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Stroke Epidemiological Study at the Centre Hospitalier Universitaire (CHU) de Cocody in Abidjan, Côte d'Ivoire

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Abstract

Background: Recent literature reported a recurrent increase in hemorrhagic stroke (HS) rates in low- and middle-income countries. However, the causes and mechanisms of the rising HS rates are unknown. To address these issues, the present epidemiological study was carried out in the neurovascular unit of the neurology department at the Centre Hospitalier Universitaire (CHU) de Cocody in Abidjan (Africa). **Methods:** The study included 60 patients hospitalized from January 1 to December 31, 2016, who underwent brain CT (computerized tomography) scans. We examined the medical records and survey forms in these patients with acute stroke (within 7 days) admitted to the Neurovascular Unit receiving only stroke patients. In these patients, we explored stroke distribution according to socio-demographic variables: age, gender and socio-professional categories. In addition, common risk factors were assessed. **Results:** In Côte d'Ivoire, our studies showed an ischemic stroke (IS) rate of 66.67% and a hemorrhagic stroke (HS) rate of 33.33%. Our studies indicated that stroke particularly affects the 40 - 60 age group. Then, stroke frequency has fallen in the 30 - 40 and 60 - 70 age groups, becoming rare in relatively young (<20 years) and elderly (>70 years) subjects. In the sample analyzed, stroke occurred in women (56.67%) compared with men (43.33%). However, there was no gender-specific predilection for stroke. In addition, 90% of strokes occur in the working population and 10% in the non-working population. Arterial hypertension was the highest medical risk factor among patients (66.13%), compared with the other risk factors *i.e.* alcohol (17.42%), smoking (12.90%), previous stroke (9.67%), diabetes (6.65%), heart disease (6.65%) and dyslipidemia (3.23%). Specifically, hypertension was the main risk factor causing HS (45%) and IS (21.66%) in patients. **Conclusion:** Stroke particularly affected socio-economically active subjects (aged

40 - 60) in Africa, which were subjected to high prevalence of hemorrhagic stroke (HS). Chronic stress related to working life and unfavorable socioeconomic conditions would be a triggering event for hemorrhagic stroke.

Keywords

Hemorrhagic Stroke, Ischemic Stroke, Age, Gender, Hypertension, Alcohol, African Studies

1. Introduction

Stroke is the second leading cause of both disability and death worldwide, with the highest burden of the disease shared by low- and middle-income countries [1]. In 2016, there were 13.7 million new incident strokes globally: 87% of these were ischemic strokes and by conservative estimation about 10% - 20% of these account hemorrhagic stroke [2]. In 2017, the Global Burden of Disease (GBD) Study reported 11.9 million incidents, 104.2 million prevalent, 6.2 million fatal cases of stroke and 132.1 million stroke-related DALY (disability-adjusted life-years). Although stroke incidence, prevalence, mortality and DALY rates declined from 1990 to 2017, the absolute number of people who developed new stroke, died, survived or remained disabled from stroke has almost doubled. Most of the burden of stroke-related disease (80% of all incident strokes, 77% of all stroke survivors, 87% of all stroke deaths and 89% of all stroke-related DALY) is located in low- and middle-income countries [3]. On the other hand, the annual number of strokes and deaths due to stroke increased substantially from 1990 to 2019, despite substantial reductions in age-standardized rates, particularly among people older than 70 years [4]. However, among people younger than 70 years, prevalence rates increased by 22.0% and incidence rates increased by 15.0%. In 2019 GBD study, the age-standardized stroke-related mortality rate was 3.6 times higher in the World Bank low-income group than in the World Bank high-income group, and the age-standardized stroke-related DALY rate was 3.7 times higher in the low-income group than the high-income group. Ischemic stroke constituted 62.4% of all incident strokes in 2019 (7.63 million), while intracerebral hemorrhage constituted 27.9% (3.41 million) and subarachnoid hemorrhage constituted 9.7% (1.18 million) [4]. In 2019, the five leading risk factors for stroke were high systolic blood pressure (contributing to 79.6 million DALY or 55.5% of total stroke), high body-mass index (34.9 million DALY or 24.3%), high fasting plasma glucose (28.9 million DALY or 20.2%), ambient particulate matter pollution (28.7 million DALY or 20.1%), and smoking (25.3 million DALY or 17.6%) [4].

In Côte d'Ivoire (Africa), stroke accounts for a third of hospital admissions (between 32.4% and 38%) and is the leading reason for admission [5]. Between 2000 and 2013, the hospital prevalence of stroke remained stable at 28% with an

average age of 58. The main risk factors were Arterial Hypertension (AH) (45%) and alcohol (27%). Ischemic strokes (IS) predominated (56% - 59%), with a significant rate of hemorrhagic strokes (HS) (41% - 44%) [5].

From 2016 to 2019, the Global Burden of Disease (GBD) studies reported recurrently the highest burden of the disease to be located in low- and middle-income countries, with an increasing rates of hemorrhagic stroke (HS) [4] [5]. However, the causes and mechanisms of the rising HS rates in these countries are unknown. To address these issues, the present epidemiological study was carried out in the neurovascular unit of the neurology department at the Centre Hospitalier Universitaire (CHU) de Cocody in Abidjan (Africa). Data were collected from medical records of 60 patients hospitalized for stroke. Then, we explored stroke distribution according to socio-demographic variables: age, gender and socio-professional categories. In addition, common risk factors were assessed. The aim of the study is to understand the rise in hemorrhagic stroke rates in low- and middle-income countries.

2. Methods

We undertook this retrospective study in the neurology department's neurovascular unit at the Centre Hospitalier Universitaire (CHU) de Cocody in Abidjan, Côte d'Ivoire. That unit receives only stroke patients. The study included 60 patients hospitalized from January 1 to December 31, 2016, selected according to specific criteria.

2.1. Sampling Criteria

To carry out these studies, selection criteria were used to identify the medically diagnosed stroke patients.

2.1.1. Inclusion Criteria

- Patients with sudden onset of disturbed consciousness and neurological deficits (sensorimotor, sensory or cognitive).
- Patients who underwent brain CT (computerized tomography) scans to determine the type of stroke, *i.e.* how cerebral blood flow was interrupted: ischemic stroke (IS) caused by blood vessel obstruction or hemorrhagic stroke (HS) triggered by vessel rupture.

A brain CT scan eliminated anything other than a stroke, *i.e.* subdural hematoma, extradural hematoma, subdural empyema (a suppurated extra-cerebral collection located between the dura and arachnoid), extra-dural empyema or cerebral abscess. Empyemas are extra-cerebral (extra- or sub-dural), compartmentalized, suppurated collections. We subsequently looked for signs of hypodensity, indicating cerebral infarction (ischemia), or hyperdensity, synonymous with cerebral hemorrhage (hematoma) [6].

These patients are then subjected to an interview (see **Table 1**) and clinical examination by the physician, to evoke the diagnosis of ischemic or hemorrhagic stroke.

Table 1. Survey on disease history and identification of risk factors.

	Questions	Answers	
History of the disease	When did the condition begin?		
	How do neurological deficits (sensorimotor, sensory, cognitive) appear?		
	What are the affection-accompanying signs (headache, nausea, vomiting, visual signs)?		
	Are the signs associated with hyperthermia?		
	Did the patient present a consciousness disturbance?		
		Answer yes	**Answer no**
Risk factors	Does the patient have high blood pressure?		
	Is the patient diabetic?		
	Is the patient a smoker?		
	Is the patient an alcoholic?		
	Is the patient taking anticoagulants?		
	Is the patient taking any toxic substances?		
	Is the patient a drug addict?		
	Is the patient taking contraception?		

For questions on risk factors, the expected answer was yes or no.

2.1.2. Exclusion Criteria

- Any patient in whom a clinical suspicion of stroke has been raised, but no confirmatory cerebral CT scan is available.
- Any medical file with insufficient epidemiological information.

2.2. Procedure

We analyzed the medical records of stroke subjects, supplemented by survey forms, to determine the history of the disease and identify risk factors.

2.2.1. Medical Records

We examined the medical records, including medical history, clinical examination, diagnostic hypotheses, complementary examinations, prognosis, treatment and follow-up of the pathology. These records provide a detailed description of the pathology.

2.2.2. Survey Forms

In order to determine the history of the disease and identify risk factors in a subject who has suffered a stroke with coma or aphasia, a survey form was drawn up to collect data by questioning patients or patients' relatives. Table 1 summarizes the essence of the questionnaires.

The history of the disease was constituted through the following questions:

1) When did the disease begin? This was used to include or exclude patients. If the disease occurred during 2016, the patient was included in the study; otherwise, he or she was excluded.

2) How do neurological deficits develop: motor, sensory or cognitive? The sudden onset of neurological deficits indicates a vascular cause, *i.e.* a stroke [7] [8].

3) What are the accompanying signs (headache, nausea, vomiting and visual signs)? The existence of these signs indicates encephalic damage. They enable a differential diagnosis between IS and HS. Headache, nausea and vomiting are generally encountered in HS [9].

4) Are the signs associated with hyperthermia? The absence of hyperthermia rules out encephalitis of infectious origin [10] [11].

5) Did the patient exhibit a consciousness disturbance? The existence of a disturbance of consciousness is generally synonymous with HS. It is assessed by the Glasgow Coma Scale [12].

6) The usual cardiovascular risk factors such as hypertension, diabetes, smoking, alcoholism and drug addiction were investigated on questioning. Similarly, any cardiovascular risks associated with taking anticoagulants, contraceptives or various toxic substances were assessed. The answer "yes" indicates the presence of the risk factor in the patient, while "no" indicates its absence.

2.3. Statistical Analysis

Epi info 7 software is used by public health professionals for the rapid assessment of epidemics and the development of surveillance systems for small and medium-sized diseases. It can be used to create questionnaires and databases, enter and analyze data, and produce epidemiological statistics, graphs and maps. Z-test was used to compare qualitative variables. In addition, we used the chi-square test to assess the different stroke rates obtained in the socio-professional categories.

3. Results

For our studies, we sampled 60 patients clearly identified as stroke victims. The frequency of stroke in these patients was assessed according to stroke type, age, gender, socio-professional categories and related risk factors.

3.1. Stroke Type Frequency

Table 2 shows that 40 patients suffered an ischemic stroke (66.67%); 20 patients suffered a hemorrhagic stroke (33.33%). The rate of ischemic stroke (IS) was significantly higher ($Z = 3.44$, $p = 0.001$) than the rate of hemorrhagic stroke (HS).

3.2. Stroke Frequency by Age Group

Figure 1 shows the frequency of strokes (HS + IS) by age group. Patient ages

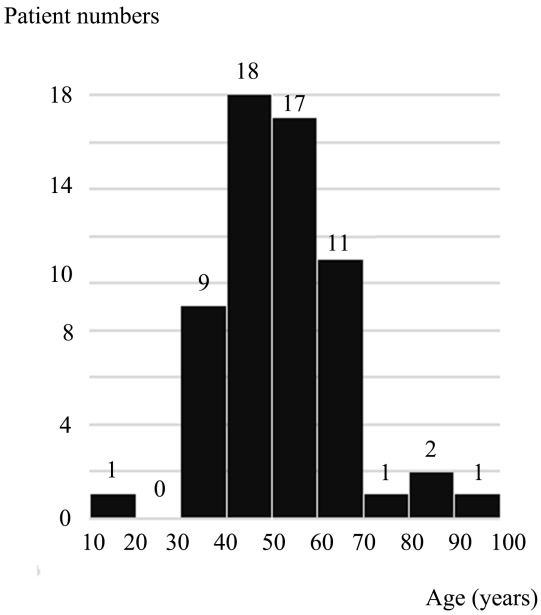

Figure 1. Stroke rates by age groups: 10 - 20 (0.6%); 30 - 40 (15%); 40 - 50 (30%); 50 - 60 (28.33%); 60 - 70 (18.33%); 70 - 80 (0.6%); 80 - 90 (3.33%); 90 - 100 (0.6%). Mean age: 52.61 ± 13.33 years; Median age: 52 years; Extreme ages: 19 - 93 years.

Table 2. Occurrence rates by type of stroke.

Stroke (S)	Number of sufferers	Percentage
Ischemic (IS)	40	66.67
Hemorrhagic (HS)	20	33.33
Total	60	100

HS occurrence was increased in the patients examined.

were obtained during the interview and ranged from 19 to 93 years. Of the 60 patients examined, the 40 - 50 and 50 - 60 age groups were the most affected (18 and 17 patients respectively). Stroke frequency has fallen in the 30 - 40 (9 patients) and 60 - 70 (11 patients) age groups, becoming rare in the 70 - 80 (1 patient) and 80 - 90 (2 patients) age groups, or virtually non-existent in the very young 10 - 20 (1 patient) and 20 - 30 (0 patients) age groups. The majority of sufferers (91.66%) are in the 30 - 70 age bracket, while the peak of sufferers (58.33%) was exhibited in the 40 - 60 age bracket. Consequently, strokes frequently occurred in people between the ages of 30 and 60 who are engaged in working life, whereas they were less frequent in the elderly (70 - 90 age group) and in the very young (10 - 30 age group).

3.3. Stroke Frequency by Gender

Table 3 shows the distribution of strokes by gender. In the sample analyzed 34 women (56.67%) suffered strokes, compared with 26 men (43.33%). However, there was no gender-specific predilection for stroke ($Z = 1.60$, $p = 0.109$).

Table 3. Distribution of strokes by gender.

Gender	Number of sufferers	Percentage
Women	34	56.67
Men	26	43.33
Total	60	100

There is a slight female predominance, which is not significant: the sex ratio is 1.3 women/1man.

3.4. Stroke Frequency by Socio-Professional Categories

Figure 2 shows a high prevalence of stroke among housewives (28.33%) and shopkeepers (21.67%) and workers (11.67%). These rates tend to fall among senior executives (10%), office employees (8.33%) and teachers (6.67%). Rates remain relatively low among non-working population categories: students (1.67%), unemployed (3.33%) and retirees (5%). The different stroke rates obtained in the socio-professional categories are significantly different ($\chi^2 = 40.33$, $p < 0.01$). As a result, 90% of strokes occur in the working population and 10% in the non-working population. Consequently, work-related stress is a determining factor in the occurrence of stroke.

3.5. Causative Factors for Stroke

Figure 3 shows the distribution of strokes according to risk factors. Arterial hypertension was the highest medical risk factor among patients (66.13%), compared with the other risk factors *i.e.* alcohol (17.42%), smoking (12.90%), previous stroke (9.67%), diabetes (6.65%), heart disease (6.65%) and dyslipidemia (3.23%). As a result, hypertension and alcohol abuse were major risk factors for stroke. More specifically, hypertension was the main risk factor for HS (45%) and IS (21.66%) in the patients we studied.

4. Discussion

4.1. Type of Stroke

In Côte d'Ivoire, our studies showed an ischemic stroke (IS) rate of 66.67% and a hemorrhagic stroke (HS) rate of 33.33% (**Table 2**). Similar results were reported by Diarra [5] in Côte d'Ivoire (IS 58% vs. HS 42%), Traoré [13] in Mali (IS 52.4% vs. HS 45.3%), Ouédraogo [14] in Ouagadougou (IS 55.3% vs. HS 38.3%) and Ahmad [15] in Madagascar (IS 66.0% vs. HS 34.0%). These African series seem to indicate a higher rate of HS than the current estimates of global stroke burden, which reports cerebral infarction rates of 80% - 90% and intracerebral hemorrhage of 10% - 20% [4] [16].

Indeed, studies carried out in many other low- and middle-income countries confirm a high rate of HS such as those reported by Ngo [17]: HS 65% vs. IS 35%; Parvaiz [18]: HS 64.7% vs. IS 35.3% and Adoukonou [19]: HS 60% vs. IS 40%.

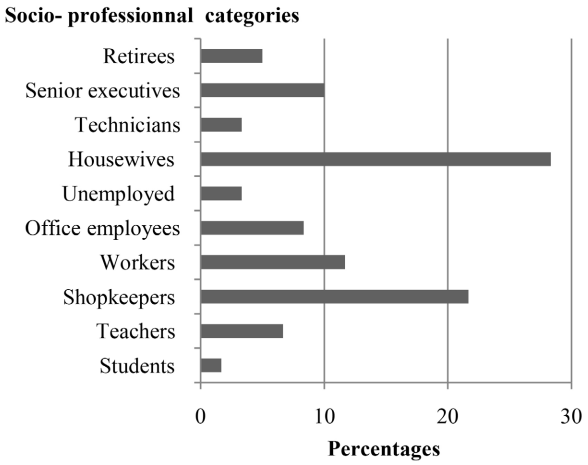

Figure 2. Stroke frequency by socio-professional categories.

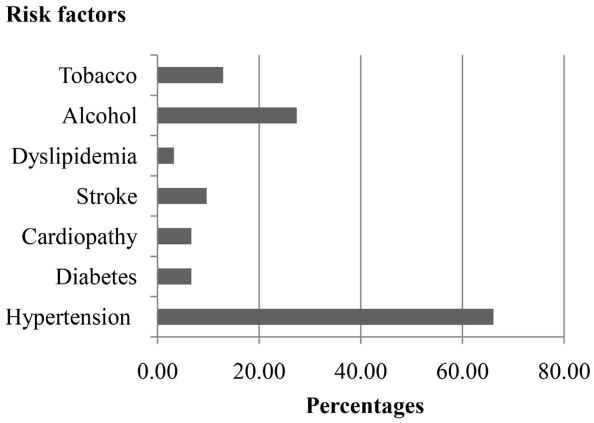

Figure 3. Stroke occurrence rates according to risk factors.

Thus, a predominance of hemorrhagic stroke appeared in most African studies. The mechanism of hemorrhagic stroke in our studies seems to stem from a sudden rise in blood pressure followed by rupture of the blood vessels in the majority of cases. In addition to eating habits (excess alcohol intake, malnutrition), intense stress can be blamed, with its trail of annoyances and profound afflictions. Indeed, today's African populations are subject to the stresses of poverty and unfavorable socio-economic conditions, which can promote hemorrhagic stroke.

4.2. Age

Our studies show that stroke particularly affects the 40 - 60 age group. Studies carried out in several African countries have shown that stroke affects the same range of age groups: 40 - 59 years [20]; 40 - 49 years [21]; 40 - 59 years [22]; 50 - 60 years [23]. However, vulnerability in older age groups (50 - 70 years) and (60 - 75 years) has been reported [24] [25].

In addition, our studies show that the frequency of stroke is high at an average age of 52.61 years. Several African studies show that the average age of stroke

onset falls into the vulnerable 40 - 60 age bracket: 44 years [26]; 46 years [27]; 53.3 [28]; 55.69 [29]; 57.6 with extremes of 28 and 93 [30]; 58.2 [20]; 58.39 [31]; 60 [32]; 62 [33].

These observations show that stroke particularly affects socio-economically active subjects (aged 40 - 60) in Africa. Surrounding this central age group, which is particularly vulnerable to stroke, are the extreme poles of vulnerability in relatively young (30 - 40 years) and elderly (60 - 70 years) subjects. Indeed, our results indicate that hemorrhagic stroke generally occurs in younger subjects, unlike ischemic stroke, which occurs in older subjects. In subjects aged over 76, ischemic stroke is the most frequent (88.5%), compared with 11.5% for hemorrhagic stroke [34]. Younger people adopt high-risk behaviors, such as the consumption of alcohol, drugs and other toxic products, which are harmful to the cardiovascular system, thus favoring the occurrence of hemorrhage. On the other hand, hemorrhagic stroke drops drastically over the age of 70 and in young people under 20, suggesting that the stress of modern working life is a triggering event for hemorrhagic stroke between the ages of 40 and 60.

4.3. Gender

In our studies, stroke occurred in 34 women (56.67%) and 26 men (43.33%) (**Table 3**). However, there is no statistical difference between women and men. Similar rates were reported by Hassane Bana [35]: women 54.5% vs. men 45.5%. Several African studies have reported a predominance of stroke in women: 55.3% [20]; 56.2% [30]; 56% [32]. However, other studies have reported a predominance of stroke in men relative to women: 53% vs. 47%, respectively [24] [36]. The male predominance in stroke patients has also been found in other African studies by Ngoufo [37] and Ouédraogo [14]. Even an equal ratio (women 50.7% vs. men 49.3%) was reported [36]. However, results from the general literature show that death rates did not differ according to gender after hemorrhagic stroke, but were higher in women than in men (18% vs. 12% respectively) after ischemic stroke [38].

In our studies, the apparently high rate of strokes in women may be linked to the stress generated by problems at home, underemployment and a precarious life. All these factors encourage people to take refuge in alcoholism to drown out their problems. Another important cause would be the development of obesity in women after the menopause [39]. The related overweight could be an important stroke risk factor.

4.4. Stroke Frequency by Socio-Professional Categories

In our studies, the majority of sufferers (91.66%) are in the 30 - 70 age bracket, while the peak of sufferers (58.33%) was exhibited in the 40 - 60 age bracket. In addition, 90% of strokes occur in the working population and 10% in the non-working population. Consequently, strokes frequently occurred in people between the ages of 30 and 65 who are engaged in working life.

Two categories of working populations are differently affected by stroke. Those who work in an anxiety-inducing environment have a high prevalence of stroke, *i.e.* housewives (28.33%), shopkeepers (21.67%) and workers (11.67%). The second category, which works in a calm and secure environment, shows a tendency towards reduced stroke prevalence, *i.e.* senior executives (10%), office employees (8.33%) and teachers (6.67%). Similar findings have been reported by other [13] [35].

In our study, stroke rates were high among housewives and shopkeepers. In Côte d'Ivoire, housewives have to look after the children, do the housework, feed the family and pay the various bills, especially when these women are widows or single. These women live in very unfavorable socio-economic conditions, which can generate chronic stress. Like housewives, shopkeepers are also subject to chronic stress, due to market volatility and uncertainty about the future. However, the still high prevalence of stroke among senior executives is thought to be due to the stress of competition and performance requirement.

4.5. Stress and Hypertension

In our studies, arterial hypertension (AH) appears to be a major risk factor for stroke, with a predominance of hemorrhagic stroke, as in most African studies. Our studies suggest that chronic stress induced by an unfavorable working life and poor socio-economic conditions were the triggering events for high blood pressure leading to hemorrhagic stroke between the ages of 40 and 60. Indeed, between the ages of 40 and 69, each difference of 20 mm Hg in usual systolic blood pressure or 10 mm Hg in usual diastolic blood pressure is associated with a more than two-fold difference in stroke mortality [40]. All these proportional differences in vascular mortality are about half as great at age 80 - 89 as at age 40 - 49 [40]. However, following ischemic stroke, hypertension increases the risk fourfold, in both sexes and at all ages [41].

Broadly stated, an acute stressor-evoked blood pressure reaction results from net changes in autonomic (sympathetic and parasympathetic) nervous system activity that alter cardiac output and peripheral vascular resistance among other hemodynamic parameters [42]. Indeed, individuals expressing exaggerated stressor-evoked cardiovascular reactions, particularly exaggerated blood pressure reactions, appear to be at elevated risk for precursors to psychological stress [42].

Psychological stress has long been implicated in the development of coronary heart disease (CHD), the leading public health burden in industrialized nations [43] [44]. Psychological stress causes reduced blood flow and narrowing of coronary vessels in dogs, and shows electrocardiographic signs of myocardial ischemia, following an episode of anger [45]. As a chronic, slowly progressing disease, psychological stress has long been implicated in the development of coronary heart disease, which results primarily from the progressive narrowing of the blood vessels that supply the heart with oxygenated blood. Beginning early in life and progressing over a period of decades, this vessel narrowing can ultimately lead to several clinical endpoints, including an inadequate ejection of

blood from the heart (heart failure), non-fatal and fatal heart attacks (myocardial infarctions), irregular cardiac rhythms (arrhythmias), and chest pain (angina) caused by an insufficient supply of blood to cardiac tissue (ischemia) [42].

According to Esler *et al.* [46], chronic stress induced changes in sympathetic nerve biology, including multiple triggers of abnormal sympathetic nerve "bursts" during a cardiac cycle, increasing noradrenaline release. During essential hypertension, but not in healthy individuals, bursts of sympathetic nerve fibers occur. Another manifestation of psychological stress in essential hypertension is the activation of brain stem noradrenergic neurons that project to the hypothalamus and amygdala. These pathophysiological findings strongly support the idea that chronic psychological stress plays an important role in the pathogenesis of essential hypertension [46].

Indeed, during chronic stress the sympathetic adrenergic medullary-axis increased heart rate, blood pressure, and the release of catecholamines which include epinephrine and norepinephrine [47]. Epinephrine and norepinephrine are mainly synthesized by the central noradrenergic neurons and are released mainly from the adrenal medulla in the bloodstream [48]. Norepinephrine (noradrenaline) is an endogenous molecule involved in cardiovascular regulation as well as being used as clinical therapeutic agents to constrict blood vessels [49]. Consequently, while stressor-evoked autonomic cardiovascular responses may be adaptive for the short-term, the recurrent exaggerated cardiovascular stress reactions can be maladaptive in the long-term [50]. For example, acute and repeated stress-induced increases in blood pressure can damage the endothelial (inner) layer of peripheral blood vessels through turbulent blood flows that promote shear stress at vessel bifurcations, causing increased permeability of the endothelium. Consequently, endothelial damage in the aorta or coronary arteries can be induced by stress factors that cause sharp increases in blood pressure [42]. Carroll *et al.* [51] reported the long-term erosive effects of exaggerated reactivity on the vascular system, as well as its short-term ability to trigger acute cardiovascular events. As a result, chronic stress can induce a permanent rise in blood pressure, leading to the major hemorrhagic stroke observed in our studies.

4.6. Alcohol, Hypertension and CVD

Alcohol is the 2nd major risk factor for stroke identified in our studies. Alcohol intake typifies a well-known trigger of cardiovascular disease (CVD) and the dominant cause of death in males aged 15 to 59 years [52]. It has been described that up to 19% of alcohol-attributable deaths were due to cardiovascular diseases (CVD) in 2016, after cancer and liver disease [53].

Excessive alcohol consumption accounts for about 16% of cases of hypertension worldwide [52] [54]. High drinking frequency leads to a high prevalence of hypertension, both in men and women [55]. Long-term alcohol consumption increases the risk of developing hypertension by 30% Zatu *et al.*, [56] and significantly changes blood pressure [57]. Indeed, sustained alcohol misuse increases in both short-term and long-term systolic blood pressure (*i.e.* hypertensive dis-

ease) [58]. Moderate alcohol drinkers (15 - 30 g/d) had a 37% higher risk of hypertension, while heavy drinkers (>30 g/d) had a 52% greater risk when compared with light drinkers [59]. In addition, a reduction in alcohol consumption led to a dose-dependent reduction in blood pressure, both in healthy drinkers and in drinkers at risk of cardiovascular disease [60]. A positive, linear association was described between alcohol consumption and the risk of hypertension [54]. Alcohol abuse also reduces the effectiveness of antihypertensive drugs [61].

Finally, our studies show that 6.66% of those surveyed suffer from heart disease. Indeed, ethanol chronically consumed in large amounts acts as a toxin to the heart and vasculature. Cardiac injury produced by chronic alcohol abuse can progress to CVD endpoints including congestive heart failure, alcoholic cardiomyopathy, atrial fibrillation, peripheral artery disease [62] [63] and eventual death [64]. Heavy drinkers have a substantial risk of developing atrial fibrillation if aged 30 years or above. No significant anomaly was observed in 20 - year-olds, while light to moderate alcohol consumption increased susceptibility to atrial fibrillation in subjects aged 60 or over [65].

Moreover, long-term alcohol excessive consumption results in alcoholic cardiomyopathy (ACM), which is a secondary nonischemic dilated cardiomyopathy and the most frequent type of ethanol-induced heart damage [66]. ACM is characterized by left ventricular dilation with impaired systolic function, and its emergence has been closely linked with the quantity and total time of ethanol intake [67].

Together, these observations show that a factor becomes a risk for stroke when it is able to interact with the cardiovascular system to negatively induce hypertension through various mechanisms.

In conclusion, studies carried out in several African countries confirm a higher rate of HS (33% - 65%) than the current estimates of global stroke burden reporting a 10% - 20% rate for HS. In these low- and middle-income countries, stroke particularly affects the socio-economically active subjects aged 40 - 60 years. Our studies suggest that chronic stress and alcohol abuse induced by an unfavorable working life and poor socio-economic conditions were the triggering events for high blood pressure leading to hemorrhagic stroke between the ages of 40 and 60.

Conflicts of Interest

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

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