

Profile of Cardiovascular Risk Factors in Nigerians with Stroke

Jamila Ado Yau¹, Kamilu Musa Karaye², Basil N. Okeahialam³

¹Public Health and Diagnostic Institute, Northwest University, Kano State, Nigeria

²Bayero University Kano/Aminu Kano Teaching Hospital, Kano State, Nigeria

³Jos University Teaching Hospital, Plateau State, Nigeria

Email: jamilayau@yahoo.com

How to cite this paper: Yau, J.A., Karaye, K.M. and Okeahialam, B.N. (2016) Profile of Cardiovascular Risk Factors in Nigerians with Stroke. *World Journal of Cardiovascular Surgery*, 6, 125-137.

<http://dx.doi.org/10.4236/wjcs.2016.610020>

Received: September 18, 2016

Accepted: October 28, 2016

Published: October 31, 2016

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Abstract

Background: There is paucity of data on cardiovascular disease (CVD) risk factors among stroke patients in our population. This study aimed at assessing CVD risk factors amongst stroke patients compared with apparently healthy controls. **Methods:** This was a case-control study conducted at Aminu Kano Teaching Hospital Kano. One hundred stroke subjects were consecutively recruited and compared with 100 age and sex matched controls. The CVD risk factors assessed were hypertension, diabetes mellitus, dyslipidemia, obesity, cigarette smoking, alcohol consumption, socioeconomic status (SES), increased age, male gender and Human Immunodeficiency Virus (HIV) status. **Results:** Mean age was 56.4 ± 15.8 years for cases and 54.5 ± 15.4 years for controls ($p = 0.39$), and 53% of the former and 52% of the latter were males ($p = 0.887$). The most prevalent CVD risk factor was hypertension, found in 71% of cases and 42% of the controls, ($p = 0.01$). All heart diseases were found in 70% of cases and 21% of controls ($p < 0.001$), and hypertensive heart disease (HHD) was the commonest, found in 55% of cases and 18% of controls ($p < 0.001$). Dyslipidemia was found in 53% of cases and 37% of the controls ($p = 0.023$), diabetes mellitus/hyperglycemia in 23% of the cases and 6% of the controls ($p = 0.01$), history of transient ischemic attack (TIA) in 19% of cases and 1% of the controls ($p = 0.01$), while atrial fibrillation was found in 9% of cases only. Other risk factors were uncommon. **Conclusion:** The most frequent CVD risk factors among Nigerians with stroke were systemic hypertension, heart diseases, male sex and dyslipidemia, while HIV and other risk factors were uncommon. Thus medical attention and public enlightenment should focus on the common ones as detected in this study.

Keywords

Stroke, Risk Factors, Hypertension, Nigerians

1. Introduction

Global burden of stroke is high, inclusive of its increasing incidence, mortality, disability adjusted life years (DALYs), and economic impact, particularly in low and middle-income countries (LMIC) [1]. Stroke is the second leading cause of death worldwide after ischemic heart disease (IHD) accounting for 6.7 million deaths (12% of total deaths) in 2012 [2]. Globally, about 16 million new cases of stroke and 62 million stroke survivors were estimated in 2005, and this is expected to increase to over 23 million new stroke cases and 7.8 million stroke deaths by 2030 in the absence of significant global public health response [3] [4].

The Prevalence and pattern of CVD is distinctly different in Sub-Saharan Africa compared with the rest of the world. Among the CVDs, there is relative increase in occurrence of atrial fibrillation in addition to other traditional risk factors [5]. Given the etiologic role of atrial fibrillation for stroke, significant additional surveillance is needed and more detailed analysis of the mechanisms of atrial fibrillation is warranted [6]. Other emerging risk factors such as HIV infection are shown to be relevant to the etiology of CVDs including stroke. Knowledge on the prevalence of these risk factors will aid in health care planning as well as serve as base line for further surveys.

The rising incidence of stroke might not be unrelated to the prevalence of cardiovascular risk factors, which has not been well studied in Kano, Nigeria, a city that seems to relatively be at an advanced stage of epidemiologic transition [7]. We therefore aimed to study the prevalence of CVD risk factors in adult stroke patients attending a tertiary level hospital, in comparison to controls without stroke, in Kano, Nigeria.

2. Methodology

This was a case-control study conducted over a period of twenty weeks (August 15th to December 15th 2011) at Aminu Kano Teaching Hospital (AKTH).

Before the commencement of the study, the study protocol was approved by the ethics committee of AKTH, Kano. Informed written consent was obtained from all subjects, and for those who could not sign a thumb print was taken or consent was signed by a next of kin. The HELSINKI declaration on investigations of human subjects was respected [8].

Patients with stroke admitted into the emergency and the medical wards of the hospital satisfying the inclusion criteria were recruited consecutively until the sample size was obtained. Control group was formed by individuals without stroke presenting to the General Out-Patients (GOP) Clinic with minor ailments and were investigated in a similar manner as were the cases. The 2 groups were matched for age and gender.

Sample size was estimated using the formula: $N = Z^2P(1-P)/d^2$

where N = minimum sample size,

Z = standard deviation = 1.96 (at 95% confidence interval),

D = sample error = 5%,

P = prevalence of HIV among stroke patients = 3.4%⁹, HIV infection was used to es-

timate the minimum sample size because it was the least common risk factor for stroke in a recent study by Ezeala *et al.* [9].

Inclusion criteria for the cases were: admission to the medical wards or the emergency unit with stroke as defined by the World Health Organization (WHO) criteria, and presenting within the first seven days of the event; age of 18 years and above, and giving informed consent to participate in the study [10]. Patients less than 18 years of age, or those who did not have stroke, declined consent or who presented after the first seven days of stroke were excluded from the study.

The inclusion criteria for the control group were-subjects who presented to GOP with minor ailments but who have never suffered a stroke, aged 18 years and above, and who gave consent to participate in the study. GOP subjects less than 18 years, or who have had a stroke or who declined consent were excluded.

The assessed risk factors were: age, male gender; hypertension; diabetes mellitus (DM); current tobacco smoking; heavy alcohol consumption; heart diseases such as hypertensive heart disease (HHD), atrial fibrillation (AF), valvular heart disease and cardiomyopathies, dyslipidaemia, sedentary life style and use of oral contraceptive pills (OCP) in women. HIV screening was included as it is considered an emerging risk factor for stroke [11].

2.1. Stroke

Stroke was defined according to the World Health Organization (WHO) clinical criteria as a “rapidly developing clinical syndrome of focal (or global in the case of sub-arachnoid haemorrhage) disturbance of cerebral function lasting longer than 24 hours (unless interrupted by surgery or death), presumably of vascular origin” [12].

Hypertension was defined according to the recommendation of WHO/International society of Hypertension (ISH), using the cutoffs of systolic blood pressure (SBP) of ≥ 140 and or diastolic blood pressure (DBP) of ≥ 90 mmHg [13] or on antihypertensives prescribed by a physician. **Diabetes Mellitus** was defined as: Fasting plasma glucose of ≥ 7 mmols/l in an individual with typical symptoms of DM, or on at least 2 separate occasions if there were no such symptoms [14]; the plasma glucose ≥ 11.1 mmols/l two hours after a glucose tolerance test [14]; a previously diagnosed diabetic was considered as such even if glycemic control had been achieved. **Hyperglycemia** was defined as fasting plasma glucose ≥ 7.0 mmol/l post stroke in a patient without a previous history of DM [15]. **Dyslipidemia** was defined as the presence of fasting Total Cholesterol (TC) > 5.2 mmols/l (200 mg/dl), low density lipoprotein (LDLc) > 3.38 mmols/l (130 mg/dl), high density lipoprotein (HDLc) < 1.0 mmols/l (40 mg/dl) in men and 1.2 mmol/l (50 mg/dl) in females or Triglycerides > 1.70 mmol/l (150 mg/dl) [16]. **Cigarette smoking** was quantified as the average number of sticks of cigarette smoked per day for a specific duration. It was considered a risk factor if smoking was daily regardless of the dose. **Obesity** was defined as body mass index (BMI) ≥ 30 kg/m². Waist Circumference was also recorded for the patients, and considered high if > 88 cm in females and > 102 cm in males.

2.2. Excessive Alcohol Ingestion

Alcohol intake was considered excessive in males if >21 units/week and >14 units/week in females was consumed [17]. Increased age: defined as more than 55 yrs in males and 65 yrs in females [12]. Gender: the two genders were recognized (male and female) according to what the subject claims. Sedentary life style: life style of individuals who do not engage in at least 20 minutes of light to moderate intensity exercise daily [7]. Low socioeconomic status: this was judged from the level of education, income or employment. It was defined as having monthly income of <20,000 Naira for single person, or <25,000 Naira for a couple and an additional 5000 Naira for each child. This was based on the local purchasing power of the Naira and the salary scale of the Kano state Government for civil servants [18]. Human immunodeficiency viral infection (HIV) was identified by the detection of HIV-specific antibodies in serum or plasma with the highly sensitive HIV-1/HIV-2 enzyme immunoassay (EIA) tests. Consent was obtained prior to HIV screening with pre and post test counseling. The patients that were eventually found to be HIV positive were referred for further workup and treatment at the appropriate clinics in AKTH. Heart diseases considered included HHDx, atrial fibrillation, cardiomyopathies, ischemic heart disease (IHD), and valvular heart diseases. These were diagnosed based on standard criteria, using history, physical examination, electrocardiography and echocardiography [19] [20]. ECG was done using Bionet Cardiocare EKG-2000 machine (made in South Korea) and echocardiographic machine used was ALOKA SSD-4000 (made in Germany) Machine and a 2.5 to 5.0 Hz linear array transducer.

A computerized tomography scan was done on patients who could afford its high cost. However, for those who couldn't afford the CT scan, stroke was sub-typed into ischemic and hemorrhagic types based on the WHO validated clinical criteria [10]. A diagnosis of ischemic stroke was made in the following circumstances: 1) when the stroke occurred in a state of relative inactivity, 2) absence of preceding headache. 3) absence of vomiting, 4) absence of post-stroke loss of consciousness, 5) presentation with mild to moderately elevated blood pressure as compared with severely elevated blood pressure for hemorrhagic stroke, and/or 6) a past history of transient ischemic attack(s) [10]. A diagnosis of hemorrhagic stroke was made in the presence of severely elevated BP and inverse of the above features [21].

Data were collected using a pre-tested semi-structured interviewer administered questionnaire which was administered by one of us YJA.

2.3. Statistical Analysis.

Data was collected from all the 200 subjects in data sheets, and then analyzed using SPSS (version 19.0). Chi-square, Fisher's exact probability, Student's *t*- and Mann-Whitney U tests were used to compare categorical and continuous variables as appropriate. P value of ≤ 0.05 was considered to be statistically significant.

3. Results

A total of 100 stroke patients were consecutively recruited into the study and compared

with 100 age and sex matched controls.

The mean age for the cases was 56.4 ± 15.8 years and 54.5 ± 15.4 years for the controls ($p = 0.39$). Among cases, 53% were males and 47% were females, while in the control group 52% were males and 48% were females ($p = 0.887$).

The profile of CVD risk factors among cases and controls is presented in **Table 1**. Hypertension was the commonest CVD risk factor present in 71% of the cases and 42% of the controls ($p < 0.001$). The prevalence of low SES, family history of stroke or TIA, heart diseases, LVH based on ECG criteria, positive HIV status, atrial fibrillation, DM, hypertension and dyslipidemia were all higher among cases than controls ($p < 0.05$). However, excess alcohol intake, atrial fibrillation and HIV were exclusively found in the stroke patients. The mean SBP was 152.26 ± 31.50 mmHg among the cases and 128.5 ± 15.99 mmHg among the control group ($p < 0.001$), while the mean DBP for the cases and control was 93.38 ± 20.13 mmHg and 80.75 ± 12.69 mmHg respectively, ($p < 0.001$). The mean fasting blood sugar for the cases was 6.274 ± 2.45 mmol/L and 4.6 ± 1.3 mmol/L for the controls (p -value < 0.001). The mean TC, LDL, HDL and TG for the cases were 5.16 ± 1.07 , 2.9 ± 0.91 , 1.26 ± 0.43 , 1.21 ± 0.52 respectively, and 4.81 ± 0.81 , 3.03 ± 0.76 , 1.20 ± 0.3 , 1.113 ± 0.43 for the control group (p -values 0.0081, 0.33, p -0.339, p -0.18 respectively).

Table 1. Profile of cardiovascular risk factors among cases and controls.

Variable	Cases N (%)	Controls N = (%)	p-value
Male gender	53 (53%)	52 (52%)	0.889
Increased age	47 (47%)	44 (44%)	0.670
Cigarette smoking	10 (10%)	9 (9%)	0.809
Excessive alcohol Intake	5 (5%)	0 (0%)	
Sedentary life style	82 (82%)	72 (72%)	0.090
Low SES	64 (64%)	42 (42%)	<0.016
Family history Of stroke	14 (14%)	5 (5%)	<0.030
Obesity	15 (17%)	16 (16%)	0.790
History of TIA	19 (19%)	1 (1%)	<0.001
Heart disease	70 (70%)	21 (21%)	<0.001
LVH(ECG)	34 (34%)	15 (15%)	0.002
HIV	2 (2%)	0 (0%)	
Atrial fibrillation	9 (9%)	0 (0%)	
Recreational Drugs	2 (2%)	1 (1%)	0.560
COCP	2 (2%)	4 (4%)	0.414
Diabetes mellitus	23 (23%)	6 (6%)	0.010
Hypertension	71 (71%)	42 (42%)	0.001
Dyslipidemia	53 (53%)	37 (37%)	0.023

Key: N, total number of subjects; ECG, electrocardiography; TIA, transient ischemic attack; LVH, left ventricular hypertrophy; HIV, human immunodeficiency virus; COCP, combined oral contraceptive pills; SES, Socioeconomic status. Values expressed as number with percentages in bracket.

Among the heart diseases, HHD was the commonest, seen in 55% of the cases and 18% of the controls, $p < 0.0001$, followed by rheumatic valvular heart disease (RHD) in 8% of cases and 2% of controls ($p = 0.052$), IHD in 6% of cases and 1% of the controls, ($p = 0.059$), while Dilated cardiomyopathy (DCM) was present in 1% of the cases only. Echocardiography was done on all the cases and the controls.

4. Discussion

The present study assessed the prevalence of cardiovascular risk factors in stroke patients in comparison with controls. The most frequent risk factors for stroke in our study were systemic hypertension, heart diseases, male sex and dyslipidemia, while HIV and other risk factors were uncommon.

The results show that stroke occurred at a relatively young age (56.4 ± 15.8), which is in keeping with an earlier cross-sectional study in the same centre, and to previous reports from other centers in Nigeria [22] [23]. However this is at variance with studies from the western world, including a recent study in Portugal, in which a mean age of 73.2 ± 8.7 years among stroke patients was reported [24]. This may be a reflection of differences in life expectancy between the developed and developing world. As regards gender distribution, the present study did not find any significant difference between the 2 genders, in keeping with findings from a previous study [22]. Another study by Desalu *et al.* demonstrated a relative increase in stroke prevalence in females who were older than the male counterpart [25]. This was attributed to a greater life expectancy among the women, as 60.3% of those with stroke were aged more than 70 years [25].

Hypertension was the commonest risk factor for stroke in this study found in 71% of the cases and 42% of the controls. It is well established that higher blood pressure levels are potent determinants for stroke, especially ischemic stroke and intracerebral hemorrhage [26]. Similarly, previous works from Kano, Benin-City (south-south Nigeria), Maiduguri and Burkina Faso all revealed a high prevalence of 79%, 66%, 87%, and 84% respectively [22] [27]-[29]. Studies done in whites showed a much lower value when compared with blacks (52% in whites vs 76% in black Africans, $p < 0.001$) in a population based study [30]. In addition, McGruder *et al.* showed that among stroke survivors, blacks were 1.65 times more likely to be hypertensive than whites [31]. Stroke is more common, more severe, and carries a higher mortality among blacks when compared with other races [32]. This is attributed to the fact that blacks have an increased frequency of traditional risk factors for stroke such as diabetes mellitus, hypertension, and obesity [32] [33]. However, management of hypertension with antihypertensive therapy reduces the risk of stroke by about 42% in the general population [34] [35].

In the present study, DM was found in 13% of the cases and 6% of the control group while post stroke hyperglycemia was found in 10% of the cases. Similarly, Karaye *et al.* reported a similar prevalence of DM of 14%, from Kano, while Desulu *et al.* and Amu *et al.* reported a higher prevalence of 23.8% from Ido-Ekiti and 26.25% from Benin city respectively [22] [25] [27]. However, Watilla *et al.* and Zabsonre from Maiduguri and Burkina Faso reported a lower prevalence of 8% and 7.3% respectively [23] [29]. The

difference between the findings in the Northern and Southern parts of the country could be probably be explained by differences in dietary habits, coupled with adoption of western lifestyle and possibly genetic factors.

Prospective, community based epidemiologic studies conducted in the United States and Europe suggest that approximately one fifth of stroke patients have DM [39]. Diabetes is an important risk factor for stroke and an independent risk factor for death [37]. It has been noted that diabetes and hypertension have an additive effect on the risk of stroke [38]. DM is a major risk factor for the development of atherosclerosis and the excess risk of stroke in patients with diabetes mellitus is about four times higher when compared with normal individuals in the general population [39]. Hyperglycemia after stroke is common and associated with a poorer outcome [40]. Several studies have found that short and long-term mortality rates and risk of death are higher in stroke patients with admission hyperglycaemia [40]-[42].

Dyslipidemia was significantly higher among the cases (53%) as compared to the controls (37%) in the present study. Similarly, reports from the USA showed prevalence of dyslipidemia in stroke patients of 50.7%, while other studies reported lower rates of 15% in Maiduguri, and 20.6% in Burkina Faso [23] [29] [43]. This could be related to a higher cut off value of total cholesterol of 5.5 mmols/l as compared to 5.2 mmols/l used in the present study. Furthermore Kano has been described in a National Survey to have the highest burden of hypertension and dyslipidemia in the country [7].

Conversely, lower total cholesterol levels were reported in male stroke patients as compared with healthy controls from Gombe, (Nigeria), while no significant difference between the cases and controls were found in Benin (Nigeria) [27] [44]. The mean HDL cholesterol among the cases was higher than what was obtained among the controls although the difference was not statistically significant. Ephraim *et al.* and Misirli *et al.* reported no statistically significant difference in the HDL_C cholesterol between stroke patients and control subjects [45] [46]. The mean TG and LDL_C did not differ significantly between the cases and the control group in the present study, in agreement with another study [45]. Similarly a recent study in Calabar (Nigeria) reported no statistical difference in HDL_C, LDL_C and triglycerides between stroke cases and their controls [46]. The predictive role of lipid profile in stroke is still unclear in spite of the fact that various large randomized trials of statins have established the reduction of stroke risk associated with lowering lipid levels [47]. This might be due to other beneficial effects of statins on the reduction of stroke risk which include stabilization of atherosclerotic plaques, improvement of endothelial function, antioxidant properties, increased nitric oxide bioavailability, inhibition of inflammatory responses and immunomodulatory actions [48].

Although blacks seem to suffer less from AF than Caucasians, consistent with our findings, it is still an important independent risk factor for stroke and a predictor of early recurrence [30] [49]. In a community based study, Hajat *et al.* reported a prevalence of AF among white subjects as 25% and 7% among Blacks ($p = 0.001$) [30]. Our finding was similar to what was reported from India (8%), but lower than reports from

Canada (12%) [50] [51]. Reports from Benin, Southern Nigeria revealed lower prevalence of 5% among the cases Vs 0% among the control group, and this could be explained by the low prevalence of heart disease in the Benin study [27]. In the worldwide Inter-stroke study, cardiac causes (of which AF constituted >50%) emerged among the 10 most important risk factors for stroke with a population attributable risk of 6.7% [52] [53].

Low SES was observed to be a significant risk factor in our study, as previously documented [27]. Low SES is associated with higher incidence of stroke, stroke risk factors, and rates of stroke mortality within and between populations worldwide [54] [55]. TIA appeared to be an important risk factor in this study. Similarly, a Hajat *et al.* in United Kingdom and Desalu *et al.* in South Western Nigeria reported prevalence similar to the findings in this study [25] [30]. However lower prevalence was reported from North Eastern Nigeria [23]. Whites have higher prevalence of TIA as compared with blacks [52].

Family history of stroke was significantly higher among the stroke patients as compared to the controls as was previously noted [27]. Sedentary life style was common among the two groups, though the difference between the two groups was not statistically significant ($P = 0.09$), although lower prevalence was previously reported among stroke patients [27].

Cigarette smoking and alcohol ingestion are uncommon in both study groups. Cigarette smoking was also reported to be insignificant in earlier studies among Nigerians, but a recent study in Benin (Nigeria) revealed that it was a strong risk factor (11.25% vs 1.25%) [22] [56] [57]. Smoking promotes atherosclerosis, platelet aggregation and vascular occlusion [23]. The low prevalence of alcohol consumption reflects the different socio-cultural norms of different parts of the country.

The prevalence of HIV infection was low in the present study. HIV is increasingly becoming a known risk factor for stroke in Sub-Saharan Africa where it has been shown to be associated with coagulation abnormalities, such as Protein S deficiency [58] [59]. HIV remained an independent predictor of stroke after adjustment for traditional risk factors as reported by Chow *et al.* [60]. Hypotheses to explain this excess risk include inflammation, endothelial dysfunction, and macrophage activation [61]. However Mochan *et al.*, found the causes of stroke in HIV-positive stroke patients to be similar to those in HIV negative stroke patients while Watila *et al.* in Maiduguri (Northeastern Nigeria) and Ezeala *et al.* from Southeastern Nigeria reported a prevalence of 1.3% of HIV in stroke cases and 3.4% in the female stroke cases respectively [9] [23] [62]. This could be explained by the relatively low prevalence of HIV in Nigeria of 3.9% [63]. However, HIV infection is confirmed to be a risk factor for stroke thus the need for screening of all patients [62].

Heart disease appears to be an important risk factor in this study. HHD was the commonest, followed by IHD and RHD. Similarly, Karaye *et al.* in a previous study in Kano reported a high prevalence of heart disease (65.4%) among stroke patients [22]. This contrasts with the finding by Amu *et al.* in Benin City, who reported a low preva-

lence in both the cases and controls (2.5% vs 0% ($p > 0.05$)), although the prevalence of hypertension in their study was 85% [27]. The prevalence of heart disease was found to be lower in the study by Amu *et al* probably because echocardiography was not used in all the patients [27]. Echocardiography has been shown to have higher sensitivity and specificity than ECG in detecting LVH and other structural cardiac abnormalities [64].

In this study, the other risk factors were uncommon, but should in no way be neglected. One of the strengths of this study is in its case-control design involving a relatively sizeable number of subjects. Some of the limitations of the study include a relatively large percentage of patients not having a brain Computed Tomography or Magnetic Resonance Imaging and other risk factors such as protein C and S deficiency and antiphospholipid antibodies could not be assessed due to cost and non availability. Performing a brain scan for all patients would have increased the strength of the study, by assessing the relationship between risk factors and stroke subtypes.

5. Conclusion

This study has demonstrated that the most frequent risk factors for stroke were systemic hypertension, heart diseases, male sex and dyslipidemia, while HIV and other risk factors were uncommon. Community friendly intervention programmes aimed at preventing and modifying the risk factors in persons prone to stroke should be incorporated into the health care system so as to recognise them early and effectively manage them. This study could form a basis for larger population based studies to determine the prevalence of stroke and its associated risk factors.

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