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## Stroke characterization in Sun Saharan Africa: Congolese population

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## ABSTRACT

**Background:** Stroke is the second cause of death worldwide and over than 80% of deaths occurs in developing countries. However, its characteristics in the Democratic Republic of Congo (DRC) are poorly defined. This study aimed to describe the key features of stroke in a hospital population of Kinshasa in DRC and to assess the frequency of cardiovascular risk factors and their impact on target organs.

**Methods:** A descriptive study was carried out from three hospitals in Kinshasa between January and April 2013. Cardiovascular risk factors, clinical and biological data were collected during the study period. The study involved 166 patients aged 18 years and over.

**Results:** The mean age of patients was  $59.6 \pm 12.3$  years, the sex ratio for male of 1.9. Stroke was ischemic in 66% of cases. Hypertension was the most frequent cardiovascular risk factor (84.3%), followed by high blood cholesterol (45.2%). The etiologies of ischemic stroke (TOAST classification) were dominated by lacunas (38.5%) and embolic heart diseases (12.8%). The origin was unknown in 45.9% of cases. Coma was observed in 37% of patients on admission and was the main independent prognostic factor of mortality, which was 19.3%. Left ventricular hypertrophy and renal failure were found respectively in 64.7% and 34% of patients.

**Conclusion:** This study found a growing increase of ischemic stroke in a society where hemorrhagic type used to be the most common, a high rate of hypertension, hypercholesterolemia and diabetes, indicative of a fast epidemiological transition.

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## 1. Introduction

Stroke is a pathology with a high mortality rate despite the progress in its management [1,2]. It is the second leading cause of death worldwide. It has been recently reported that 16.9 million people suffer a stroke each year, which represents a global incidence of 258/100,000/year [3]. It accounts for 11.3% of all deaths each year of which 87% occur in low- and middle countries including the Democratic Republic of Congo (DRC) [4,5]. It's also the first cause of acquired disability in adults with an important burden since it affects the working age adults [6].

A lot of progress has been made in the knowledge of the risk factors owing to cardiovascular investigations progress which has contributed to reduce the incidence of strokes in developed countries [1,2]. For the past recent years efforts have been focalized on diverse procedures of

treatment, particularly thrombolysis [2]. However, this has a limited application in low- income countries due to technical and patient eligibility criteria constraints [6,7]. A lot still needs to be done with the perspective of reducing the high mortality rate particularly in sub-Saharan Africa (SSA) [1,3]. Managing the clinical profile, risk and prognostic factors may contribute to the improvement of prevention strategies representing an alternative means to reduce the morbi-mortality rates.

It has been found that 74.2% of the global stroke burden (measured in stroke-related disability-adjusted life years) was linked to behavioral factors (such as poor diet, smoking, and low physical activity), 72.4% to metabolic factors (such as high systolic blood pressure and high total cholesterol), and 29.2% to air pollution. However high blood pressure had the greatest contribution to stroke risk [8].

In the Democratic Republic of Congo, there is a lack of stroke population-based studies. The hospital statistics and other studies carried out before the year 2000 indicate a large proportion of the hemorrhagic type varying between 44 and 52% [9], young aged patients, a high prevalence of hypertension and a high hospital mortality [9,10]. There is an urgent need of updating those data on stroke in order to recommend future interventions tailored with evidence-based findings. In order to make our contribution to the definition of stroke characteristics in SSA

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and especially in DRC, we conducted the present study with the objective of describing the key features of stroke in an in-hospital population of Kinshasa in DRC.

## 2. Methods

A descriptive study was carried out in three hospitals of Kinshasa, one public hospital (Ngaliema Hospital) and two private hospitals (Nganda Hospital Center and the Kinshasa Medical Center). A total of 166 patients with stroke were consecutively recruited in a period of three months. Were included in the study the patients aged at least 18 years old with clinical diagnosis of stroke and CT-scan confirmation.

Information about the following variables was collected during medical history: age, sex, history of hypertension with regular treatment or not; history of with diabetes with regular treatment or not, alcohol intake, smoking, history of transient ischemic attack or stroke, history of coronary artery disease or peripheral artery disease, use of oral contraceptives. Were considered hypertensive, patients with a known history of hypertension (under treatment or not) or a measured blood pressure  $\geq 140/90$  mm Hg [11] at the admission to the hospital and during the first week of hospitalization (beyond the acute phase of stroke). Diabetics were those either with a known history of diabetes (under treatment or not) and/or a fasting glucose  $\geq 126$  mg/dl [12] at the admission and beyond the first week of hospitalization. Alcoholism was defined as a greater than or equal to regular drinking 3 glasses (15 g) of alcohol per day. The former smoking was defined as smoking cessation of more than a year. The state of consciousness was evaluated according to the Glasgow Coma Scale [13]. Obesity has been defined by a BMI  $\geq 30$  [14]. Regular or irregular heartbeat was assessed by cardiac auscultation. The auscultation of carotid arteries was performed to check for the presence of a murmur. At the exit, the level of disability was evaluated by the Barthel score [15]. The status on discharge/exit (alive or deceased) and the duration of hospitalization (number of days) were also noted.

- A brain CT- scan was used to confirm the diagnosis of stroke.

Cardiovascular evaluation: electrocardiogram; the US scan of heart (SONOSITE M-TURBO and SONOSITE TITAN) performed according to the American Society of Echocardiography and the European Association of Echocardiography recommendations; left ventricular hypertrophy was defined by a left ventricular mass  $> 115$  g/m<sup>2</sup> for male and 95 g/m<sup>2</sup> for female [16]; echo-Doppler of carotid artery.

- Laboratory tests results: complete blood count, lipid profile, glycaemia and renal function on admission, 7th day and on discharge.

Data were collected using standardized methods by three groups of agents who were previously trained. Each group was composed of a medical doctor and a medical student and was supervised by the principal investigator. The cardiovascular US scan was performed by two cardiologists' echocardiographers and the brain CT-scan by two radiologists. The study protocol was approved by the hospital ethics committee and the study was conducted in accordance with the Helsinki Declaration II. All study participants provided written informed consent.

**Table 1**  
Patients demographic, clinical and biological characteristics by types of stroke.

	Stroke			p
	All n = 166	Ischemic n = 109(65.7%)	Hemorrhagic n = 57(34.3%)	
Male, n (%)	108(65.1)	74(67.9)	34(59.6)	0.3
Age (years), mean (SD)	59.6 (12.3)	61.9(11.9)	55.2(11.9)	0.001
BMI (kg/m <sup>2</sup> ), mean (SD)	28.2 (15.3)	27.3 (7.0)	29.9 (24.4)	0.3
Body area (m <sup>2</sup> ), mean (SD)	1.88 (0.2)	1.90 (0.2)	1.88 (0.2)	0.86
SBP admission (mmHg), mean (SD)	152.5(34.0)	147.18(33.4)	162.7(33.2)	0.005
DBP admission (mmHg), mean (SD)	90.6(21.8)	88.10(22.7)	95.53(19.4)	0.03
Heart rate (bpm), mean (SD)	84.3(14.9)	84.2(15.8)	84.5(15.8)	0.90
Consciousness (coma), n (%)	62(37.3)	33(30.3)	29(50.9)	0.01
Glycaemia intake (mg/dl), mean (SD)	151.5(90.4)	154.6(95.8)	145.3(78.9)	0.53
Glycaemia intake $\geq 126$ mg/dl, n (%)	71(42.8)	47(43.1)	24(42.9)	0.97
Glycaemia 7th day (mg/dl)	113.4(44.9)	114.3(44.8)	111.73(45.2)	0.73
Glycaemia 7th $\geq 126$ mg/dl, n (%)	38(23)	27(24.8)	11(19.3)	0.45
Urea (mg/dl), mean (SD)	44.4(33.9)	45.6(36.9)	42.1(27.1)	0.52
Creatinine (mg/dl), mean (SD)	13.0(9.5)	14.0(10.8)	11.2(5.8)	0.02
Clearance creatinine (ml/min), mean (SD)	82.9(42.3)	75.6(37.9)	96.9(46.6)	0.01
Clearance creatinine $< 60$ ml/min, n(%)	52(31.3)	38(34.9)	14(24.6)	0.17
Total cholesterol (mg/dl), mean (SD)	192.11(36.4)	189.1(61.7)	198.2(51.7)	0.34
LDL cholesterol (mg/dl), mean (SD)	125.5(41.5)	124.2(61.7)	128.2(43.7)	0.56
HDL cholesterol (mg/dl), mean (SD)	51.8(42.7)	53.8(44.7)	47.7(17.8)	0.49
Triglycerides (mg/dl), mean (SD)	108.1(49.9)	104.8(44.2)	114.8(59.2)	0.22
Hemoglobin (mg/dl), mean (SD)	13.2(4.8)	13.3(5.8)	12.8(2.2)	0.56
White blood cells/mm <sup>3</sup> mean (SD)	8514(4255)	8174(4366)	9166(3991)	0.15

SD: Standard deviation; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure.

All analyses were performed using EXCEL, EPI INFO 7 and SPSS software. Descriptive statistics were used to summarize the study population characteristics. Continuous variables were reported using mean with standard deviation. Categorical variables were reported as a frequency and percentage. The Student's *t*-test and  $\chi^2$  [2] test were respectively used for means and proportion comparisons. The ANOVA and post-hoc test (Tukey) served to compare the subgroups of population. The logistic regression helped to identify variables with a significant and independent influence on the vital outcome during hospitalization. Significance was set at *p*-value of  $< 0.05$ .

## 3. Results

A total of 186 patients were initially recruited with a clinical diagnosis of stroke but only 166 were included in the study (89%). Twenty patients were not included, among them 12(6.5%) were deceased before performing brain CT- scan, 4 (2.2%) presented a different diagnosis (cerebral tumors and abscesses) and 4 (2.2%) others did not make any test.

Patients' demographic, clinical and biological characteristics are shown in Table 1 and the cardiovascular risk factors in Fig. 1. Of all the patients enrolled, 108 (65.1%) were male. The mean age was  $59.6 \pm 12.3$  years. One hundred and nine (65.7%) patients had an ischemic stroke while 57 (34.3%) others suffered from hemorrhagic stroke. More than a third of patients (37.3%) had an impaired consciousness at all levels, with a Glasgow score average of  $12.3 \pm 2.5$ . One hundred and nine (65.7%) patients had an ischemic stroke. Hypertension was the most common cardiovascular risk factor with 140 (84.3%) patients affected, including 132 with known history of hypertension. Of these 132 known hypertensive patients, five (4%) were under a regular anti-hypertensive treatment while 80 (60.6%) and 47 (35.6%) were either under irregular or no treatment, respectively. Diabetes was observed in 60 (36.1%) patients among whom 45 (27%) were known diabetics. Obesity was found in 28 (16.9%) patients. The average blood glucose at admission was  $113.4 \pm 44.8$  mg/dl and increased to  $151.5 \pm 90.33$  mg/dl at day 7. Hypercholesterolemia was observed in almost half of patients (45.2%). Compared to hemorrhagic stroke, patients with ischemic stroke were older, had a lower, both systolic and diastolic blood pressure; a less altered state of consciousness; and a lower clearance of creatinine.

Echocardiographic data are shown in Table 2. Left atrial enlargement (LAE) was observed in 22 (13.3%) patients and the left ventricle one in 9 (5.4%) patients. LAE was more common in ischemic than in hemorrhagic stroke, but this difference was not statistically significant. The

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