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Short, Medium, and Long-Term Stroke Mortality in Libreville and Associated Factors

Grass Aurelle Mambila Matsalou[1], Jennifer Nyangui Mapaga[1], Pupchen M. Gnigone[1], Minka'a Pagbe Michael[2], Chermine Mboumba Mboumba[1], Christian Allognon Mahutondji[2], Aissata Ibrahima Camara[1], Annick A. Nsounda[1], Nelly Diouf Mbourou[1], Michel-Arnaud Saphou-Damon[1], Elsa Ayo Bivigou[2], Philomene Kouna Ndouongo[1]

[1]Neurology Department, University Hospital of Libreville, Libreville, Gabon
[2]Cardiology Department, University Hospitalof Libreville, Libreville, Gabon
Email: aurellematsaloumambila@gmail.com

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Abstract

Strokes are common around the world and especially in sub-Saharan Africa. They are responsible for severe sequelae and the majority of deaths. In Gabon, no study on stroke mortality has been conducted. Objective: To determine short, medium, long-term mortality and factors associated with long-term stroke mortality. Method: Our study took place in the Neurology Department of the University Hospital Center of Libreville (UHCL). It was a historical cohort study with descriptive and analytical purposes covering the period from June 1 to August 31, 2018 and taking into account hospitalized patients from January 1, 2013 to December 31, 2017. We conducted a comprehensive systematic recruitment of patients with stroke, 18 years old and more, and had been agreed to give information. We included all patients meeting the inclusion criteria. The data was gathered using Epi-Info 7 software. The CHI-2 test was used for the comparison of frequencies and the Student's test, for comparison of means. Multivariate analysis with logistic regression allowed us to look for factors associated with long-term mortality. A result was statistically significant for a $p < 0.05$ value. Results: At 3 months, 28 patients (18.1%) died, at 6 months thirty-one patients or 20.1% died. At 5 years old, fifty-three patients or 34.4% had died. The factors associated with long-term mortality, if the lost of sight were all alive were tobacco ($p = 0.01$) and stroke ($p = 0.008$). If all those who were lost to sight had died, no factor was associated with 5-year mortality. Conclusion: Stroke mortality must not be taken for granted, it can be underestimated because of the large number of lost sight. Measures must be put in place to strengthen post-stroke monitoring.

Keywords

Stroke, Mortality, Associated Factors, Libreville

1. Introduction

Globally, seven of the top 10 causes of death are due to non-communicable diseases (NCDs). Stroke is the world's second-biggest killer after ischaemic heart disease, with 11% of total deaths [1]. In developing countries, it occupies the same place behind cardiovascular diseases and ahead of infectious diseases [2]. The World Health Organization (WHO) estimates that by 2030, 80% of all strokes will occur in people living in low- and middle-income countries (LMICs), where they will account for 7.9% of total mortality [3]. The hospital mortality rate reported in the literature varies considerably, depending on the characteristics of the patients. They can go as high as 70%, even in studies conducted in Europe [4] and the United States [5]. The predictive factors of in-hospital mortality after a stroke are described in the literature and can be the subject of multiple controversies. These factors may be related to age, high National Institute of Health Score Scale (NIHSS), type of haemorrhagic stroke, stroke size, and patient care during the acute phase [6] [7] [8]. In sub-Saharan Africa, stroke is a double burden of morbidity and mortality due to a lack of appropriate infrastructure, of awareness among populations about stroke, and care that is often expensive and not accessible to all. Stroke-related mortality is poorly described in the sub-Saharan literature, the few conducted studies show high mortality rates notably, 24.04% in Burkina Faso [9], 26.8% in Cameroon [10], and 29.9% in Bangui [11] and is probably underestimated, seeing that the majority of patients in sub-Saharan Africa turn to traditional medicine [12]. In industrialized countries, however, the recourse to traditional medicine has been declining since the introduction of stroke dedicated centres known as "neurovascular units". In Gabon, non-communicable diseases (NCDs) were responsible for 6,500 deaths and accounted for 21% of the risk of premature death in 2022 [11]. Essola *et al*. (2017) found that stroke was the leading cause of medical death in the intensive care unit of Libreville University Hospital [13]. It is one of the most frequent reasons for hospitalization in neurology and also for mortality and disability in Gabon [14]. Measures need to be put in place to strengthen post-stroke follow-up. However, no study of mortality and associated factors in this pathology has been carried out in neurology, which justifies our study.

2. Methodology

Our study took place in the neurology department of the Libreville University Hospital (CHUL). It was a historical cohort study with descriptive and analytical purpose, covering the period from 1 June to 31 August 2018 and involving patients hospitalized from 1 January 2013 to 31 December 2017. We have systematically and comprehensively recruited patients. The patients included were

over18 years, had suffered a stroke and had given their consent or that of a relative. Outcomes were defined by mortality, which corresponds to death at discharge, in the short-term (3 months), medium-term (6 months) and long-term (5 years). The patients included in our study were selected using the hospitalization register to collect socio-demographic data (age, sex, education level); medical history (high blood pressure, diabetes, smoking, alcohol, stroke recurrence, migraine, obliterative arteriopathy of the lower limbs); clinical data on admission (mode of transport, Glasgow score, NIHSS) and paraclinical data: brain CT, brain magnetic resonance imaging (MRI). Patients or their relatives were then contacted for verbal notification of living or deceased status. In the event of death, a verbal autopsy with relatives enabled us to determine the date of death. Data was entered using Epi-Info 7 software. The CHI-2 test was used for comparison of frequencies and the Student's test for comparison of means. Multivariate analysis with logistic regression allowed us to look for factors associated with long-term mortality. A result was statistically significant for a value of $p < 0.05$.

3. Results

We enrolled 163 patients, aged between 30 and 95 years, with an average age of 57 ± 11.9 years. Our study comprised 91 men (55.8%) and 72 women (44.1%), giving a sex ratio of 1.26. Socio-demographic data are summarized in Table 1.

High blood pressure was the most common risk factor at 68.7%, followed by alcohol consumption (46%), smoking (15.6%), previous stroke (15%), diabetes (10.5%), migraine (1.5%) and obliterative arteriopathy of the lower limbs (0.6%).

Table 1. Distribution of patients by age group, sex, and education level in Libreville.

Variable	Headcount(n)	Percentage (%)
Age (years)		
[30 - 45[	28	17.2
[45 - 60[	**73**	**45**
[60 - 75[	47	29
[75 - 90[	13	8
[90 - 95[	2	1.22
Gender		
Masculine	**91**	**55.8**
Female	72	44.1
Educational level		
Uneducated	**68**	**41.7**
Secondary education	43	26.3
Primary education	39	23.9
Superior education	13	8

Transport by ambulance and personal vehicle were in the majority at 33.33% each. Taxi transport accounted for 26.67% and other modes of transport were reported at 6.67%.

On admission, the mean Glasgow score was 14.51 (±1.14), the average NIHSS was 10 ± 4.4. Table 2 shows clinical data on patient admission.

Ischaemic stroke was the most common type of stroke (60.1%), with the middle cerebral artery territory as the most affected (72.2%). Haemorrhagic stroke was present in 39.9% of cases, with a preference for the deep territory. The remaining data on the distribution of patients according to stroke type is shown in Table 3.

Hospital stay ranged from 3 to 33 days with an average of 11.51 ± 6.34 days.

At discharge from hospital, according to the disability score, most of our patients were dependent, with an average ranking of 3.47 (±1.5) and a mean Barthel score of 66.68 (±21.21) with extremes ranging from 30 to 100. The mean NIHSS score at exit was 6.18 (4.4) and in 98.8% of cases, patients were discharged to home.

At 3 months, 28 patients (18.1%) had died, at 6 months thirty-one patients (20.1%) had died. At 5 years, fifty-three patients (34.4%) had died. These data are shown in Table 4.

Based on the hypothesis of minimum and maximum bias (*i.e.* whether lost to sight patients were alive or deceased), the cumulative mortality at 3 months was

Table 2. Distribution of patients according to the parameters and data of the physical exam at their admission, Libreville.

Variable	Headcount (n)	Percentage (%)
Motor deficit		
No motor deficit	11	7
Hemiparesis	**81**	**49**
Predominantly brachiofacial hemiparesis	9	6
Predominantly crural hemiparesis	3	2
Hemiplegia	59	36
Sensory disorder		
Absent	**136**	83
Present	27	17
Parameters	**Average (SD)**	**[Min-Max]**
Temperature (˚C)	36.89 (±0.57)	[35 - 40]
BMI (Kg/m^2)	27.61 (±4.23)	[18.61 - 33.41]
Glasgow	14.51 (±1.14)	[10 - 15]
Pulse	85.66 (±16.72)	[48 - 155]
Blood sugar	6.68 (±2.70)	[04.17 - 8.5]

Table 3. Distribution of patients by stroke type, territory, topography, Libreville.

Variable	Headcount (n)	Percentage (%)
Type of stroke		
Ischaemic	**98**	**60.1**
Haemorrhagic	62	38
Ischaemia + haemorrhage	3	1.8
Arterial territory		
Medium cerebral	**73**	**72.2**
Anterior cerebral	17	16.8
Vertebral basilar	11	10.8
Topography		
Lobar	16	9.8
Deep		
Internal capsule	**32**	19.6
Central gray nuclei	17	10.1

Table 4. Mortality in the short, medium and long term, Libreville.

Variable	Headcount (n)	Proportions (%)
At 3 months		
Deceased	**28**	**18.1**
Lost to sight	37	24
Alive	89	57.7
At 6 months		
Deceased	**31**	**20.1**
Lost to sight	41	26.6
Alive	82	53.2
At 5 years old		
Deceased	**53**	**34.4**
Lost to sight	42	27.2
Alive	59	38.3

18.17% and 42.21%; cumulative mortality at 6 months was 20.13% and 46.75%; 5-year cumulative mortality was 34.42% and 61.69% as presented in Table 5. The factors associated with long-term mortality, if all lost to sight were alive, were smoking ($p = 0.01$) and stroke ($p = 0.008$). No factor was associated with 5-year mortality. Table 6 and Table 7 report the remainder of the factors associated with long-term mortality at 5 years, considering both assumptions (whether sight loss was deceased or alive).

Table 5. Mortality rate at 3 months, 6 months and 5 years, considering attrition bias, Libreville.

	3 months		6 months		5 years	
	Hypothesis 1	**Hypothesis 2**	**Hypothesis 1**	**Hypothesis 2**	**Hypothesis 1**	**Hypothesis 2**
Alive	126	89	124	82	101	59
Deceased	28	65	31	72	53	95
Mortality	18.17%	42.21%	20.13%	46.75%	34.42%	61.69%

Table 6. Distribution of sex and age of patients according to long-term mortality (lost to sight are all alive), Libreville.

Variable	**Total**	**Deceased**	**RR** [IC 95%]	**p**
Gender				0.868
Masculine	91	29 (31.9)	1	
Female	72	24 (33.3)	1.07 [0.55 - 2.07]	
Age				
[30 - 45[	28 (17.3)	6 (21.4)	1	
[45 - 60[	73 (45.1)	21 (28.8)		
[60 - 75[	47 (29.0)	18 (38.3)		
[75 - 95[	14 (8.6)	8 (57.1)		
Risk factors				
HBP (yes)	112 (68.7)	41 (36.6)	1.20 [0.98 - 1.47]	0.108
Diabetes (yes)	17 (10.4)	5 (29.4)	0.86 [0.32 - 2.33]	0.997
Smoking (yes)	25 (15.3)	14 (56.0)	2.64 [1.29 - 5.42]	**0.01**
Stroke (yes)	24 (14.7)	14 (58.3)	2.9 [1.38 - 6.11]	**0.008**
Hypercholesterolaemia (yes)	5 (3.1)	1 (20.0)	0.52 [0.06 - 4.53]	0.998
Alcohol (yes)	75 (46.0)	26 (34.7)	1.10 [0.78 - 1.55]	0.618
Stroke type				0.039
Haemorrhagic stroke	62 (38.0)	14 (22.6)	1	
Ischaemic stroke	101 (62.0)	39 (38.6)	1.31 [1.04 - 1.64]	

Table 7. Factors associated with long-term mortality by sex, age. Risk factors and stroke type (lost of sight all dead).

Variable	**Total (%)**	**Deceased (%)**	**RR [IC 95%]**	**p**
Sex				0.315
Male	91 (55.8)	55 (60.4)	1	
Female	72 (44.2)	49 (68.1)	1.21 [0.83 - 1.77]	
Age				
[30 - 45[	28 (17.3)	19 (67.9)	1	
[45 - 60[	73 (45.1)	40 (54.8)		
[60 - 75[	47 (29.0)	34 (72.3)		
[75 - 95[	14 (8.6)	11 (78.57)		

Continued

Risk factors				
HBP (yes)	112 (68.7)	76 (67.9)	1.21 [0.95 - 1.52]	0.111
Diabetes (yes)	17 (10.4)	12 (70.6)	1.36 [0.50 - 3.68]	0.539
Smoking (yes)	25 (15.3)	17 (68.0)	1.21 [0.55 - 2.62]	0.635
Stroke (yes)	24 (14.7)	17 (70.8)	1.38 [0.61 - 3.13]	0.438
Hypercholesterolaemia (yes)	5 (3.1)	1 (20.0)	0.14 [0.02 - 1.24]	0.058
Alcohol (yes)	75 (46.0)	46 (61.3)	0.9 [0.64 - 1.26]	0.545
Stroke type				0.390
Haemorrhagic stroke	62 (38.0)	37 (59.7)	1	
Ischaemic stroke	101 (62.0)	67 (66.3)	1.12 [0.86 - 1.45]	

4. Discussion

The purpose of our study was to assess mortality and determine factors associated with long-term mortality. Stroke mortality is higher in the first weeks after the onset of vascular events. Das et al reported that mortality in the first 7 days was 23% and could reach 50% by the second week [15]. This mortality remains very high in the first 30 days in stroke patients, even more so in developing countries. In Uganda 30-day mortality was 43.8% [14], in Gambia 41% [16] and 40% in Nigeria [17]. The early death of stroke in Africa reflects the scarcity of human resources, management techniques and pharmacological resources. In the majority of developing countries, stroke is still managed in general practice because it does not have neurovascular units [15]. Also early deaths that usually occur in the first 30 days may be related to the mechanisms and complications related to stroke but also to the comorbidities of the patient explaining why despite optimal management even in developed countries, mortality remains high [7]. A month after the stroke, the mortality rate remains high in most developing countries. Wafeu and al in 2020 in Cameroon found hospital mortality of 23.1% at 3 months [7]. In Uganda Namale and al. in 2020 reported that 31 (23%) patients died within the first 30 days and 13 (14%) additional patients died within 90 days of stroke [18]. In 2019 in Tanzania out of a cohort of 149 stroke patients, 50% of patients died at 90 days [19]. Nuttaki and al in Zambia reported a mortality rate of 22% to 90 days among those who survived hospitalization compared to 24% during hospitalization [20]. Studies show that 90-day mortality is associated with hospital mortality. It may depend on several factors such as advanced age, history of stroke, atrial fibrillation and hospital-acquired lung infections [21]. Six months after a stroke our mortality was equivalent to that of Sarbazi and al in 2018 at 23.3% [22]. Kaduka and al in 2018 make the same observation during their follow-up at 6 months after the stroke [22]. Predictors factors of mortality at 6 months may be the age over 65 and the severity of NIHSS. Also the risk of death at 6 months was increased by 2 in the hemorrhagic stroke group compared to ischemic stroke [21].

Early studies of long-term outcomes after stroke showed low 5-year survival rates and mortality up to 72%. The risk of mortality was ten to twelve times higher in the first year [22] [23] [24] [25] [26]. After the first year, mortality decreases but remains 2 - 3 times higher than the standard mortality of the general population [27] [28]. Adoukonou *et al.* in 2020 studied mortality at 3 and 5 years which was 21.5% and 23.5% [29] respectively. In Tanzania at 5 years a much higher case fatality rate of 71.8% was found [30]. High mortality in this Tanzanian study may be related to socio-economic level. Indeed, the study was conducted in rural areas where agriculture is the main means of subsistence; the prevention of vascular risk factors is not often a priority because of the high cost of drugs.

Dževdet Smajlović and al in 2006 found a higher risk of death in the first year after stroke (46%) 11% of patients died in the second year and mortality in the third and fifth years was 4% and 6% respectively.

Risk of death over 5 years from two Australian cohorts was 58% and 59% [31]. In a study in Denmark, mortality rates at 1 and 5 years after stroke were 41% and 60%, respectively [28]. Even long-term stroke mortality from these studies is not negligible and the majority of long-term mortality studies are conducted in hospitals with the possibility of selection bias. In our study, factors such as tobacco and stroke history could be associated with long-term mortality if the patients were all alive. Age, male sex, smoking and diabetes are predictors of long-term mortality [32]. Age is a well-known risk factor for mortality, the risk of mortality may be 3.98 times higher for an age 75 years [33]. Male sex was found to be a factor associated with long-term mortality, which could be explained by lower life expectancy in men, while the protective role of estrogen in women could reduce mortality [29].

Diabetes increases the risk of death by more than 1.40 times after two years as reported in several studies [34] [35]. This risk is somewhat higher in patients with ischemic stroke, this may be due to the long-term consequences of diabetes, such as thrombotic complications and microvascular dysfunction [36]. In addition, the increased risk of recurrent stroke and death in diabetic patients may be the result of vascular changes caused by the synergistic effect of chronic hyperglycemia, free fatty acid release and insulin resistance [37]. The impact of smoking on stroke risk and mortality is also well established. Smoking has a higher risk of death for ischemic stroke, which can be multiplied by six [38]. Studies show that one in three patients after ischemic stroke and one in four after intracerebral hemorrhagia survive 5 years [22]. The prognosis would be better at 5 years for a patient with intracerebral hemorrhagia than that with a cerebral infarction. Also depression is another mortality risk factor with an Odds ratio (OR) of 1.22 (1.02–1.47) (95% CI).

The burden of depression on mortality risk in stroke patients appears only after 2 to 5 years after stroke [35]. In addition, persons with disabilities are at higher risk of death at any age [39]. Stroke mortality in Africa is high even though most

patients do not go to hospital after stroke because of mystic-religious beliefs, lack of awareness of the warning signs of stroke and the high cost of treatment. Prevention strategies and better acute management of strokes must be put in place in our context where the majority of strokes occur in young subjects, the vital forces of the nation that should participate in socio-economic development.

Our limitations lie in the small sample size resulting from the large number of people lost to follow-up, which makes it impossible to extrapolate our results. It would therefore be desirable to carry out a study on a large cohort of patients. Another limitation is that the patient files were in complete and therefore could not be included in the study.

5. Conclusion

Short-, medium- and long-term mortality is significant in our study, showing the impact of strokes in our population. Factors associated with long-term mortality are previous stroke history and smoking. Better stroke prevention strategies need to be put in place to fight against this scourge, especially in our context.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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