

Research



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Risk factors of mortality among patients with stroke in eastern region of the democratic republic of Congo: a retrospective series study

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Abstract

Introduction: stroke is a condition of public health concern and it's a major cause of acquired disability. The rapid and adequate management (diagnosis and multidisciplinary care) and keeping cardiovascular risk factors well-controlled can help to reduce the incidence of stroke-related death. The study aims to identify factors associated with stroke mortality in the Eastern region of the Democratic Republic of Congo (DRC). **Methods:** this series was retrospectively carried out from 2016 to 2020 in different departments managing stroke patients of the following hospitals of Butembo and Katwa health zones: Katwa Referral Hospital, Kitumba Referral Hospital, Matanda Hospital and the Catholic University of Graben Teaching Hospital. Files of patients with the diagnosis of stroke were retrieved and reviewed. The parameters such as socio-demographics, medical history, clinical findings, treatment received and patients' mortality outcomes were recorded. The Odds Ratio was used for assessing the risk level attributable to mortality from strokes. Univariate and multivariate analyses were conducted to determine significant predictors of mortality. **Results:** one hundred and eighty (180) patients with stroke were included. Stroke-related mortality was 57/180 (31.7%). The factors found to be positively associated with mortality are hemorrhagic stroke (aOR 21.21, 6.2-61.3), reaching hospital (late than 24h aOR 33.8, 16.65-66.6), poor compliance to anti-diabetic medication (aOR 8.46, 3.0-4.3), recurrent stroke (aOR 5.81, 2.0-13.8) poor

compliance to antihypertensive (aOR 4.46, 1.4-8.0), and the advanced age >75 years (aOR 6.50, 1.96-21.50). The factor negatively associated with mortality includes being a male (aOR: 0.98, 0.41-2.31). **Conclusion:** stroke is a common cause of mortality in Butembo. Six management variables remained significant in predicting mortality. These factors, most of which can be modified, should constitute the elements of capacity building by healthcare personnel to significantly reduce this mortality.

Introduction

Stroke is the leading cause of acquired disability in the world, the second cause of dementia after Alzheimer's disease, and the third cause of death after ischemic cardiomyopathy, making it a public health concern [1-4]. In terms of public health, it constitutes one of the major and challenging problems in critical care medicine. Between 1990 and 2017, an increased number of stroke patients was observed worldwide. However, this increase was largely linked to population growth and aging [1,5]. In developing countries, the incidence of stroke is estimated at 18,875 cases per year, one-third of which recur with a death rate twice as high as the initial stroke. The prevalence of stroke in Black Africans is 5 to 24%. Out of 434 autopsies performed on hypertensive patients in South Africa, 51% was due to stroke [6-9]. The proportion of deaths caused by stroke is 10 to 12% affecting patients under the age of 65 [6,10]. In the Democratic Republic of Congo (DRC), hypertension, diabetes mellitus, age, and sex were found to be the major risk factors of stroke among hospitals [2,6]. Non-communicable diseases were responsible for 21% of all deaths, including 9% for cardiovascular disease in 2018 [2]. However, the local data show that stroke accounts for 6% of overall morbidity at the University Hospital of Kinshasa [6]. The other Congolese studies carried out before 2000 underline the lethal characteristics of the stroke [11]. According to the WHO, stroke and cardiovascular disease will constitute in the coming years the main challenge of the health

system in developing countries due to mortality [12]. Stroke is a medical emergency, its management particularly requires the attending physician to teach the population to recognize the first clinical signs which are often overlooked, and to consult directly an appropriate center to avoid any delay in treatment and the worst prognosis [5,13]. Urgent hospitalization in a stroke unit saves lives and reduces residual disability by early prevention of specific complications and the introduction of anti-thrombotic prevention. Early and adequate management (diagnosis, multidisciplinary approach) and control of cardiovascular risk factors including high blood pressure contributed to the decrease in the incidence and mortality from stroke between 1930 and 1980 in the United States of America and Europe. However, this management did not decrease mortality [8]. Based on the magnitude of stroke-related mortality in Butembo, we aimed to describe the factors that are associated with mortality. The goal of this study was to identify the factors associated with stroke mortality in the Eastern region of the DRC.

Methods

This study was a retrospective series carried out from 1st April 2016 to 30th March 2020 in the different departments managing stroke patients in the following hospitals of Butembo and Katwa health zones, North Kivu, DRC: Katwa Referral Hospital, Kitatumba Referral Hospital, Matanda Hospital, and the Catholic University of Graben (UCG) Teaching Hospital. These health facilities provide a sufficient study framework to access the strokes victims of Butembo City. The city does not have a specialized facility like stroke units, or neurosurgical management of patients with stroke. Thus, the internal medicine departments of those Butembo City hospitals are the main units to manage these patients. We proceeded with an exhaustive sampling collection. So, all stroke patients attending those four health institutions during our study period constituted our population. We included patients with the clinical diagnosis of

stroke, living or deceased. We excluded patients with a transient ischemic attack and those who absconded. Several variables found from prior studies were tracked in the hospitals' registries and grouped into several categories: demographics (age, gender), cardio-vascular risk factors for in-hospital mortality (diabetes, arterial hypertension, recurrent strokes, alcoholism, chronic smoking, obesity, use of combined contraceptives pills, delayed management), neurological presentation (coma, hemiplegia, aphasia, coma and hemiplegia, visual disturbances and hemiplegia, visual disturbances), hypertension and diabetic management (good or poor observance) care continuum (time from strokes to seeking care) and discharge status (death, still alive).

Statistical analyses were performed using SPSS 15.0 software. We also used MS Word and MS Excel for word processing. The statistical calculations consisted of the frequency and the odds ratio. The odds ratio test was used to indicate the level of the risk attributable to a factor F in the occurrence of mortality from stroke in our study facilities. When the P-value was less than 0.05, the association between the two category variables was said to be statistically significant. All the identifying parameters of patients remain anonymous. The proposal of this work had been presented and approved by the ethical review board of the Integrated Multidisciplinary Research Center (IMRC) of the Adventist University of Lukanga before the data gathering under trial No 09/IMRC/2019. The study has been conducted according to good ethical practice.

Ethics approval and consent to participate: ethical approval was provided by the Integrated Multidisciplinary Research Center (IMRC) of the Adventist University of Lukanga, under trial No 09/IMRC/2019. The study has been conducted according to good ethical practice.

Consent for publication: individual informed consent was undertaken. Informed consent from the study participants was obtained.

Results

The study included 180 patients admitted with a final diagnosis of stroke. The stroke-related mortality was 31.7% during the 5-years as shown in Table 1. The basic demographic characteristics, medical history, intoxication and occurrence, neurological findings at admission, type of stroke, timing from admission and stroke mortality are summarized in Table 2.

Predictors of mortality

By age, patients above age 75, who were mostly women were most affected by stroke and most at risk of death due to stroke. Regarding the medical histories, recurrent stroke was the most incriminated risk factor in the occurrence of death from stroke followed by poor observance of hypertension treatment. Alcohol intoxication tripled the risk of death from stroke. Hemorrhagic stroke was the least common type of stroke but with a high mortality rate multiplied by 21 with a P-value <0.0001. Early management of stroke was a protective factor against the occurrence of mortality from stroke by reducing 16 times the risk of death in stroke patients. Coma associated with hemiplegia was the most common neurological clinical presentation at admission with a poor outcome as shown in Table 3.

In multivariate modeling, factors with a P-value of less than 0.2 were entered in the multiple logistic regression model to determine how the independent variables are jointly associated with the outcome. Six management variables remained significant in predicting mortality: hemorrhagic stroke (aOR 21.21, 6.2-61.3), reaching hospital (late than 24h aOR 33.8, 16.65-66.6 and before 4h aOR 41.6, 0.51-61.3), poor compliance to anti-diabetic medication (aOR 8.46, 3.0-4.3), recurrent stroke (aOR 5.81, 2.0-13.8) poor compliance to antihypertensive (aOR 4.46, 1.4-8.0), and the advanced age > 75 years (aOR 6.50, 1.96-21.50). The factor negatively associated with mortality includes being a male (aOR: 0.98, 0.41-2.31).

Discussion

To our knowledge, this is the first retrospective stroke study established in Eastern DRC spanning eight variable categories to understand the biggest drivers for poor outcomes in stroke patients and to highlight areas for quality improvement. A total of 180 patients with stroke recruited in this study were hospitalized at Matanda, Katwa, Kitatumba hospitals, and Graben Catholic University Teaching Hospital during our study period; Mortality due to stroke was 57 (31.7%). These hospitals' mortality reflects the severity of the disease in the region. It is lower than that reported in African literature as in the study made by Mohammed Bouyad in Morocco in 2016 which found 73.1% [14]. This difference could be explained by the small number of our study population, but also a relatively unreported number of undiagnosed stroke-related deaths that didn't reach the hospital. However, our results are close to those of Ossou Nguiet *et al.* Touré in their study done in Dakar-Senegal who found 25% and 24.8% respectively [10,15-17].

The age of 75 and above was significantly linked to the mortality of stroke with a female predominance. Older age is a factor of poor prognosis more found in ischemic and hemorrhagic strokes. Our results are similar to the studies carried out by Andersen *et al.* In the United States and Touré in Senegal which found respectively 44.7% and 42.7% of mortality in the age group of 76 years and over [10,18-19]. Some studies, however, report a male predominance [4,14,20].

High blood pressure remains the most common risk factor and is a common cause of death from stroke [20,21]. In our study, poor compliance with antihypertensive therapy was significantly linked to mortality from stroke, as well as poor control of diabetes mellitus. The impact of the variation in blood pressure was reported in previous studies [21-27]. Our results agree with those found in Sub-Saharan Africa which showed a significant difference in mortality between patients followed

regularly for hypertension and diabetes mellitus [6,10].

Chronic alcoholism increases the risk of death by stroke by 3.91, while non-alcoholism is a protective factor. The long term active smoking multiplied the risk by 1.38. Our results corroborate with those of Mohammed Bouayad who found a mortality rate linked to chronic smoking of 77.7% [14].

Recurrences of strokes continue to be common around the world. In our study, recurrent stroke increased the risk of death by 5.81 times. The stroke-related mortality has been the subject of observations in other studies carried out in Africa, in this case in a study by Kamadore Touré who found a prevalence of 9.9% [16] and by Zabsonre *et al.* who found a prevalence of 7.3% [11]. The lack of patients' awareness about the stroke disease and its risk factors could explain the occurrence of this recurrence. Obese patients are 3.84 times more likely to die from a stroke. This risk is statistically significant for the sole reason that the 95% confidence interval does not contain 1 and p less than 0.05. From Table 2, it emerges that patients who were taking combined contraceptives were 100% exposed to the risk of dying from stroke.

Coma and hemiplegia are the main presentations encountered in our patients with a mortality rate of 40.2%. Adding the finding of isolated coma without hemiparesis, our finding meet the results found by Touré in his study done in Dakar-Senegal where he found mortality at 68.46% [10] as well as what has been observed in developed countries like in France [22] and Africa [6].

Patients with hemorrhagic stroke have a 21.21 times risk of death. This risk is statistically significant because the 95% confidence interval does not contain 1. Our results are similar to those found by Mohammed Bouayad who obtained a mortality rate of 73.1% linked to hemorrhagic stroke [14]. This would be explained by a high frequency and the poorly controlled blood pressure. Early management is a protective factor against the occurrence of death from stroke, but

patients managed late are 16.65 times at risk of dying compared to those managed early.

Predictors of mortality

Factors predictive of mortality due to stroke in Butembo city include delays in reaching care, type of stroke (hemorrhagic stroke), recurrent strokes, poor compliance to antihypertensive, and anti-diabetic medication, and age of 75 and above. As previously discussed, timely access to neurovascular intervention is essential for stroke patients, therefore delays in reaching care negatively impact patient outcomes [28,29]. The factor negatively associated with mortality includes being a male. Patient baseline and stroke risk factors are consistent with previous studies that report worse outcomes for patients with hemorrhagic stroke [30].

Poor compliance with antihypertensive therapy was significantly linked to mortality from stroke, as well as poor control of diabetes mellitus. These patients experienced a more than fourfold mortality than all other patients. Low adherence results in suboptimal blood pressure control, which is associated with adverse cardiovascular and nervous outcomes and increased treatment costs. Adverse effects of medication are an important cause of diminished adherence [31]. The dramatic increase in mortality for patients with recurrent stroke stresses the importance of increasing access to neurosurgery in future interventions to address morbidity and mortality.

Limitation

This study included either clinical or radiologically diagnosed stroke. Frequently patients presented to other health centers and traditional medicine before being referred to us; this could probably bias the results. There was neither neurosurgical, nor other advanced treatments of those patients due to the nonexistence of those services.

Conclusion

It emerges from this study that the mortality of stroke is high. Several factors have been significantly associated with this mortality, notably hemorrhagic stroke, reaching hospital late than 24h, advanced age, non-compliance with antihypertensive and antidiabetic treatment, recurrent stroke, as well as late management. There is an urgent need to build an advanced capacity for improving the management of stroke patients in this region.

What is known about this topic

- *Stroke is a growing global problem, which is responsible for a substantial burden of disability and death and which generates substantial healthcare costs;*
- *Suitable knowledge of prevention of associated mortality factors should materially influence the outcome from stroke and increase the chances of full recovery;*
- *The knowledge of the factors associated with stroke mortality in the Eastern region of the DRC is poor.*

What this study adds

- *This study will serve as a reference for healthcare workers working in this region in particular and those of low middle-income countries in general.*

Competing interests

The authors declare no competing interests.

Authors' contributions

LKK conceived and designed the study. NKM undertook the data collection, did the statistical analysis, and wrote the first draft of the manuscript. LKK, BMK, LMK, and ESB, AKN, ZTK, and HML did the manuscript correction, review of the final

manuscript. HML and ZTK did the supervision of the work. All authors contributed to the intellectual content and approved the final manuscript. All authors have read and agreed to the final manuscript.

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Tables

Table 1: annual frequency of stroke mortality at Butembo and Katwa health zones

Table 2: baseline demographic characteristics, medical history, intoxication and occurrence, neurological findings at admission, type of stroke, timing from admission and stroke mortality

Table 3: neurological findings at admission and mortality from stroke

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Table 1: annual frequency of stroke mortality at Butembo and Katwa health zones

Year	Total admission	Death	%
2016	42	20	47,6
2017	16	12	75
2018	50	10	20
2019	28	12	42,8
2020	44	3	6,8
Total	180	57	31,7

Table 2: baseline demographic characteristics, medical history, intoxication and occurrence, neurological findings at admission, type of stroke, timing from admission and stroke mortality

Variable	Total (N=180)	Died, n (%) (n=57)	Survived, n (%) (n=123)	Crude OR [95% CI]	Adjusted OR [95% CI]
Age ≤45 years					
Yes	16	5 (31.25)	11 (68.75)	0,98 [0,28-3,26]	1.27 [0.37-4.39]
No	164	52 (31.71)	112 (68.29)	1.00	1.00
Age 46-60 years					
Yes	55	9 (16.36)	46 (83.64)	3,41[2,13-6,64]	3.6 [1.1-16.81]
No	125	48 (38.4)	77 (61.6)	1.00	1.00
Age 75	59	30 (50.85)	29 (49.15)	3,60 [1,76-7,42]	6.50 [1.96-21.50].
	121	27 (22.31)	94 (77.69)	1.00	1.00
Sex					
Male	89	20 (22.47)	69 (77.53)	0.423 [0.2208-0.8105]	0.98 [0.41-2.31]
Female	91	37 (40.66)	54 (59.34)	1.00	1.00
Hypertensive treatment					
Poor-compliance	65	36 (55.38)	26 (83.87)	6.45 [2.20-18.91]	4.46 [1.4-8.0]
Compliance	31	5 (16.13)	29 (44.62)	1.00	1.00
Diabetic treatment					
Non-observance	15	8 (53.33)	7 (46.67)	8.4571 [2.301-33.5767]	8.46 [3.0-14.3]
Observance	42	5 (11.9)	37 (88.1)	1.00	1.00
Recurrent strokes					
Yes	34	22 (64.71)	12 (35.29)	5.81 [2.61-12.93]	5.81 [2.0-13.8]
No	146	35 (23.28)	111 (76.02)	1.00	1.00
Chronic alcoholism					
Yes	31	18 (58.06)	13 (41.94)	3.9053 [1.7522-8.7043]	2.50 [1.88-11.50]
No	149	39 (26.17)	110 (73.82)	1.00	1.00
Chronic smoking					
Yes	13	5 (38.46)	8 (61.54)	1.2061 [0.3773-3.8562]	1.50 [1.96-6.50]
No	167	57 (34.13)	110 (65.86)	1.00	1.00
Oral contraceptive pills					
Yes	4	4 (100.00)	0 (0.00)	-	-
No	176	53 (30.11)	123 (69.89)	-	-
Type of stroke					
Hemorrhagic	39	32 (54.87)	7 (45.13)	20.85 [8.26-52.58]	21.21 [6.2-61.3]
Ischemic	139	25 (47.83)	114 (52.17)	1.00	1.00
None	2	0	0		
Timing from admission to death					
Late	62	43 (69.35)	19 (30.65)	16.81 [7.73-36.54]	33.8 [16.65-66.6]
Early	110	14 (57.73)	104 (42.27)	1.00	1.00

Table 3: neurological findings at admission and mortality from stroke

Neurological variables	Total (N=180)	Death (n=57)	%
Coma	45	13	28,8
Hemiplegia	25	7	28
Visual disturbances	15	5	33,3
Coma and hemiplegia	67	27	40,2
Visual disturbances and hemiplegia	13	2	15,3
Aphasia	15	3	20