Stroke in Maputo Central Hospital, Mozambique: a cross-sectional study 2014-18

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Abstract

Background: Stroke is the second leading cause of death worldwide. The prevalence of hypertension (the major risk factor for stroke) in Mozambique increased from 33.1% in 2005 to 38.9% in 2014/2015, although awareness and control remained at very low levels (15% and 3%, respectively). The aim of this study is to characterize the demographic and clinical pattern of stroke in Maputo Central Hospital (MCH), Mozambique.

Methods: A cross-sectional hospital-based study was carried out in MCH, collecting secondary data from hospitalized patients with stroke. Using systematic probabilistic sampling, clinical records were used to analyze data for the period 2014-18.

Results: Of the 402 clinical records, 53.5% were female. The mean age was 60.68 years (13.98 SD). Around 96% was an acute stroke event, and 91% was first-ever episode. Thirty one percent did not receive a CT scan for confirmation. Of the 247 CT scanned patients, 50.2% were ischemic. The area of middle cerebral artery was affected in 83.4% patients. The most common co-morbidity was hypertension (87.1%). Near 96% of hemorrhagic stroke were associated with hypertension (Ischemic = 78.7%, $p < 0.001$). The overall case-fatality was 22.9%. Confirmed hemorrhagic stroke patients were 6.47 years younger than ischemic (56.40 vs 62.87 years; $p < 0.001$). Younger ages and female were associated with clinical improvement (aOR = 0.964; $p = 0.002$ and aOR = 1.890; $p = 0.044$, respectively). Hemorrhagic stroke were 56.8 percent points more likely associated with death (aOR = 0.432; $p = 0.010$). The likelihood of clinical improvement was 20.5 percent points better over the years (aOR = 1.205; $p = 0.086$)

Conclusions: Stroke associated with hypertension is common in MCH, mostly likely due to an increase in hypertension prevalence and extremely low awareness and control. Favorable clinical outcome improved over the years. Efforts for CT scan to all stroke episodes should be emphasized by MCH managers.

Background

Stroke (cerebrovascular accident) is currently recognized as a major public health problem throughout the world, including in low income countries. In 2016, the global lifetime risk (LtR) of stroke from the age of 25 years onward was 24.9% [1]. The LtR of stroke for both sexes combined by global burden disease region 2016 in Mozambique ranged from 5.0% to 10.9% [1]. Between 2005/06, the crude and adjusted (world reference population) annual incidence rates of stroke in Mozambique were 148.7 per 100,000 and 260.1 per 100,000 aged 25 years, respectively. Of these, 81.6% represented a first-ever stroke event, with ischemic stroke accounting for the majority of the cases, and hypertension being a risk factor in 86.2 of stroke patients before hospitalization [2].

Hypertension is a well known and major risk factor for stroke. The prevalence of hypertension in Mozambique increased from 33.1% in 2005 to 38.9% in 2014/2015, although awareness remained at very low levels (15%) [3]. Despite this increase in hypertension levels, only 7% of the hypertensive patients were in treatment, and control was only achieved in 3.2% [3].

The scarcity of stroke studies and associated increase of hypertension prevalence with poor control in Mozambique motivated the researchers to not only conduct this study, but also update the data of stroke events in Mozambique. The aim of this study is to characterize the demographic and clinical pattern of stroke in Maputo Central Hospital, Mozambique.

Methods

Context

Maputo Central Hospital (MCH) is located in the city of Maputo (capital of Mozambique), and was founded in 1906. MCH is a quaternary level public hospital (the highest level in Mozambique) and is an associated-University College Hospital. It has an integrated network of services, with five large departments: Pediatrics, Surgery, Gynecology-Obstetrics, Medicine and Orthopedics. The Department of Medicine has four Medicine wards: cardiology, pneumology, neurology, and specialized examinations sector. There is only one Computed Tomography (CT) scan for the entire hospital. The bed occupancy in the Department of Medicine for the period of 2014–18 was high, exceeding 100%.

Study Design

A cross-sectional hospital-based study was carried out in 2019, collecting secondary data (clinical records) from hospitalized patients with stroke from the years 2014–18. All the Medicine wards from MCH were selected for the study data collection. The eligibility was for patients with ≥ 18 years, regardless of the sex, and with known binary outcome (clinical improvement or death).

Study Sample Size

Sample size was calculated assuming a confidence level of 95%, an error of 0.05, and a proportion of stroke of 0.26 (from the adjusted annual incidence rates of stroke 260.1 per 100,000 aged ≥ 25 years [2].

Sampling Strategy

A systematic random sampling was used in which every Nth member of the target population is selected to be included in the study. The sampling unit is the clinical form of the hospitalized stroke patient.

Selection of the clinical records

For each year, the sample size was determined proportionally to the size of registered stroke cases from 2014–18. For each year, the clinical records were selected based on the following strategy: first, clinical records list (population frame) was identified and a number assigned to each clinical record; then, the sample interval (number of registered stroke patients divided by sample size) was computed and a random number was chosen to start with; finally, from this first random number, clinical records were systematically selected until the sample size was complete.

Data Collection

A semi-structured data collection tool with open and closed variables to be collected was used. Before the beginning of the study a pilot study took place by applying the data collection tool to 20 clinical records of stroke patients from 2013. Some adjustments were made to improve the original version of the data collection tool.

Variables

The tools had information to be collect related to the following quantitative and qualitative variables: i) age; ii) sex; iii) hospitalization date; iv) type of event (acute or sub-acute); v) episode (first-ever or recurrent); vi) classification (ischemic or hemorrhagic); vii) confirmation method (clinical or clinical plus CT scan); viii) cerebral artery affected area; ix) co-morbidities; x) length of stay (LOS) in the ward; and xi) clinical outcome (clinical improvement or death). For this study purpose, intracerebral and subarachnoid hemorrhages were considered as hemorrhagic stroke.

Outcomes of interest

The main outcomes are: (i) percentage of ischemic and hemorrhagic strokes; (ii) percentage of stroke patients with clinical improvement or death.

Statistical analysis

All data were introduced and analyzed using SPSS version 23.0. Univariate and bivariate statistical analysis was performed. For quantitative variables descriptive statistics such as mean and standard deviation (*SD)* were used, while absolute frequencies and

percentage were calculated for qualitative variables. Confidence intervals (95% CI) were also calculated for each variable. Associations between stroke classification, gender, and episodes type with the mean age at stroke event were calculated using t-test. The t-test was also used to find association between stroke classification and the mean LOS in the hospital. To find association between sex and confirmed stroke classification on the clinical outcome (clinical improvement or death) and between co-morbidities and confirmed stroke classification, Pearson chi-square test was performed. To ascertain the effects of age, sex, stroke classification, and year of admission on the likelihood that patients have favorable clinical outcome (clinical improvement = 1; death = 0), a binary logistic regression was performed. Wald test and Hosmer & Lemeshow was used for model evaluation and goodness-of-fit test, respectively. Odds ratio (OR) and 95% confidence intervals of each predictor were also generated. For all statistical procedures, a 0.05 significance level was adopted for rejecting the null hypothesis.

Results

A total of 402 clinical records were analyzed, of which 100 (24.9%) from 2014, 79 (19.7%) form 2015, 70 (17.4%) form 2016, 79 (19.7) from 2017, and 74 (18.4%) from 2018. The mean age was 60.68 years (13.98 *SD),*, ranging from 25 to 97 years. Female were more frequent (53.5%, 95% CI: 48.6—58.4). Acute onset accounted for 96.3% (95% CI: 94.5—98.1) of registered cases, and first-ever episode was predominant (90.8%, 95% CI: 88.0—93.6). Stroke classification was unspecified on 121 (30%) of clinical records. Of the 281 clinical records with stroke classification, ischemic stroke registration accounted for 50.2% (95% CI: 44.4—56.9) —Table 1.

Of the 281 clinical records with stroke classification, 98.6% (277) were confirmed by CT scan [50.2% (139) ischemic and 49.8% (138) hemorrhagic]—Table 2. Of the 277 clinical records with a CT scan stroke confirmation, the cerebral area of the middle artery was affected in 83.4% (231), followed by the area of posterior cerebral artery (12.6% - 35)—Table 2.

The most frequent associated co-morbidity was hypertension (87.1%), followed by the combination of hypertension and diabetes (9.2%). Single presentation of diabetes and HIV accounted for 1.5% and 2.2% of registered cases, respectively—Table 1. Near 96% and 79% of confirmed hemorrhagic and ischemic stroke were respectively associated with hypertension ($p < 0.001$)—Table 2. Ischemic events were associated with diabetes and HIV single risk factors, and combined hypertension and diabetes risk factors—Table 2.

The mean LOS in the hospital was 5.76 (4.55 *SD),*, ranging from 1 to 30 days. The overall case-fatality rate was 22.9% (95% CI: 18.8—27.0)—Table 1.

The overall case-fatality rate among all registered strokes and among those strokes registered cases with CT scan confirmation was 22.9 (95% CI: 18.8 - 27.0) and 20.3% (95% CI: 15.6—25.0), respectively—Table 2. Although more CT scan confirmed hemorrhagic registered patients died (24.3% vs 16.3%), this difference was not significant ($p = 0.097$). There were no significant difference between male and female on the clinical improvement outcome ($p = 0.215$)—Table 2.

Sex and episode type (first-ever vs recurrent) was not significant associated with the mean age of patients ($p = 0.958$ and 0.082, respectively). Confirmed Hemorrhagic stroke patients were 6.47 years younger than ischemic (56.40 vs 62.87 years; $p < 0.001$). There were no significant association between the confirmed stroke type (ischemic and hemorrhagic) and the mean LOS in the hospital ($p = 0.393$)—Table 3.

In the binary logistic regression model, younger ages and female were associated with clinical improvement (aOR = 0.964; $p = 0.002$ and aOR = 1.890; $p = 0.044$, respectively). Hemorrhagic stroke were 56.8 percent points more likely associated with death (aOR = 0.432; $p = 0.010$). The likelihood of clinical improvement was 20.5 percent points better over the years (2014–18), although not statistically significant at 0.05 significance level (aOR = 1.205; $p = 0.086$)—Table 4.

Discussion

The findings of this study show that the classic textbook pattern of 80/20 ischemic/hemorrhagic stroke is no longer valid in MCH, and there is a more equal proportion between ischemic/hemorrhagic stroke events. This study also shows that hemorrhagic

strokes are occurring at more early ages than ischemic, the fatality-rate is relatively high, and significant proportion of hospitalized patients in MCH do not receive a CT Scan for stroke confirmation and classification.

This ischemic/hemorrhagic non-classic pattern of stroke was also observed in 2005/2006 although with higher incidence for ischemic (42.0% vs 36.1%) when Damasceno et al. studied the incidence, characteristics, and short-term consequences of hospitalizations for stroke in Maputo, Mozambique [2]. High proportion of hemorrhagic stroke is observed in African countries, differing from the patterns in developed countries. In the INTERSTROKE study, hemorrhagic stroke was 34% in Africa and 9% in high-income countries [4]. The proportion of hemorrhagic stroke in Africa ranges from 29 to 57%, in comparison with 16 to 20% in North America [5].

Hemorrhagic stroke is correlated with the prevalence and severity of uncontrolled hypertension [5 - 9]. Extremely high levels of uncontrolled hypertension are observed in Mozambique. Treatment and control among the hypertensive are only 7.3% and 3.2%, respectively [3]. The increased prevalence of hypertension in Mozambicans (from 33.1% in 2005 to 38.9% in 2014/15) [3] associated with low treatment levels and poor control might well be the determinant factors for the ischemic/hemorrhagic shifting patterns of stroke observed in this study. In fact, this study found that hypertension (87.1%) was the most frequent associated risk factor, followed by the combination of hypertension and diabetes (9.2%). Among CT scan confirmed hemorrhagic stroke, hypertension was a significant associated risk factor in 96% of the cases compared with 79% of the confirmed ischemic stroke cases.

In this study, hemorrhagic stroke was found to occur in younger ages than ischemic, which is also in line with the literature. Ischemic stroke is more associated with diabetes mellitus, cardiac disease, age above 61 years and previous transient ischemic attacks. This study found a significant difference of mean age of 63 years for ischemic stroke and 56 for hemorrhagic stroke—Table 3. Damasceno et al. also reported first-ever episode of hemorrhagic strokes occurring at younger ages in Maputo (60.5 years for ischemic and 54.7 years for hemorrhagic) [2]. This younger age for hemorrhagic stroke might also be related with uncontrolled hypertension. The study aimed to assess the current prevalence, awareness, treatment and control of arterial hypertension in Mozambican population reported high prevalence of hypertension in participants aged 15–24 years (13.1%) [3], which also corroborates the younger age for hemorrhagic stroke.

Another important finding of this study is the high case-fatality rate of stroke. In 2005/06, the intrahospital mortality was 33.3%, being higher in hemorrhagic (47.9%) than in ischemic (17.4%) for the first-ever stroke event [2]. This study showed an overall case-fatality rate of 22.9% (20.3% among CT scanned stroke confirmed cases), which is not much different from the 2005/06 study. Hospital-based studies have demonstrated a one-month case fatality rate between 27 and 46% in Africans [6, 7, 9]. In the hospital-based INTERSTROKE study, the one-month case fatality rate for stroke was 22% in the African region compared to 4% in high-income countries [4].

This relatively high case-fatality rate can be explained by the scarcity of human, technical, and pharmacological resources. Patients are cared for in a medical ward and not in stroke units, and thrombolytic therapeutic is not available for acute management of stroke in Maputo [2]. A third of stroke patients was not confirmed by CT scan and received only a clinical diagnosis, with negative implication for a properly clinical and pharmacological quality of care. Despite this relatively high case-fatality, favorable outcome improved over the years, and was associated with younger ages and female patients.

The reduced mean LOS (5.76) is the lowest one when compared with 12 days in a rural south-western hospital in Nigeria [10], 18.2 days in National hospital in Abuja [11], but similar to Ghana where the mean LOS of 6.2 days have been reported [12]. The median LOS for Maputo was 6 days for the year 2005/06 [2]. This relatively low mean LOS can be explained by the inexistence of a Stroke Unit and the high occupancy bed rates in MCH.

This study has limitations. Only one public hospitalization data were analyzed, so it excludes stroke patients admitted in other differentiated and private hospitals in Maputo. Another limitation is the high proportion of unspecified strokes (30.1%), which could lead to different patterns than observed in this analysis. In the future, the authors aim to conduct a one-year prospective study on admitted stroke patients in MCH in order to obtain a clearer picture of the ischemic/hemorrhagic pattern.

Although this limitations, this study brings an update on stroke in MCH, and provides a useful knowledge for preventive actions and raise the importance of stroke epidemic in the major public hospital of Mozambique.

Conclusions

This study analyzed five years of stroke demographic and clinical pattern in Maputo Central Hospital, the major associated-University College Hospital in Mozambique. Stroke associated with hypertension is common in MCH, mostly likely due to an increase in hypertension prevalence and extremely low awareness and treatment control. A change in the classic 80/20 ischemic/hemorrhagic proportion was observed, with an equal proportion of ischemic and hemorrhagic events. Efforts for CT scan to all stroke episodes should be emphasized by MCH managers in order to provide a better clinical and pharmacological therapeutic and follow-up. Primary prevention for an increased hypertension awareness and control should be considered and emphasized by health authorities in order to reduce the stroke risk and the burden of the disease. Hypertension screening opportunities, such as the May Measurement Month initiative, should be explored as a public health practice for higher hypertension awareness, treatment and control.

List Of Abbreviations

CI—Confidence intervals; CT scan—Computed Tomography scan; LOS—Length of stay; LtR - Lifetime risk; MCH—Maputo Central Hospital; OR—Odds ratio; SD—Standard deviation; SPSS - Statistical Package for Social Sciences

Declarations

Ethics approval

The study received authorization from the Institutional Committee on Bioethics in Health - Faculty of Medicine / Maputo Central Hospital (CIBS FM&HCM/106/2018).

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that they have no competing interests.

Authors’ contributions

The “first-last-author-emphasis” (FLAE) norm combined with “sequence-determines-credit” (SDC) norm was applied for the sequence of authors. YB and JAHA conceived and designed the protocol, collected the data, and wrote the manuscript. JAHA additionally performed data analysis. ON, DV, HB, FS, JB, NA, CC and EL contributed to manuscript writing and revision. All authors read and approved the final manuscript.

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Tables

Table 1: Univariate analysis of trends and differences in demographic and clinical patterns of stroke patients in Maputo Central Hospital, 2014-18

Variables	Description/categories	Admission year										Total 2014-2018		
		2014		2015		2016		2017		2018				
		N	%	N	%	N	%	N	%	N	%	N	%	95% CI
Age	Mean	62.50	-	63.15	-	57.89	-	59.46	-	59.55	-	60.68	-	59.31 - 62.05
	SD	13.45	-	12.84	-	13.75	-	15.49	-	13.95	-	13.98	-	-
Sex	Male	46	46.0	35	44.3	32	45.7	37	46.8	37	50.0	187	46.5	41.6 - 51.4
	Female	54	54.0	44	55.7	38	54.3	42	53.2	37	50.0	215	53.5	48.6 - 58.4
Stroke onset	Acute	94	94.0	76	96.2	65	92.9	79	100.0	73	98.6	387	96.3	94.5 - 98.1
	Sub-acute	6	6.0	3	3.8	5	7.1	0	0.0	1	1.4	15	3.7	1.9 - 5.5
Episode	First-ever episode	88	88.0	75	94.9	62	88.6	74	93.7	66	89.2	365	90.8	88.0 - 93.6
	Recurrent episode	12	12.0	4	5.1	8	11.4	5	6.3	8	10.8	37	9.2	6.4 - 12.0
Classification	Ischemic	34	34.0	24	30.4	25	35.7	27	34.2	31	41.9	141	50.2*	44.4 - 56.0*
	Hemorrhagic	20	20.0	22	27.8	27	38.6	37	46.8	34	45.9	140	49.8*	44.0 - 55.6*
	Unspecified	46	46.0	33	41.8	18	25.7	15	19.0	9	12.2	121	30.1	-
Confirmation method	Clinical	48	48.0	34	43.0	18	25.7	15	19.0	10	13.5	125	31.1	26.6 - 35.6
	Clinical + CT Scan	52	52.0	45	57.0	52	74.3	64	81.0	64	86.5	277	68.9	64.4 - 73.4
Cerebral artery affected area	Anterior	3	3.0	3	3.8	5	7.1	0	0.0	0	0.0	11	3.9**	1.6 - 6.2**
	Middle	42	42.0	37	46.8	33	47.1	60	75.9	64	86.5	236	83.7**	78.8 - 87.6**
	Posterior	9	9.0	6	7.6	14	20.0	4	5.1	2	2.7	35	12.4**	8.6 - 16.2**
	Unspecified	46	46.0	33	41.8	18	25.7	15	19.0	8	10.8	120	29.9	-
Co-morbidities	Hypertension	84	84.0	69	87.3	61	87.1	71	89.9	65	87.8	350	87.1	83.8 - 90.4
	Diabetes	2	2.0	1	1.3	0	0.0	0	0.0	3	4.1	6	1.5	0.3 - 2.7
	Hypertension + Diabetes	11	11.0	6	7.6	9	12.9	7	8.9	4	5.4	37	9.2	6.4 - 12.0
	HIV	3	3.0	3	3.8	0	0.0	1	1.3	2	2.7	9	2.2	0.8 - 3.6
Clinical outcome	Clinical improvement	72	72.0	56	70.9	57	81.4	60	75.9	65	87.8	310	77.1	73.0 - 81.2
	Death	28	28.0	23	29.1	13	18.6	19	24.1	9	12.2	92	22.9	18.8 - 27.0
LOS (days) in hospital	Mean	5.87	-	6.62	-	5.61	-	5.59	-	5.01	-	5.76	-	5.32 - 6.20
	SD	4.37	-	5.41	-	3.89	-	4.42	-	4.48	-	4.55	-	-

Legend: * Percentages only for categories with information (N = 281). ** Percentages only for categories with information (N = 282). *SD* – Standard Deviation.

Table 2: Stroke confirmation, cerebral artery affected area through CT Scan, sex, co-morbidities and clinical outcome in Maputo Central Hospital, 2014-18

Variable	Description	Clinical + CT Scan		Total
		N	%	
Stroke classification	Ischemic	139	98.6	141
	(%)	(50.2)		
	Hemorrhagic	138	98.6	140
	(%)	(49.8)		
Total		277	98.6	281
Cerebral artery affected area	Anterior	11	100	11
	(%)	(4.0)		
	Middle	231	97.9	236
	(%)	(83.4)		
	Posterior	35	100	35
	(%)	(12.6)		
Total		277	98.2	282

		Death		Total
		N	%	
Stroke classification**	Ischemic	23	16.3*	141
	Hemorrhagic	34	24.3*	140
Total		57	20.3	241

		Clinical improvement		Total
		N	%	
Sex	Male	139	74.3^{+}	187
	Female	171	79.5^{+}	215
Total		310	77.1	402

		Stroke classification**		P value
		Ischemic	Hemorrhagic	
Co-morbidities	Hypertension	111	134	<0.001
	(%)	(78.7)	(95.7)	
	Diabetes	4	0	0.038¥
	(%)	(2.8)	(0.0)	
	Hypertension +Diabetes	18	6	0.011
		(12.8)	(4.3)	
	HIV	8	0	0.004¥
		(5.7)	(0.0)	
Total		141	140	281

Legend: * p = 0.097; ** only with a CT scan confirmation; $^{+}$ p = 0.215; ¥ - Chi square with Yates correction

Table 3: Bivariate analysis on differences between the grouping predictor variables and test variables (age and length of days in the hospital) in Maputo Central Hospital, 2014-18

Variables		N	Mean	*SD*	P value
Age	Male	187	60.64	13.99	0.958
	Female	215	60.72	14.00	
	Ischemic	141	62.87	14.88	<0.001
	Hemorrhagic	140	56.40	13.46	
	First-ever episode	365	60.30	14.26	0.082
	Recurrent episode	37	64.49	10.23	
LOS (days) in the hospital	Ischemic	141	6.59	5.47	0.393
	Hemorrhagic	140	6.10	3.98	

Table 4: Logistic regression analysis for stroke clinical outcome (clinical improvement = 1 or death = 0) 2014-18 in Maputo Central Hospital

	β	*S.E.* β	Wald's χ^2	*Df*	P value	e^{β} (aOR)	95% C.I. for aOR	
ɛdictor							Lower	Upper
e	-0.037	0.012	9.837	1	0.002	0.964	0.942	0.986
x								
le	Ref							
male	0.637	0.316	4.073	1	0.044	1.890	1.019	3.508
ıssification								
hemic	Ref							
morrhagic	-0.840	0.328	6.564	1	0.010	0.432	0.227	0.821
ar of admission	0.186	0.109	2.942	1	0.086	1.205	0.974	1.491
nstant	3.219	0.906	12.612	1	<0.001	24.996		
st			χ^2	*Df*	P value			
ld test			85.107	1	<0.001			
smer & Lemeshow			3.954	8	0.861			

gelkerke $R^2 = 0.121$;
ɛdicted logit of (clinical improvement) = 3.219 - 0.037*Age + 0.637*Sex - 0.840*Classification+0.186*year of admission