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Full Length Research Paper

Risk factor profile among black stroke patients in Northeastern Nigeria

Watila M. M.[1]*, Nyandaiti Y. W.[1], Ibrahim A.[2], Balarabe S. A.[3], Gezawa I. D.[4], Bakki B.[1], Tahir A.[1], Sulaiman M. M.[1] and Bwala S. A.[1]

[1]University of Maiduguri Teaching hospital, P. M. B. 1414, Maiduguri, Borno State. Nigeria.
[2]Federal Medical Centre, Azare, Bauchi State, Nigeria.
[3]Usman Danfodio University Teaching Hospital Sokoto. Nigeria
[4]Aminu Kano Teaching Hospital, PMB 3011 Kano, Nigeria.

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Few studies have evaluated risk factors among stroke patients in our population. This study is aimed at exploring risk factors among black stroke patients. A total of 524 stroke patients seen at University of Maiduguri Teaching Hospital between January 2005 and June 2011 were evaluated to ascertain risk factors. Prestroke risk factors were obtained from patient's medical history and hospital records. Risk factors such as hypertension were gotten from case history, with hypertension defined as blood pressure (BP) of ≥ 140/90 mmHg or features of long standing hypertension. History of smoking, alcohol intake, transient ischaemic attack (TIA) were also noted. Hypertension was the commonest risk factor, found in 87% of patients, followed by hypercholesterolaemia 15.1%, past history of stroke 11.5%, diabetes 10.1%, alcohol 8.8%, smoking 6.8%, TIA 5.3%, heart failure 2.4% and preeclampsia-eclampsia 2.0%, while 19.7% had more than one risk factor. About 53% had no prior knowledge of being hypertensive, and only about 10% had treatment for hypertension prior to having a stroke. Males had higher systolic BP. Alcohol consumption and smoking were commoner in males and the young. The younger patients were more likely to acquire basic education, nephrotic syndrome and HIV infection. Hypertension and hypercholesterolaemia were common among the middle age group, while past history of stroke and multiple risk factors were commoner among the elderly. Thirty-day fatality was 17.7% and higher in older patients. Hypertension was found to be the most important risk factor for stroke among our study population. Public enlightenment on the importance of early detection of hypertension and adherence to antihypertensive medications will go a long way in reducing the morbidity and mortality associated with stroke in our environment.

Key words: Risk factors, hypertension, stroke, blacks, Nigerians.

INTRODUCTION

Stroke is the second most common cause of death worldwide (Beaglehole and Yach, 2003) and a leading cause of disability in adults (Murray and Lopez, 1997). A large percentage of stroke deaths occur in low-income to middle-income countries (Strong et al., 2007). An estimate of the leading cause of death in developing countries reported that strokes account about 8% of total deaths (Beaglehole and Yach, 2003). The morbidity and mortality from stroke may continue to increase in sub-Saharan Africa even as it is decreasing in developed countries (Tolonen et al., 2002; Connor et al., 2007). Stroke mortality in Nigeria is high, with stroke reviews reporting a 30-day case fatality rate raging from 28 to 40% (Ogun et al., 2005; Wahab et al., 2007). Discrepancies occur in stroke presentation and outcome between blacks and Caucasians, which may be attributable to differences in risk factors. Hypertension is

*Corresponding author. E-mail: Watilamusa@yahoo.com. Tel: +2348134701715.

Table 1. The Siriraj stroke scale.

$$Siriraj\ Stroke\ Score = (2.5 \times level\ of\ consciousness) + (2 \times vomiting) + (2 \times headache) + (0.1 \times DBP) - (3 \times atheroma\ marker) - 12$$

Consciousness: Alert = 0; drowsy, stupor = 1; coma = 2
Vomiting: no = 0; yes = 1
Atheroma markers: none = 0; yes = 1
Score of:
< - 1= Ischemic stoke
> +1= Hemorrhagic stroke
Between -1 and +1= Indeterminate stroke

the most important risk factor for stroke worldwide, and the risk of all stroke subtypes increase with increasing blood pressure (Leppala et al., 1999; WHO, 1997; Makino et al., 2000). Hypertension appears to be more prevalent in blacks; while diabetes mellitus, smoking, atrial fibrillation (AF) and myocardial infarctions (MI) are commoner in whites (Sacco et al., 1995; Hajat et al., 2004). Risk factors should influence practice and prevention, as large proportion of Nigerians are still living in poverty and it will be logical to focus our attention on stroke prevention strategies. This study was designed to evaluate various risk factors of stroke in Northeastern Nigeria.

METHODS

Our subjects were all black and resident in Nigeria. We recruited 524 patients who consented; Information about all patients admitted to the program was captured prospectively in an in-hospital stroke registry between January 2005 and May 2010 at the University of Maiduguri Teaching Hospital (UMTH), a tertiary hospital located in Northeastern Nigeria, with a bed capacity of 600. The study was approved by the Research and Ethics committee of the hospital.

Stroke was clinically defined in accordance with the World Health Organization criteria as “rapidly developing clinical sign of focal and/or global disturbance of cerebral function, with symptoms lasting twenty-four hours or longer or leading to death with no apparent cause other than of vascular origin”. (WHO, 1988)

Data collected and recorded in a stroke proforma for each patient at the time of the presentation include: Age, sex, educational level, and residence in a rural or urban area. Educational level was categorized into those with at least a secondary education and those with less than a secondary education. The presence of stroke risk factors was determined from medical histories, clinical examination, diagnostic procedures, and their past medical records. Hypertension was defined as a previously recorded systolic blood pressure ≥ 140 mmHg or diastolic blood pressure ≥ 90 mmHg on two separate occasions or during the course of stroke admission; those aware of being hypertensive as told by a health professional; or subjects taking antihypertensive medications. Compliance with antihypertensive medications in those diagnosed hypertensive was noted.

Diabetes mellitus was defined as those who had a prior diagnosis of DM, on antidiabetic medications, or previous fasting blood glucose level ≥ 7 mmol/L or random plasma glucose of > 11 mmol/L (Sridharan et al., 2009). Transient ischaemic attacks (TIA) was defined as sudden onset of focal neurological deficit with complete recovery within 24 h. Atrial fibrillation (AF) and myocardial infarction (MI) were diagnosed by clinical examination and electrocardiography. Heart failure was diagnosed based on clinical examination. HIV infection was diagnosed using the enzyme linked immunosorbent assay (ELISA). Hypercholesterolaemia was defined as fasting cholesterol concentration of > 5.5 mmol/L (200 mg/dl) (Tolonen et al., 2005). Sickle cell disease was diagnosed from history and haemoglobin electrophoresis. Information on social habits such as alcohol intake and cigarette smoking were obtained; smokers were considered as those who had smoked consistently for more than a year inclusive of those who had stopped smoking less than 6 months in accordance with a study by Tuomilehto et al. (1996). Consistent cigarette smoking is defined as ≥ 1 cigarette/day for ≥ 1 year, and significant alcohol intake was estimated as ≥ 200 g/week for more than a year (Moroney et al., 1998).

Other less common causes of stroke, such as antiphospholipid antibody syndrome, giant cell arteritis, thyrotoxicosis were screened only when there was a clinical suspicion of such conditions.

A computerized tomography scan (CT) or magnetic resonance imaging (MRI) was used to distinguish between intracerebral haemorrhage (ICH), cerebral ischaemia (CI) and subarachnoid haemorrhage. Being a resource poor setting, a large percentage (78.6%) of our patients did not have a neuroimaging. In such patients, stroke subtype was distinguished using the Siriraj stroke scale (SSS) (Poungvarian et al., 1991). The SSS had been validated in our centre in a study by Nyandaiti and Bwala, (2008) and is useful in resource poor settings to clinically assist in differentiating between stroke types.

The score was computed for each patient using the formula shown in Table 1. We categorized patients risk factors based on age and sex.

Statistical analysis

Risk factor differences among stroke groups were based on age and gender; the student’s t-test was used to compare differences in mean values, while the χ^2 tests was used to compare differences in percentages of risk factor.

RESULTS

During the study period, 590 patients were seen with suspected diagnosis of stroke. Sixty-six patients were

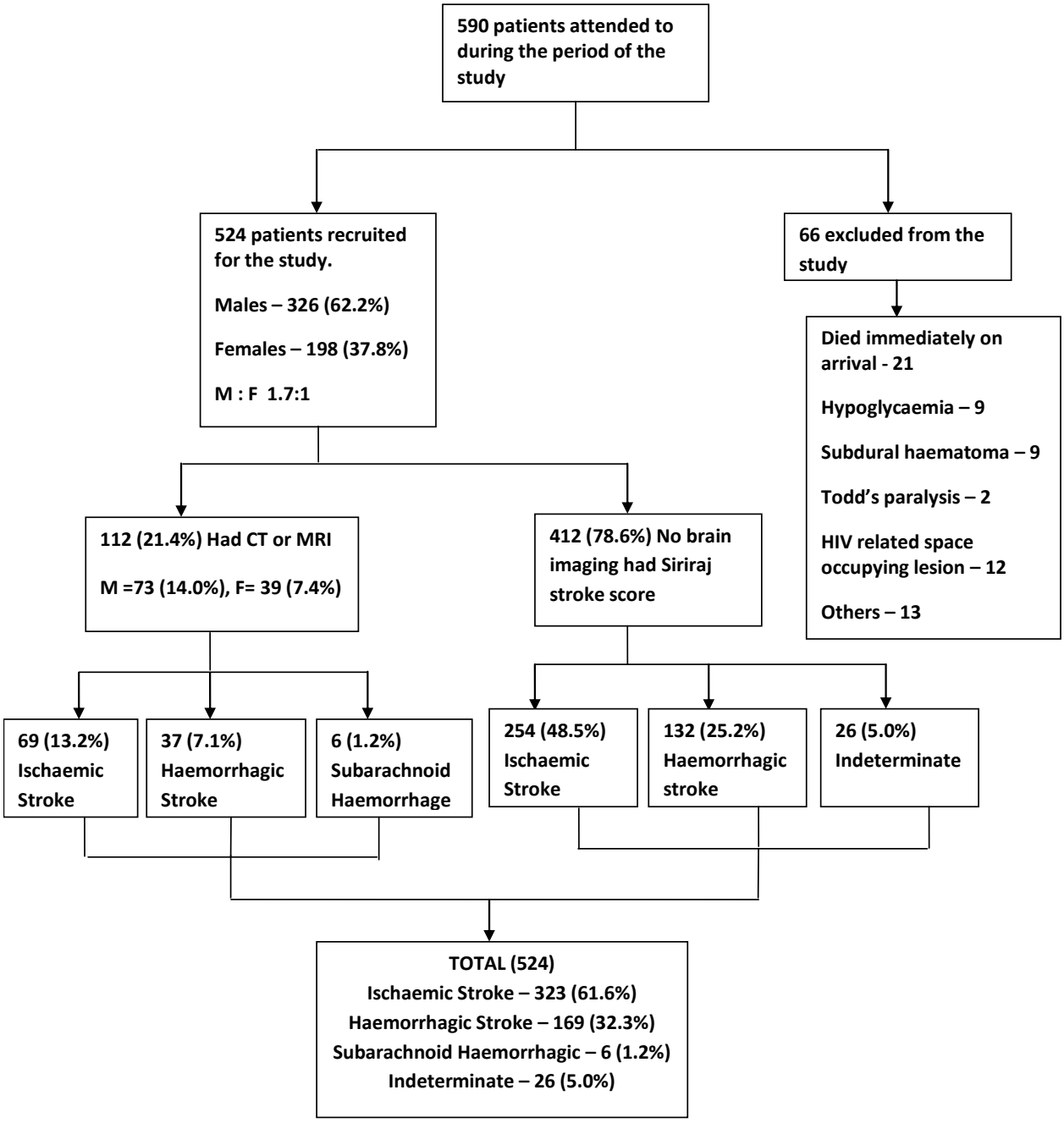

Figure 1. Flow chart showing the selection criteria and stroke subtype among the study subjects.

excluded from the study for various reasons (Figure 1). Therefore, 524 subjects were recruited for the study. The patients were all black Africans. The mean age of the patients was 56.4 ± 13.0 years, with 37.8% being females, with a male: Female ratio of 1.65:1. Less than one-third of the total subjects had basic formal education. Figure 2 summarizes the risk factors of the general population. The most frequent risk factors are hypertension 87%, hypercholesterolaemia 15.1%, past history of stroke 11.5%, diabetes mellitus 10.1%, alcohol 8.8%, smoking 6.8%, TIA 5.3%, heart failure 2.4%, preeclampsia-eclampsia 2.0% and 19.7% having more than one risk factor.

The main characteristics comparing men and women are presented in Table 2. Males were significantly older than females ($p = 0.001$). There were more females than males in the 26 to 35 years age group ($p = 0.001$). Females were more likely to have ischaemic stroke ($p = 0.002$), while males were more likely to have haemorrhagic stroke ($p = <0.001$). Females were less

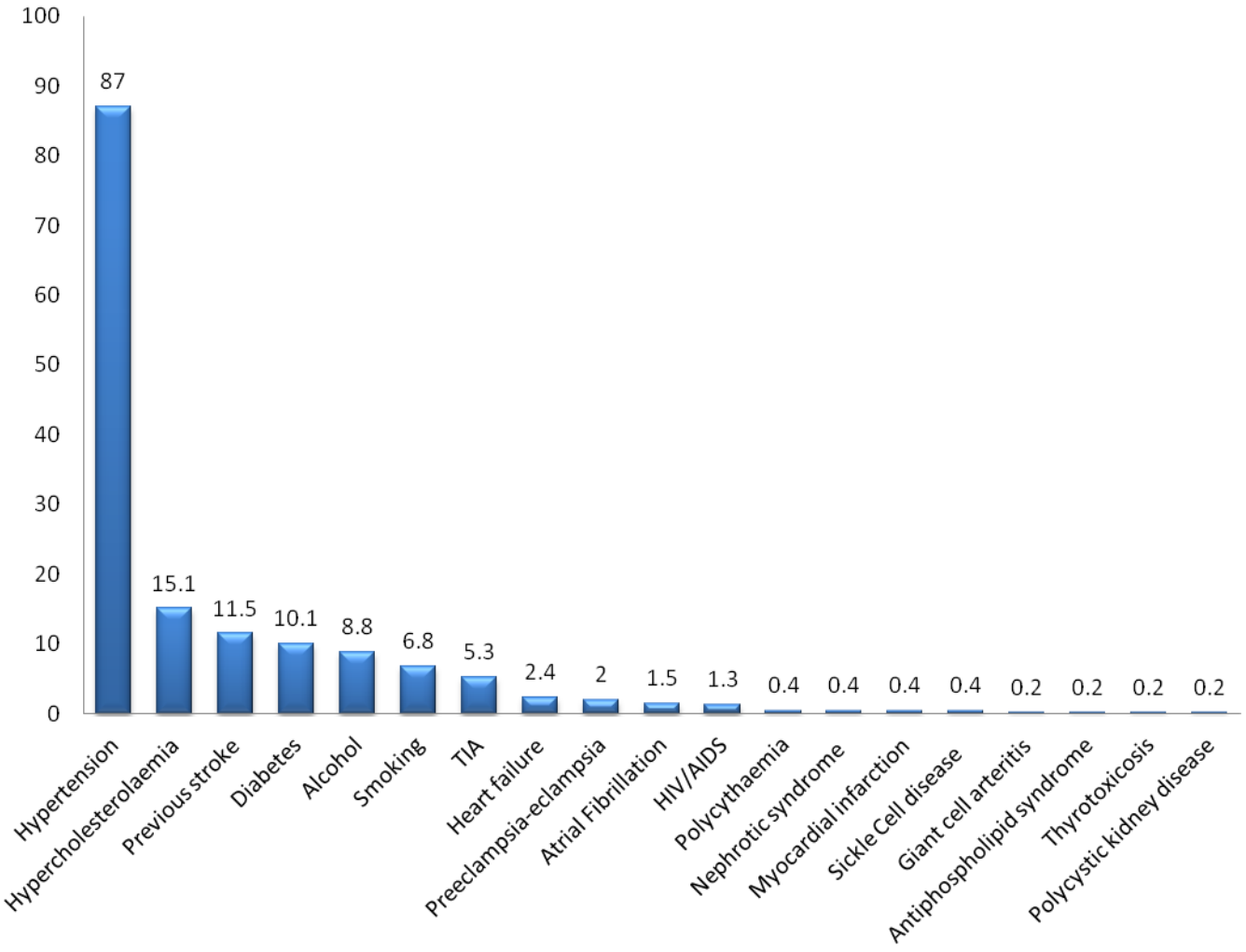

Figure 2. Distribution of stroke risk factors among the study subjects.

likely to have basic (postsecondary) education (p = <0.001). There was no significant gender difference in the frequency of hypertension as a risk factor. About 60.7% of males compared with 40.4% of females had a prestroke knowledge of being hypertensive (p = <0.001). Males were more likely to be on antihypertensive medication(s) (p = 0.036). Despite the aforementioned advantages in males, they still had a higher systolic blood pressure at presentation (p = 0.034). The proportion of those smoking or taking alcohol was higher among males than among females (p = <0.001); while females were more likely to have AF (p = 0.029). Preeclampsia and eclampsia is an important risk factor in females.

Table 3 shows the distribution of risk factor by age among the study subjects. The younger age group (<45 years) were more likely than the older ones to be formally educated (p = 0.002), to be current smokers (p = 0.018), to be infected with HIV (p = <0.001) and to have nephrotic syndrome (p = 0.007). In keeping with the age of reproduction, preeclampsia-eclampsia was more common in the younger age group (p = <0.001). The younger age were more likely not to have a discernable risk factor (p = <0.001). The middle age group (45 to 65 years) were more likely to be hypertensive (p = <0.001), to be diabetic (p = 0.023) and to have hypercholesterolaemia (p = 0.045). The older age group (>65 years) were more likely to have a past history of stroke (p = 0.045) and were more likely to have more than one risk factor (p = <0. 001). The overall 30-day stroke fatality was 17.7%, and these deaths were less likely to occur among the young (p = 0.01). No significant sex difference in 30-day fatality.

DISCUSSION

Most studies in Nigeria that looked at risk factors for stroke were mainly retrospective in design. Our study showed that stroke occurs at a relatively younger age, a finding that is in with keeping earlier reports (Gillum,

Table 2. Distribution of study subjects in relation to sex.

Variable	Male (n=326)	Female (n=198)	p-Value*	Total (N=524)
Mean age (years)	57.9 ± 12.4 (18-90)	53.9 ± 13.6(20-90)	0.001	56.4 ± 13.0 8-90)
Age group (years)				
<25	6 (1.8)	5 (2.5)	0.596	11(2.1)
26-35	8 (2.5)	17 (8.6)	0.001*	25(4.8)
36-45	39 (12.0)	32 (16.2)	0.173	71(13.5)
46-55	78 (23.9)	51 (25.8)	0.637	129(24.6)
56-65	108 (33.1)	58 (29.3)	0.360	166(31.7)
66-75	72 (22.1)	30 (15.2)	0.052	102(19.5)
76-85	12 (3.7)	4 (2.0)	0.284	16(3.1)
>86	3 (0.9)	1 (0.5)	0.596	4 (0.8)
Education				
No secondary	208 (63.8)	170 (85.9)	<0.001*	378 (72.1)
Secondary	118 (36.2)	28 (14.1)	146 (27.9)	
Rural dweller	81 (24.8)	52 (26.3)	0.718	133(25.4)
Urban dweller	245 (75.2)	146 (73.7)		391 (74.6)
Stroke type				
Ischaemia	184 (57.0)	139 (70.2)	0.002*	323 (61.6)
Haemorrhage	124 (38.0)	45 (22.7)	<0.001*	169 (32.3)
Indeterminate	15 (4.6)	11 (5.5)	0.637	26 (5.0)
SAH	5 (1.5)	1(0.5)	0.283	6 (1.2)
Hypertension	280 (85.9)	176 (88.9)	0.322	456 (87.0)
Previous stroke	33 (10.1)	27 (13.6)	0.221	60 (11.5)
Hypercholesterolaemia	47 (14.4)	32 (16.2)	0.588	79 (15.1)
Diabetes	31 (9.5)	22 (11.1)	0.555	53 (10.1)
Alcohol	44 (13.5)	2 (1.0)	<0.001*	46 (8.8)
Smoking	35 (10.7)	1 (0.5)	<0.001*	17 (5.2)
TIA	36 (6.8)	11 (5.5)	0.866	28 (5.3)
Preeclampsia-eclampsia	0 (0.0)	10(5.1)	<0.001*	10 (2.0)
Heart failure	5 (1.5)	8 (4.0)	0.074	13 (2.4)
Atrial fibrillation	2 (0.6)	6 (3.0)	0.029*`	8 (1.5)
HIV	4 (1.2)	3 (1.5)	0.781	7 (1.3)
Polycythaemia	2 (0.6)	0 (0.0)	0.269	2 (0.4)
Nephrotic syndrome	2 (0.6)	0 (0.0)	0.269	2 (0.4)
Myocardial infarction	2 (0.6)	0 (0.0)	0.269	2 (0.4)
Sickle cell disease	2 (0.6)	0 (0.0)	0.269	2 (0.0)
Giant cell arteritis	1 (0.3)	0 (0.0)	0.435	1 (0.2)
Antiphospholipid syndrome	1 (0.3)	0 (0.0)	0.435	1 (0.2)
Thyrotoxicosis	1 (0.3)	0 (0.0)	0.435	1 (0.2)
Polycystic kidney disease	1 (0.3)	0 (0.0)	0.435	1 (0.2)
More than one risk factor	59 (18.1)	44 (22.2)	0.249	103 (19.7)
No discernable risk	11 (3.4)	5 (2.5)	0.584	16 (3.1)
SBP (mmHg)	160.0 ± 35.4	153.6 ± 29.8	0.034*	157.6 ± 33.5
DBP (mmHg)	98.9 ± 20.6	95.5 ±17.1	0.052	97.6 ±19.4
Awareness of hypertension	198 (60.7)	80 (40.4)	<0.001*	278 (53.1)
Hypertensive medication	13 (6.6)	0.036*	53 (10.1)	40 (12.3)
30-day fatality	58 (17.8)	35 (17.7)	0.973	93 (17.7)

Students' t-test for continuous variable; χ^2, for categorical variable. *, p-value ≤ 0.05; SAH, subarachnoid haemorrhage, TIA, transient ischaemic attack; SBP, systolic blood pressure; DBP, diastolic blood pressure.

Table 3. Distribution of risk factors by age of subjects.

Risk factor	< 45 years (n=88)	45-65 years (n=314)	> 65 years (n=122)	p-Value
Level of education				
Less than secondary	46 (52.3)	202 (64.3)	92(75.4)	0.002*
Secondary education	42 (47.7)	112 (35.7)	30 (24.6)	
Hypertension	59 (67.1)	292 (93.0)	105 (86.1)	<0.001*
Previous stroke	4(4.5)	37 (11.8)	19 (15.6)	0.045*
Hypercholesterolaemia	14 (15.9)	56 (17.8)	9 (7.4)	0.023*
Diabetes	2 (2.3)	43 (13.7)	8 (6.6)	0.002*
Alcohol intake	9 (10.2)	31 (9.9)	6 (4.9)	0.226
Current smoking	12 (13.6)	19 (6.1)	5 (4.1)	0.018*
TIA	5 (5.7)	14 (4.5)	9 (7.4)	0.472
Preeclampsia-eclampsia	7 (8.0)	0 (0.0)	0 (0.0)	<0.001*
Heart failure	2 (2.3)	9 (2.9)	2 (1.6)	0.754
Atrial fibrillation	0 (0.0)	4 (1.3)	4 (3.3)	0.136
HIV/AIDS	6 (6.8)	1 (0.3)	0 (0.0)	<0.001*
Nephrotic syndrome	2 (2.3)	0 (0.0)	0 (0.0)	0.007*
Myocardial Infarction	0 (0.0)	1 (0.3)	1 (0.8)	0.611
Sickle cell disease	1 (1.1)	1 (0.3)	0 (0.0)	0.403
Antiphospholipid syndrome	1 (1.1)	0 (0.0)	0 (0.0)	0.084
Thyrotoxicosis	1 (1.1)	0 (0.0)	0 (0.0)	0.084
Giant cell arteritis	0 (0.0)	1 (0.3)	0 (0.0)	0.715
Polycystic kidney disease	1 (1.1)	0 (0.0)	0 (0.0)	0.084
More than one risk factor	10 (11.4)	40 (12.7)	53 (43.0)	<0.001*
No discernable risk factor	6 (6.8)	5 (1.6)	5 (4.1)	0.031*
30-day fatality	6 (6.8)	60 (19.1)	27 (22.1)	0.01*

χ^2, For categorical variables. *, p-value ≤ 0.05; TIA, transient ischaemic attack.

1998; Bravata et al., 2005). Men were older than females in this study; this is similar to an earlier study done in this centre (Watila et al., 2011), but at variance with studies done in whites (Bravata et al., 2005; Wadley et al., 2007).

More than two-third of our patients, especially women, had no basic education. Low educational attainment may probably translate into a low income. Stroke incidence appears to increase with lower educational attainment, social class and income (Bravata et al., 2005), but Chang et al. (2002) in a study among Africans reported contrasting findings. The relationship between high stroke incidence and low social class as found in this study, has not been fully elucidated, but may be related to inequalities in access to health care, as well as dietary factors (Chang et al., 2002; McFadden et al., 2009).

A variety of risk factor exists in this study, with hypertension being the most important regardless of age and sex. Hypertension is the most significant risk factor for stroke worldwide (Sacco et al., 1995; Feigin et al., 1998; Simons et al., 1998; McGruder et al., 2004; Smeeton et al., 2009; Andersen et al., 2010). The prevalence of hypertension in this study is similar to other Nigerian studies (Bwala, 1989; Amu et al., 2005) and similar to other epidemiological studies in Mozambique (Damasceno et al., 2010) and India (Sridharan et al., 2009). Studies done in whites show a much lower value when compared with blacks (Wadley et al., 2007; Hajat et al., 2001; Ohira et al., 2006). A study by McGruder et al. (2004) showed that blacks were 1.65 times more likely to be hypertensive than whites. Management of hypertension prevents strokes (Simons et al., 1998; Ohira et al., 2006) with studies showing that antihypertensive therapy reduces the risk of stroke by about 42% (MacMahon and Rogers, 1994; Bronner et al., 1995). A study by Zhang et al. (2004) reported that 50% or more of all strokes in Asians could be prevented if hypertension is controlled. We noted that more than half of our patients had no prior knowledge of being hypertensive and this lack of knowledge is more pronounced among females; nonetheless uncommon in some studies (Broderick, 1997; Samal et al., 2007). This trend may reflect poor public knowledge, poor health practices and access to healthcare. Even when blacks are treated for hypertension, they were less likely than whites to be compliant with medications and have their blood pressure controlled (Howard et al., 2006). A study by Woo et al. (2004) reported that women were more likely to have their hypertension treated than men, which is at variance

with our study. Knowledge of risk factors for stroke is influenced by educational level (Samal et al., 2007).

Diabetes is an important risk factor for stroke (Tuomilehto et al., 1996; Andersen et al., 2010; Hu et al., 2005) and an independent risk factor for death (Tuomilehto et al., 1996). It has been noted that diabetes and hypertension have an additive effect on the risk of stroke (Hu et al., 2005; Iso et al., 1989). Studies have shown that blacks were more likely to be diabetic (Hajat et al., 2001, 2004; McGruder et al., 2004) but the percentage of our patients with diabetes was rather low when compared with those in whites (Hajat et al., 2001). A study has shown a preponderance of males being more likely to be diabetic (Andersen et al., 2010) but our study revealed no sex difference.

Hypercholesterolaemia appears to be an important risk factor for stroke in this study. High total cholesterol has been associated with stroke and stroke mortality (Iso et al., 1989) but another study reported a contrary view (Rhoads and Feinleib., 1983). The role of lipids in stroke patients in our environments needs further work in carefully selected stroke subjects. This finding may be important in this respect in our environment, as our populace now imbibe the western habit of eating high fatty foods and doing away with the indigenous high fiber diet.

Although blacks suffer less AF (Hajat et al., 2001) consistent with our study; it is still an important independent risk factor for stroke and also a predictor of early recurrence (Simons et al., 1998; Moroney et al., 1998). Anticoagulation is of use in preventing stroke recurrence especially in the elderly (Atrial Fibrillation Investigators, 1994), a treatment we do not commonly make use of.

Prior history of stroke is an important risk in our study; this is in keeping with a study by Simons et al. (1998) commonly due to lack of proper treatment of stroke risk factors. Other reasons for the high stroke recurrence in our study may be due to poor health care and education among our patients.

In sub-Saharan Africa, there is now an excess of stroke risk from HIV infection commonly in the young (Damasceno et al., 2010) as reported in this study. Viral pathogens have been linked to atherogenesis and vasculitis in cerebral vasculature (Lindsberg and Grau, 2003).

Alcohol intake and cigarette smoking are commoner in males and the young in this study; which is comparable to a study in black Caribbean patients (Smeeton et al., 2009). Smoking is a potential risk factor for stroke, and is more prevalent in males and the young (Ueshima et al., 2004) while the study by Andersen et al. (2010) reported an equal frequency of smoking in both genders. A high prevalence (49%) was reported in a study by Li et al. (2005). Smoking promotes atherosclerosis, platelet aggregation and vascular occlusion. Light alcohol intake is adjudged to be protective, but heavy alcohol intake significantly increases the risk of stroke; this increase of risk was more marked in hypertensive, suggesting a synergistic effect of alcohol and hypertension (Kiyohara et al., 1995). Women with preeclampsia-eclampsia have a significantly higher risk of stroke (both hemorrhagic and ischemic), and after delivery this risk remains significant at least 12 months for hemorrhagic stroke and 6 months for ischemic stroke (Tang et al., 2009). Preeclampsia-eclampsia is common in this part of the world due to poor antenatal care (Audu et al., 2002). Other factors that may contribute to pregnancy as a stroke risk are: Malnutrition, stress from pregnancy, increased risk of cardiac disease and haemostatic impairment (Qureshi et al., 1997; Zhang et al., 2009). Pregnancy-related causes of stroke may explain the significant switch in sex ratio in the age group 26 to 35 years of age; and may explain the relatively younger age of women in this study since they occur within the reproductive age group. Pregnancy-related strokes in our environment may be an area for further studies. The other risk factors in this study although important, contribute a smaller percentage to stroke risk in this environment, but should in no way be neglected. A multicentre study in Nigeria is imperative to assess various risk factors on a larger scale. The strength of the study is that it is a prospective study, and incorporating a large percentage of stroke admissions during the study period. Some of the weaknesses of this study include a relatively large percentage of patients not having a CT or MRI. Performing a brain scan for all patients would have increased the strength of the study, by assessing the relationship between risk factors and stroke subtype.

In conclusion, this study showed that hypertension is the most important risk factor. Hypertension is however a potentially preventable and treatable condition. We need to embark on public awareness towards regular BP checks and optimum BP control. We should also take time to educate our patients and insist on compliance. Nigerians must begin to understand the risk factors for strokes in order to reduce its incidence. Stroke is one condition in which the word “prevention is better than cure” stands true. Africa stands at a disadvantaged position with respect to stroke care. Although more neurologists are being trained albeit grossly insufficient and unevenly distributed, resources for stroke care are still grossly inadequate. Poverty combined with illiteracy is a major factor militating against the effective management of hypertension, which if achieved will significantly reduce stroke incidence in our environment. Preventive strategies are more cost effective than managing index cases. It is time to act towards risk factor modifications.

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