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ORIGINAL ARTICLE

Prospective assessment of patients with stroke in Tikur Anbessa Specialised Hospital, Addis Ababa, Ethiopia

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ABSTRACT

Introduction: The burden of stroke is increasing in many low- and middle-income countries. In Ethiopia, stroke has become a major cause of morbidity, long-term disability, and mortality. Time from stroke onset to hospital presentation is a critical factor in acute stroke care. This study aimed to describe risk factors for stroke and clinical presentation of patients presenting to the emergency centre with stroke.

Methods: We conducted a cross sectional study conducted from August 2015 to January 2016 in an urban tertiary care centre in Addis Ababa, Ethiopia. Descriptive statistics and multivariable logistic regression models were used to evaluate associations between stroke types and stroke risk factors, and delayed presentation and clinical indicators. P-values less than .05 were considered statistically significant.

Results: A total of 104 patients were included. The mean age was 53 years, and 56% were male. Only 30% of patients arrived using an ambulance service. The most common presenting symptoms were altered mental status (48%), hemiparesis (47%), facial palsy (45%), hemiplegia (29%), and aphasia (25%). Hypertension was the most common risk factor (49%), followed by cardiovascular disease (20.2%) and diabetes mellitus (11%). The majority of strokes were haemorrhagic in aetiology (56%). The median arrival time to the emergency centre was 24 h after symptoms onset; only 15% presented within three hours. Patients with hypertension, or presented with loss of consciousness were significantly more likely to have haemorrhagic stroke ($p < .001$ and $p = .01$ respectively). The only risk factor robustly associated with ischaemic stroke was cardiac illness (odds ratio 3.99, $p = .01$).

Discussion: Our study identified hypertension to be the most common risk factor for stroke. The predominant aetiology type in this cohort is haemorrhagic stroke. Lastly, the median arrival time to an emergency centre was 24 h after symptom onset.

African relevance

- Non-communicable diseases are rapidly rising in Africa.
- Current stroke management is perceived to be poor, especially in resource-limited settings.
- Different risk factors apply to an African population in the development of a stroke.
- Time to care is very important to save brain tissue but there are unique challenges in resource-limited settings.

Introduction

Globally, 16.9 million new cases of stroke occur each year, resulting in 5.9 million deaths, with over two-thirds of strokes and stroke deaths occurring in low- and middle-income countries (LMICs) [1]. It is estimated that over 87% of disability adjusted life years (DALYs) from stroke occur in LMICs [2]. With the absence of a significant global public health response, the burden of stroke is expected to increase to over 23 million total new cases and 7.8 million deaths per year by 2030 [3]. The continent of Africa is disproportionately affected by stroke due to population

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Table 1
Patient demographics versus time of emergency centre arrival.

Demographics		Time from onset of symptoms to EC arrival		p-value	Type of stroke		p-value
		≤6 h (n = 28)	> 6 h (n = 76)		Ischaemic (n = 46)	Haemorrhagic (n = 58)	
Age	< 35 years	4/28	10/76	0.83	6/46	8/58	0.82
	35–60 years	14/28	43/76		24/46	33/58	
	> 60 years	10/28	23/76		16/46	17/58	
Sex	Male	13/28	45/76	0.24	24/46	34/58	0.51
	Female	15/28	31/76		22/46	24/58	
Occupation	Farmer	7/28	26/76	0.63	13/46	20/58	0.64
	Government employee	2/28	9/76		6/46	5/58	
	Unemployed	11/28	25/76		18/46	18/58	
	Student	8/28	16/76		9/46	15/58	
Level of education	Not educated	13/28	42/76	0.82	26/46	29/58	0.55
	Elementary	6/28	14/76		6/46	14/58	
	High school	4/28	7/76		5/46	6/58	
	College/university	5/28	13/76		9/46	9/58	
Mode of arrival	Ambulance	10/28	21/76	0.54	13/46	18/58	0.20
	Private car/taxi	18/28	55/76		33/46	40/58	

growth, poor and under-developed healthcare systems, unchecked industrialisation, and the increased adoption of Western diets. These trends lead to increases in the prevalence of hypertension, diabetes, and obesity, all of which are significant risk factors for stroke [1,4].

Ischaemic and haemorrhagic strokes are medical emergencies that require emergent diagnosis and management. The critical area for intervention in an ischaemic stroke is the "ischaemic penumbra", the region of brain tissue that is threatened but viable after the occlusion of a cerebral artery. Facilities in high-income countries have access to thrombolysis techniques, such as tissue plasminogen activator (tPA), and angiographic interventions in order to effectively restore perfusion to the ischaemic penumbra, depending on patient presentation [5–7]. Even when these interventions are not available, facilities in high-resources settings have therapeutics to address dehydration, hypoxia, hyperglycaemia, extreme hypertension, and increased intracranial pressure; all of which can reduce the severity of long-term disability from stroke. In contrast, in LMICs, there are patient- and system-related factors that amplify the burden of stroke, especially delays in patient presentations. These delays result in missed opportunities for early interventions to stabilise stroke victims.

In Ethiopia, there is limited information available about the epidemiology of stroke, including lack of patient demographics and risk factors, clinical presentation, and barriers to care. These data are beneficial when creating public awareness programs, developing strategies for primary prevention, and improving access to care. The goals of this study are to describe factors associated with stroke and the clinical presentation of patients with stroke and to determine the rate of and reasons for delayed patient presentation, especially in low-resource settings.

Methods

We conducted a cross-sectional study in the adult emergency centre (EC) of an urban university hospital in Addis Ababa, Ethiopia, from August 2015 to January 2016. The study site is a tertiary referral hospital with neurological and neurosurgical expertise. We screened all patients presenting to the adult EC with stroke-like symptoms or altered level of consciousness for eligibility at the triage. All patients with CT-confirmed diagnosis of acute stroke were also included. We excluded patients with post-traumatic neurologic deficits or new stroke symptoms in the context of central nervous system lesions due to malignancy or infection.

After patients were evaluated and resuscitated by the clinical team, we requested informed consent from patients or a surrogate decision maker in cases of altered mental status or aphasia. If informed consent was granted, a trained data collector used a pre-tested, standardised questionnaire to collect data about the subject's background and medical history, and the nature and duration symptoms (Appendix A, Data supplement). We reviewed emergency centre clinical records for documented physical examination findings and results of laboratory investigations and radiographic examinations.

Our sample size calculation of 114 was based on a similar study conducted by Chalachew et al. [8]. We adjusted the formula for a population less than 5000, resulting in a minimum sample size of 65 patients for our study. We performed analysis using SPSS version 20. We used descriptive statistics as well as multivariable logistic regression models to evaluate associations between stroke types and stroke risk factors, and between delayed presentation and clinical indicators. P-values less than 0.05 were considered statistically significant. The study was approved by the Institutional Review Boards of the emergency centre and the university.

Results

A total of 104 patients were included in the study, of whom 58 were male (56%). The mean age was 53 years (standard deviation 17). Patient demographics, educational status, occupation and mode of arrival are summarised in Table 1.

Risk factors for stroke are summarised in Table 2. Fifty-one patients (49%) had at least one known risk factors for stroke. Hypertension (49%) was the most common stroke risk factor, followed by cardiac

Table 2
Risk factors versus type of stroke.

Risk Factor	Ischaemic stroke (n = 46) n (%)	Haemorrhagic stroke (n = 58) n (%)	p-value
Hypertension	21 (45.7)	30 (51.7)	0.001
Cardiac illness	15 (32.6)	6 (10.3)	< 0.01
Diabetes Mellitus	6 (13)	5 (8.6)	0.4
Previous history of stroke	3 (6.5)	3 (5.2)	0.7
HIV	1 (2.2)	3 (5.2)	0.48
Smoking	2 (4.3)	1 (1.7)	0.42
TIA	3 (6.5)	0	< 0.05
Family history of stroke	1 (2.2)	0	0.25

HIV, human immunodeficiency virus; TIA, transient ischaemic attack.

illness (20%) and diabetes (11%). Nine patients (9%) had both diabetes and hypertension. Valvular heart disease (VHD) was the most commonly identified type of cardiac illness, followed by ischaemic heart disease and hypertensive heart disease. Seven patients (7%) had atrial fibrillation. The mean duration of hypertension was six years, with a range of one year to 25 years. Many patients with previously diagnosed stroke risk factors were not taking any medications (24/51; 47%), and only 18 (35%) reported that they took their medications as prescribed, while nine (18%) had stopped taking previously prescribed medications for hypertension.

Only 16 patients (15%) arrived to the EC within three hours of symptom onset. Twelve patients (11%) arrived between three to six hours and 76 (73%) arrived over six hours after of symptom onset. The median time to EC arrival was 24 hours (IQR 67 h), with a range from one hour to 503 hours. Patient demographics versus time onset is illustrated in Table 1.

The 76 patients who arrived later than six hours from the onset of symptoms were asked the reasons for the delay. The most common reason for delayed presentation was delays due to referrals (42; 55%), with 81% of referrals resulting in delays. Other common reasons included 39 patients who had to travel long distances (51%), 12 who thought their symptoms would resolve spontaneously (16%), and seven who did not have enough money to pay for transportation (9%). Others reported that they did not have assistance traveling to the hospital (3/76; 4%), or went to a traditional healer first (2/76; 3%). Fourteen patients reported both delays related to referrals and traveling long distances contributing to delayed presentation (18%). Less than one third of patients were brought to the EC by ambulance. A delay in arrival time to the EC was not statistically significantly associated with age, sex, educational status or mode of transport. In multivariable logistic regression evaluating predictors of delayed presentation, there was no individual predictor or combination of predictors that was statistically significant (omnibus likelihood ratio test p = 0.91).

Presenting symptoms included loss of consciousness (n = 50; 48%), hemiparesis (n = 39; 47%), facial palsy (n = 45; 43%), hemiplegia (n = 28; 29%) and aphasia (n = 19; 33%), as depicted in Table 3.The median systolic blood pressure (SBP) at triage was 140 mmHg, and 25 patients (24%) had SBP > 160 mmHg. The mean heart rate (HR) was 86 (SD15), with a range of 56–180 beats per minute. Seven patients had atrial fibrillation. The median Glasgow Coma Score (GCS) was 11. Twenty out of 104 patients (19%) had GCS of eight or less, 34 had GCS between nine and twelve (33%); and 50 had GCS between 13 and 15 (48%). There were slightly more patients with haemorrhagic stroke (n = 58; 56%) than ischaemic stroke (n = 46; 44%). Patients with cardiac disease were significantly more likely to have ischaemic strokes (p = .005). Patients with hypertension were significantly more likely to have haemorrhagic stroke (p < .001). Patients who presented with loss of consciousness were more likely to have haemorrhagic stroke (p = .01). In a multivariable logistic regression model, the only risk factor robustly associated with ischaemic stroke was cardiac illness (odds ratio 3.99 [95% confidence interval 1.37, 11.6], p = 0.01).

Discussion

In Ethiopia, stroke is the most common neurological condition in patients admitted to hospitals, accounting for 24% of all neurological admissions in our institution, and is associated with significant morbidity and mortality [9,10]. In this study we identified the stroke types, risk factors, and clinical presentations of stroke victims presenting to an urban university emergency centre in Ethiopia. While ischaemic strokes account for almost 90% of strokes in the United States, we found that over half of stroke victims in our setting suffered from haemorrhagic strokes. A prior study of stroke in Ethiopia by Abebe et al. found a higher rate of ischaemic stroke, but several other studies in sub-Saharan Africa have found that haemorrhagic strokes are more common [2,8,11–15]. Hypertension, cardiac disease and diabetes were the most common risk factors present in both types of stroke, which conforms to the results of other studies in LMICs [8,16]. In addition, while almost half of patients had at least one known risk factor, few were receiving appropriate treatment to reduce their risk of stroke.

In general, both patient- and system-related factors play a major role in shaping patient outcomes [17]. Patient-related factors include awareness of the significance of stroke symptoms, proximity to health care facilities, financial strain and support systems at home, and reliance on natural healers. System-related factors include infrastructure development, presence of ambulance services and the lack of specialised health care centres; these affect a patient's ability to reach the health care facility and to get appropriate care. Both patient- and system-related factors likely contribute to the burden of stroke in Ethiopia.

Access to healthcare is generally limited in Ethiopia. Common barriers include transport and the popularity of traditional healers. The main reasons for delayed presentation in this study included delayed referrals and difficulty traveling long distances to our hospital. Other factors included financial constraints, lack of family or social support systems, and patients' misconceptions about their symptoms. These challenges are not unique to Ethiopia. A study by Hundt et al. in South Africa showed that 85% of stroke patients reported significant delays in seeking medical attention, and almost half believed that their symptoms were not serious or that they would self-resolve [17].

Table 3
Patient clinical presentation versus time of emergency centre arrival.

Clinical presentation		Time from onset of symptoms to EC arrival		p-value	Type of stroke		p-value
		≤6 h (n = 28)	> 6 h (n = 76)		Ischaemic (n = 46)	Haemorrhagic (n = 58)	
Loss of consciousness		15	35	0.49	14	36	0.01
Hemiplegia		8	20	0.81	17	11	0.04
Hemiparesis		12	37	0.59	22	27	0.89
Facial palsy		13	32	0.69	24	21	0.12
Aphasia		6	13	0.61	12	7	0.06
SBP	< 140	13	31	0.37	30	14	< 0.001
	140–160	3	18		6	15	
	≥160	12	27		10	29	
GCS	3–8	7	13	0.55	2	18	< 0.001
	9–12	10	24		12	22	
	13–15	11	39		32	18	
Stroke Type	Ischaemic stroke	13/28	33/76	0.20			
	IPH	15/28	43/76				

SBP, systolic blood pressure; GCS, Glasgow Coma Score; IPH, intraparenchymal haemorrhage.

This study highlights several opportunities for improved stroke care in Ethiopia. Primary prevention strategies targeting the most common risk factors for stroke in this population—including hypertension, cardiac disease and diabetes—may help to reduce the prevalence of stroke. Secondary prevention strategies focusing on helping stroke victims to recognise the significance of their symptoms and gain access to appropriate medical care in a timely fashion may reduce the long-term disability associated with stroke once it has occurred. While we do not currently have the capacity for thrombolysis in the country, other supportive care measures are available for stroke victims, including airway management, blood pressure control, antiplatelet therapy, anticoagulation, and neurosurgical decompression for increased intracranial pressure. The lack of functional CT scanners to diagnose strokes, the lack of ambulances to transport stroke victims to appropriate care facilities, and disorganised referral systems are major challenges in stroke care in our setting.

The findings presented here can be a valuable tool for both physicians and the government, as it reveals several gaps in public knowledge about stroke and obstacles in its effective treatment. Public education about the symptoms of stroke and the importance of early recognition and treatment may help to improve outcomes as well as emphasise that treatment options are available that can minimise disability. Development of a network of local and regional stroke centres with expertise in early stroke evaluation and management may address some of the challenges around timely diagnosis and referral.

This study has several limitations. As a hospital based study, the observations made may not be representative of all cases of stroke occurring in the community. Because this study was done in a tertiary hospital where critical patients requiring neurosurgical interventions were referred, the prevalence of haemorrhagic stroke in the community may be overestimated. In addition, we counted on patient reports of their risk factors, which may introduce recall bias.

Further research about stroke epidemiology and risk factors on a population level, and about the impact of medical care on clinical outcomes of stroke patients in Ethiopia are important next steps for better understanding stroke care in Ethiopia.

Conclusion

Stroke victims in Ethiopia are often significantly delayed in arriving in the EC because of long transport distances and inefficient referral systems. Haemorrhagic stroke was the predominant stroke type in this study and hypertension was the most common risk factor identified. Public education programs about the symptoms and treatment of stroke and efforts to improve the capacity to diagnose and treat stroke victims may improve patient outcomes.

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Conflicts of Interest

The authors declare no conflict of interest.

Dissemination of Results

Findings have been locally disseminated by the authors and presented at the 2016 African Conference on Emergency Medicine in Cairo, Egypt.

Authors' Contributions

The authors have all contributed either to the conception of the work; the acquisition, analysis, or interpretation of data; drafting and revising; final approval of the version to be published; and agreed to be accountable for all aspects of the work.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.afjem.2017.11.001.

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