

Assessment of Risk Factors and Treatment Outcome of Stroke Admissions at St. Paul's Teaching Hospital, Addis Ababa, Ethiopia

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Abstract

Background: Stroke is becoming a significant cause of morbidity and mortality in low and middle income countries. Currently, there is limited data about stroke in Ethiopia to design a strategy to combat the disease.

Objective: To assess the overall prevalence, potential risk factors and outcome of stroke admissions at St. Paul's Teaching Referral Hospital.

Patients and methods: A hospital based retrospective study was conducted at St. Paul's Teaching Referral Hospital in April 2016. The study has focused on review of medical records of all stroke admissions to the hospital from September 1st, 2015 to August 30th, 2016. Socio-demographic information, risk factors, and treatment outcomes of patients were assessed and data were entered and analyzed using Statistical Programs for Social Sciences 23.0. Descriptive analysis and Chi-square tests were used to assess the association between socio-demographic variables, potential risk factors and treatment outcomes of patients with stroke. P-value<0.05 was considered significant.

Results: A total of 163 stroke patients with a median age of 68 years and M:F ratios of 1.3:1 were analyzed. Hemorrhagic stroke was the most common type of stroke accounting for 61.3% of cases. The most commonly identified risk factors were; Hypertension (60.7%), structural heart disease (18.4%), atrial fibrillation (14.7%) and diabetes mellitus (11%). In hospital case fatality rate was 30.1% and a significant number (45.4%) of patients was discharged with neurologic deficit and the median duration of hospital stay was 11.14 days.

Conclusion: In this study, hemorrhagic stroke was the most common type of stroke. Gender, stroke subtype, previous history of stroke and transient ischemic attack were the main determinants of treatment outcome.

Keywords: Stroke; prevalence; Risk factors; Treatment outcome; Determinants of treatment outcome; Ethiopia

Abbreviations CT: Computed Tomography; DAMA: Discharged against Medical Advice; DM: Diabetes Mellitus; DWND: Discharged with Neurologic Deficit; ECG: Electrocardiography; HIV: Human Immune-Deficiency Virus; ICH: Intra-Cerebral Hemorrhage; ICU: Intensive Care Unit; MRI: Magnetic Resonance Imaging; SAH: Sub-Arachnoid Hemorrhage; SNNP: South Nations and Nationalities People; SPHMMC: St. Paul's Hospital Millennium Medical College; SPSS: Statistical Software for Social Sciences; TIA: Transient Ischemic Attack; WHO: World Health Organization

Introduction

Stroke is one of the most common causes of morbidity and mortality worldwide [1]. The global incidence of stroke is estimated to be approximately 15 million new strokes per year, two thirds of which occur in low- and middle-income countries (LMICs) [2-4]. It has been estimated that disability adjusted life years from a stroke is over 87% in LMICs, which is about seven times the disability adjusted life years lost in high-income countries (HICs) [5,6]. Stroke ranks as the third

leading cause of death worldwide, with 5.8 million fatal cases per year. It is now being recognized as an important cause of death in sub-Saharan Africa [2].

The prevalence of ischemic stroke is relatively higher than hemorrhagic stroke in most studies from Africa. In Nigeria, the prevalence of hemorrhagic and ischemic stroke in two hospitals was 29.5% and 54.7% respectively [7]. From a hospital based data in Senegal, 70% of strokes were of ischemic in nature and hypertension was identified as the major risk factor in 68% followed by diabetes mellitus in 37.3% of cases [8]. However, hemorrhagic stroke was the most common cause of stroke accounting for 59.2% of patients who had brain Computerized Tomography (CT) scan in a study conducted in a single center in Ethiopia a decade ago [9]. A prospective hospital-based study conducted at another center in Ethiopia reported ischemic stroke as the commonest type of stroke [10].

Few studies from Africa have identified stroke as the most common neurologic disease requiring hospital admission. In a study in north-western Nigeria, stroke was found to be the major (77.6%) neurologic admission and the most common cause of neurologic and medical death [11]. The pattern of admissions for neurological diseases among Ethiopian patients at two hospitals in Addis Ababa about three decades

ago showed stroke (45%) and bacterial meningitis (12%) as the two most common causes of admissions [12].

Previous hospital based studies in Ethiopia reported a higher percentage of hemorrhagic stroke than ischemic stroke, which is different from studies in other countries. The aim of this study was to assess the current magnitude, associated factors and treatment outcome of stroke among medical admissions to St. Paul's Hospital Millennium Medical College (SPHMMC) over a period of one year. It was conducted to provide a useful data in the establishment of evidence based interventions for Ethiopians through studying the types of stroke, common risk factors, treatment outcomes and determinants of poor outcome among stroke patients treated at St. Paul's teaching Hospital.

Patients and Methods

Study setting

The study was conducted at St Paul's Hospital Millennium Medical College. The hospital is the third oldest hospital in Addis Ababa and it is the second largest tertiary referral hospital in the country. It provides care to approximately 250,000 people each year and receives referrals from all over the country.

Study design

A hospital based retrospective study design was used to analyze the medical records of all stroke patients admitted to the hospital from September 1, 2015 to August 30, 2016. The data were used to assess the prevalence of stroke, potential associated risk factors and to compare the types and frequencies of these potential risk factors among patients admitted to St. Paul's Hospital with a diagnosis of stroke. The Overall outcome of these patients was also evaluated. All patients who had been admitted with a diagnosis of stroke and had a brain CT scan or Magnetic Resonance Imaging (MRI) were included in the study.

Data collection

Data were collected by trained data collectors using a check list sheet from the medical records of those patients who had been admitted to the medical ward and medical ICU with a diagnosis of stroke over the specified time period. The check list contained socio-demographic data, HIV status, type of stroke, common risk factors (hypertension, diabetes mellitus, substance use, neurologic risk factors and atrial fibrillation) and possible treatment outcomes of patients.

Data processing and analysis

Data were cleaned, entered and analyzed using Statistical Software for Social Sciences (SPSS) version 23.0. Descriptive statistics were used to calculate mean, medians and proportions. Moreover, 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 texts.

Ethical consideration

The study was approved by The St. Paul's Hospital Millennium Medical College Institutional Review Board and all information

obtained from patients' medical records was treated with utmost confidentiality.

Results

There were 1252 admissions to St. Paul's Hospital medical wards and ICU during the study period. Among these admissions, 201 (16.1%) were due to stroke. Of these admissions, 163 (80.6%) were to medical wards and the rest 39 (19.4%) were to adult ICU. The medical records of only 163 (81.1%) stroke patients were retrieved from records office and all were included in the study. The medical records of the remaining 39 (19.4%) patients were not analyzed since they had incomplete data.

Demographic characteristics and types of stroke

The majority (56.4%) was men and the mean age of patients was 57.5 ± 15.8 years, ranging from 18-96 years. 'Stroke in the young', defined as stroke in the age less than 45 years, accounted for 31 (19%) patients. The major affected age group was 64-84 (41.1%) years followed by 45-64 (38.7%) years. Most (62.9%) patients were Orthodox Christian and 42.9% of them were Amhara in ethnicity (Table 1). The median age of patients was 62 (Inter Quartile Range (IQR), 45-84) years and 59 (IQR, 25-64) years for ischemic and hemorrhagic stroke, respectively. The most common type of stroke was hemorrhagic stroke seen in 100 (61.3%) patients followed by ischemic stroke in 58 (35.6%) patients (Table 2).

	Parameter	Number (%)
Age	<25	5 (3.1)
	25-44	26 (16)
	45-64	63 (38.6)
	65-84	67 (41.1)
	≥ 85	5 (3.1)
Gender	Male	92 (56.4)
	Female	71 (43.6)
Religion	Orthodox	103 (62.9)
	Protestant	32 (19.7)
	Catholic	2 (1.1)
	Muslim	16 (10.1)
	Other	10 (6.2)
Ethnicity	Oromo	61 (37.5)
	Amhara	70 (42.9)
	Tigre	7 (4.3)
	SNNP	23 (14.1)
	Somali	1 (0.6)
	Other	1 (0.6)

Table 1: Demographic characteristics of study population (n=163) (SNNP: South Nations and Nationalities People).

Parameter		Type of stroke n (%)			Overall, n (%)
		Ischemic	SAH	ICH	
		58 (35.6)	5 (3.1)	100 (61.3)	163 (100)
Age (years)	<25	-	-	5 (5)	5 (3.1)
	25-44	10 (17.2)	1 (20)	15 (15)	26 (16)
	45-64	19 (32.8)	4 (80)	40 (40)	63 (38.6)
	65-84	28 (48.3)	-	39 (39)	67 (41.1)
	≥ 85	1 (1.7)	-	1 (1)	2 (1.2)
Gender	Male	26 (44.8)	3 (60)	63 (63)	92 (56.4)
	Female	32 (55.2)	2 (40)	37 (37)	71 (43.6)

Table 2: Age and gender distribution of stroke subtypes (n=163) (SAH: Sub-Arachnoid Hemorrhage; ICH: Intra-Cerebral Hemorrhage).

Antecedent risk factors

Hypertension was found to be the most common antecedent risk factor in 92 (56.4%) patients. History of antecedent hypertension was identified in 80.0%, 61.0% and 58.6% of patients with subarachnoid hemorrhage, hemorrhagic and ischemic strokes, respectively. Diabetes mellitus (DM) was identified as a risk factor in 19 (11.6%) patients and 14 (8.5%) patients had both hypertension and diabetes mellitus (Table 3). Among patients with antecedent hypertension, nearly half (49.5%) of patients had never been on antihypertensive treatment, but only 26 (16.6%) patients were on regular medication (Figure 1).

Risk factor	Number (%)
Hypertension	92 (56.4)
Diabetes Mellitus	19 (11.6)
Smoking	13 (8.0)
Structural heart disease	30 (18.4)
Atrial fibrillation	24 (14.7)
Transient ischemic attack	9 (5.5)
Previous Stroke	15 (9.2)
HIV	1 (0.6)
Hypertension and diabetes mellitus	14 (8.5)

Table 3: Risk factor profile of the study population (n=163) (HIV: Human Immune-Deficiency Virus).

Neurological presentation

The majority (81.6%) of patients presents with focal neurologic deficit. Among patients with ischemic stroke, most (79.3%) presents with altered mental status. But, focal neurologic deficit was the commonest (82.9%) neurologic presentation among patients with intra-cerebral hemorrhage. Among patients who presented with altered mentation or coma nearly half (43.3%) died in the hospital. This figure was higher than in those who presented with focal

neurologic deficit, but was no statistically significant (p=1.49) (Figure 2).

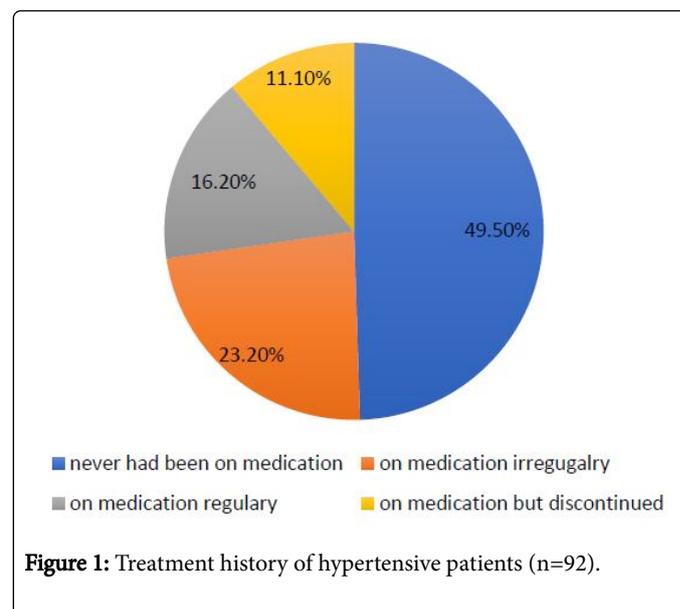


Figure 1: Treatment history of hypertensive patients (n=92).

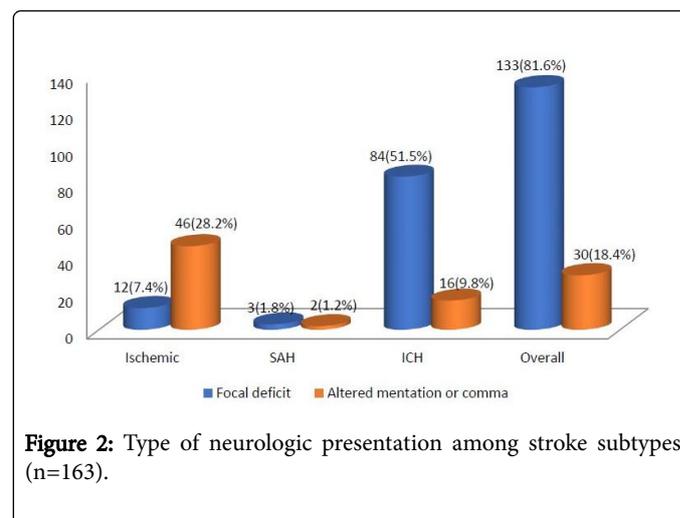


Figure 2: Type of neurologic presentation among stroke subtypes (n=163).

Outcome

The in-hospital case fatality rate of stroke was 30.1% and the majority (59.2%) of death was in men. The larger proportion (48.9%) of death was observed in the age group of 45-64 years. Most (45.4%) patients were discharged with significant neurologic deficit. Only 36 (22.1%) patients were discharged with significant neurologic improvement. The median length of hospital stay was 11.14 ± 10.4 days and ranged from 1 to 62 days (Table 4). Among in-hospital deaths, the majority (63.3%) were in those with intracerebral hemorrhage as indicated in Figure 3. However, the proportion of patients with significant neurologic improvement was higher in ischemic stroke than hemorrhagic stroke group (29.3% vs. 17%) and was statistically significant (p=0.029). Of 11 patients who had a previous history of stroke, 7 (63.4%) died in hospital showing a statistically significant association (p=0.049). In addition, transient ischemic attack and atrial fibrillation had also a significant association with in-hospital mortality (p-values of <0.01 and 0.02, respectively) (Table 5).

Socio-demographic factor	Treatment Outcome n (%)				P-value*
	Dead*	Improved	DWND	DAMA	
	49 (30.1)	36 (22.1)	74 (45.4%)	4 (2.4)	0.1
Age					
<25	-	2 (5.5)	2 (2.7)	1 (25)	
25-44	3 (6.1)	6 (16.7)	17 (23.0)	-	
45-64	24 (48.9)	13 (36.1)	24 (32.4)	2 (50)	
65-84	22 (45.0)	14 (38.9)	30 (40.5)	1 (25)	
≥ 85	-	1 (2.8)	1 (1.4)	-	
Gender					0.014
Male	29 (59.2)	13 (36.1)	49 (66.2)	1 (25)	
Female	20 (40.8)	23 (63.9)	25 (33.8)	3 (75)	

Table 4: Treatment outcome of stroke patients (n=163) (DWND: Discharged with Neurologic Deficit, DAMA: Discharged against Medical Advice, statistical test was done for death).

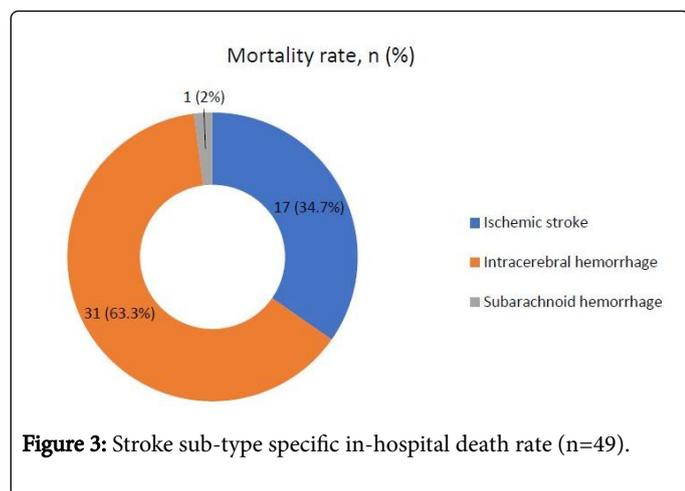


Figure 3: Stroke sub-type specific in-hospital death rate (n=49).

Risk factor		Death N (%)	P-value
Hypertension	Present	29	0.657
	Absent	20	
Diabetes mellitus	Present	8	0.392
	Absent	41	
Smoking	Present	4	0.057
	Absent	45	
Structural heart disease	Present	5	0.199
	Absent	44	
Previous stroke	Present	7	0.047
	Absent	42	
TIA	Present	5	0.00
	Absent	44	

Atrial fibrillation	Present	9	0.02
	Absent	40	
HIV	Present	-	0.14
	Absent	49	

Table 5: Patterns of risk factors among in-hospital deaths (n=49) (HIV: Human Immune Deficiency virus; TIA: Transient Ischemic Attack).

Discussion

In this study, the majority of patients are in the age group of 64-84 (41.1%) years, followed by 45-64 (38.7%) years and the least number of patients are in the age group above 85 (1.2%) years. This finding is similar to the result from Ayder referral hospital in Ethiopia, where half of the patients were in the age group of 64-84 (50.0%) years, but different from a study done at Tikur Anbessa hospital in Addis Ababa where a quarter of patients were under 34 years followed by 55-64 (23.6%) years [6,13]. The mean age of patients with stroke in this study was 57.53 ± 15.8 years, which are higher than the results of studies done at Tikur Anbessa hospital, with mean age at diagnosis ranging from 50.6-53.2 years [9,14]. The mean age of study subjects is lower than the finding from the Ayder referral hospital that reported the mean age of 62.8 years [15]. On a study from Kenya referral hospital, the mean age was reported to be 61.3 years [16]. In our study, the median age of patients was 62 and 59 years in ischemic and hemorrhagic strokes, respectively. Males were higher than females with male-to-female ratio of 1.3:1. Several other hospital-based studies conducted in Ethiopia [9,14], Kenya [19] and Nigeria [17,18] also reported similar findings.

The most common type of stroke found in this study was a hemorrhagic stroke with ischemic to hemorrhagic stroke ratio of 0.55, including SAH among the hemorrhagic stroke group. Other studies in Ethiopia found a similar low ratio of ischemic to hemorrhagic stroke [9,13,14]. But this finding is in contrary to studies done in other African countries where there was a higher ischemic to hemorrhagic ratio [16-18]. These differences could be due to; first, a higher proportions (84%) of hypertensive patients were not on proper antihypertensive treatment and likely to have uncontrolled hypertension, which is a common cause of hemorrhagic stroke. Second, all the studies in Ethiopia were conducted in tertiary referral hospitals that deal with patients with significant neurologic deficit. Minor neurologic deficits that are seen among most patients with ischemic stroke are likely to be managed in primary hospitals.

Consistent with other studies [10,17-19], hypertension was found to be the most common identified risk factor among our stroke patients. The proportion of hypertensive patients was higher than studies from Northwest and Southern Ethiopia [10,19]. But, it is low when compared to a report from Tikur Anbessa Hospital [12]. Other hospital-based studies from other African countries have also reported higher proportion of hypertension among stroke patients [16-18]. DM was found in 11.6% of patients with stroke in this study; which is lower than the results from another hospital based studies in East Africa where the prevalence of DM was 26% and 33.7% in Ethiopia and Kenya respectively [14,16]. But, it is almost comparable to the result from the Gondar Hospital in Ethiopia, where the prevalence of DM was 10% [19]. About 8.5% of patients had both DM and hypertension, which is again comparable with the result from Gondar [19]. This entails the synergistic effect of hypertension and DM on stroke.

Therefore, the beneficial effect of screening and treatment of hypertension and DM for the prevention of stroke cannot be overemphasized. The prevalence of atrial fibrillation in this study was 14.7% among those patients who had Electrocardiography (ECG). It is lower than reports from Copenhagen stroke study where the prevalence of atrial fibrillation among stroke patients was 18% [20]. It is also lower than the report from Gondar referral hospital where the prevalence was 28.7% [19]. The lower proportion of atrial fibrillation in our study might be due to only single resting ECG determination, where paroxysmal atrial fibrillation could be missed. Similar to other studies [12,15,19,21], the rate of tobacco smoking was very low among our patients.

The in-hospital case fatality rate in this study was 30.1%, which is higher than reports from hospital based retrospective studies from Addis Ababa, North, North West and Southern part of Ethiopia that range from 12 to 21% [10,14,15,19]. But our finding is similar to the 30 day case fatality rate of 30% reported in a systematic review of hospital-based prospective studies in Sub-Saharan Africa [6]. But, it is lower than the case fatality rates of stroke reported from Tikur Anbessa Hospital [9,21]. There is a higher case fatality rate due to hemorrhagic stroke (31%) compared to ischemic stroke (29.3%), which is similar to reports from Ayder Hospital and other Sub Saharan African countries [15,21]. Gender and stroke subtype has a significant association with in-hospital death among our patients (p-value of 0.01 and 0.03, respectively), which is similar to multiple studies [10,16,18,19]. Among the reported risk factors, atrial fibrillation was associated with increased in-hospital death (p=0.02). This finding is also similar to studies from the European community stroke project and Copenhagen stroke center [20-22]. Similarly, previous history of stroke and transient ischemic attack were associated with increased in-hospital death (p-values of 0.04 and <0.001, respectively) as observed in other studies [20-22].

Conclusion

In this study, hemorrhagic stroke was the most common reason for stroke admission. Patients with hemorrhagic stroke were younger than those with ischemic stroke. Hypertension and structural heart disease were the common risk factors. The most common determinants of in-hospital mortality were gender, type of stroke, previous history of stroke and transient ischemic attack. The in-hospital case fatality rate was high. Moreover, a significant proportion of survivors were discharged with neurologic deficit.

Recommendation

A prospective community based study is required to define the true magnitude and socio-demographic characteristics of stroke and the associated factors in the general population. Strategies for screening and management of hypertension, structural heart disease and atrial fibrillation should be given priority as these are the most prevalent risk factors identified. An emergency care setup capable of early patient evaluation, identification and management of early stroke complications is crucial for prevention of early stroke related mortality.

Ethics Approval

The St. Paul's Hospital Millennium Medical College Institutional Review Board approved the study.

Consent for Publication

Not applicable.

Availability of Data and Materials

The institutional review board of SPHMMC does not allow sharing original data unless indicated in the approval process.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contributions

BG, TB, TM and HA conceived the study, and designed the study; BG oversaw the data collection process. TB, BA, TM and HA analyzed the data; TB and BA and HA wrote the final draft; TB and HA reviewed the final draft and approved it.

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