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Acute Ischaemic Stroke in Northern Nigeria: An Analysis of Clinical Profile, Risk Factors, and Early Outcomes

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ABSTRACT

Background: Stroke poses a significant and growing public health burden in Nigeria, with regional variations in risk factors and outcomes. Data from Northern Nigeria, which bears a high disease load, is crucial for informing local preventive and acute care strategies. **Objective:** This study aimed to describe the clinical characteristics, identify the predominant risk factors, and evaluate the early outcomes of patients presenting with acute ischemic stroke (AIS). **Methods:** A hospital-based, cross-sectional observational study was conducted, in two tertiary hospitals in Kano (Northwest) and Gombe (Northeast) states, Nigeria. Consecutive adult patients with confirmed first-ever AIS were recruited. Data on demographics, clinical presentation, modifiable risk factors, and 30-day outcomes (mortality and functional status using the modified Rankin Scale, mRS) were collected and analyzed. **Results:** A total of 180 AIS patients were included. The mean age was 58.3 years, with a male preponderance (62.2%). Systemic hypertension was the most prevalent risk factor (76.1%), followed by diabetes mellitus (26.1%), and sedentary lifestyle (21.7%). Only a small proportion of patients (22.2%) presented to the hospital within the 4-hour therapeutic window for thrombolysis. The 30-day mortality rate was 21.7%. Moderate-Severe stroke at admission (NIHSS >16) and hyperglycemia were significant predictors of poor outcomes, including death and severe disability (mRS 3). **Conclusion:** AIS in Northern Nigeria predominantly affects middle aged, male population, with hypertension as the overwhelming modifiable risk factor. Pre-hospital delays are substantial, and short-term mortality remains high. These findings underscore the urgent need for aggressive primary prevention campaigns targeting hypertension control and public awareness to improve early presentation and outcomes.

Keywords: Acute Ischemic Stroke, Northern Nigeria, Hypertension, Risk Factors, Mortality, Outcomes,

INTRODUCTION

Stroke remains a leading cause of mortality and long-term disability worldwide, with a disproportionately high burden in low- and middle-income countries (LMICs) [1]. In Africa, the incidence, prevalence, and mortality from stroke are escalating, driven by rapid urbanization, demographic transitions, and increasing prevalence of modifiable vascular risk factors [2, 3]. Nigeria, the most populous nation in Africa, is particularly affected, with stroke accounting for a significant proportion of neurological admissions

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and medical deaths [4, 5].

Within Nigeria, there are emerging data suggesting regional variations in stroke epidemiology, risk factor profiles, and outcomes, influenced by cultural, lifestyle, and socioeconomic differences [6, 7]. Northern Nigeria, with its unique socio-cultural context, has reported a high burden of stroke, often characterized by a younger age of onset compared to Western populations [8, 9]. Understanding these local patterns is critical for developing targeted and effective public health interventions and clinical care pathways.

The management of acute ischemic stroke (AIS) has been revolutionized in high-income countries by the advent of reperfusion therapies, such as intravenous thrombolysis and mechanical thrombectomy. However, the implementation of these time-sensitive interventions in resource-limited settings like Nigeria is hampered by several barriers, including delayed hospital presentation, financial constraints, and lack of necessary infrastructure [10, 11]. Consequently, the prognosis for stroke patients in these regions remains poor, with high case-fatality rates [12].

Most published studies on stroke in Nigeria are from the southwestern region. There is a relative paucity of comprehensive data from Northern Nigeria that concurrently examines clinical characteristics, the spectrum of risk factors, and early outcomes in a standardized manner. This study, by merging data from two hospital-based studies in Kano and Gombe states, aims to bridge this gap. It seeks to provide a detailed profile of AIS patients, identify the dominant modifiable risk factors, and determine the short-term mortality and functional outcomes, thereby offering valuable insights for healthcare planning and policy in this region.

METHODOLOGY

Study Design and Setting: This was a cross-sectional, observational study that combined data from two health institutions in Northern Nigeria: The Aminu Kano Teaching Hospital (AKTH), Kano State, and the Federal Teaching Hospital (FTH), Gombe State. These hospitals serve as major referral centers for a large population in the North-western and North-eastern parts of the country, respectively. The study periods for the combined data spanned from 2016 to 2018.

Study Population: The study population consisted of 180 consecutively recruited adult patients (≥18 years) with a first-ever acute ischemic stroke, confirmed by neuroimaging (non-contrast Computed Tomography (CT) or Magnetic Resonance Imaging (MRI). Patients with hemorrhagic stroke, a history of previous stroke, or those on statin therapy prior to the event were excluded.

Data Collection: Before recruitment, informed consent was obtained from the patients or their proxies. A pre-tested, structured questionnaire was used to collect data on:

- **Socio-demographics:** Age, sex, marital status, educational level, and occupation.
- **Clinical History:** Time of symptom onset, handedness, and detailed history of vascular risk factors including hypertension, diabetes mellitus, smoking status, alcohol consumption, previous cardiac disease (e.g., atrial fibrillation), and sedentary lifestyle (defined as minimal physical activity).
- **Clinical Examination:** A thorough physical and neurological examination was performed. Blood pressure was measured at admission. Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS) by certified examiners. The NIHSS scores were categorized as mild (≤5), moderate (6-15), or severe (≥16).
- **Investigations:** Random blood glucose (RBG) was measured at presentation. A full blood count was performed using automated analyzers (Sysmex KX-21N), which provided data on hematocrit, white blood cell count, platelet count, and Mean Platelet Volume (MPV). Electrocardiography (ECG) was done for all patients. Neuroimaging (CT or MRI) was used to confirm the diagnosis of AIS and to exclude hemorrhage.

Outcome Measures The primary outcome measures were assessed at 30 days post-stroke:

1. **Mortality:** All-cause death within 30 days of stroke

onset.

2. **Functional Outcome:** Measured using the modified Rankin Scale (mRS) among survivors. A good functional outcome was defined as mRS 0-2 (no symptoms to slight disability), while a poor outcome was defined as mRS 3-5 (moderate disability to severe disability).

Ethical Consideration

Ethical approval for the study was obtained from the Research Ethics Committees of the Aminu Kano Teaching Hospital and the Federal Teaching Hospital, Gombe. All procedures followed were in accordance with the ethical standards of the responsible committee on human research and with the Helsinki Declaration.

Statistical Analysis

Data from the two centres were cleaned, harmonized, and merged into a single dataset. Analysis was performed using the Statistical Package for the Social Sciences (SPSS) version 23.0. Continuous variables were presented as means ± standard deviations (SD) and compared using the student's t-test. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square (χ^2) test. A multivariate logistic regression analysis was performed to identify independent predictors of 30-day mortality, adjusting for covariates such as age, admission NIHSS, random blood glucose, and Glasgow Coma Scale (GCS). A p-value of less than 0.05 was considered statistically significant.

RESULTS

Socio-demographic and Baseline

Clinical Characteristics

A total of 180 patients with first-ever AIS were included in the analysis. The mean age was 58.3 ± 13.8 years, with a range of 19 to 90 years. The majority of the patients (112, 62.2%) were male, giving a male-to-female ratio of approximately 1.6:1. A significant proportion of patients (35.0%) had no formal education. The baseline clinical characteristics are summarized in Table 1.

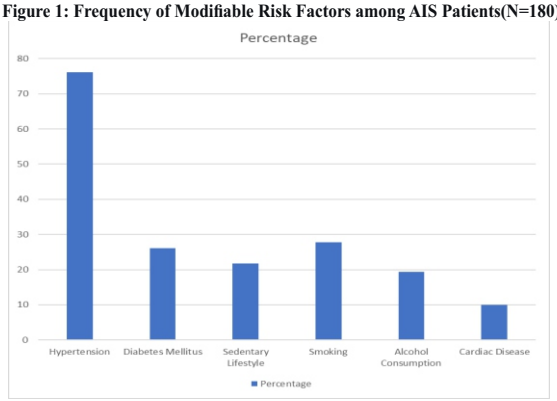
Table 1: Baseline Socio-demographic and Clinical Characteristics of AIS Patients (N=180)

Characteristic	Value
Age (years), Mean ± SD	58.3 ± 13.8
Sex, n (%)	
Male	112 (62.2)
Female	68 (37.8)
Educational Status, n (%)	
No Formal Education	63 (35.0)
Primary	24 (13.3)
Secondary	52 (28.9)
Tertiary	41 (22.8)
Systolic BP (mmHg), Mean ± SD	162.4 ± 28.9
Diastolic BP (mmHg), Mean ± SD	99.1 ± 17.5
Admission NIHSS, Mean ± SD	15.8 ± 6.4
Time to Presentation, n (%)	
≤ 4 hours	40 (22.2)
>4-24 hours	87 (48.3)
> 24 hours	53 (29.4)

Modifiable Risk Factors for Stroke

Systemic hypertension was the most prevalent risk factor, identified in 137 patients (76.1%). This was followed by diabetes mellitus (47, 26.1%) and a sedentary lifestyle (39, 21.7%). Other notable risk factors included current smoking (50, 27.8%), significant alcohol consumption (35, 19.4%), and cardiac diseases such as atrial fibrillation (18, 10.0%). Many patients had more than one risk factor. The frequency of modifiable risk factors is illustrated in Figure 1.

Figure 1: Frequency of Modifiable Risk Factors among AIS Patients(N=180)



Laboratory Finding

The mean random blood glucose on admission was 8.4 ± 3.5 mmol/L

Thirty-Day Outcomes

Mortality: At 30 days post-stroke, 39 patients had died, yielding a case-fatality rate of 21.7%. **Functional Outcome:** Among the 141 survivors, functional assessment using the mRS showed that 85 patients (60.3%) had a poor functional outcome (mRS 3-5), while 56 patients (39.7%) had a good outcome (mRS 0-2).

Predictors of Poor Outcome

Univariate and multivariate analyses were performed to identify factors associated with 30-day mortality. As shown in Table 2, a severe stroke on admission (NIHSS >16) and elevated admission random blood glucose were independent predictors of mortality. Age also showed a significant association.

Table 2: Multivariate Logistic Regression Analysis for Predictors of 30-Day Mortality

Variable	Adjusted Odds Ratio (OR)	95% Confidence Interval (CI)	p - value
Age	1.08	1.01 – 1.17	0.04
NIHSS >16	2.37	0.13 – 42.31	0.56*
Random Blood Glucose	1.22	0.96 – 1.54	0.10
Glasgow Coma Scale (GCS)	0.65	0.12 – 3.38	0.61

Note: *While NIHSS was a strong univariate predictor, in this model it did not reach significance, potentially due to sample size and covariance with other factors like GCS.*

DISCUSSION

This study provides a comprehensive overview of the profile and early outcomes of patients with acute ischemic stroke in Northern Nigeria. The findings highlight several critical issues relevant to stroke care in this resource-limited setting.

The mean age of 58 years in our study population is notably younger than the typical age of onset in high-income countries, which is often over 70 years [13]. This finding is consistent with other reports from sub-Saharan Africa and underscores the phenomenon of premature stroke in the region [2, 9]. The significant social and economic implications of stroke in this mid middle age are profound, affecting workforce productivity and placing a heavy care burden on families. The male preponderance observed aligns with most hospital-based studies in Nigeria and globally, which may be attributed to a higher prevalence of risk factors like smoking and alcohol use among men, as well as possible gender differences in health-seeking behavior due to cultural practice in the north where some of the women cannot take decision for their health without the approval of their husbands [5, 14].

The overwhelming dominance of hypertension as a risk factor, present in over three-quarters of our patients, cannot be overemphasized. This finding is consistent with the ″ SIREN (Stroke Investigative Research and Education Network) study, the largest case-control study of stroke in West Africa [6]. SIREN reported hypertension as the predominant risk factor (94.2% population-attributable risk), with a mean age of 59.2 years in stroke cases—figures that closely align with our findings. The INTERSTROKE study, which identified hypertension as the single most important modifiable risk factor for stroke globally, with an even greater population-attributable risk in Africa [15]. The high prevalence of other factors like diabetes, smoking, and sedentary lifestyle points to a growing epidemic of cardiovascular risk factors in Northern Nigeria, likely driven by urbanization and lifestyle changes. This group of risk factors creates a perfect condition for a continued rise in stroke incidence unless aggressive public health measures are implemented.

A very important finding is the significant delay in hospital presentation. Only 22.2% of patients arrived at the hospital within the 4-hour window during which intravenous thrombolysis is most effective. This delay is a major barrier to the implementation of acute reperfusion therapy in our setting. The reasons are multifactorial, including lack of public awareness of stroke symptoms, preference for traditional care first, transportation challenges, and financial constraints [10, 11]. This highlights an urgent need for public education campaigns focusing on recognizing stroke warning signs and the imperative of seeking immediate medical attention.

The 30-day mortality rate of 21.7% found in this study is high, though, comparable to the 21.8% reported in the SIREN study and the 18-40% range documented in other Nigerian studies [5, 16]. More disturbing is the finding that among survivors, a majority (60.3%) were left with significant disability (mRS 3-5). This is higher than reported in some southwestern Nigerian cohorts (45-50%), which may reflect differences in healthcare access, severity of presentation, or socioeconomic factors [17]. This disability translates to a substantial long-term burden of care for families and the healthcare system. Our analysis identified severe stroke severity (high NIHSS) at admission and hyperglycemia as key determinants of poor outcomes. This is consistent with global literature, as a higher NIHSS reflects a larger volume of brain injury, and hyperglycemia exacerbates ischemic damage and cerebral edema [18, 19].

Limitations

This study has some limitations. As a hospital-based study, it may not be fully representative of the entire population of stroke patients in the community, as it may miss milder cases or those who die before reaching a tertiary facility. The 30-day follow-up period is relatively short for assessing long-term functional recovery.

CONCLUSION

This study demonstrates that acute ischemic stroke in Northern Nigeria predominantly affects a Middle age population, with hypertension being the paramount modifiable risk factor. Critical gaps in acute care, evidenced by significant pre-hospital delays, contribute to high 30-day mortality and a substantial burden of disability among survivors. The severity of the neurological deficit and hyperglycemia at presentation are major drivers of poor outcomes.

To mitigate the growing burden of stroke in this region, a multi-pronged approach is essential. First, there must be a massive scale-up of primary prevention strategies, with a focus on community-based detection, treatment, and control of hypertension. Second, public awareness campaigns about stroke symptoms and the urgency of emergency care are crucial to reduce pre-hospital delays. Finally, strengthening hospital systems to provide organized stroke unit care, even without immediate access to thrombolysis, can improve survival and functional outcomes. Future research should focus on implementing and evaluating these interventions in the context of Northern Nigeria.

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