Research Article **ISSN 2835-6276**

American Journal of Medical and Clinical Research & Reviews

Patterns of Clinical Presentation and Radiological Findings in Patients with Haemorrhagic Stroke Reviewed by the Neurosurgery Service at a Tertiary Hospital in Southern Nigeria

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Received: ***01 Sep 2026;*** ***Accepted:*** ***05 Sep 2026;*** ***Published:*** ***10 Sep 2026***

Citation: Hart IT, Linda Iroegbu-Emeruem. Patterns of Clinical Presentation and Radiological Findings in Patients with Haemorrhagic Stroke Reviewed by the Neurosurgery Service at a Tertiary Hospital in Southern Nigeria. AJMCRR. 2026; 5(9): 1-15.

Abstract

Background: *Haemorrhagic stroke (HS) carries disproportionate mortality in sub-Saharan Africa, where hypertension is highly prevalent and often inadequately controlled. Understanding the clinical and radiological profile of HS patients referred for neurosurgical evaluation is essential for guiding prevention and resource allocation.*

Objective: *To describe the demographic characteristics, clinical presentation, risk factor profile (with emphasis on hypertension), and computed tomography (CT) findings of patients with non-traumatic HS reviewed by the neurosurgery service at Rivers State University Teaching Hospital, southern Nigeria.*

Methods: *This retrospective cross-sectional study included consecutive patients with CT-confirmed, non-traumatic HS reviewed by neurosurgery over 12 months (March 2025 – February 2026). Patients managed solely by neurologists without neurosurgical consultation were excluded. Data on demographics, risk factors, symptoms, examination findings, CT features, ICH score, and WFNS grade were analysed using descriptive statistics.*

Results: *Sixty-two patients were included (56.5% male; mean age 53.4 ± 11.5 years). Hypertension was the dominant risk factor, documented in 79.0% of the cohort and 96.1% of patients with recorded blood pressure status. Loss of consciousness (72.6%) was the most common presenting symptom. The mean admission Glasgow Coma Scale score was 8.8 ± 3.7, with 50.8% of patients presenting with severe impairment (GCS 3–8). On CT, deep hypertensive-type haemorrhages predominated: capsuloganglionic/basal ganglia (33.9%) and thalamic (27.1%). Intraventricular extension occurred in 58.1% and hydro-*

cephalus in 38.7%. Disease severity was objectively high: among 50 patients with a calculated ICH score, 18 (36.0%) scored 3 or 4, indicating high predicted mortality; among 30 patients graded on the WFNS scale, 25 (83.3%) presented in poor grade (WFNS 4 or 5). In-hospital mortality was 32.3%.

Conclusion: *Patients with haemorrhagic stroke referred to the neurosurgery service in our centre present with profound neurological compromise, as reflected by low admission GCS, high ICH scores, and predominantly poor WFNS grades. Hypertension remains the overwhelming modifiable risk factor. These findings underscore the urgent need for community-based hypertension control programmes and strengthened neurosurgical critical care capacity in southern Nigeria.*

Keywords: Haemorrhagic stroke, intracerebral haemorrhage, hypertension, neurosurgery, Nigeria, sub-Saharan Africa, ICH score, WFNS grade.

Introduction

Stroke remains a leading cause of mortality and long-term neurological disability worldwide, accounting for up to 11.3% of all deaths globally.[1] While ischemic stroke predominates in high-income countries, haemorrhagic stroke (HS) – including intracerebral haemorrhage (ICH), subarachnoid haemorrhage (SAH), and intraventricular haemorrhage – carries a disproportionately high burden, responsible for nearly half of all stroke-related deaths despite constituting only 10–20% of all strokes. The one-month mortality for ICH ranges from 30% to 55% in resource-limited settings, and survivors often face devastating neurological deficits.[2,3]

In sub-Saharan Africa, the epidemiology of stroke differs significantly from Western populations. Studies from Nigeria have reported a higher proportion of HS, ranging from 25% to 45% of all strokes, largely attributable to the high prevalence of undetected, untreated, or poorly controlled hypertension.[4-6] Additional risk factors such as diabetes mellitus, substance use, coagulopathies, and structural vascular lesions (e.g., aneurysms, arteriovenous malformations) contribute to the burden.[3] However, robust epidemiological data from the Niger Delta region – an area characterized by unique socioeconomic, environmental, and healthcare challenges – remains sparse.

Rivers State University Teaching Hospital (RSUTH) serves as a major tertiary referral centre for Port Harcourt and the surrounding Niger Delta states. The hospital is equipped with functional computed tomography (CT) and magnetic resonance imaging (MRI) facilities, enabling timely radiological diagnosis. Within the hospital, the management of HS follows a collaborative model: neurologists provide primary medical management, while neurosurgeons are consulted for patients with significant mass effect, intraventricular haemorrhage with hydrocephalus, cerebellar haemorrhage, deteriorating neurological status, or aneurysmal SAH warranting surgical intervention. However, not all patients with HS are referred to the neurosurgery service; those with smaller hematomas, stable neurology, or contraindications to surgery may be managed exclusively by the neurology team without neurosurgical input.

To date, no systematic study has described the patterns of clinical presentation and radiologic findings specifically among patients with HS reviewed

by the neurosurgery service at RSUTH. This subgroup is clinically important, as they generally represent more severe haemorrhages with higher morbidity and mortality, posing unique challenges in our setting – including affordability of surgery, intensive care unit bed availability, and timely access to operating theatres. Such data are essential for guiding neurosurgeons, informing preoperative counselling, advocating for resources tailored to surgically-relevant HS, and establishing a baseline for future outcomes research.

Therefore, we undertook this retrospective, descriptive cross-sectional study to document the demographic characteristics, clinical features at presentation, and CT findings of consecutive patients with non-traumatic HS reviewed by the neurosurgery service at RSUTH over a 12-month period (March 2025 to February 2026). Patients with HS managed solely by the neurology team without neurosurgical consultation were excluded. By delineating the pattern of disease in this neurosurgery-reviewed cohort, we hope to provide actionable insights for neurosurgeons, neurologists, and health planners working to reduce the burden of severe HS in southern Nigeria and similar settings across sub-Saharan Africa.

Methods

This retrospective cross-sectional study was conducted at the Neurosurgery Service of Rivers State University Teaching Hospital (RSUTH), Port Harcourt, Nigeria, a major tertiary referral centre for the Niger Delta region equipped with functional computed tomography (CT) and magnetic resonance imaging (MRI) facilities. The Neurosurgery Service collaborates closely with the Neurology Unit. Patients with suspected stroke are initially evaluated in the emergency department or medical wards. Neurologists provide primary medical management, while neurosurgeons are consulted for patients with haemorrhagic stroke demonstrating significant mass effect, intraventricular haemorrhage with hydrocephalus, cerebellar haemorrhage (>3 cm or with brainstem compression), deteriorating neurology, aneurysmal subarachnoid haemorrhage (SAH), or large lobar haemorrhages (>30 cm^3) in young or deteriorating patients. Patients with small hematomas, stable neurology, or contraindications to surgery were managed exclusively by neurologists without neurosurgical consultation and were excluded from this study.

The study covered a 12-month period from 1st March 2025 to 28th February 2026. All consecutive patients meeting inclusion criteria were enrolled (total population sampling). Inclusion criteria were: non-traumatic haemorrhagic stroke confirmed by CT, review by the neurosurgery service (at neurology request, directly from emergency department, or primary neurosurgery presentation), age ≥12 years, and available medical records and CT images. Exclusion criteria were: haemorrhagic stroke managed exclusively by neurologists without neurosurgical consultation, traumatic intracranial haemorrhage, haemorrhagic conversion of ischemic infarct, and incomplete records or unavailable CT images.

Data were extracted retrospectively from patient case notes, emergency and neurosurgery ward registers, CT reports, and theatre records. A structured proforma was used, and data were entered into Microsoft Excel. Demographic variables collected included age, sex, and occupation. Clinical presentation documented the presence or absence of headache, vomiting, seizures, loss of consciousness, limb weakness, speech impairment, and visual disturbance. Examination findings included Glasgow

Coma Scale (GCS) recorded as eye, verbal, and motor subscores with total GCS categorised as mild (13–15), moderate (9–12), or severe (3–8). Pupil examination was described (reactive, sluggish, unreactive, pinpoint, anisocoric, or fixed). Systolic and diastolic blood pressures (SBP, DBP) were recorded in mmHg, and mean arterial pressure (MAP) was calculated as DBP + 1/3(SBP – DBP). Motor deficit was described (hemiparesis, hemiplegia, quadriparesis, paraparesis, or none) with side of weakness recorded. Medical history and risk factors included hypertension, diabetes mellitus, previous stroke, substance use (alcohol, tobacco), anticoagulant or antiplatelet use, and other relevant history (HIV, sickle cell disease, kidney disease, etc.) captured as free text.

All patients underwent non-contrast cranial CT scan reviewed by the attending neurosurgeon and a radiologist when available. Radiologic findings recorded included main bleed location (basal ganglia, thalamus, lobar, cerebellum, brainstem, capsular/capsuloganglionic, intraventricular, SAH, or ACA territory), with sub-location specified for basal ganglia (putamen/globus pallidus vs. caudate) and lobar (frontal, parietal, temporal, occipital, or parietooccipital) haemorrhages. Bleed side (right, left, bilateral, or midline), intraventricular extension (IVH), midline shift (MLS, measured in mm where recorded), and hydrocephalus were documented. Hematoma volume (cm^3) was calculated using the ABC/2 method where available or taken from the radiology report. Other descriptive findings were recorded as free text. Severity scores included the ICH Score (0–6 based on GCS, volume, IVH, infratentorial origin, and age) and WFNS grade for SAH patients. For descriptive context, management and outcome variables were collected: ICU admission, surgery (yes/no and type: decompressive craniotomy, haematoma evacuation, external ventricular drain, aneurysm clipping, suboccipital craniotomy), discharge status (alive, dead, transferred, left against medical advice), length of stay (LOS), and free-text comments.

To ensure data quality, two authors independently reviewed a random 10% of records, with discrepancies resolved by consensus. Incomplete entries were cross-checked with original case notes, and all patient identifiers were removed for anonymisation. Data were analysed using IBM SPSS Statistics Version 26.0 and Microsoft Excel. Descriptive statistics summarised all variables. Categorical variables (sex, symptoms, risk factors, bleed location, IVH, MLS, hydrocephalus) were presented as frequencies and percentages. Continuous variables (age, GCS, blood pressures, MAP, hematoma volume, LOS) were tested for normality using the Shapiro-Wilk test. Normally distributed data were presented as mean ± standard deviation; non-normally distributed data as median with interquartile range. Subgroup comparisons (e.g., bleed location versus GCS category) used chi-square tests for categorical variables and independent t-tests or Mann-Whitney U tests for continuous variables as appropriate, with $p < 0.05$ considered statistically significant. Data visualisation was performed using Excel and SPSS.

Ethical approval was obtained from the Health Research Ethics Committee of RSUTH, Port Harcourt. The requirement for written informed consent was waived due to the retrospective nature of the study with no direct patient contact. All patient data were anonymised, confidentiality was maintained, and no individual identifiers are reported. The study adhered to the Declaration of Helsinki (2013 revision).

Results

A total of 62 patients with haemorrhagic stroke were reviewed by the neurosurgical service during the study period. Denominators differ between variables because not every parameter was recorded for every patient; the relevant denominator is stated wherever it differs from the full cohort of 62.

Demographic Characteristics

The mean age of the cohort was 53.4 ± 11.5 years (median 52 years; range 12–82 years). The burden of disease was concentrated in the productive middle decades, with the 40–49, 50–59 and 60–69 year age bands each accounting for 18 patients (29.0%), together comprising 87.1% of the cohort. There was a modest male preponderance, with 35 males and 27 females (male-to-female ratio 1.3:1).

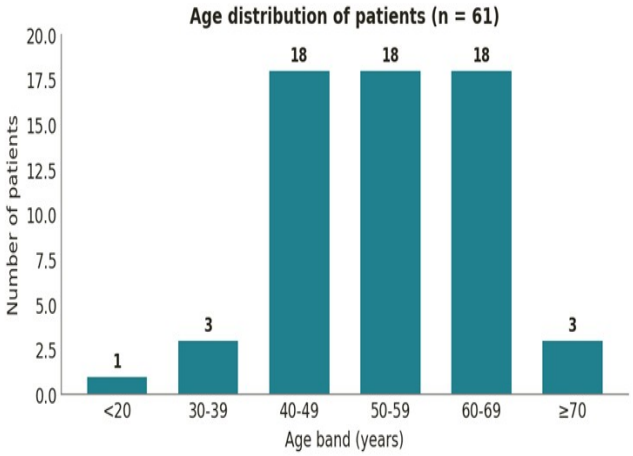

Figure 1. Age distribution of patients with haemorrhagic stroke (n = 61 with recorded age).

Table 1: Demographic characteristics and risk factors (N = 62).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	Mean ± SD = 53.4 ± 11.5; median 52; range 12–82	—	—
Sex	Male	35	56.5
	Female	27	43.5
Risk factors	Hypertension	49	79.0
	Alcohol use	15	24.2
	Diabetes mellitus	8	12.9
	Antiplatelet use	7	11.3
	Coagulopathy	5	8.1
	Previous stroke	3	4.8
	Tobacco use	2	3.2
	Substance abuse	2	3.2
	Anticoagulant use	1	1.6

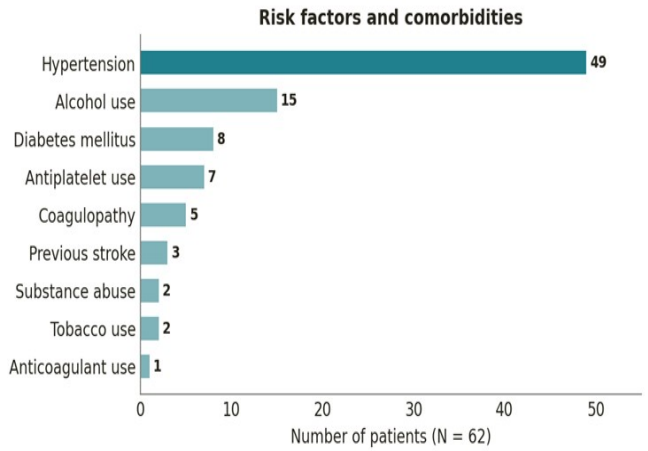

Figure 2. Frequency of risk factors and comorbidities (N = 62).

Clinical Presentation

The most common presenting feature was a depressed or altered level of consciousness, with loss of consciousness reported in 45 patients (72.6%). This was followed by headache in 29 (46.8%), limb weakness in 25 (40.3%), vomiting in 24 (38.7%), speech impairment in 19 (30.6%), seizures in 14 (22.6%) and visual disturbance in 2 (3.2%).

Table 2: Presenting clinical features (N = 62).

Clinical feature	Frequency (n)	Percentage (%)
Loss of consciousness / altered consciousness	45	72.6
Headache	29	46.8
Limb weakness	25	40.3
Vomiting	24	38.7
Speech impairment	19	30.6
Seizures	14	22.6
Visual disturbance	2	3.2

Neurological Status on Examination

The mean admission Glasgow Coma Scale (GCS) score was 8.8 ± 3.7 (median 8; range 3–15). The majority of patients presented in a poor neurological state: 30 patients (50.8% of the 59 with a recorded GCS) had severe impairment of consciousness (GCS 3–8), 16 (27.1%) were in the moderate range (GCS 9–12) and only 13 (22.0%) presented with mild impairment (GCS 13–15). On pupillary examination, 31 patients had bilaterally reactive pupils, while prognostically important abnormalities were frequent: 15 had sluggishly reactive pupils, 5 were unreactive, 4 had pinpoint pupils, and single patients demonstrated anisocoria and fixed dilated pupils.

Patients were markedly hypertensive at presentation, with a mean systolic blood pressure of 185.2 ± 35.6 mmHg (range 110–267 mmHg) and a mean diastolic blood pressure of 104.9 ± 22.0 mmHg (range 63–158 mmHg). A focal motor deficit was present in the great majority: hemiparesis in 23 patients, hemiplegia in 10, quadriparesis and quadriplegia in 4 each, and paraparesis in 1. Where lateralised, the deficit affected the left side in 17 patients and the right in 16, with bilateral weakness in 4.

Table 3: Neurological and haemodynamic findings on examination.

Parameter	Category	Value
GCS	Mean ± SD (median; range)	8.8 ± 3.7 (8; 3–15)
	Severe (3–8)	30 (50.8%)
	Moderate (9–12)	16 (27.1%)
	Mild (13–15)	13 (22.0%)
Pupils	Bilaterally reactive	31
	Sluggish	15
	Unreactive	5
	Pinpoint	4
	Anisocoria / fixed dilated	1 / 1

Blood pressure	Systolic, mean ± SD (range)	185.2 ± 35.6 (110–267)
	Diastolic, mean ± SD (range)	104.9 ± 22.0 (63–158)
	Mean arterial, mean ± SD (range)	131.6 ± 25.0 (82–194)
Motor deficit	Hemiparesis	23
	Hemiplegia	10
	Quadriparesis / quadriplegia	4 / 4
	Paraparesis / none	1 / 1

Radiological Findings

Computed tomography localised the haemorrhage in 59 patients. Deep, hypertensive-type haemorrhages predominated, accounting for 36 cases (61.0% of localised bleeds) — capsuloganglionic / basal ganglia bleeds in 20 (33.9%) and thalamic bleeds in 16 (27.1%). Infratentorial haemorrhage was identified in 8 patients (cerebellar in 6, and brainstem/pontine and posterior fossa in 1 each), primary intraventricular haemorrhage in 5 (8.5%) and lobar haemorrhage in 4 (6.8%). Aneurysmal subarachnoid haemorrhage accounted for 6 patients (9.7% of the cohort), most commonly arising from the anterior communicating artery. Where lateralised, the haemorrhage was left-sided in 28 patients and right-sided in 22.

Table 4: Radiological findings on cranial CT.

Radiological variable	**Category**	**Frequency / value**
Bleed location*	Capsuloganglionic / basal ganglia	20 (33.9%)
	Thalamus	16 (27.1%)
	Cerebellar	6 (10.2%)
	Aneurysmal SAH / skull base	6 (10.2%)
	Primary intraventricular	5 (8.5%)
	Lobar	4 (6.8%)
	Brainstem (pons) / posterior fossa	1 / 1 (3.4%)
Bleed side	Left	28
	Right	22
	Midline / bilateral	1 / 2
Haematoma volume (cm^3)	Mean ± SD (median; range), n = 45	18.2 ± 11.0 (16; 3–50)
	≥ 30 cm^3	7 (15.6%)
Secondary signs	Intraventricular extension	36 (58.1%)
	Hydrocephalus	24 (38.7%)
	Midline shift	13 (21.0%)
Severity scores	ICH score 3–4 (n = 50)	18 (36.0%)
	WFNS grade 4–5 (n = 30)	25 (83.3%)

*Location available in 59 patients; percentages calculated against this denominator.

The mean haematoma volume, recorded in 45 patients, was 18.2 ± 11.0 cm³ (median 16 cm³; range 3–50 cm³), with 7 patients (15.6%) having a volume of ≥ 30 cm³. Secondary radiological signs of severity were common: intraventricular extension was present in 36 patients (58.1%), hydrocephalus in 24 (38.7%) and midline shift in 13 (21.0%). Disease severity was further quantified by the ICH score, available in 50 patients, of whom 18 (36.0%) scored 3 or 4. Among the 30 patients graded on the World Federation of Neurosurgical Societies (WFNS) scale, 25 (83.3%) presented in poor grade (WFNS 4 or 5).

Management and Outcome

Twenty patients were admitted to the intensive care unit, and definitive surgery was performed in 8 patients, comprising decompressive or suboccipital craniotomy with haematoma evacuation, external ventricular drain insertion, and aneurysm clipping. A recurring and important finding was the inability to access recommended critical care or surgery for socioeconomic reasons: at least 13 patients who required ICU admission or an indicated neurosurgical procedure could not proceed because they could not afford care or because no ICU bed was available.

Outcome was documented in 31 patients. In-hospital mortality was recorded in 20 patients (32.3% of the cohort), frequently occurring early — before or shortly after presentation, or prior to a planned intervention — and in several instances driven by secondary complications such as sepsis, acute respiratory distress syndrome and multi-organ failure. A further 6 patients were referred to other facilities, 2 were discharged against medical advice, and a small number improved spontaneously without surgery.

Table 5: Management and in-hospital outcome.

Variable	Category	Frequency (n)
ICU admission	Admitted	20
Surgery	Performed	8
	Indicated but not done (cost / no bed)	≥13
Outcome (documented, n = 31)	In-hospital death	20 (32.3% of cohort)
	Referred out	6
	Discharged against medical advice	2
	Spontaneous improvement (no surgery)	3

Discussion

This study provides a detailed description of the clinical presentation and radiological findings of 62 patients with non-traumatic haemorrhagic stroke reviewed by the neurosurgery service at Rivers State University Teaching Hospital over a 12-month period. Our findings demonstrate that patients referred for neurosurgical evaluation in this southern Nigerian tertiary centre are predominantly middle-aged, hypertensive, and present with profound neurological compromise. Deep haemorrhages involving the basal ganglia and thalamus account for the majority of cases, and objective severity scores – including the ICH score and WFNS grade – indicate a cohort at high risk of

mortality.

Hypertension as the Dominant Driver

The most striking finding in our study is the overwhelming contribution of hypertension to haemorrhagic stroke in our cohort. Hypertension was documented in 79.0% of all patients and in 96.1% of those with recorded blood pressure status. This is consistent with reports from other Nigerian centres, where hypertension rates among haemorrhagic stroke patients range from 70% to 90%.[4-6] Ogun et al. in Ibadan reported hypertension in 82% of patients with primary intracerebral haemorrhage[5], while Komolafe et al. in Ile-Ife documented a similar prevalence.[6] Our finding that other traditional risk factors – diabetes mellitus (12.9%), alcohol use (24.2%), and antiplatelet use (11.3%) – were considerably less frequent further underscores hypertension as the predominant modifiable risk factor in our environment.

The high prevalence of hypertension in our cohort reflects several interconnected realities in the Niger Delta region. First, hypertension is widely underdiagnosed; many patients in our series were either unaware of their hypertensive status or were diagnosed for the first time on admission with stroke. Second, among those with a prior diagnosis, treatment adherence is poor, often due to cost of medications, inconsistent supply, reliance on traditional medicine, or lack of perceived illness. Third, lifestyle factors in an urbanising Nigerian setting – including high dietary salt intake, alcohol consumption, physical inactivity, and psychosocial stress – contribute to the rising burden of hypertension even in young and middle-aged adults. The mean age of our cohort (53.4 years) and the concentration of cases in the 40–69 year age bands (87.1% of patients) highlight the tragic loss of productive life years from a largely preventable disease.

Severity of Clinical Presentation

Our patients presented with remarkably severe neurological compromise. The mean admission GCS score of 8.8 ± 3.7, with over half (50.8%) in the severe category (GCS 3–8), indicates that the majority of patients were either stuporous or comatose at the time of neurosurgical review. This is a bit worse than reported in some other Nigerian series. For instance, a study from Enugu reported that 45.5% of patients were admitted with GCS ≤ 8/15, while a series from Lagos found only 35% presenting with GCS ≤ 8.[7,8] The greater severity in our cohort likely reflects a combination of factors: larger haematoma volumes (mean 18.2 cm^3, with 15.6% ≥ 30 cm^3), the high frequency of intraventricular extension (58.1%), and delays in presentation. Many patients in our setting first present to primary or secondary health facilities where CT is unavailable, losing critical hours before transfer to RSUTH.

The ICH score, a validated predictor of 30-day mortality, was calculated for 50 patients in our cohort.[9] Notably, 36.0% of these patients scored 3 or 4 – levels associated with predicted mortality of 72% to 97% in the original ICH score validation study.[9] This objective measure confirms what the clinical examination already suggested: our neurosurgery-reviewed cohort represents a group with extremely high acuity and poor expected outcomes. Similarly, among patients with aneurysmal subarachnoid haemorrhage, 83.3% presented with WFNS grade 4 or 5, the poorest prognostic categories.[10,11] These findings are sobering but important: they tell us that the patients who reach neurosurgical care in our setting are not the mild or moderate

haemorrhages, but rather the most severe cases – those who have survived long enough to reach a tertiary centre but often with irreversible brain injury already established.

Radiological Patterns

The radiological findings in our study align closely with the epidemiology of hypertensive haemorrhage. Deep-seated haemorrhages – capsulogangli-onic/basal ganglia (33.9%) and thalamic (27.1%) – together accounted for 61.0% of all localised bleeds. This distribution is consistent with the classic pathophysiology of hypertension-induced rupture of small penetrating arteries, particularly the lenticulostriate arteries supplying the basal ganglia and the thalamoperforating arteries supplying the thalamus.[3,12] Lobar haemorrhages (6.8%) were notably less common in our series, which contrasts with data from high-income countries where cerebral amyloid angiopathy accounts for a larger proportion of lobar bleeds, particularly in the elderly. The low rate of lobar haemorrhage in our predominantly middle-aged cohort further supports hypertension as the dominant aetiology, with cerebral amyloid angiopathy likely playing a minimal role.

The frequency of intraventricular extension (58.1%) and hydrocephalus (38.7%) in our cohort is higher than reported in many series from high-income countries, where rates of intraventricular extension typically range from 30% to 54%.[13,14] This difference likely reflects the larger haematoma volumes and deeper location of bleeds in our patients, as thalamic haemorrhages in particular have a predilection for rupturing into the ventricular system. The presence of hydrocephalus – often requiring external ventricular drainage – is a major determinant of poor outcome[15], yet in our setting, many patients who required an EVD could not receive one due to financial constraints or lack of ICU bed availability. This recurring theme of indicated but unfunded or unavailable care represents a critical ethical and practical challenge for neurosurgical practice in resource-limited Nigeria.[16]

Comparison with Other Nigerian and African Studies

Our findings are broadly consistent with other published series from Nigeria and sub-Saharan Africa. A study by Nwani et al. in Anambra State reported similar rates of hypertension (78%) and deep haemorrhage location (64%) among patients with intracerebral haemorrhage.[17] Likewise, Owolabi et al. in a multi-centre Nigerian stroke registry found that haemorrhagic stroke accounted for 32% of all strokes, with hypertension present in over 80% and deep haemorrhages predominating.[4] However, our patients appear to be more severely affected on presentation than those in many of these series. This is likely because our study specifically captured patients referred to the neurosurgery service, rather than all haemorrhagic stroke patients. In our institution, patients with small hematomas, stable neurology, or contraindications to surgery are managed by the neurology team without neurosurgical consultation and are therefore excluded from this analysis. The patients we see as neurosurgeons are, by definition, the sickest ones – those with mass effect, intraventricular extension, hydrocephalus, or deteriorating neurology.

The Challenge of Surgical Access and Socioeconomic Barriers

While not the primary focus of this paper, the management data from our cohort reveals a sobering reality. Only 8 patients (12.9%) underwent definitive surgery, despite many more having indications for intervention. At least 13 patients who required

ICU admission or a neurosurgical procedure could not receive it because they could not afford care or because no ICU bed was available. This pattern – patients dying before a planned intervention, or families signing against medical advice due to cost – is unfortunately familiar to neurosurgeons across sub-Saharan Africa.[16,18] The in-hospital mortality rate of 32.3% in our cohort, while high, may actually underestimate the true case fatality rate, as it does not account for patients who died before reaching the hospital or those taken home by families to die without formal documentation.[7,19] In high-income countries, 30-day mortality for intracerebral haemorrhage ranges from 30% to 50% even with full access to intensive care and surgery.[20] That our mortality rate falls within that range, despite severely limited resources, speaks to the severity of disease we are managing – and suggests that with better resources, outcomes might improve.

Strengths and Limitations

This study has several strengths. It is the first systematic description of haemorrhagic stroke patients reviewed by the neurosurgery service at RSUTH, providing a baseline for future research. The inclusion of consecutive patients over a 12-month period reduces selection bias, and the detailed characterisation of clinical and radiological features provides a comprehensive picture of the cohort. The use of validated severity scores (GCS, ICH score, WFNS grade) adds objectivity to our description of disease severity.

However, several limitations must be acknowledged. First, this is a retrospective study, and data completeness varied across variables. Not every patient had a recorded GCS, hematoma volume, or ICH score; denominators were therefore stated transparently throughout the results. Second, selection bias is inherent: we only included patients who reached RSUTH and were reviewed by neurosurgery. Patients who died before presentation, were managed solely by neurologists, or were treated at primary or secondary facilities are not represented. Third, the lack of long-term follow-up data means we could only report in-hospital mortality, not 30-day or one-year functional outcomes. Fourth, the single-centre design limits generalisability to other Nigerian or African settings with different populations and resources. Finally, the absence of a neurologist-only comparison group means we cannot directly compare the severity of neurosurgery-reviewed patients with those managed medically without consultation.

Implications for Clinical Practice, Public Health, and Policy

Our findings have several practical implications. For clinicians in the emergency department and neurology service, the high prevalence of hypertension and deep haemorrhage location should inform rapid decision-making: a middle-aged hypertensive patient presenting with acute hemiparesis and depressed consciousness is highly likely to have a deep intracerebral haemorrhage, and neurosurgical consultation should be sought early when mass effect or intraventricular extension is present.

For public health, the message is unambiguous and urgent. Hypertension is the dominant driver of severe haemorrhagic stroke in our environment, yet it remains underdiagnosed, undertreated, and poorly controlled. Community-based screening programmes, affordable antihypertensive medications, and health education on treatment adherence must be prioritised by the Rivers State Ministry of Health and the National Primary Health Care De-

velopment Agency. The fact that the mean age of our cohort is 53 years – with many patients in their 40s – means that the disease is striking people in their most productive years of work and family responsibility. Each death or severe disability from a preventable hypertensive haemorrhage represents an immeasurable loss to families and the wider community.

For health policy and hospital administration, our data provide a clear justification for investment in neurosurgical critical care. The high rates of intraventricular extension and hydrocephalus – conditions treatable with external ventricular drainage – coupled with the reality that patients died because EVDs could not be placed due to cost or bed unavailability, represents a failure of the health system to deliver life-saving interventions. Expanding ICU capacity, subsidising neurosurgical consumables, and implementing a health insurance scheme that covers emergency neurosurgical procedures would save lives.

Conclusion

This study provides the first systematic description of the clinical presentation and radiological findings of patients with non-traumatic haemorrhagic stroke reviewed by the neurosurgery service at Rivers State University Teaching Hospital, a major tertiary centre in southern Nigeria. Over a 12-month period, 62 patients were included. The typical patient was a middle-aged hypertensive male (mean age 53.4 years; 56.5% male) presenting with loss of consciousness (72.6%) and severe neurological compromise (mean GCS 8.8; 50.8% with GCS 3–8). Hypertension was the dominant modifiable risk factor, documented in 79.0% of the cohort and 96.1% of those with recorded blood pressure status – far exceeding all other risk factors combined.

Radiologically, deep hypertensive-type haemorrhages predominated, with the capsuloganglionic/basal ganglia (33.9%) and thalamus (27.1%) being the most common locations. Intraventricular extension (58.1%) and hydrocephalus (38.7%) were frequent, contributing to the high disease severity reflected in objective scoring systems: 36.0% of patients with calculable ICH scores scored 3 or 4 (predicted mortality 72–97%), and 83.3% of those with aneurysmal subarachnoid haemorrhage presented with poor WFNS grade (4 or 5). In-hospital mortality was 32.3%, a figure that likely underestimates true case fatality given that many patients died before reaching neurosurgical care or were taken home by families.

The recurring theme of this study is that patients with haemorrhagic stroke who reach neurosurgical evaluation in our setting are among the most severely affected, with established brain injury, poor prognostic scores, and high predicted mortality. Yet, paradoxically, many of these same patients cannot access the intensive care or surgical interventions they require due to financial barriers and limited ICU capacity. This disconnect between clinical need and available resources represents the central challenge of neurosurgical practice in resource-limited Nigeria.

Recommendations

Based on our findings, we propose the following recommendations stratified by target audience.

For Public Health Authorities (Rivers State Ministry of Health and National Primary Health Care Development Agency)

1. Implement community-based hypertension screening programmes. Given that 79.0% of

our cohort were hypertensive – and many were newly diagnosed only at the time of stroke – systematic screening at primary health centres, markets, places of worship, and workplaces would identify at-risk individuals before catastrophic complications occur.

2. Improve access to affordable antihypertensive medications. The cost and inconsistent supply of antihypertensive drugs remain major barriers to treatment adherence. Government subsidy of essential medications (e.g., amlodipine, lisinopril, hydrochlorothiazide) through the public health system would improve adherence and reduce stroke incidence.
3. Launch a public health campaign on stroke awareness and hypertension control. Using local languages, radio, television, and social media, the campaign should educate the public on the link between untreated hypertension and stroke, the importance of medication adherence, and the warning signs of stroke requiring emergency presentation.

For Hospital Administration (Rivers State University Teaching Hospital)

1. Expand intensive care unit capacity dedicated to neurosurgical patients. The finding that patients requiring ICU admission or external ventricular drainage could not receive these services due to bed unavailability is unacceptable. Additional ICU beds with neurosurgical-trained nursing staff should be prioritised.
2. Establish a neurosurgical rapid access pathway. Patients with CT-confirmed haemorrhagic stroke and indications for surgical intervention (e.g., large hematoma, intraventricular extension with hydrocephalus, cerebellar haemorrhage with brainstem compression) should be fast-tracked for neurosurgical review and operating theatre prioritisation.
3. Develop a social support or health insurance scheme for neurosurgical emergencies. Many families in our cohort could not afford surgery. A hospital-based compassionate fund or linkage to the National Health Insurance Authority (NHIA) for emergency neurosurgical coverage would reduce the number of patients who die without receiving indicated care.

For Clinicians (Neurosurgeons, Neurologists, Emergency Physicians)

1. Maintain a low threshold for neurosurgical consultation. The severity of our cohort suggests that patients referred late may already have irreversible brain injury. Early consultation – even for patients with moderate-sized hematomas or stable neurology – allows for serial examinations and timely intervention should deterioration occur.
2. Standardise documentation of severity scores. The ICH score and WFNS grade are powerful prognostic tools and should be calculated and recorded prospectively for every patient with haemorrhagic stroke. This would facilitate future research and quality improvement initiatives.

For Researchers and Academic Institutions

1. Establish a multi-centre stroke registry for the Niger Delta region. Single-centre studies provide valuable local data, but a regional registry would capture a larger cohort, allow for comparison between centres, and provide the sample size needed for multivariable analyses of predictors of outcome.
2. Conduct prospective studies on long-term functional outcomes. Our study reports only in-

hospital mortality. Future studies should follow patients to 30 days, 90 days, and one year, using validated functional scales such as the modified Rankin Scale (mRS) or Glasgow Outcome Scale (GOS) to capture disability among survivors.

3. Evaluate community-based interventions for hypertension control. Interventional studies – such as task-shifting hypertension screening to community health extension workers, mobile health reminders for medication adherence, or home-based blood pressure monitoring programmes – should be rigorously evaluated for their impact on stroke incidence in our population.

References

1. Feigin V, Abate M, Abate Y et al. Global, regional, and national burden of stroke and its risk factors, 1990–2021: a systematic analysis for the Global Burden of Disease Study 2021. The Lancet Neurology, 23, 973-1003
2. Van Asch CJ, Luitse MJ, Rinkel GJ. vand der Tweel I, Algra A, Klijn CJ. Incidence, case fatality, and functional outcome of intracerebral haemorrhage over time, according to age, sex, and ethnic origin: a systematic review and meta -analysis. Lancet Neurol. 2010 Feb;9(2):167-76.
3. An SJ, Kim TJ, Yoon BW. Epidemiology, Risk Factors, and Clinical Features of Intracerebral Hemorrhage: An Update. J Stroke. 2017 Jan;19 (1):3-10. doi: 10.5853/jos.2016.00864. Epub 2017 Jan 31. PMID: 28178408; PMCID: PMC5307940.
4. Owolabi MO, Arulogun O, Melikam S, Adeoye AM, Akarolo-Anthony S, Akinyemi R, Arnett D, Tiwari H, Gebregziabher M, Jenkins C, Lackland D. The burden of stroke in Africa: a glance at the present and a glimpse into the future. Cardiovascular journal of Africa. 2015 Mar;26(2 H3Africa Suppl):S27.
5. Ogun SA, Ojini FI, Ogungbo B, Kolapo KO, Danesi MA. Stroke in south west Nigeria: a 10-year review. Stroke. 2005 Jun 1;36(6):1120-2.
6. Komolafe MA, Owagbemi OF, Alimi TI. The distribution and pattern of neurological disease in a neurology clinic in Ile-Ife, Nigeria. Nigerian Journal of Clinical Practice. 2018 Nov 1;21 (11):1520-4.
7. Ndubuisi, C. A., Okhueleigbe, M. O., Mbadugha, T. N., Ndukuba, K. O., Inojie, M. O., & Ohaegbulam, S. C. (2019). Factors influencing the outcome of spontaneous intracerebral haematoma in a Neurosurgical Hospital in South-East Nigeria. The Nigerian postgraduate medical journal, 26(2), 113–117. https://doi.org/10.4103/npmj.npmj_22_19
8. Ojini, Frank & Danesi, Mustapha. (2003). Pattern of neurological admissions at the Lagos University Teaching Hospital. Nig J Clin Pract. 5. 38-41.
9. Hemphill JC III, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH Score: a simple, reliable grading scale for intracerebral hemorrhage. Stroke. 2001;32(4):891-7.
10. Fung C, Inglin F, Murek M, Balmer M, Abu-Isa J, Z'Graggen WJ, Ozdoba C, Gralla J, Jakob SM, Takala J, Beck J. Reconsidering the logic of World Federation of Neurosurgical Societies grading in patients with severe subarachnoid hemorrhage. Journal of neurosurgery. 2016 Feb 1;124(2):299-304.
11. Connolly ES Jr, Rabinstein AA, Carhuapoma JR, Derdeyn CP, Dion J, Higashida RT, et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage. Stroke. 2012;43 (6):1711-37.

12. Steiner T, Salman RA, Beer R, Christensen H, Cordonnier C, Csiba L, Forsting M, Harnof S, Klijn CJ, Krieger D, Mendelow AD. European Stroke Organisation (ESO) guidelines for the management of spontaneous intracerebral hemorrhage. International journal of stroke. 2014 Oct;9(7):840-55.
13. Witsch, J., Falcone, G. J., Leasure, A. C., Matouk, C., Endres, M., Sansing, L., Woo, D., & Sheth, K. N. (2021). Intracerebral Haemorrhage with Intraventricular Extension Associated with Loss of Consciousness at Symptom Onset. Neurocritical care, 35(2), 418–427. https://doi.org/10.1007/s12028-020-01180-2
14. Hallevi, H., Albright, K. C., Aronowski, J., Barreto, A. D., Martin-Schild, S., Khaja, A. M., Gonzales, N. R., Illoh, K., Noser, E. A., & Grotta, J. C. (2008). Intraventricular haemorrhage: Anatomic relationships and clinical implications. Neurology, 70(11), 848–852. https://doi.org/10.1212/01.wnl.0000304930.47751.75
15. McGurgan, I. J., Ziai, W. C., Werring, D. J., Al-Shahi Salman, R., & Parry-Jones, A. R. (2020). Acute intracerebral haemorrhage: diagnosis and management. Practical neurology, 21 (2), 128–136. Advance online publication. https://doi.org/10.1136/practneurol-2020-002763
16. Emejulu JKC, Nkwerem SPU. The Rating of Nigerian Neurosurgical Facilities Based on the Availability of Sub-Specialty Services in 2024. Niger Med J 2025; 67 (1): 3046-3057. https://doi.org/10.71480/nmj.v67i2.1098
17. Nwani PO, Nwosu MC, Asomugha LA, Enwereji KO, Arinzechi EO, Ogunniyi A. Pattern and outcome of stroke in a Nigerian tertiary hospital. Niger J Clin Pract. 2016;19(1):85-89.
18. Ogun A, Oshinaike O, Ogun B. Challenges and opportunities in the prevention and treatment of stroke in Africa: Perspectives from across the continent. Journal of the Neurological Sciences, 405, 76-79
19. Pouladzadeh, Mandana1; Hoveizavi, Hesam2; Hosseinzadeh, Mofid1. Risk Factors for Hemorrhagic Stroke in Patients Admitted to the Emergency Department: A Retrospective Cross-sectional Study. Biomedical and Biotechnology Research Journal 9(2):p 125-131, Apr–Jun 2025. | DOI: 10.4103/bbrj.bbrj_186_25
20. Ahmed, R., Shakir, A. H., Moizuddin, S. S., Haleem, A., Ali, S., Durrani, K., Khan, A., & Baig, S. (2001). Predictors of in-hospital mortality for intracerebral haemorrhage: a hospital-based study in Pakistani adults. Journal of stroke and cerebrovascular diseases : the official journal of National Stroke Association, 10 (3), 122–127. https://doi.org/10.1053/jscd.2001.25462