
SAH	Subarachnoid Hemorrhage
SIREN	Stroke Investigative Research and Educational Network
SNNPR	Southern Nations Nationalities and Peoples Region
SPSS	Statistical Software for Social Sciences

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References

[1] R. L. Sacco, S. E. Kasner, J. P. Broderick, L. R Caplan, A. Culebs, et al An Updated Definition of Stroke for the 21st Century: a statement for health care profesionals from the American heart association/American stroke Association, stroke 44 (2013) 2064-2089.

[2] Benjamin EJ, Virani SS, Callaway CW, Chang AR, Cheng S, Chiuve SE, et al, Heart disease and stroke statistics, 2018 update: a report from the American Heart Association [published online ahead of print January 31, 2018]. Circulation. DOI: 10.1161/CIR.0000000000000558.

[3] Mira Katan, Andreas Luft, Global Burden of Stroke, Semin Neurol. 38 (2018) 208-211.

[4] V. L Feigin, G. A Roth, M. Naghavi, P. Parmar, R. Krishnamurthi, S. Chugh, 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, Lancet Neurol. 15 (2016) 913–24.

[5] Owolabi MO, Akarolo-Anthony S, Akinyemi R, Arnett D, Gebregziabher M, Jenkins C, et al. The burden of stroke in Africa: a glance at the present and a glimpse into the future. Cardiovascular journal of Africa. 26 (2015) 27-38.

[6] X. Y. Yao, Y. Lin, J. L. Geng, Y. M. Sun, Y. Chen, G. W. Shi, et al, Age- and Gender-Specific Prevalence of Risk Factors in Patients with First-Ever Ischemic Stroke in China, Stroke Research and Treatment 2012; 136398, 6 pages.

[7] Wiberg B, Sundström J, Ärnlöv J, Terént A, Vessby B, Zethelius B, Lind L. Metabolic Risk Factors for Stroke and Transient Ischemic Attacks in Middle-Aged Men: A Community-Based Study with Long-Term Follow-Up. Stroke; 2006 Dec; 37: 2898-2903.

[8] M. koolaee, L. Shahmoradi, S. R. NiakanKalhori, Ghannadan. H, E. Younesi, Prevalence of Stroke Risk Factors and Their Distribution Based on Stroke Subtypes in Gorgan: A Retrospective Hospital-Based Study—2015-2016. Hindawi. 2018.

[9] Shenkutie Greffie E. Risk Factors, Clinical Pattern and Outcome of Stroke in a Referral Hospital, Northwest Ethiopia. Clinical Medicine Research. 2015; 4 (6): 182.

[10] 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; 08 (03).

[11] Deresse B, Shaweno D. Epidemiology and in-hospital outcome of stroke in South Ethiopia. Journal of the neurological sciences. 2015; 355 (1-2): 13842.

[12] Stevens E, McKevitt PC, Emmett DE, Wang DY, Wolfe PCD. The Burden of Stroke in Europe. 2018.

[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] O'Donnell MJ, Xavier D, Liu L, Zhang H, Chin SL, Rao-Melacini P, et al. Risk factors for ischaemic and intracerebral haemorrhagic stroke in 22 countries (the INTERSTROKE study): a case-control study. The Lancet. 2010; 376 (9735): 112-23.

[15] Owolabi MO, Sarfo F, Akinyemi R, Gebregziabher M, Akpa O, Akpalu A, et al. Dominant modifiable risk factors for stroke in Ghana and Nigeria (SIREN): a case-control study. The Lancet Global health. 2018; 6 (4): e436-e46.

[16] S. Harris, S. Sungkar, AlRasyid, M. Kurniawan, T. Mesiano, R. Hidayat. TOAST Subtypes of Ischemic Stroke and Its Risk Factors: A Hospital-Based Study at Cipto Mangunkusumo Hospital, Stroke Research and Treatment; 2018, 9589831, 6 pages.

[17] Maredza M, Bertram M, Tollman S. Disease burden of stroke in rural South Africa an estimate of incidence, mortality and disability adjusted life years. BMC Neurology. 15 (2015), 13 pages.

[18] Sultan M, Debebe F, Azazh A, Hassen GW. Epidemiology of stroke patients in Tikur Anbessa Specialized Hospital Emphasizing clinical characteristics of Hemorrhagic Stroke Patients. Ethiop J Health Dev. 2017.

[19] Zewdie A, Debebe F, Kebede S, Azazh A, Laytin A, Pashmforoosh G, et al. Prospective assessment of patients with stroke in Tikur Anbessa Specialised Hospital, Addis Ababa, Ethiopia. African Journal of Emergency Medicine. 2018; 8 (1): 21-4.

[20] Adeloye D. An Estimate of the Incidence and Prevalence of Stroke in Africa: A Systematic Review and Meta-Analysis. PLOS ONE. 2014; 9 (6): e100724.

[21] Tshikwela ML, Londa FB, Tongo SY. Stroke subtypes and factors associated with ischemic stroke in Kinshasa, Central Africa. African health sciences. 2015; 15 (1): 68-73.

[22] WorkuT, Tadesse Y, Hughes P, Lemessa T. PATTERNS OF COMPLICATIONS SEEN IN PATIENTS WITH HYPERTENSION. Ethiop Med J, 2015, Supp. 2.

[23] Putaala J. Ischemic stroke in the young: Current perspectives on incidence, risk factors, and cardiovascular prognosis. European Stroke Journal. 2016; 1 (1): 28-40.

[24] L. Kaduka, Anne Korir, C. O. Oduor, J. Kwasa, J. Mbui, S. Wabwire, et al, Stroke distribution patterns and characteristics in Kenya's leading public health tertiary institutions: Kenyatta National Hospital and Moi Teaching and Referral Hospital, Cardiovascular journal of Africa; may 2018 Volume 29, No 2.

[25] Gebremariam Sennay A., Yang Hannah S., Types, risk profiles, and outcomes of stroke patients in a tertiary teaching hospital in northern Ethiopia, (2016), doi: 10.1016/j.ensci.2016.02.010.

[26] T. G. Temesgen, B. Teshome and P. Njogu, Treatment Outcomes and Associated Factors among Hospitalized Stroke Patients at Shashemene Referral Hospital, Ethiopia, Stroke Research and Treatment Volume 2018, Article ID 8079578, 5 pages.

[27] Zhang F-L, Guo Z-N, Wu Y-H, et al. Prevalence of stroke and associated risk factors: a population based cross sectional study from northeast China. BMJ Open 2017; 7: e015758. doi: 10.1136/bmjopen-2016-015758.

[28] M. Atadzhanov, P. N. Mukomena, S. Lakhi, O. A. Ross and J. F. Meschia, Stroke Characteristics and Outcomes of Adult Patients Admitted to the University Teaching Hospital, Lusaka, Zambia; The Open General and Internal Medicine Journal, 2012, 5, 3-8.

[29] K. T. Kibret and Y. M. Mesfin, Prevalence of hypertension in Ethiopia: a systematic meta-analysis Public Health Reviews (2015) 36: 14 DOI 10. 1186/s40985-015-0014-z.

[30] R. Ravenni, J. F. Jabre, E. Casiglia, and A. Mazza, Primary stroke prevention and hypertension treatment: which is the first-line strategy?: Neurology International 2011; volume 3: e12.

[31] E. J. Kim, X. Yin, J. D. Fontes, J. W. Magnani, S. A. Lubitz, D. D. McManus et al, Atrial fibrillation without comorbidities: Prevalence, incidence and prognosis (from the Framingham Heart Study). (Am Heart J 2016; 177: 138-44).

[32] Robert G. Hart, Lesly A. Pearce, and Maria I. Aguilar, Anti thrombotic therapy to prevent stroke in patients who have none valvular Atrial Fibrillation; Ann Intern Med. 2007; 146: 857-867.

[33] J. A Rathore, Z. A. Kango, M. Nazir, and A. Mehraj, RISK FACTORS FOR STROKE: A PROSPECTIVE HOSPITAL BASED STUDY; J Ayub Med Coll Abbottabad 2013; 25 (1-2).