ORIGINAL RESEARCH

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Pattern of stroke in a rural Kenyan hospital

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Abstract

Background
The pattern of stroke in rural population differs from that in urban ones. Although there are many studies on this condition in sub-Saharan Africa, few studies about stroke pattern in a Kenyan rural area exist.. This study therefore aims at describing the characteristics of stroke in a rural Kenyan hospital.

Patients and Methods
The study was conducted on 227 consecutive patients admitted with a World Health Organization (WHO) diagnosis of stroke in Kangundo Hospital, a level IV facility in Machakos, Eastern Kenya, between April 2015 and September 2016. The sub-type and anatomical distribution of stroke as well as the age, gender of the patients were recorded prospectively. Diagnosis was made through physical neurological examination and confirmed by Computerized Tomography (CT) scan imaging. Only those with complete bio-data, past medical and social history, clinical and physical findings of the patients and imaging results were included. The data were entered into a pre-formatted questionnaire, analysed for means, standard deviations and frequencies, and are presented in tables and bar charts.

Results
Out of 3200 medical admissions, 227 (7.09%) had a confirmed diagnosis of stroke. Ischaemic stroke was more common (67.4%) than haemorrhagic stroke (32.6%). It affected mainly the anterior circulation, especially the middle cerebral artery (39%). The mean age of patients was 68.8 years, (Range 32 – 96). It was more common in females (62%) than in males (38%). Hypertension was the most common (74%) risk factor followed by alcohol abuse (63%), tobacco smoking (48%) and diabetes mellitus (42%).

Conclusion
Ischaemic stroke was the more common major cause of morbidity in the rural hospital studied in Kenya. It occurred most commonly among elderly females, with the most frequent comorbidities being hypertension. In addition, modifiable lifestyle factors like alcohol abuse and cigarette smoking contributed to the prevalence; hence we recommend the control of blood pressure and glucose as well as lifestyle modification to reduce the scourge in our studied population.

Keywords: Stroke, rural, types, risk factors, age

Introduction

Stroke in rural communities is a major cause of morbidity and mortality worldwide including in sub-Saharan Africa[1-3]. It differs from that in urban ones with regard to incidence[4,5], age and gender distribution[6,7], risk factor profile[7,8] and mortality rate[9,10]. The pattern is important in informing planning and management strategies[11]. Data are, however, disparate and scarce from sub-Saharan Africa[4,5]. In Kenya, it is a substantial cause of morbidity and mortality[12] but the pattern is not elucidated. The aim of this study was, therefore, to determine the pattern of stroke in a rural Kenyan hospital.

Patients and Methods

The study was done on patients admitted with a diagnosis of stroke in Kangundo Hospital during an interval of 18 months, between April 2015 and September 2016. Kangundo is a level IV rural health facility located 80 kilometres away from Nairobi City and has a bed capacity of 170. Only patients who met the World Health Organization (WHO) criteria of focal or global disturbance of cerebral function of sudden onset lasting at least 24 hours or leading to death with no apparent cause other than vascular origin were included[13].

This included black adults of both genders. Patients with history of head trauma or no neuro-imaging on record were excluded from study. Informed consent was obtained from all the patients and their relatives. Patients who were stable and conscious were informed about the study and its importance. For the unconscious patients, their relatives were informed about the study and permission to include these patients in the study was sought from the relatives. Those who gave consent were included in the study but only their serial numbers were used not names.

Data on age, gender and risk factors of stroke patients were obtained prospectively, directly from the patient or their next of kin. Relevant medical and social history of the patients, including history of confirmed comorbidities namely hypertension, diabetes, cardiac disorder, drug history, history of substance use (mainly alcohol abuse and cigarette smoking), history of previous stroke and HIV was also obtained. Investigations such as head Computerised Tomography (CT) scan and Brain Magnetic Resonance Imaging (MRI) were used to determine the type of stroke and assess the cerebral territory affected by ischemic stroke. Atrial fibrillation was

confirmed by electrocardiography.

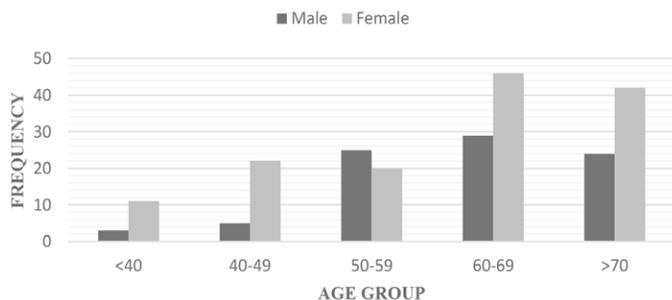## Age and gender distribution of stroke in Kangundo Hospital, Kenya

Figure 1: Age and gender distribution of stroke in Kangundo Hospital, Kenya

Table 1: Risk factors for stroke in Kangundo Hospital, Kenya

Risk factor	Frequency			
	Male	Female	Total	%
Hypertension	63	105	168	74
Alcohol abuse	74	69	143	63
Cigarette smoking	62	47	109	48
Diabetes	42	31	73	32
Diabetes+ hypertension	30	34	64	28
Atrial Fibrillation	18	27	45	20
Previous history of stroke	13	32	45	20
Family history	9	27	36	16
HIV Infection	7	20	27	12

Data were entered into a pre-formatted questionnaire
Subjects were divided into males and females and clustered in 10 year age groups. Stroke was classified as either ischemic or haemorrhagic. Ischaemic stroke was classified according to the brain territory affected and the main arterial supply namely anterior, middle or posterior cerebral arteries. Data were entered into the computer and analysed using SPSS® (Statistical package for social science) software (Version 20.0, Chicago, Illinois) and Microsoft Office Excel, 2007 (Microsoft Corporation). Measurements were expressed in means, frequencies and standard deviations. Results were presented in tables and bar charts.

Results
Within the 18 months that this study was carried out, the Hospital recorded 3200 medical admissions of which 227 patients were admitted due to stroke. This accounted for 7.09% of all medical admissions.

1. Type and anatomical distribution of lesions
Out of the 227 patients, 153 (67.4%) had ischaemic stroke, while the remaining 74 (32.6%) had haemorrhagic stroke. Among the 153 ischaemic stroke cases, the vascular territory most commonly involved was the middle cerebral artery (77; 50.3%), followed by the anterior cerebral artery (54; 35.3%) and the posterior cerebral artery (22; 14.4%).

2. Age and gender distribution
The mean age of the patients was 68.8±6.8 years (range 32 – 96 years). The mean age for males was 64.28±6.31 years while that for females was 69.34±7.22 years. The mode was 64 years. The incidence of stroke increased with advancing age, with majority (62%) of the patients being above 60 years. The peak was 60 – 69 years. Stroke was more common among female subjects (62%). Except for the 50 – 60 year age group, stroke was consistently higher in females. There were 86 males and 141 females, giving an overall male: female ratio of 3:5 (Figure 1).

3. Risk factors
The most common risk factor of stroke was hypertension (168; 74%) followed by alcohol abuse (143; 63%), cigarette smoking (109; 48%), diabetes mellitus (73; 32%), diabetes and hypertension (64; 28%) and atrial fibrillation (45; 20%) (Table 1).

Discussion
Stroke constituted over 7% of medical admissions in our studied group. This was higher than 3.04 per 1000 reported for Nairobi Hospital[14] and 3.77 per 1000 reported for Kenyatta National Hospital1[5] both of which received predominantly urban populations. Our finding was concordant with reports that stroke was more common in rural than urban populations[5]. This difference has been attributed to distribution of risk factors[4]. In view of the poor outcome of stroke in rural Kenya[16], effort should be expended in its control.

1. Type and anatomical distribution
The sub-type and anatomical distribution of stroke lesions influence clinical assessment, treatment decisions, prognosis and risk of recurrence[17] and are important for country – specific health care planning[3]. In the current study, 67.4% of the cases were ischemic stroke. This is within the range of 55 – 83% reported in contemporary literature from South Asian[18] and other countries (Table 2).

These results show wide diversity probably depending on race, genetics, gender, age, lifestyle, diet and socioeconomic status[20,24,25]. In the present study, the profile of risk factors and hence the mechanism may be important. Pertinent to this suggestion is the finding that hypertension which was the predominant risk factor is usually associated with haemorrhagic rather than ischaemic stroke.

The site of cerebral vessel occlusion influences the spatial pattern and temporal progression of infarction and is important in interpreting imaging findings[26]. In the current study, the middle cerebral artery was the most involved vessel. This is consistent with literature reports[27] and is probably related to the anatomy of cerebral arterial blood supply. In this regard, recent studies reveal that the pattern of cerebral arteries in the Kenyan population resembles that of other populations[28,29].

2. Age and gender distribution
The mean age of patients was 68.8 years with a peak at 60 – 69 years. This mean age is higher than 54.7 and 61.5 years reported in urban Kenyan hospitals[14,15]. It is, nonetheless,

comparable with those reported for other rural populations (Table 3). This is consistent with reports that stroke victims from rural populations are older than their urban counterparts[6,7].

The male: female ratio of 3:5 is comparable with 3:7 reported for the Australian[30] population. Other studies reported only marginal female predominance (Table 3). It is probably related to the loss of the protective effect of oestrogen among post-menopausal women[31].

3. Risk factors

Recent studies reveal that risk factors for stroke in rural populations of sub-Saharan Africa namely hypertension, dyslipidaemia, smoking, cardiac events, diabetes and HIV infection resemble those reported for other world regions[32]. The distribution however varies from country to country. Whereas, in the current study, hypertension, excessive alcohol consumption, cigarette smoking and diabetes mellitus predominated, the latter four were reported to be rare in Uganda[7]. This implies that risk factors for stroke must be considered by country.

Hypertension

Hypertension was the predominant risk factor, similar to the urban and other rural cohorts. High blood pressure has been implicated as a major risk for stroke in many rural communities in South Africa[3], Kenya[33], Tanzania[32] and Uganda[7] (Table 3). This is consistent with the profile of cardiovascular disease risk factors reported in rural Kenyan populations[34, 35]. Indeed, hypertension is a highly prevalent condition in many rural parts of Kenya. This implies that control of blood pressure constitutes an important step in mitigating prevalence of stroke in these communities.

Table 2: Proportion of stroke subtype in rural populations of some countries

Author	Country	Proportion of Subtype (%)			
		IS	ICH	SAH	Unknown
Correia et al., 2013[6]	Portugal	75.3	16.1	3.3	4.4
Desalu et al., 2011[11]	Nigeria	64.4	31.7	3.0	1.0
Gebremarian and Yang, 2016[19]	Ethiopia	55.6	32.4	5.6	4.9
Li et al., 2015[20]	China	73.1	24.7	0.8	1.4
Newbury et al., 2017[21]	Australia	77.3	14.9	3.8	5.0
Sridharan et al., 2009[22]	India	82.3	16.1	1.6	-
Powles et al., 2002[23]	Bulgaria	64	27	9	-
Walker et al., 2010[4]	Tanzania	82.5	17.5	-	-
Current Study, 2016	Kenya	67.4	32.6	-	-

Excessive alcohol consumption

A remarkable finding of the present study is that 63% of stroke patients had a history of heavy alcohol consumption, which is an independent risk factor for ischaemic stroke[40-42]. It induces hypertension, promotes hypercoagulability, predisposes to atrial fibrillation, and accelerates large artery atherosclerosis, cardiac arrhythmia, cerebral arterial spasm, blood clotting disorders and, cardiogenic embolism[42-44].

The high prevalence of alcohol abuse in stroke patients is consistent with reports that alcohol abuse is highly prevalent in rural Kenya probably due to availability of cheap, home manufactured alcohol[45]. We therefore recommend campaigns and programs to educate people on the side effects of alcohol use in order to reduce the stroke burden.

Table 3: Mean age, gender distribution and risk factors for stroke in some rural communities

Reference	Country	Mean age	M:F Ratio	Prevalence of predominant risk factors (%)
Desalu et al., 2011[11]	Nigeria	68	1:1.1	Hypertension (85.2) Diabetes Mellitus (23.8) Tobacco Smoking (23.8)
Sridharan et al., 2009[22]	India	67	1:1.15	Hypertension (83.2) Diabetes Mellitus (26.8) Cigarette Smoking (22.8)
Mateen et al., 2012[36]	Bangladesh	72.3	1:1	Hypertension (47.4) Cigarette Smoking (38.1) Diabetes Mellitus (18.1)
Vijiaratnam et al., 2015[30]	Australia	77	3:7	Hypertension (73) Hypercholesterolemia (36) Diabetes mellitus (27)
Firoozabadi et al., 2013[37]	Iran	69.6	1:1.1	Hypertension (54.7) Cardiac disease (24) Diabetes Mellitus (14.9)
Nakibuuka et al., 2015[7]	Ugandan	-	-	Hypertension (27.1) Obesity (24.1) Elevated W:H ratio (25.8)
Correia et al., 2013[6]	Portugal	72.5	1.3:1	Hypertension (58) Hypercholesterolemia (24.8) Diabetes mellitus (18.6)
Wiborg et al., 2003[38]	Germany	67.5	-	-
Del Brutto et al., 2014[39]	Ecuador	69.8	3:2	Hypertension (65) Obesity (60) Diabetes mellitus (50)
Current Study	Kenya	68.8	3:5	Hypertension (74) Alcohol Abuse (63) Cigarette smoking (48)

Cigarette smoking

Up to 25% of all strokes are directly related to cigarette smoking which independently increases the risk of stroke up to three-fold[46, 47]. In the current study, 48% of the patients had a positive history of cigarette smoking. This is higher than 39% reported in Asian and other sub-Saharan African countries (Table 3). In Uganda, for example, it constituted less than 5%[7]. This implies that there are variations in the preponderance of the risk caused by smoking. These variations are probably related to the amount and duration of smoking[46]. The high prevalence in the current study is related to the prevalence of this vice in rural Kenya[45,48]. Cigarette smoking causes endothelial dysfunction, inflammation, insulin resistance, alteration in lipid profile, hemodynamic stress, hypercoagulable state and oxidative stress, all of which contribute to vasomotor dysfunction and atherothrombosis[49,50]. Health campaigns to promote

smoking cessation will help reduce the risk of stroke.

Diabetes mellitus

Diabetes mellitus alone was implicated in 32% of cases. This is much higher than those reported in other studies, only lower than 50% reported in Ecuador[39]. This high occurrence may be related to the comparatively high prevalence of dysglycaemia reported in rural Kenyan communities[34,35]. Diabetics have a 2.5 greater risk of stroke than their non-diabetic counterparts[51]. Early diagnosis and good control of diabetes is recommended in order to reduce the risk of stroke. Having both diabetes and hypertension increases the risk of getting a stroke. In the current study, 28% of patients had both diabetes and hypertension. This compares to 28.8% by Jowi and Mativo1[4]. Stroke prevention should therefore aim at health campaigns to increase awareness, ensure early diagnosis and achieving good control of these two non-communicable conditions.

Atrial fibrillation

Atrial fibrillation (AF) is an independent risk factor for cardio-embolic stroke[52-54]. Embolism of cardiac origin causes up to 25% of all ischaemic strokes[55], through contractile dysfunction, structural remodelling, cardiopathy and stasis, increasing the risk of thromboembolism. Simultaneously, AF increases risk of large artery atherosclerosis, ventricular systolic dysfunction and in – situ small – vessel occlusion[56,57]. The prevalence of AF is generally low but increases with age[58,59]. In the current study, 20% of the patients had AF. This was lower than 65.9 % in an Egyptian study[60]. Strokes in association with AF are more often fatal, disabling and associated with greater morbidity and recurrence than other causes of stroke[61]. Patients with AF should therefore be monitored to forestall stroke.

Family history

A positive family history is an independent risk factor for both ischaemic and haemorrhage stroke[43,62]. An increase in the incidence of stroke by two-fold has been reported among first degree relatives[63]. It may be present in up to 37% of stroke cases[64]. In the current study, 16% of the patients had a positive family history of stroke. This was higher than 6.1% reported by Essa et al.[60]. It implied that the population may have genetic markers of stroke, and should be investigated further. There was also the need for regular screening in subjects with a positive family history.

Previous stroke

A history of previous stroke predisposes to recurrent stroke incidences[60]. Our study showed that 20% of the stroke patients had a positive history of stroke. This is within the range of 19 – 32% reported in literature[65]. First time stroke survivors are at a significantly increased risk for further stroke compared to the general population[65]. Recurrent stroke has higher mortality and poor health related quality of the life[66]. Accordingly, stroke victims should be closely monitored and followed up for mitigation of predisposing factors to avert recurrence.

HIV infection

HIV has recently emerged an independent risk factor for stroke including in rural populations[32,67]. In this study 12% of the patients had HIV infection. This is comparable with 15% reported in rural Tanzania[32]. HIV infection can cause stroke through accelerated atherosclerosis, hypercoagulability, inflammation of small intracranial arteries leading to a prothrombotic effect[68], opportunistic infection, cardioembolism, coagulopathy, diabetes and hypertension[19,21,22]. In view of the high prevalence of HIV infection in Kenya, victims should be followed up and started on treatment to mitigate the risk of stroke.

Conclusion

Stroke, more commonly the ischaemic type, is a major cause of morbidity in rural hospitals in Kenya. It occurs most commonly among the elderly and more in females. The most frequent risk factors are hypertension and modifiable lifestyle factors like alcohol abuse and cigarette smoking. We recommend control of blood measure, blood sugar and lifestyle modification.

Acknowledgement

Conflict of interest

There is no conflict of interest.

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