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STROKE TYPES, RISK FACTORS, QUALITY OF CARE AND OUTCOMES AT A REFERRAL HOSPITAL IN WESTERN KENYA

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ABSTRACT

Background: **The prevalence of stroke is increasing in sub-Saharan Africa due to increases in size of aging population and stroke risk factors. We assessed risk factors, quality of care and outcomes of stroke to identify modifiable risk factors and areas of care that need improvement for better outcomes.**
Objectives: **To describe the stroke types, risk factors, outcomes and stroke quality of care in a large academic medical centre hospital.**
Design: **Hospital based retrospective study.**
Setting: **Moi Teaching and Referral Hospital (MTRH), Eldoret, Kenya.**
Subjects: **All patients >18 years admitted with a diagnosis of stroke as per the WHO definition and with a supporting brain imaging (CT scan/ MRI)were included in the study. Data abstracted from the files included demographic details, stroke sub-type, stroke risk factors, inpatient stroke care quality indicators(based on US Joint Commission stroke quality indicator definitions) and in hospital stroke outcomes. Descriptive statistics was used to summarise the data.**
Results: **A total of 155 patients had stroke between January 2010 and December 2014 of whom 42% were male, the median age was 61 (IQR: 49-72) years. Majority (73%) had hypertension. The prevalence of diabetes was 4%. Left hemiplegia/hemiparesis was the predominant presentation (50%). Haemorrhagic strokes were frequent (52%) with anterior circulation stroke comprising 97% of all strokes. Assessment of quality of care indicators showed that overall, 84% of the patients had a brain CT scan on day one of admission,93% had a GCS documented at admission, 32% were on statins and 3% were screened for dysphagia before oral intake. Among patients with ischaemic strokes; none underwent thrombolysis, 24% received DVT prophylaxis, 54% received statins, and 73% received anti-thrombotic therapy by hospital day two. In hospital mortalityoccurred in 43(27%)with a higher rate among haemorrhagic strokes (31%) compared to ischaemic stroke (24%)(p=0.364).**
Conclusion: **Haemorrhagic stroke was the most common type of stroke admitted, hypertension was the predominant risk factor and most strokes involved the anterior circulation. In-hospital mortality was 27%. There were several opportunities to improve evidence-based quality of care indicators.**

INTRODUCTION

Stroke is the second leading cause of death worldwide and the most common cause of long term disability among adults (1). Approximately 80% of all deaths due to stroke occur in developing countries (2).Data from sub0Saharan Africa(SSA) indicate that case fatality rates from strokes are higher than those from developed countries (3).This may be related to limited healthcare capacity and uncontrolled risk factors such as hypertension. Stroke affects younger persons in developing countries as compared to developed countries (4). In the US, stroke mortality is declining overall, but remains higher among African Americans than whites (5).

Many risk factors for stroke have been described including age, sex, hypertension, hyperlipidaemia, cigarette smoking, alcohol consumption, diabetes mellitus, low fruit and vegetable consumption in the diet, physical inactivity, obesity, atrial fibrillation and other cardiac disorders (6). Worldwide, the factor most associated with elevated ischaemic and haemorrhagic stroke risk is hypertension, with a combined population attributable risk of 90% for all strokes (7).

Stroke outcomes such as functional capacity and mortality are greatly influenced by in-patient stroke care quality provided. Treatment of patients with acute stroke on dedicated wards (stroke units) has been proven to be of major significance for the overall improvement of long-term stroke prognosis (8). Stroke units are lacking in a majority of hospitals in sub-Saharan Africa.

The Stroke Quality Enhancement Research Initiative (QUERI); a national stroke quality improvement group within the US Veterans Health Administration (VHA), developed chart review methodology for assessment of evidence-based quality indicators based on existing US Joint Commission stroke quality indicators and other stroke processes of care relevant to VHA medical centres (9). The quality indicators included: National Institute of Health Stroke Scale (NIHSS) documentation, Thrombolysis(when indicated), Anti-thrombotic therapy by hospital day two, Lipid management, Deep Vein Thrombosis (DVT) prophylaxis, Anti-coagulation for atrial fibrillation, Dysphagia screening before oral intake, Pressure ulcer assessment, Fall risk assessment, Early ambulation, Smoking cessation counselling, anti-thrombotic therapy at discharge, Rehabilitation consult and stroke education at discharge. Most of these quality indicators are easy to assess and involve processes of care that are inexpensive to implement (e.g. providing aspirin or appropriate nursing care) thus are relevant to resource limited settings for measuring and improving the quality of stroke care.

MATERIALS AND METHODS

Study Design: Retrospective review of inpatients records.

Study Methods: All consecutive medical file records of patients admitted with a diagnosis of stroke as per the WHO definition (the rapid development of clinical signs and symptoms of a focal neurological disturbance lasting more than 24 hours or leading to death with no apparent cause other than vascular origin) with a supporting brain imaging test at MTRH, Eldoret, Kenya from January 2010 to December 2014 were reviewed. Data abstracted from the files included demographic details, stroke sub-type, stroke risk factors, inpatient stroke care quality indicators and stroke outcomes (discharge destination and death). We modified the chart review forms used in the VHA stroke quality study (9) for use in this project and created a new quality indicator of CT scan by hospital day one since it is relevant in our setup. In addition, the GCS rather than the NIHSS was used to assess stroke severity. Inpatient stroke care quality was assessed using the measure specifications for the existing evidence-based stroke quality indicators.

For each indicator, a pass rate was calculated by dividing the number of patients meeting the process of care (indicator) by the total number of patients eligible for that indicator. The study was approved by the MTRH/Moi University College of Health Sciences Institutional Research and Ethics Committee (IREC).

Inclusion criteria: Patients 18 years or older admitted with a diagnosis of stroke as per the WHO definition and with a supporting Brain imaging (CT scan/MRI).

Exclusion criteria: Patients with Transient Ischaemic Attack (TIA) or Sub-arachnoid Haemorrhageor those with clinical signs and symptoms of stroke but with a normal brain CT scan or other non-stroke diagnosis.

Definition of variables: Hypertension: documented systolic blood pressure of ≥140 mm Hg or diastolic blood pressure of ≥ 90 mm Hg more than 48 hours after admission or history of treated hypertension.

Diabetes mellitus: documented pathologic elevated fasting blood glucose level (FBS ≥ 7.1mmol/l) or random blood sugar ≥ 11.1mmol/l or history of diabetes on dietary management or on insulin/oral hypoglycemic agents.

Atrial fibrillation: documented by standard Electrocardiogram (EKG).

Previous stroke: documented evidence for acute neurologic deficit ≥24 hours before current event.

Hypercholesterolemia: documented elevated plasma total cholesterol levels of >5.18 mmol/l or LDL cholesterol levels >2.6 mmol/l or HDL levels < 1.3 mmol/l, or had been using lipid-lowering medication.

Tobacco use: documented tobacco use (smoking) until the time of stroke, or recent tobacco use but had stopped less than three months before the acute stroke event.

Statistical analysis: Data analysis was performed using SAS Version 9.3. Categorical variables were summarised as frequencies and the corresponding percentages. Continuous variables that assumed Gaussian distribution were summarised as mean and the corresponding standard deviation while those that violated the Gaussian assumptions (skewed) were summarised as median and their corresponding interquartile range (IQR). Gaussian assumptions were assessed using Shapiro-Wilk test for normality and the normal probability plots. Association between the categorical variables was assessed using Pearson's Chi-Square test or Fischer's exact whichever was appropriate. The association between two independent continuous distributions was assessed using two sample t-test if the Gaussian assumptions were satisfied otherwise the non-parametric analogue (Wilcoxon two sample test) was used. High total cholesterol and high LDL, and low HDL were defined using clinically acceptable limits. A participant was considered to have high total cholesterol using a cut-off of 5.18 mmol/l, high LDL

using a cut-off of 2.6 mmol/l and low HDL using a cut-off of 1.3 mmol/l. Hypercholesterolemia was a composite of high total cholesterol, high LDL and low HDL. A subject was considered to be hypertensive if his/her systolic blood pressure (SBP) was ≥140 and/or diastolic blood pressure (DBP) was ≥90mmHg more than 48 hours after admission. The qualities of care indicators were analysed to estimate the individual Quality Indicator pass rate (percentage).

RESULTS

Stroke epidemiology: A total of 155 confirmed stroke cases were recorded over the study period as per the inclusion criteria. Twenty eight patients presented with clinical features of stroke but were excluded from the study due to the following reasons; six had traumatic brain injury, five had subdural haematoma, five had sub-arachnoid haemorrhage, three had epidural haematomas, two had brain tumors, two had brain atrophy, two were children aged five and nine years with ischaemic strokes due to complications of sickle cell anaemia, two CT scans were reported as normal and in one patient brain CT scan was not done. During the same period 27,288 patients(49 % females)were admitted to the adult medical wards thus giving a stroke period prevalence of 568 per 100,000. Haemorrhagic strokes comprised 81(52%), ischaemic strokes 74 (48%). More females had stroke 90 (58%) and stroke was most prevalent in persons older than 69 years, Figure 1.

Figure 1
Distribution of participants by age groups
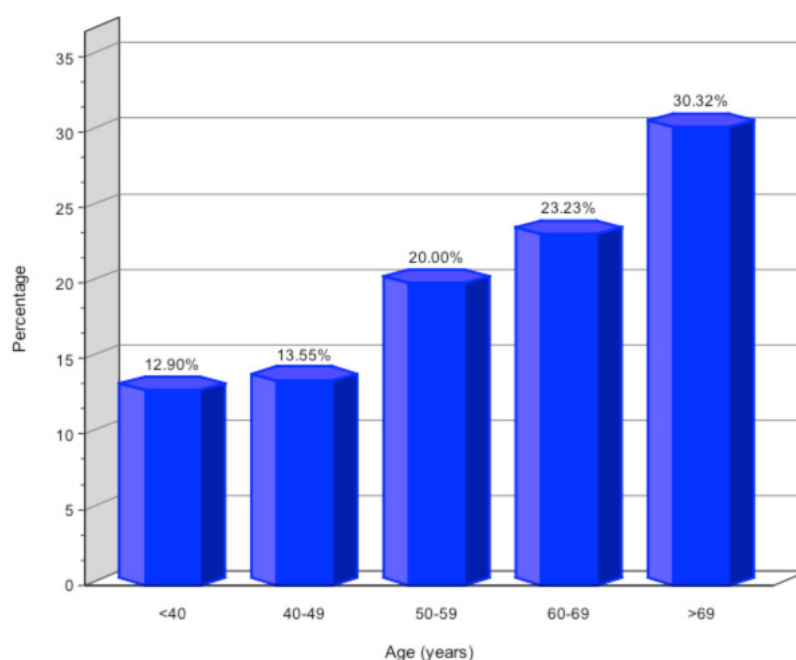
The median duration of presentation to hospital after stroke was two days(IQR: 1-3). The median duration of hospital stay was five days (IQR: 3-9). Majority of the patients were of low socio-economic status with only 27 (18%) affording a basic medical insurance scheme under the National Hospital Insurance Fund (NHIF). Most of the strokes involved the anterior circulation 149(97%). The median Glasgow Coma Scale (GCS) score at admission was 12 (IQR: 10-14). These baseline characteristics are summarised in Table 1.

Table 1
Baseline characteristics of the study participants

Variable	Ischaemic stroke n (%) or Median(IQR) n=74 (48%)	Haemorrhagic stroke n (%) or Median (IQR) n=81 (52%)	p-value	Overall n =155
Age (years)	64 (49-75)	59 (47-68)	NS	61 (49-72)
Gender Female (%)	49 (66%)	41 (51%)	0.049	90 (58%)
Days to presentation	3 (1-4)	2 (1-3)	NS	2 (1-3)
Days hospitalised	6 (3-10)	5 (3-7)	NS	5 (3-9)
Admission GCS	12 (10-14)	12 (9-15)	NS	12 (10-14)
Patient has NHIF	9 (13%)	18 (23%)	NS	27 (18%)
Circulation (anterior)	72 (99%)	77 (95%)	NS	149 (97%)

Clinical presentation: Left hemiparesis/hemiplegia was the most common clinical presentation followed by right hemiparesis/hemiplegia as shown in Table 2.

Table 2
Clinical presentations

Clinical presentation	Ischaemic	Haemorrhagic	Overall
	n (%)	n (%)	n ()
Left hemiparesis/hemiplegia	37 (50)	40 (49)	77 (50)
Right hemiparesis/hemiplegia Aphasia	27 (36)	30 (37)	57 (37)
Left hemiparesis/hemiplegia Aphasia	2 (3)	1 (1)	3 (2)
Aphasia only	3 (4)	3 (4)	6 (4)

Stroke risk factors: Hypertension was the most prevalent risk factor identified. Eighty two (53%) of the participants were known to have hypertension before onset of stroke. Combining participants who had history of hypertension prior to stroke with those newly diagnosed (using systolic blood pressure ≥ 140 and/ or diastolic blood pressure ≥ 90 mmHg more than 48 hours after admission), gave an overall prevalence of hypertension of 73%. There was a higher proportion of participants with hypertension in the haemorrhagic stroke group as compared to ischaemic stroke group (p=0.004). The distribution of stroke risk factors are shown in Table 3.

Table 3
Stroke risk factors

Risk factor	Ischaemic stroke n = 74 (48%)	Haemorrhagic stroke n=81 (52%)	p-value	Overall 155 (100%)
	n (%)	n (%)		n (%)
History of Hypertension	33 (45)	49 (60)	0.048	82 (53)
Hypertension at admission (SBP≥140 I DBP≥90)	42 (58)	64 (79)	0.006	106 (69)
History of hypertension or hypertension at admission	46 (62)	67 (83)	0.004	113 (73)
Diabetes Mellitus	2 (3)	4 (5)	NS	6 (4)
Cigarette smoking	6 (9)	6 (8)	NS	12 (9)
Alcohol intake	17 (27)	15 (21)	NS	32 (24)
Prior stroke	14 (19)	10 (12)	NS	24 (15)
HIV*	6 (16)	1 (3)	NS	7 (10)
Atrial fibrillation*	8 (25)	1 (5)	NS	9 (17)

*Results were available for 57 and 53 participants respectively

Lipid profile results were available for 57 of the study participants. The predominant lipid abnormality was low HDL 39(68%) followed by high LDL 25(45%). There was no statistically significant difference in lipid abnormalities between participants with haemorrhagic vs ischaemic strokes. The lipid parameters are shown in Table 4.

Table 4
Lipid profiles

Lipids (mmol/l)	Ischaemic stroke, n (%)	Haemorrhagic stroke, n (%)	Overall, n (%)
Total Cholesterol>5.18	3 (9)	4 (17)	7 (12)
LDL>2.6	11 (33)	14 (61)	25 (45)
HDL<1.3	25 (74)	14 (61)	39 (68)
Hypercholesterolemia (Total cholesterol>5.18 I LDL>2.6 I HDL<1.3)	29 (85)	19 (83)	48 (84)

Quality of care indicators (QIs): The quality of care indicators had a variable pass rate with dysphagia screening before oral intake scoring the least (3%) while anti-coagulation for atrial fibrillation had the highest score (100%). Some of the QIs that had no documentation on the charts were not scored and were excluded from analysis. The QIs pass rates are shown in Table 5.

Table 5
Quality of care indicator pass rate

Process of Care	Denominator Eligible	Proportion of Eligible Patients with Performance Measure Present (%)
Anti-coagulation for atrial fibrillation	8	100
GCS documented	155	92
CT scan by Hospital Day 1	155	84
Anti-thrombotic by Hospital Day 2(HD2)	74	73
Anti-thrombotic at discharge	48	64.5
Rehabilitation consultation	155	61
Early ambulation(physiotherapy by HD2)	155	33
Lipid management (statin use)	155	32
Smoking cessation counselling	12	25
DVT prophylaxis	74	24
Dysphagia screen before oral intake	155	3
Thrombolysis (tPA) given	0	-

Outcome: The overall in hospital mortality was 43 (27%) and there was no statistically significant difference in mortality between haemorrhagic and ischaemic stroke groups as shown in Table 6.

Table 6
Outcomes

	Ischaemic, n (%)	Haemorrhagic, n (%)	p-value	Overall, n (%)
Discharged to MTRH MOPC*	48 (65%)	48 (69%)	NS	96 (52%)
Referred to the nearest hospital*	8 (11%)	8 (10%)	NS	16 (10%)
Deceased	18 (24%)	25 (31%)	NS	43 (27%)

MTRH MOPC =medical outpatient clinic
*Patients referred back to their local/primary hospital for continued care

DISCUSSION

Stroke epidemiology: During the study period, 155 patients were diagnosed with stroke. Eighty one (52%) had haemorrhagic strokes while 74 (48%) had ischaemic strokes. Over the same study period 27,288 patients were admitted to the adult medical wards giving a stroke period prevalence of 568 per 100,000. This is lower than that reported by Jowi *et al* of 3042/100,000(10). This difference could be because our hospital is a public national referral hospital while the Nairobi hospital is an upmarket urban private hospital with different disease patterns and patient characteristics. Our figure is however higher than those reported in community surveys of stroke in Africa of 58-300/100000 (11, 12).

The most prevalent stroke sub-type was haemorrhagic 81 (52%) contrary to what has been reported elsewhere in Kenya as well as in the developed countries. Jowi *et al* reported a prevalence of 85% for ischaemic stroke at the Nairobi Hospital (10) as well as Ogeng'o *et al* who reported a predominance of ischaemic strokes at the Kenyatta National Hospital (KNH) in Nairobi (13). Matuja *et al* in Tanzania reported a predominance of haemorrhagic strokes at 60.1 % (14) while Garbusinski *et al* in The Gambia reported a prevalence of 46% for haemorrhagic strokes, 30% for ischaemic strokes with the rest being unclassified (15). Previous studies of stroke in SSA indicate that cerebral hemorrhage is the leading cause of fatal stroke while cerebral infarction is found more in the developed countries (16,17). According to the GBD 2010(Global Burden of Diseases, Injuries, and Risk Factors) study for haemorrhagic stroke, there was a 47% increase in absolute numbers of

haemorrhagic stroke cases worldwide with highest rates (80%) occurring in low- and middle income regions such as sub-Saharan Africa and East Asia, and lowest rates in High Income North America and Western Europe(18). The higher rates of haemorrhagic strokes has been associated with high prevalence of uncontrolled systolic hypertension, low serum total cholesterol levels, cigarrete smoking and alcohol consumption(7,19,20).

We found that stroke was more prevalent amongst women 90(58%) than men. Similar results were reported by Ogeng'o *et al* (13), Garbusinki *et al* (15), Desalu *et al* (S.W Nigeria) (21) and indeed in many other Middle east and eastern countries. This has led some authors to pose the question whether we should change the old belief that stroke is predominantly a male disease. The increasing incidence of strokes among women has been attributed to the high prevalence of stroke risk factors such as hypertension,diabetes, obesity among women(22) and the longer lifespan of women as compared to men.

Stroke risk factors: Hypertension was the predominant identifiable stroke risk factor and was present in 73% of the study population. More patients with hypertension had haemorrhagic strokes compared to those with ischaemic strokes (p=0.004). Most studies in SSA indicate that uncontrolled hypertension is the single most common risk factor for stroke (23). Jowi *et al* found a prevalence of 80%, Ogeng'o *et al* 61.1% and Garbusinski *et al* 48%. Importantly for the haemorrhagic stroke patients, recent studies have suggested that rapid normalisation of blood pressure in patients with intra-cerebral hemorrhage may lead to reduced hematoma growth and better outcomes (24); future studies in SSA should specifically examine the degree and timeliness with which blood pressure is controlled in these patients.

Diabetes mellitus was present in 6 (4%) of study participants. All these participants had concomitant hypertension. This prevalence is lower compared to 33.7% reported by Jowi *et al* at Nairobi Hospital. Garbusinski *et al* reported a prevalence of 5% while Lekoubou *et al* (25) reported a prevalence of 14.5%.

The predominant cholesterol abnormality was a low HDL cholesterol (68%) followed by high LDL cholesterol(45%). The findings are similar to those by Jowi *et al* who found moderate to high LDL 34.6% and high HDL in only one patient. Low HDL has been shown to be a significant predictor of stroke recurrence among the elderly as well as in patients without diabetes(26). There was no statistically significant difference in cholesterol abnormalities among patients with haemorrhagic stroke compared to those with ischaemic stroke.

Prior stroke occurred in 24 (15%) of study participants which is comparable to that reported by Garbusinki *et al* 12% and Lekoubou *et al* 14.5%. HIV infection is an emerging risk factor for stroke especially in SSA where the burden of HIV infection is highest. We found a prevalence of 10% which is slightly higher than the National (Kenya) prevalence of 6% (27). All the participants who were HIV positive had ischaemic strokes. HIV test was however only done on 57 participants with the majority not being tested.

Atrial fibrillation (confirmed on EKG) was present in nine study participants of whom eight had ischaemic strokes and one had a haemorrhagic stroke. EKG was only done on 53 participants who were clinically suspected to have an arrhythmia.

History of Cigarette smoking was present in 12 (9%) of the study population. This may be an underestimate due to reporting bias or lack of inquiry / unrecorded information.

Quality of care: The majority of participants (84%) had a brain CT scan done within 24 hours of admission. In developing countries,availability of timely brain imaging as well as affordability is an issue resulting in delay in stroke diagnosis and treatment. Hoffmeister *et al* in a study of in-patient ischaemic stroke care in Chile reported that only 9.6% of patients had a brain CT scan within 4.5 hours of symptom onset (28). In our study, time to CT scan from symptom onset was not measured or documented. This is increasingly important since patients with ischaemic stroke should be allowed to have elevated blood pressure for at least 48 hours post-stroke to enhance brain perfusion (5), but patients with intracerebral hemorrhage should have rapid normalisation of blood pressure (24).

Among ischaemic stroke patients, none underwent thrombolysis. This was due to many factors such as late presentation (median duration to hospital presentation was two days) with no patient presenting within two hours of symptom onset, delay in brain imaging, stringent thrombolysis criteria, costs of thrombolysis and inadequate personnel. Similar reasons limit thrombolysis use in developed countries and only a small proportion of patients benefit from this mode of therapy. The rate of use of anti-thrombotic therapy by hospital day two was 73%, DVT prophylaxis 24% and only 54% were on lipid / statin therapy. The passes rates of these quality indicators and others in Table 3 were low compared to rates reported in developed countries (29) and are therefore earmarked for improvement. All patients with atrial fibrillation were on anti-coagulation as required and this may reflect recent investments in cardiac and anti-coagulation programmes in the hospital.

Outcome: The overall in hospital mortality was 43 (27%) with a tendency to higher mortality with haemorrhagic strokes 25 (31%) vs 18 (24%) although

the difference was not statistically significant. Jowi *et al* reported a 5% in hospital mortality,Lekoubou *et al* reported an in hospital mortality of 20.6% at the Yaoundé Central Hospital while Garbusinki *et al* reported an in hospital mortality of 41%. Desalu *et al* reported a 30 day case fatality rate of 23.8% with significantly more deaths among haemorrhagic strokes 34.3% vs 18.5% among ischaemic strokes. In hospital mortality rates in developed countries range from 3-11% with a 30 day case fatality rates of 12-22% (30).Our relatively high in hospital mortality may have been due to a combination of factors such as stroke severity as well as sub-optimal stroke quality of care. An analysis of predictors of mortality did not yield significant results as the confidence intervals included one.

Study limitations: Being a retrospective study, incomplete data or information recorded in the charts is a major limitation; however, the retrospective study of the quality of care is appropriate as it negates the possibility of influencing the care given. There is also a possibility that we only studied a survival cohort of stroke patients who made it to our referral hospital and thus the study participants may not be representative of all stroke patients in our catchment area.

In conclusion, haemorrhagic stroke was prevalent with more females suffering a stroke than men. Hypertension was the most common risk factor with low HDL being the predominant lipid abnormality. Our in hospital mortality rate though comparable to those in the region is still higher than that reported in developed countries. Certain quality of care indicator pass rates were low and are therefore earmarked for improvement for better stroke outcomes.

Community based / Primary care interventions to control hypertension are urgently needed in Kenya, as are systematic programmes to standardise, measure, and report common inpatient stroke quality indicators. Implementation of quality improvement strategies that include ongoing data monitoring and feedback related to vascular risk factor control and in hospital care is a useful and needed step in improving the quality of stroke care and patient outcomes in Kenya and in SSA in general.

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