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Stroke Subtypes and Outcomes in Hypertensive Patients at the Rivers State University Teaching Hospital, Port Harcourt, Nigeria

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ABSTRACT

Introduction: The global burden of stroke is increasing alarmingly, with hypertension reported as the most prevalent risk factor. The aim of this study was to assess stroke among patients with hypertension as well as the factors associated with 30 days mortality at the Rivers State University Teaching Hospital.

Materials and Methods: This was a hospital-based descriptive cross-sectional study of adult hypertensive patients who received a clinical diagnosis of a stroke between January 2022 to December 2023. Sociodemographic, clinical and brain imaging data and were recorded, along with mortality at 30 days. Data was analysed by using SPSS version 25.

Results: A total of 311 patients were admitted with a diagnosis of stroke of which, 249 (80.1%) were hypertensive. The mean age of the hypertensive stroke patients was 60.7 ± 12.1 years, 140 (56.2%) were women and 226 (90.8%) of these patients were aware of their hypertensive status. Brain imaging revealed that 194 (77.9%) patients had an ischaemic stroke while 55 (22.1%) had a haemorrhagic event. At the end of 30 days, 62 (24.9%) persons died and there was a significant relationship between increasing age and mortality ($p=0.021$), while the mean systolic blood pressure was significantly higher in the hypertensive patients that died ($p=0.045$).

Conclusion: Hypertension is a major risk factor for stroke morbidity and mortality. Urgent measures are needed to improve on blood pressure control as these may potentially reduce stroke occurrence rates in hypertensive subjects.

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Received: May 31, 2025; **Accepted:** June 05, 2025; **Published:** June 14, 2025**Keywords:** Hypertension, Stroke, Stroke Subtypes, Mortality, Nigeria**Introduction**

Fifteen million people worldwide have been estimated to experience a stroke annually, which makes it the second most common cause of mortality globally and the third most common cause of disability. This stroke mortality is seven times higher in low-income countries than in high-income countries with the added continuous drain communicable diseases contributing to the disease load in sub-Saharan Africa, however, controlling the risk factors of stroke is an effective prevention and control strategy for stroke [1-3].

Hypertension, diabetes mellitus, dyslipidaemia, and unhealthy lifestyle are all modifiable risk factors for stroke in the general population, among which hypertension is recognized as the most prevalent risk factor, affecting over one billion persons in the world [4,5]. High blood pressure results in haemodynamic consequences on the blood vessels as studies consistently demonstrate this interplay, with hypertension significantly increasing the likelihood of both ischemic and haemorrhagic strokes, with the greatest risk for intracerebral haemorrhage. The blood pressure variables

such as systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean arterial pressure (MAP) have all been associated with an increased risk of stroke. Hypertension has been reported in about 64% of patients with stroke with the hazard of stroke reported to increase linearly when blood pressure levels exceed 115/75mmHg, increasing the risk up to seven times in untreated hypertensive patients [5-7]. A 5mm Hg reduction in DBP could reduce the risk of stroke by 40% while a 10mmHg reduction of SBP could reduce the risk of stroke by 30%, thus the emphasis on antihypertensive therapy to address this pressing concern [8,9].

Studies in Nigeria consistently show hypertension as a major risk factor for stroke, including both ischemic and haemorrhagic types, demonstrating a significant increase in stroke risk with untreated or uncontrolled hypertension [10-12]. Hypertensive patients with comorbid conditions such as increasing age and body mass index, family history of stroke or other cardiovascular disease, smoking, and alcohol use are also reported to be at an increased risk for the occurrence of stroke. Furthermore, the presence of both hypertension and diabetes further dramatically elevates the stroke risk, with some studies showing a seven-fold increase in risk when both conditions are present [1,2,13].

There are limited data on risk factors for stroke in hypertensive patients in sub-Saharan Africa, including Nigeria. Therefore, this study aims to assess stroke and its risk factors among patients with hypertension as well as the factors associated with 30 days mortality amongst these patients at the Rivers State University Teaching Hospital.

Materials and Methods

This study was conducted in the Rivers State University Teaching Hospital (RSUTH) which is in Port Harcourt, the capital of Rivers State, South-South of the Federal Republic of Nigeria, a tertiary hospital owned and funded by the Government of Rivers State.

This was a hospital-based descriptive cross-sectional study and the study population consisted of all adult (18 years of age and older) hypertensive patients who received a clinical diagnosis of either an ischemic stroke or a haemorrhagic stroke with neuroimaging confirmation admitted into the medical wards of the department of Internal Medicine of the hospital between January 2022 to December 2023 [14]. Hypertension was defined historically from the patient, or as mentioned in the patients’ clinical records, and/or a systolic BP greater than or equal to 140mmHg and/or diastolic greater than or equal to 90mmHg, or currently on anti-hypertensive medication [15]. Patients unable to do brain imaging or whose initial diagnosis of stroke was later changed to another cause were excluded.

Data was collected with a structured questionnaire to include sociodemographic factors, hypertension history and other stroke related variables such as comorbidity status and clinical features of neurologic impairment. The stroke subtype following brain imaging and in-hospital treatment outcomes were also recorded with the patients followed up to determine outcome at 30 days. The primary outcome in the hypertensive patients was mortality at 30 days. Age, gender, stroke subtype, blood glucose and blood pressure at presentation were evaluated to determine their relationship with the primary outcome.

Data was entered into Microsoft office excel and exported into Statistical Package for Social Sciences (SPSS) version 25 (IBM Inc., Armonk, USA) for analysis. Mean and standard deviation was used for continuous variables and proportions for categorical variables. Chi square test and student’s t test were used to test for significant relationship between 30 days mortality and categorical and continuous variables respectively. A p value of <0.05 was considered statistically significant.

Results

During the study period, 311 patients were hospitalized with an initial admission diagnosis of stroke in the Rivers State University Teaching Hospital, of which, two hundred and forty-nine (249) were hypertensive and were included in the study after fulfilling the inclusion criteria.

The mean age of the 249 recruited hypertensive patients was 60.7±12.1years with a range of 35 to 88years and 141(56.6%) were aged 60 years and above. There was a slight female preponderance as 140(56.2%) were women, giving a female to male ration of 1.3:1. The majority of the respondents were married, had attained secondary level of education, and domiciled in an urban area as shown in table 1.

Table 1: Sociodemographic Characteristics of the Study Population

Sociodemographic characteristic	Frequency	Percent
Age group		
<40years	11	4.4
40-59years	97	39.0
≥60years	141	56.6
Sex		
Male	109	43.8
Female	140	56.2
Level of education		
No formal education	35	14.1
Primary	59	23.7
Secondary	87	34.9
Tertiary	68	27.3
Place of residence		
Rural	45	18.1
Urban	181	72.7
Semi-urban	23	9.2
Marital status		
Single	62	24.9
Married	166	66.7
Divorced/Separated	5	2.0
Widowed	16	6.4

The symptoms of a stroke in these hypertensive patients were first noticed at wake up or in the morning in 82(32.9%) and 111(44.6%) patients respectively, however, only 59(23.7%) presented to the hospital within the first 24 hours of symptom onset with 35(14.1%) presenting after 7 days of symptom onset. The most frequent presenting symptoms included focal neurological deficit in 172(69.1%) patients, speech disturbance in 149(59.8) and acute confusional state in 101(40.6%) persons. Whereas 226(90.8%) of these patients were aware of their hypertensive status, 102(41.1%) self-reported poor adherence to antihypertensive medications and 67(26.9%) were living with diabetes mellitus. Fifty-eight (23.3%) persons had a past medical history of a prior stroke and 20(8.0%) had a TIA.

Brain imaging revealed that 194(77.9%) patients had an ischaemic stroke while 55(22.1) had a haemorrhagic event. These clinical characteristics of the study population are summarized in table 2.

Table 2: Clinical Characteristics of the Study Population

Clinical feature	Frequency	Percent
Time of day of symptom onset		
At wake up	82	32.9
Morning	111	44.6
Afternoon	39	15.7
Night	17	6.8
Duration of symptoms before presentation to the hospital		
<24 hours	59	23.7
≥24hours to one week	155	62.2
≥one week	35	14.1

Presenting symptoms at presentation	172	69.1
Focal neurological deficit	95	38.2
Headache	101	40.6
Acute confusional state	149	59.8
Speech disturbance	65	26.1
Loss of consciousness	19	7.6
Seizures		
Past medical history		
Hypertension	226	90.8
Diabetes mellitus	67	26.9
Dyslipidaemia	33	13.3
Prior TIA	20	8.0
Prior stroke	58	23.3
Social history		
Significant current alcohol use	31	12.4
Current tobacco use	12	4.8
Stroke subtype		
Ischaemic	194	77.9
Haemorrhagic	55	22.1

On admission of these hypertensive stroke patients, the average mean arterial pressure (MAP) was 119.8 ± 21.7 mmHg, 196(78.7%) persons had an increased systolic blood pressure (SBP) ≥ 140 mmHg (range 240 to 92 mmHg) while 179(71.9%)

had diastolic hypertension with diastolic blood pressures (DBP) ≥ 90 mmHg (range 199 to 62 mmHg). Only 52(20.9%) had increased random blood glucose (RBG) ≥ 11.1 mmol/l. These findings of the study population are shown in table 3.

Table 3: Blood Pressure and Blood Glucose Values in the Study Population

Characteristic	Mean (SD)
Random blood glucose (mmol/l)	9.7 $\pm$ 6.6
Prevalence of hyperglycaemia	20.9%
Systolic blood pressure (mmHg)	161.4 $\pm$ 30.1
Prevalence of systolic hypertension	78.7%
Diastolic blood pressure (mmHg)	98.9 $\pm$ 20.6
Prevalence of diastolic hypertension	71.9%
Mean arterial pressure (mmHg)	119.8 $\pm$ 21.7

At the end of 30 days, 62(24.9%) persons died while 187(75.1%) were alive. The sociodemographic and clinical characteristics of the deceased patients revealed a significant relationship between increasing age and mortality as well as the mean SBP which was significantly higher in the patients that died as shown in table 4. There was no significant relation between sex or stroke subtype with mortality and although the mean DBP, MAP and RBG were higher in the deceased patients, this was not statistically significant.

Table 4: Relationship between Patients' Characteristics and Mortality at 30 Days

Patient's characteristics	Mortality at 30 days		χ^2	p value
	Dead frequency (%)	Alive frequency (%)		
Age group				
<40years	2(18.2)	9(81.8)	30.46	0.021
40-59years	19(19.6)	78(80.4)		
≥ 60 years	41(29.1)	100(70.9)		
Sex				
Male	27(24.8)	82(75.2)	1.002	0.543
Female	35(25.0)	105(75.0)		
Stroke subtype				
Ischaemic	46(23.7)	148(76.3)	2.663	0.480
Haemorrhagic	16(29.1)	39(70.9)		
Random blood glucose(mmol/l) *	9.7 $\pm$ 4.9	9.7 $\pm$ 4.9		0.910 α
Systolic blood pressure (mmHg) *	166.9 $\pm$ 31.8	149.5 $\pm$ 29.4		0.045 α
Diastolic blood pressure (mmHg) *	99.8 $\pm$ 22.5	98.7 $\pm$ 20.1		0.694 α
Mean Arterial pressure (mmHg) *	122.2 $\pm$ 23.2	118.9 $\pm$ 21.2		0.309 α

Key. *=mean $\pm$ SD, α =student's t test

Discussion

Stroke causes and haemodynamic consequences are heterogeneous which makes the management of blood pressure in stroke patients complex, requiring an accurate diagnosis and precise definition of therapeutic goals. [16] This was a hospital-based descriptive cross-sectional study of 249 adult hypertensive patients who received a clinical diagnosis of stroke at the Rivers State University Teaching Hospital.

The World Stroke Organization has reported that "annually, 53% of all strokes occur in people below 70 years of age" and this is not dissimilar from the mean age of the study population of 60.7 years which is in tandem with reports from other West African researchers where stroke reportedly occur more in younger and middle- aged persons between the fourth to sixth decades of life [4, 17-19].

Globally, strokes tend to occur at an earlier age in men than women as men have a higher incidence of stroke than women at younger ages, with the incidence reversed by the age of 75 years, although recent data suggests this may not be the case for black people as the stroke risk for black women aged 65 to 74 years was similar when compared with black men; and this study observed a slightly

greater occurrence of stroke as a complication of hypertension in more women than men. This finding could be driven by race and sex group differences for stroke risk factors, mainly hypertension as well as the health seeking behaviour of women [18,20,21]. Whereas research indicates that stroke prevalence is generally higher in rural dwellers compared to urban dwellers, the reversed was observed in this study and this may be explained by the urban metropolitan setting of this institution utilized for the study [22,23].

Worldwide, stroke symptoms are commonly noticed in the morning or on waking also known as the “wake up stroke” accounting for over 20% of all acute ischemic strokes. This was not different from the observed pattern in this study as 77.5% of the patients’ symptoms were first noticed in the morning or on waking [24]. Additionally, focal neurological deficit was observed as the most common presenting symptom among the cohort. In a 2015 study by Ogbale et al, the reported average time of presentation of stroke patients for neuroimaging and care was approximately 70 hours. Furthermore, Ekeh et al from their 2014 study concluded that stroke patients in Nigeria present late as only 10.1% of their cohort presented within the 3-hour period stipulated for intervention [25,26]. Similarly, only 23.7% of the stroke patients in this study presented within 24 hours of onset of symptoms and up to 14.1% presented much later after 7 days for diagnosis and treatment. This late presentation may adversely affect outcomes as the window for fibrinolytic therapy has closed by the time a majority of the patients in the study presented to the hospital.

Hypertension is common, and poorly controlled hypertension has been identified as the most prevalent modifiable risk factor for stroke in Africa. In this study, almost all (90%) of the respondents were aware of their hypertensive status but still developed a debilitating complication of hypertension. It is noteworthy to mention that stroke is highly preventable and 84% of the stroke burden reported in 2021 were attributable to a few modifiable risk factors including some risk factors observed in this study such as hypertension, diabetes mellitus, and obesity [16,20,27].

Global reports indicate that a large proportion of strokes (85%) are ischaemic while 15% are haemorrhagic. Similarly, multiple Nigerian studies have reported that ischaemic stroke is commoner in Nigeria accounting for over 70% of all stroke cases [28-30]. In this study of hypertensive patients, ischaemic stroke was also more common, emphasizing the effect of blood pressure on atherosclerosis and vascular obstruction [8,9].

Sub-Saharan Africa has been reported to have the highest incidence and case-fatality from stroke in the world. A 30-day in hospital case- fatality rate of 24.9% was detected in this study with increasing age and a higher systolic blood pressure identified as the major contributors to mortality. Factors associated with stroke among hypertensive patients are not consistent across different studies and there are limited studies particularly to hypertensive stroke [9,10]. An equivalent case fatality rate was reported in an Ethiopian study where elevated alanine aminotransferase levels, diagnosis of stroke clinically alone, brain oedema, and a high National Institute of Health Stroke Scale (NIHSS) score were the independent predictors of 30-day mortality while discharge against medical advice and severe modified Rankin score at discharge predicted 60-day mortality [31].

A rise in blood pressure can be common after a stroke, and in some cases, it can be superimposed on chronic hypertension. The

elevated blood pressure can also be due to mental stress, centrally mediated mechanism, or neuroendocrine factors (activation of sympathetic nervous system, renin–angiotensin system, and glucocorticoid systems) [32,33]. The increased blood pressure post-acute stroke could have a beneficial effect to improve cerebral blood flow to the ischaemic regions of the brain as a few older studies have shown better functional recovery in patients who presented with a higher BP [34,35]. However, more recent studies demonstrate that elevated blood pressure in the acute phase post strokes have been consistently associated with worse outcomes including in hospital mortality, functional disability, increased incidence of recurrent stroke, haemorrhagic transformation in ischaemic strokes, and cerebral oedema [32,36,37]. In our study, over 70% of patients presented with post-stroke hypertension with either systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg, a BP range that is considered to be a relative contraindication for thrombolytic therapy in the patients who had ischaemic stroke [4].

Conclusion

This study highlights the significant association between elevated blood pressure and adverse outcomes in stroke patients at Rivers State University Teaching Hospital, emphasizing the urgency of optimizing blood pressure management in acute stroke care. Hypertension is an important modifiable risk factor for stroke, therefore implementing community-based hypertension screening and education programs to enhance early detection of hypertension and adherence to antihypertensive therapies as well as strengthening acute stroke protocols especially pertaining to BP control can help to mitigate stroke-related morbidity and mortality in Nigeria.

Statement of Ethical Approval

Ethical approval was obtained from the Health Research Ethics Committee and individual written informed consent was obtained from all participants before recruitment. (RSUTH/REC/2022226).

Disclosure of Conflict of Interest

The authors declare no conflict of interest

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