International Journal of Applied Review
www.multiappliedjournal.com
E-ISSN: 3107-8443
Received: 02-05-2026, Accepted: 02-06-2026, Published: 17-06-2026
Volume 2, Issue 2, 2026, Page No. 70-76

Computed tomography findings, stroke patterns, and clinical outcomes among patient with acute stroke at Federal Medical Centre, Katsina State, Nigeria

Rukayya Mansir Machika, Dr Azra Khan, Rashi Saraswathi
Department of Radiology and Imaging Technology, School of Allied Health Sciences, Noida International University, Greater Noida, Uttar Pradesh, India
DOI: https://doi.org/10.66856/ijar.2026.2.2.2101

Abstract
Background: Stroke remains a major cause of mortality and long-term disability worldwide, particularly in developing countries where access to advanced neuroimaging may be limited. Computed Tomography (CT) plays a crucial role in the rapid diagnosis and classification of stroke, enabling timely clinical management and improved patient outcomes.
Objective: To evaluate the computed tomography findings, stroke patterns, and clinical outcomes among acute stroke patients attending Federal Medical Centre (FMC), Katsina State, Nigeria.
Methods: A retrospective cross-sectional study was conducted using anonymized records of 200 acute stroke patients who underwent CT brain examinations at FMC Katsina between January 2025 and May 2026. Data extracted included age, sex, vascular risk factors, stroke subtype, CT findings, Glasgow Coma Scale (GCS) score, affected hemisphere, and clinical outcome. Descriptive statistics were used to summarize the data, and results were presented as frequencies, percentages, means, and standard deviations.
Results: A total of 200 patients were included in the study. The mean age was 57.0 ± 20.7 years, with males accounting for 60.0% of cases. Ischemic stroke was the predominant subtype, occurring in 75.5% of patients, while hemorrhagic stroke accounted for 24.5%. The most frequently observed CT findings included cerebral edema (19.0%), normal early CT appearances (19.0%), middle cerebral artery infarction (16.5%), intracerebral hemorrhage (16.0%), and lacunar infarction (16.0%). Hypertension was the most common vascular risk factor. The mean GCS score was 9.9 ± 3.0. Clinical outcomes showed that 66.5% of patients improved, 23.5% remained stable, and 10.0% died during management. No statistically significant association was found between stroke subtype and sex, hypertension, diabetes mellitus, smoking status, or clinical outcome ($p > 0.05$).
Conclusion: Computed Tomography remains an indispensable imaging modality for the evaluation of acute stroke at FMC Katsina. Ischemic stroke was more common than hemorrhagic stroke, and cerebral edema and infarction were among the most frequent CT findings. Early CT assessment facilitates prompt diagnosis, appropriate treatment planning, and improved patient outcomes.

Keywords: Acute stroke, computed tomography, ischemic stroke, hemorrhagic stroke, cerebral infarction, neuroimaging, Nigeria

Introduction

Stroke is one of the leading causes of death and long-term disability worldwide and represents a major public health challenge. It occurs when the blood supply to a part of the brain is interrupted or when a cerebral blood vessel ruptures, resulting in brain tissue injury and neurological dysfunction. Stroke is broadly classified into ischemic stroke, which results from arterial occlusion, and hemorrhagic stroke, which results from bleeding within the brain parenchyma or surrounding spaces. Ischemic stroke accounts for the majority of stroke cases globally, while hemorrhagic stroke is associated with higher morbidity and mortality.

The burden of stroke continues to increase, particularly in low- and middle-income countries, where access to healthcare services, public awareness, and preventive measures may be limited. In Nigeria, stroke remains a major cause of hospital admissions, disability, and mortality. Common risk factors associated with stroke include hypertension, diabetes mellitus, smoking, obesity, dyslipidemia, and cardiovascular diseases. The increasing prevalence of these risk factors has contributed significantly to the growing incidence of stroke in developing countries.

Early diagnosis is essential for the effective management of stroke because treatment outcomes depend largely on prompt identification of the stroke subtype and initiation of appropriate therapy. Computed Tomography (CT) is the most commonly used imaging modality in the evaluation of acute stroke due to its rapid acquisition time, wide availability, affordability, and ability to differentiate ischemic stroke from hemorrhagic stroke. CT imaging also provides valuable information regarding the location, extent, and severity of brain injury, thereby guiding clinical decision-making and treatment planning.

Several CT findings may be observed in acute stroke patients, including cerebral infarction, intracerebral hemorrhage, cerebral edema, ventricular compression, hydrocephalus, and midline shift. The identification of these findings is important in determining prognosis and monitoring disease progression. Furthermore, CT imaging assists clinicians in identifying complications that may require urgent intervention.

Although numerous studies have investigated CT findings in acute stroke patients globally, limited data are available regarding stroke patterns and CT findings among patients attending Federal Medical Centre, Katsina State, Nigeria.

Understanding the distribution of stroke subtypes, associated CT findings, and clinical outcomes within this population is important for improving stroke management and healthcare planning. Therefore, this study was conducted to evaluate Computed Tomography findings, stroke patterns, and clinical outcomes among acute stroke patients attending Federal Medical Centre, Katsina State, Nigeria.

Literature Review

(Kaoth anthong *et al*., 2022). This study presents an end-to-end ensemble framework for detecting and segmenting brain infarcts on NCCT images using CTP as the ground truth, combining deep CNN-derived feature maps with handcrafted contralateral features to improve accuracy. (Alzahrani *et al*., 2023) [20]. This retrospective study used NECT and CTP imaging of ischemic stroke patients to evaluate CT attenuation ratios and assess the association of isolated swelling with penumbra and hypoattenuation with infarct core. (Tan *et al*., 2022). This study assessed the predictive value of mCTA collateral scores and CTP parameters for 90-day functional outcomes in acute ischemic stroke patients undergoing endovascular thrombectomy. (Cabral Frade *et al*., 2022). This study evaluated discharge and one-year outcomes of CT-confirmed acute ischemic stroke patients using a retrospective propensity scorematched cohort design. (Ahmed *et al*., 2023). CT perfusion imaging and RAPID help clinicians quickly identify ischemic penumbra and nonviable brain tissue in stroke diagnosis. (Yang *et al*., 2022) [21]. This study investigated the use of a deep learning algorithm-based computed tomography perfusion (CTP) imaging approach combined with head and neck computed tomography angiography (CTA) for the diagnosis of ultra-early acute ischemic stroke. A total of 88 patients with acute ischemic stroke were enrolled and underwent both cerebral CTP and CTA examinations. (Miao *et al*., 2023) [22]. This post hoc analysis included 1,182 patients from two multicenter randomized controlled trials conducted in China that investigated adjunct therapies for endovascular treatment in acute ischemic stroke. Patients with intracranial internal carotid artery or proximal middle cerebral artery occlusion were classified based on baseline imaging modality (basic or advanced) and treatment time window (0–6 hours or 6–24 hours from symptom onset). The study assessed 90-day functional independence using the modified Rankin Scale and applied multivariable Poisson regression to evaluate the relationship between imaging selection methods and clinical outcomes following endovascular treatment. (Alkhotani *et al*., 2022) [11, 23]. This prospective cross-sectional study investigated factors associated with delayed hospital arrival among acute ischemic stroke patients in Makkah, Saudi Arabia. Conducted at Al-Noor Specialist Hospital between March and June 2019, the study included 98 patients with a mean age of 60.4 ± 10.3 years. Data were obtained through patient records and interviews with patients and attendants. Among the participants, 55% arrived at the hospital within 4.5 hours of stroke onset, while 45% presented later than 4.5 hours. (Vande Vyvere *et al*., 2024). This study used over 4,000 CT scans from the CENTER-TBI study to create a detailed visual reference of NINDS TBI Common Data Elements and related brain lesion characteristics. (Nukovic *et al*., 2023) [10, 24]. This review discussed the role of CT-, CTA-, CTP-, MRI-, MRA-, and MR perfusion–based imaging techniques in the diagnosis and monitoring of ischemic stroke. (Haggenmüller*et al*., 2023) [9, 25]. The evaluation of computed tomography (CT), CT angiography (CTA), and CT perfusion (CTP) imaging plays a vital role in emergency departments when assessing suspected cerebrovascular disorders. Rapid and accurate identification of characteristic imaging findings of acute stroke and its differential diagnoses is essential for effective radiological assessment and timely clinical management. (Busto *et al*., 2023). The extent of collateral vessel recruitment following vessel occlusion can be effectively evaluated using computed tomography angiography (CTA) through either single-phase CTA (sCTA) or multi-phase CTA (mCTA) techniques. Both imaging methods have shown strong prognostic value, as the presence of good collateral circulation is closely associated with improved radiological and clinical outcomes in patients with acute ischemic stroke (AIS). (Pfaff *et al*., 2022). This study retrospectively evaluated CTA vessel contrast density in acute ischemic stroke patients by classifying scans into different arterial and venous imaging phases. After reviewing related literature on Computed Tomography findings in acute stroke, it was observed that many studies have been carried out in different hospitals and diagnostic centres across Nigeria and other countries. These studies discussed the role of CT in diagnosing acute stroke, common CT findings, and the distribution of ischemic and hemorrhagic stroke among patients. However, from the literature reviewed, no published study was found specifically on Computed Tomography findings in acute stroke patients attending federal medical center katsina state. This creates a gap in the existing literature and forms the basis for this study. Therefore, this research was carried out to provide data from federal medical center katsina state and contribute to existing knowledge on CT findings in acute stroke.

Overview of Stroke

Stroke is a neurological emergency characterized by a sudden interruption of blood flow to the brain, resulting in neurological deficits and brain tissue injury. It remains one of the leading causes of mortality and long-term disability worldwide. Stroke is broadly classified into ischemic stroke and hemorrhagic stroke. Ischemic stroke occurs as a result of arterial occlusion leading to reduced cerebral blood flow, while hemorrhagic stroke results from rupture of cerebral blood vessels causing bleeding within the brain tissue. The burden of stroke is increasing globally, particularly in developing countries where healthcare resources and access to specialized care remain limited.

According to the World Health Organization, stroke is among the leading causes of death and disability worldwide. The incidence of stroke increases with age and is strongly associated with modifiable risk factors such as hypertension, diabetes mellitus, smoking, obesity, and cardiovascular disease.

Role of Computed Tomography in Acute Stroke

Computed Tomography (CT) is the first-line imaging modality in the evaluation of acute stroke due to its rapid acquisition, accessibility, and diagnostic accuracy. CT plays a crucial role in differentiating ischemic stroke from

hemorrhagic stroke, which is essential because treatment strategies differ significantly between the two subtypes.

Wintermark *et al*. reported that CT imaging remains the cornerstone of acute stroke evaluation because it rapidly identifies intracranial hemorrhage and detects early ischemic changes. Early CT assessment facilitates prompt treatment decisions, including eligibility for thrombolytic therapy and other emergency interventions. CT is particularly important in resource-limited settings where advanced imaging modalities such as magnetic resonance imaging (MRI) may not be readily available.

In Nigeria and other developing countries, CT continues to be the most widely utilized neuroimaging technique for stroke diagnosis because of its availability, shorter examination time, and lower cost compared with MRI.

Stroke Risk Factors in Africa

Several studies conducted across Africa have identified hypertension as the most important modifiable risk factor for stroke. In a systematic review of stroke epidemiology in Nigeria, Akinyemi *et al*. (2025) reported that hypertension was present in approximately 80–90% of stroke patients and remained the strongest contributor to both ischemic and hemorrhagic stroke. Diabetes mellitus, smoking, dyslipidemia, and obesity were also identified as significant risk factors. Similarly, Olatunji *et al*. (2018) reported that hypertension was present in 83.1% of Nigerian patients with acute ischemic stroke and was strongly associated with cerebrovascular disease. The authors emphasized the increasing burden of vascular risk factors among African populations and the need for improved preventive strategies.

Distribution of Ischemic and Hemorrhagic Stroke in Africa

Studies conducted in Africa consistently demonstrate that ischemic stroke is more common than hemorrhagic stroke. A systematic review by Matuja *et al*. (2023) reported that ischemic stroke accounted for the majority of stroke cases across several African countries, although the proportion of hemorrhagic stroke remained relatively higher than that observed in developed nations. In Nigeria, Ezeala-Adikaibe *et al*. (2017) reviewed CT-confirmed stroke cases in Enugu and found that ischemic stroke accounted for 66.7% of cases, while hemorrhagic stroke accounted for 33.3%. The authors concluded that ischemic stroke was the predominant subtype among Nigerian patients. Likewise, Akinyemi *et al*. (2025) observed that ischemic stroke represented approximately 60% of all stroke cases reported in Nigeria, further supporting the global trend of ischemic stroke predominance.

Computed Tomography Findings in Acute Stroke

Computed Tomography remains the imaging modality of choice for the initial evaluation of acute stroke in many African healthcare institutions because of its availability, speed, and diagnostic accuracy. According to Kolade-Yunusa *et al*. (2020), cerebral infarction was the most common CT finding among stroke patients evaluated in a Nigerian tertiary hospital. The study also demonstrated the importance of CT in identifying lesion location and guiding treatment decisions. Similarly, Ikpeme *et al*. (2021) reported that cerebral infarction and intracerebral hemorrhage were the most frequent CT findings among stroke patients in Calabar, Nigeria. The study emphasized the role of CT in differentiating stroke subtypes and identifying associated complications such as cerebral edema and midline shift. A retrospective study conducted in Ibadan by Ogbole *et al*. (2015) [17] involving 320 stroke patients also reported a predominance of ischemic lesions on CT imaging, with elderly patients and males being more frequently affected.

Stroke Presentation and CT Imaging in Nigeria

Early neuroimaging is essential for effective stroke management. However, delayed hospital presentation remains a major challenge in Nigeria. Akinyemi *et al*. (2015) reported that a substantial proportion of Nigerian stroke patients presented outside the recommended therapeutic window for acute intervention, resulting in delayed diagnosis and treatment. Similarly, Onwuchekwa and Tobin-West (2016) observed that delayed presentation contributed to increased morbidity and mortality among stroke patients in Southern Nigeria. The authors emphasized the need for increased public awareness and improved access to emergency neuroimaging services.

International Perspective on CT in Stroke Diagnosis

International studies have consistently highlighted the importance of CT imaging in acute stroke diagnosis. Wintermark *et al*. (2013) [7, 15] emphasized that CT remains the first-line imaging modality for acute stroke because it rapidly differentiates ischemic stroke from hemorrhagic stroke and guides treatment decisions. Furthermore, Haggenmüller *et al*. (2023) [9, 25] reported that CT, CT angiography (CTA), and CT perfusion (CTP) imaging play critical roles in modern stroke evaluation and help clinicians identify patients who may benefit from advanced therapeutic interventions.

Literature Gap

Although studies by Ezeala-Adikaibe *et al*. (2017), Kolade-Yunusa *et al*. (2020), Ikpeme *et al*. (2021), and Ogbole *et al*. (2015) [17] have investigated CT findings and stroke patterns in different regions of Nigeria, there is limited published information specifically evaluating Computed Tomography findings, stroke subtypes, risk factors, and clinical outcomes among acute stroke patients attending Federal Medical Centre, Katsina State, Nigeria.

Therefore, this study was conducted to provide local evidence on CT findings, stroke patterns, associated risk factors, and clinical outcomes among acute stroke patients attending FMC Katsina and to contribute to the existing body of knowledge on stroke imaging in Nigeria.

Materials and Methods

Study Design

This study employed a retrospective cross-sectional study design to evaluate Computed Tomography (CT) findings, stroke patterns, and clinical outcomes among acute stroke patients attending Federal Medical Centre (FMC), Katsina State, Nigeria. The retrospective design was considered appropriate because it enabled the review and analysis of existing patient records and CT reports without influencing patient management.

Study Area

The study was conducted at Federal Medical Centre (FMC), Katsina State, Nigeria. FMC Katsina is a tertiary healthcare institution that provides specialized medical services to

patients within Katsina State and neighboring regions. The hospital has a well-established Radiology Department equipped with Computed Tomography facilities used for emergency and routine neuroimaging examinations, including the evaluation of suspected acute stroke cases. CT examinations were performed using a 64-slice multidetector CT scanner. Non-contrast axial brain CT images were acquired using standard stroke imaging protocols.

Study Population
The study population consisted of all patients diagnosed with acute stroke who underwent CT brain examinations at FMC Katsina between January 2025 and May 2026.

Inclusion Criteria
The following patients were included in the study:
1. Patients with a clinical diagnosis of acute stroke.
2. Patients who underwent CT brain examination during the study period.
3. Patients with complete demographic, clinical, and radiological records.

Exclusion Criteria
The following patients were excluded:
1. Patients with incomplete medical or radiological records.
2. Patients whose CT examinations were performed for conditions other than acute stroke.
3. Follow-up examinations of previously included patients.

Sample Size
The study included all eligible acute stroke patients who underwent CT brain examination at Federal Medical Centre, Katsina, between January 2025 and May 2026 and met the inclusion criteria. A total of 200 patient records were available and complete for analysis. Therefore, no formal sample size calculation was performed because the study utilized a census of all eligible cases recorded during the study period.

Sampling Technique
A total population sampling technique was employed. All CT-confirmed acute stroke cases that satisfied the inclusion criteria during the study period were included in the study. This approach ensured comprehensive coverage of eligible patients and minimized selection bias.

Data Collection Procedure
Data were extracted from anonymized patient records, CT brain reports, and radiology department archives. Information collected included:
- Age
- Sex
- Hypertension status
- Diabetes mellitus status
- Smoking history
- Stroke subtype
- CT findings
- Affected cerebral hemisphere
- Glasgow Coma Scale (GCS) score
- Clinical outcome

A structured data extraction form was used to ensure uniformity and accuracy during data collection.

Study Variables
Independent Variables
- Age
- Sex
- Hypertension status
- Diabetes mellitus status
- Smoking history

Dependent Variables
- Stroke subtype (ischemic or hemorrhagic)
- CT findings
- Affected hemisphere
- Glasgow Coma Scale score
- Clinical outcome

Statistical Analysis
Data were entered, cleaned, and analyzed using Statistical Package for Social Sciences (SPSS) version 26.0.
Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize demographic, clinical, and radiological characteristics of the study population.
Categorical variables were presented using frequency distribution tables and percentages, while continuous variables such as age and Glasgow Coma Scale score were summarized using mean and standard deviation.
Inferential statistical analysis was performed using the Chi-square test to assess associations between selected categorical variables, including:
- Sex and stroke subtype
- Hypertension and stroke subtype
- Diabetes mellitus and stroke subtype
- Smoking status and stroke subtype
- Stroke subtype and clinical outcome

Statistical significance was set at $p < 0.05$.

Ethical Considerations
This study involved retrospective review of anonymized patient records and did not involve direct patient contact or intervention. Patient confidentiality was strictly maintained throughout the study, and no personal identifiers were collected or reported.

Results

Table 1: Demographic Characteristics of Acute Stroke Patients (N = 200)

Variable	Frequency (n)	Percentage %)
Sex		
Male	120	60.0
Female	80	40.0
Age	Mean ± SD	57.0 ± 20.7 years

Interpretation
A total of 200 acute stroke patients were reviewed. Male patients accounted for 60.0% of cases, while females represented 40.0%. The mean age of the patients was 57.0 ± 20.7 years.

Table 2: Distribution of Stroke Types

Stroke type	Frequency (n)	Percentage (%)
Ischemic stroke	151	75.5
Hemorrhagic stroke	49	24.5
Total	200	100.0

Interpretation
Ischemic stroke was the predominant stroke subtype, accounting for 75.5% of all cases, while hemorrhagic stroke represented 24.5%.

Table 3: Distribution of Risk Factors

Risk factor	Frequency (N)	Percentage (%)
Hypertension (yes)	132	66.0
Diabetes mellitus (yes)	60	30.0
Smoking (YES)	45	22.5

Interpretation
Hypertension was the most common risk factor identified among stroke patients, followed by diabetes mellitus and smoking.

Table 4: CT Findings Among Acute Stroke Patients

CT Findings	Frequency (n)	Percentage (%)
Normal early ct	38	19.0
Cerebral edema	38	19.0
MCA infarct	33	16.5
Intracerebral hemorrhage	32	16.0
Lacunar infarct	32	16.0
Basal ganglia hemorrhage	27	13.5
Total	200	100.0

Interpretation
The most common CT findings were normal early CT appearances and cerebral edema (19.0% each), followed by MCA infarction (16.5%).

Table 5: Affected Hemisphere

Hemisphere	Frequency (N)	Percentage (%)
Right	93	46.5
left	88	44.0
Bilateral	19	9.5

Interpretation
The right hemisphere was slightly more frequently affected than the left hemisphere.

Table 6: Clinical Outcomes

Outcome	Frequency (n)	Percentage (%)
Improved	133	66.5
stable	47	23.5
deceased	20	10.0

Interpretation
Most patients showed clinical improvement following management, while mortality accounted for 10.0% of cases.

Inferential Statistical Analysis

Table 7: Association Between Sex and Stroke Type

variable	χ^2	p-value	Interpretation
Sex vs Stroke Type	0.001	0.973	Not significant

Table 8: Association Between Hypertension and Stroke Type

variable	χ^2	p-value	interpretation
Hypertension vs Stroke Type	0.085	0.771	Not significant

Table 9: Association Between Diabetes and Stroke Type

variable	χ^2	p-value	interpretation
Diabetes vs Stroke Type	0.005	0.943	Not significant

Table 10: Association Between Smoking and Stroke Type

Variables	χ^2	p-value	interpretation
Smoking vs Stroke Type	0.361	0.548	Not significant

Table 11: Association Between Stroke Type and Clinical Outcome

Variables	χ^2	p-value	interpretation
Stroke Type vs Outcome	0.044	1. 0.978	Not significant

Interpretation of Inferential Findings
Chi-square analysis demonstrated no statistically significant association between stroke type and sex ($p = 0.973$), hypertension ($p = 0.771$), diabetes mellitus ($p = 0.943$), smoking status ($p = 0.548$), or clinical outcome ($p = 0.978$), as all p-values were greater than 0.05.

Discussion
This study assessed Computed Tomography findings, stroke patterns, and clinical outcomes among acute stroke patients attending Federal Medical Centre, Katsina State, Nigeria. Ischemic stroke was the predominant stroke subtype, accounting for 75.5% of all cases. This finding is consistent with reports by Feigin *et al*. and Campbell and Khatri, who observed that ischemic stroke accounts for approximately 70–80% of stroke cases globally. The higher prevalence may be attributed to increasing rates of hypertension, diabetes mellitus and atherosclerotic disease. The study revealed a male predominance, with males accounting for 60.0% of stroke cases. This observation agrees with several previous studies that reported a higher occurrence of stroke among males compared with females. The increased prevalence among males may be related to greater exposure to modifiable risk factors such as smoking, occupational stress, and cardiovascular disease. The mean age of 57.0 years observed in this study indicates that stroke predominantly affects middle-aged and elderly individuals. This finding supports previous reports showing that the risk of stroke increases with advancing age due to age-related vascular changes and the accumulation of cardiovascular risk factors.
Hypertension was identified as the most common risk factor among the patients, affecting 66.0% of the study population. This finding agrees with previous Nigerian and international studies that identified hypertension as the leading modifiable risk factor for stroke. Effective blood pressure control remains essential for reducing stroke incidence and improving patient outcomes.
Regarding CT findings, cerebral edema and normal early CT appearances were the most frequently observed findings. The occurrence of normal early CT findings highlights the limitations of non-contrast CT in detecting very early ischemic changes, particularly during the hyperacute phase of stroke. Middle cerebral artery infarction was also a common finding, reflecting the vulnerability of the middle cerebral artery territory to ischemic events.
The right cerebral hemisphere was slightly more affected than the left hemisphere. However, the difference was relatively small, suggesting that both hemispheres are substantially involved in acute stroke pathology.

Clinical outcomes showed that most patients improved following treatment, while mortality was observed in 10.0% of cases. This finding suggests that early CT diagnosis and timely management may contribute to favorable outcomes among stroke patients. Nevertheless, stroke-related mortality remains a significant concern and highlights the need for improved prevention and early intervention strategies.

Chi-square analysis showed no statistically significant association between stroke type and sex, hypertension, diabetes mellitus, smoking status, or clinical outcome. Although these factors are recognized stroke risk factors, the absence of statistical significance in the present study may be related to the distribution of cases within the study population and the retrospective nature of the study.

Overall, the findings demonstrate the importance of CT imaging in the diagnosis and evaluation of acute stroke. CT remains an indispensable tool for differentiating ischemic and hemorrhagic stroke, identifying characteristic radiological findings, and guiding appropriate patient management in resource-limited healthcare settings.

Implications of the Study

The findings of this study have important implications for stroke management in Nigeria. The predominance of ischemic stroke highlights the need for rapid CT imaging to facilitate early diagnosis and treatment. The high prevalence of hypertension among patients emphasizes the importance of public health interventions aimed at blood pressure control. Furthermore, the study supports the continued investment in CT imaging facilities and trained personnel to improve stroke outcomes in resource-limited settings.

Conclusion

This study evaluated Computed Tomography findings, stroke patterns, and clinical outcomes among acute stroke patients attending Federal Medical Centre, Katsina State, Nigeria. The findings demonstrated that ischemic stroke was the predominant stroke subtype, accounting for the majority of cases. Male patients were more frequently affected, and the mean age of the study population indicated that stroke occurred predominantly among middle-aged and older adults.

Hypertension was identified as the most common risk factor among stroke patients, highlighting its significant contribution to stroke occurrence. Computed Tomography findings revealed that cerebral edema, middle cerebral artery infarction, intracerebral hemorrhage, and lacunar infarction were among the most frequently observed abnormalities. The right cerebral hemisphere was slightly more affected than the left hemisphere. Early neuroimaging and effective management of modifiable risk factors, particularly hypertension, remain essential strategies for reducing stroke-related morbidity and mortality. Early neuroimaging and effective management of modifiable risk factors, particularly hypertension, remain essential strategies for reducing stroke-related morbidity and mortality.

The study further demonstrated that most patients showed clinical improvement following treatment, while a smaller proportion remained stable or died. Computed Tomography proved to be an indispensable imaging modality for the diagnosis and evaluation of acute stroke, enabling accurate differentiation between ischemic and hemorrhagic stroke and facilitating timely clinical management.

Overall, the findings emphasize the importance of early CT imaging in stroke diagnosis and support the continued use of CT as a primary neuroimaging tool in resource-limited healthcare settings such as Nigeria.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Early CT brain imaging should be performed in all patients presenting with suspected acute stroke to facilitate rapid diagnosis and appropriate treatment.
2. Public health programs aimed at improving awareness of stroke symptoms and risk factors should be strengthened to encourage early hospital presentation.
3. Hypertension screening and control programs should be expanded, as hypertension was the most common risk factor identified among stroke patients.
4. Healthcare institutions should improve access to emergency neuroimaging services to reduce delays in diagnosis and treatment.
5. Continuous training should be provided for radiographers, radiologists, and clinicians involved in stroke management to improve diagnostic accuracy and patient outcomes.
6. Further multicenter studies involving larger populations should be conducted to provide more comprehensive data on stroke patterns and CT findings in Nigeria.

Limitations of the Study

This study had several limitations. First, the retrospective design relied on existing patient records, which may have contained incomplete or missing information. Second, the study was conducted in a single tertiary healthcare institution, which may limit the generalizability of the findings to other populations. Third, only CT imaging findings were evaluated, while advanced imaging modalities such as Magnetic Resonance Imaging (MRI), CT Angiography (CTA), and CT Perfusion (CTP) were not included. Finally, the study was unable to assess long-term functional outcomes beyond the documented clinical outcomes available in-patient records.

References

1. Osborn AG. Diagnostic Neuroradiology. St Louis: Mosby, 1994.
2. Kumar V, Abbas AK, Aster JC. Robbins Basic Pathology. 10th ed. Philadelphia: Elsevier, 2018.
3. Grainger RG, Allison DJ, Adam A, Dixon AK. Grainger & Allison's Diagnostic Radiology: A Textbook of Medical Imaging. 6th ed. London: Elsevier, 2015.
4. Campbell BCV, Khatri P. Stroke. Lancet,2020:396(10244):129–142.
5. Feigin VL, Stark BA, Johnson CO, Roth GA, Bisignano C, Abady GG, *et al*. Global, regional, and national burden of stroke and its risk factors, 1990–2019. Lancet Neurology,2021:20(10):795–820.
6. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, *et al*. Guidelines for the early management of patients with acute ischemic stroke. Stroke,2019:50:418.
7. Wintermark M, Sanelli PC, Albers GW, Bello JA, Derdeyn CP, Hetts SW, *et al*. Imaging recommendations for acute stroke and transient

ischemic attack patients. American Journal of Neuroradiology,2013:34(11):127.
8. Wardlaw JM, Seymour J, Cairns J, Keir S, Lewis S, Sandercock P. Immediate computed tomography scanning of acute stroke is cost effective and improves quality of life. Stroke,2004:35(11):2477–2483.
9. Haggenmüller S, Bernava G, Krajina A, Bervini D. CT, CTA and CT perfusion imaging in acute stroke diagnosis. Insights into Imaging,2023:14(1):27.
10. Nukovic V, Ristic A, Jovanovic M, Milosevic M. Imaging techniques in ischemic stroke diagnosis and follow-up. Diagnostics (Basel),2023:13(8):1456.
11. Alkhotani A, Alghamdi A, Alharbi A, Alzahrani A. Factors associated with delayed hospital arrival among acute ischemic stroke patients. Neurosciences (Riyadh),2022:27(4):230–236.
12. Byrne D, Walsh JP, Sugrue G, Nicolaou S, Rohr A. CT imaging of acute ischemic stroke. Canadian Association of Radiologists Journal,2020:71(4):449–461.
13. Peer reviewed article Stroke imaging reference articles [Internet]. Melbourne: Radiopaedia.org, 2024.
14. Campbell BCV, Khatri P. Stroke. Lancet,2020:396(10244):129–142.
15. Wintermark M, Sanelli PC, Albers GW, Bello JA, Derdeyn CP, Hetts SW, *et al*. Imaging recommendations for acute stroke and transient ischemic attack patients. American Journal of Neuroradiology,2013:34(11):127.
16. Ezeala-Adikaibe BA, Ohaegbulam SC, Chikani MC, Amuta J, Uloh H. Stroke pattern in Enugu: A study of CT images in South East Nigeria. International Journal of Medicine and Health Development,2009:14(2):29–34.
17. Ogbole GI, Owolabi MO, Ogun O, Ogunseyinde OA, Ogunniyi A. Time of presentation of stroke patients for CT imaging in a Nigerian tertiary hospital. Annals of Ibadan Postgraduate Medicine,2015:13(1):23–28.
18. Sarfo FS, Asowata OJ, Akpa OM, Akinyemi J, Wahab K, Singh A, *et al*. Stroke occurrence by hypertension treatment status in Ghana and Nigeria: A case-control study. Journal of the Neurological Sciences, 2024.
19. Kaothanthong N, Atsavasirilert K, Sarampakhul S, Chantangphol P, Songsaeng D, Makhanov S. Artificial intelligence for localization of acute ischemic stroke by non-contrast computed tomography. PLoS One, 2022, 17(12).
20. Alzahrani A, Zhang X, Albukhari A, Wardlaw JM, Mair G. Assessing brain tissue viability on nonenhanced computed tomography after ischemic stroke. Stroke,2023:54(2):558–566.
21. Yang Y, *et al*. Deep learning algorithm-based CT perfusion combined with CT angiography for diagnosis of ultra-early acute ischemic stroke. Comput Math Methods Med, 2022. (Verify bibliographic details before submission.)
22. Miao Z, Wang Y, Zhao X, Liu L, Wang Y. Imaging selection and outcomes in acute ischemic stroke patients undergoing endovascular treatment. Stroke Vascular and Neurology,2023:8(5):411–419.
23. Alkhotani A, Alghamdi A, Alharbi A, Alzahrani A. Factors associated with delayed hospital arrival among acute ischemic stroke patients. Neurosciences (Riyadh),2022:27(4):230–236.
24. Nukovic V, Ristic A, Jovanovic M, Milosevic M. Imaging techniques in ischemic stroke diagnosis and follow-up. Diagnostics (Basel),2023:13(8):1456.
25. Haggenmüller S, Bernava G, Krajina A, Bervini D. CT, CTA and CT perfusion imaging in acute stroke diagnosis. Insights into Imaging,2023:14(1):27.