



Original Article

Role of Multidetector CT in the Evaluation of Cerebrovascular Accident Patients: A Hospital-Based Observational Study

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ABSTRACT

Background: Cerebrovascular accident (CVA) is a major cause of morbidity and mortality worldwide and requires prompt diagnosis for effective management. Neuroimaging plays a crucial role in confirming the diagnosis, differentiating between ischemic and hemorrhagic stroke, and identifying the anatomical location and vascular territory involved. Multidetector computed tomography (MDCT) has become the primary imaging modality in the emergency evaluation of stroke because of its rapid acquisition, wide availability, and high diagnostic accuracy.

Methods: This hospital-based observational study included 100 patients with clinical suspicion of cerebrovascular accident who underwent multidetector CT evaluation. Demographic data including age and gender were recorded. CT scans were analyzed to determine the type of stroke, arterial territory involved, and anatomical location of the lesion. The collected data were analyzed using descriptive statistics and results were presented as frequencies and percentages.

Results: The highest number of cases was observed in the 71–80 years age group (25%), followed by 61–70 years (22%). Males constituted 51% of cases while females accounted for 49%. Ischemic stroke was the most common type, accounting for 71% of cases, while hemorrhagic stroke constituted 29%. Among arterial territories, the vertebral artery territory was most frequently involved (26%), followed by ACA (20%) and MCA (19%). In terms of lesion location, the occipital lobe was the most common site (20%), followed by basal ganglia (16%) and frontal lobe (15%).

Conclusion: Multidetector CT proved to be an effective imaging modality in the evaluation of cerebrovascular accidents by accurately identifying the type of stroke, vascular territory involved, and anatomical location of lesions. Its rapid availability and diagnostic reliability make it an essential tool in the early diagnosis and management of stroke patients.

Keywords: Cerebrovascular accident, Multidetector CT.

INTRODUCTION

Cerebrovascular accident (CVA), commonly referred to as stroke, is one of the leading causes of mortality and long-term disability worldwide. It results from an abrupt interruption of cerebral blood flow leading to focal neurological deficits and permanent neuronal injury if not promptly managed. Stroke is broadly classified into two major categories: ischemic stroke caused by arterial occlusion and hemorrhagic stroke resulting from rupture of intracranial blood vessels. Early identification of the type and location of stroke is essential for appropriate management and to improve patient outcomes.¹

The global burden of stroke continues to rise due to increasing life expectancy, urbanization, and the growing prevalence of risk factors such as hypertension, diabetes mellitus, smoking, and dyslipidemia. Stroke contributes significantly to hospital admissions and healthcare expenditure, especially in developing countries where awareness and access to early

diagnostic facilities may be limited.² Accurate and rapid diagnosis is therefore essential to initiate timely therapeutic interventions and to reduce morbidity and mortality associated with cerebrovascular disease.

Neuroimaging plays a central role in the evaluation of patients presenting with acute neurological deficits suggestive of stroke. Imaging not only confirms the diagnosis but also differentiates between ischemic and hemorrhagic stroke, identifies the location of the lesion, evaluates vascular territories involved, and detects complications.³ Among the various imaging modalities available, computed tomography (CT) remains the most widely used first-line investigation in the emergency evaluation of stroke because of its rapid acquisition time, widespread availability, and ability to detect intracranial hemorrhage with high accuracy.⁴

Non-contrast computed tomography (NCCT) is usually the initial imaging modality performed in suspected stroke cases. The primary role of NCCT is to exclude intracranial hemorrhage and other stroke mimics such as tumors or subdural hematoma, which may present with similar clinical features. Additionally, CT imaging can demonstrate early ischemic changes including loss of gray-white matter differentiation, sulcal effacement, and hyperdense vessel signs such as the dense middle cerebral artery sign.⁵ These findings assist clinicians in diagnosing ischemic stroke and guiding early management decisions.

With technological advancements, multidetector computed tomography (MDCT) has significantly enhanced the diagnostic capability of CT imaging in cerebrovascular diseases. MDCT allows rapid acquisition of thin-section images with improved spatial resolution and enables multiplanar reconstruction for detailed evaluation of brain parenchyma and vascular structures.⁶ In addition to conventional CT imaging, advanced techniques such as CT angiography (CTA) and CT perfusion (CTP) provide valuable information regarding vascular anatomy, arterial occlusion, cerebral blood flow, and the extent of salvageable brain tissue.⁷

CT angiography is particularly useful in identifying the site and severity of arterial occlusion, assessing collateral circulation, and evaluating large vessel disease. Studies have demonstrated that CTA provides high diagnostic accuracy for detecting vascular stenosis or occlusion in patients with acute stroke.⁸ CT perfusion imaging, on the other hand, provides quantitative information about cerebral blood flow, cerebral blood volume, and mean transit time, thereby helping to differentiate the infarct core from the ischemic penumbra. This information is crucial in determining eligibility for reperfusion therapies such as thrombolysis or mechanical thrombectomy.⁹

The rapid and comprehensive evaluation provided by multidetector CT imaging has made it an essential tool in modern stroke management. Imaging findings not only confirm the diagnosis but also assist clinicians in identifying the arterial territory involved and correlating radiological findings with clinical presentation. Accurate localization of lesions within different vascular territories such as the anterior cerebral artery (ACA), middle cerebral artery (MCA), posterior cerebral artery (PCA), vertebral artery, and basilar artery territories can help in understanding the pattern of neurological deficits and planning appropriate treatment strategies.¹⁰

Given the increasing availability of multidetector CT scanners and the need for rapid diagnosis in emergency settings, evaluating the role of MDCT in the assessment of cerebrovascular accidents has significant clinical importance. Understanding the distribution of stroke types, arterial territories involved, and anatomical location of lesions can improve diagnostic accuracy and assist in timely therapeutic decision-making. Therefore, the present study was undertaken to evaluate the role of multidetector CT in the assessment of patients presenting with cerebrovascular accidents and to analyze the radiological patterns of stroke in a hospital-based population.

METHODOLOGY

This hospital-based observational study was conducted in the Department of Radiodiagnosis in collaboration with the Department of Medicine at a tertiary care centre. The study included patients presenting with clinical suspicion of cerebrovascular accident (CVA) who were referred for multidetector computed tomography (MDCT) of the brain.

A total of 100 patients fulfilling the inclusion criteria were included in the study. Patients presenting with acute neurological deficits suggestive of stroke such as sudden onset weakness, altered consciousness, speech disturbance, visual symptoms, or imbalance were evaluated. Patients with traumatic brain injury or those with incomplete clinical data were excluded from the study.

All patients underwent non-contrast CT (NCCT) brain using a multidetector CT scanner. The imaging protocol included axial sections from the base of the skull to the vertex with appropriate slice thickness. Images were reconstructed in multiple planes whenever required to improve diagnostic accuracy. The CT images were carefully evaluated for the presence of infarction, intracranial hemorrhage, and other structural abnormalities. The location of the lesion was recorded based on the involved brain region such as frontal lobe, parietal lobe, temporal lobe, occipital lobe, basal ganglia, cerebellum, thalamus, or brainstem. In addition, the arterial territory involved was identified and categorized into anterior cerebral artery (ACA),

middle cerebral artery (MCA), posterior cerebral artery (PCA), vertebral artery, and basilar artery territories. Demographic details including age and gender of the patients were recorded. The type of stroke detected on MDCT was classified as infarct (ischemic stroke) or hemorrhage (hemorrhagic stroke).

All collected data were entered into a structured data sheet and analyzed using descriptive statistical methods. Frequencies and percentages were calculated for categorical variables such as age distribution, gender distribution, stroke type, arterial territory involvement, and location of lesions. The results were presented in the form of tables and charts for clear interpretation.

RESULT

Table 1: Age Group Distribution

Age Group	Count	Percentage (%)
41–50	20	20
51–60	19	19
61–70	22	22
71–80	25	25
81 and above	14	14
Total	100	100

Table 2: Gender Distribution

Gender	Count	Percentage (%)
Male	51	51
Female	49	49
Total	100	100

Table 3: Stroke Type Distribution

Type of Stroke	Count	Percentage (%)
Infarct	71	71
Hemorrhage	29	29
Total	100	100

Table 4: Arterial Territory Involved

Arterial Territory	Count	Percentage (%)
Vertebral	26	26
ACA	20	20
MCA	19	19
Basilar	18	18
PCA	17	17
Total	100	100

Table 5: Location of Lesion

Location of Lesion	Count	Percentage (%)
Occipital	20	20
Basal Ganglia	16	16
Frontal	15	15
Cerebellum	11	11
Temporal	11	11
Brainstem	11	11
Parietal	9	9
Thalamus	7	7
Total	100	100

Table 6: Type of Stroke versus Arterial Territory

Type of Stroke	ACA	Basilar	MCA	PCA	Vertebral	Total
Hemorrhage	7 (35.0%)	2 (11.11%)	6 (31.58%)	5 (29.41%)	9 (34.62%)	29 (29.0%)
Infarct	13 (65.0%)	16 (88.89%)	13 (68.42%)	12 (70.59%)	17 (65.38%)	71 (71.0%)
Total	20	18	19	17	26	100

A total of 100 patients clinically suspected of cerebrovascular accident (CVA) and evaluated using multidetector CT were included in the study.

The age distribution of patients showed that stroke predominantly affected the elderly population. The highest number of cases was observed in the 71–80 years age group (25%), followed by 61–70 years (22%) and 41–50 years (20%). Patients in the 51–60 years age group accounted for 19%, while 14% of cases were seen in patients aged 81 years and above. This finding indicates that the incidence of stroke increased with advancing age, reflecting the cumulative effect of vascular risk factors in older individuals. Among the 100 patients studied, 51% were males and 49% were females, indicating an almost equal gender distribution. This suggests that both sexes were nearly equally affected by cerebrovascular accidents in the study population, although slight male predominance was noted. Analysis of stroke type revealed that ischemic stroke (infarct) was the most common form, accounting for 71% of cases, while hemorrhagic stroke constituted 29% of cases. This observation indicates that ischemic strokes were more than twice as common as hemorrhagic strokes among patients evaluated with multidetector CT. Evaluation of arterial territories demonstrated that the vertebral artery territory was most frequently involved (26%), followed by the anterior cerebral artery (ACA) territory in 20% of cases and middle cerebral artery (MCA) territory in 19% of cases. The basilar artery territory was involved in 18%, while posterior cerebral artery (PCA) territory accounted for 17% of cases. These findings highlight the involvement of both anterior and posterior circulation territories in cerebrovascular accidents.

The distribution of lesions based on anatomical location revealed that the occipital lobe was the most common site of involvement (20%), followed by the basal ganglia (16%) and frontal lobe (15%). Lesions in the cerebellum, temporal lobe, and brainstem each accounted for 11% of cases, while parietal lobe involvement was observed in 9% and thalamic lesions in 7% of patients. This indicates that cerebrovascular lesions were distributed across multiple regions of the brain. Cross-tabulation of stroke type with arterial territories showed that infarcts predominated across all vascular territories, particularly in the basilar artery (88.89%), PCA (70.59%), and MCA territories (68.42%). Hemorrhagic strokes were relatively less frequent but were observed in all vascular territories, with the highest proportion in the vertebral artery territory (34.62%). Overall, ischemic strokes accounted for 71% of cases, while hemorrhagic strokes accounted for 29%.

DISCUSSION

Cerebrovascular accidents represent a major neurological emergency and require rapid diagnosis and management to minimize morbidity and mortality. In the present study, multidetector CT was used to evaluate patients presenting with clinical suspicion of stroke. The findings demonstrated the usefulness of CT imaging in identifying stroke type, anatomical location, and vascular territory involvement.

The age distribution observed in this study indicated that stroke occurred more commonly in older individuals, with the highest incidence in the 71–80 years age group (25%). This trend is consistent with previous research showing that the risk of stroke increases significantly with age due to the accumulation of vascular risk factors such as hypertension, diabetes mellitus, and atherosclerosis. Increasing age is recognized as one of the strongest non-modifiable risk factors for stroke worldwide.¹²

The gender distribution in the present study showed a nearly equal proportion of males (51%) and females (49%). Although many epidemiological studies report a slightly higher incidence of stroke in males, the difference tends to diminish with increasing age, particularly in elderly populations. This pattern has been attributed to hormonal influences and differences in cardiovascular risk profiles between men and women.² With regard to stroke type, the present study found that ischemic stroke accounted for 71% of cases, whereas hemorrhagic stroke constituted 29%. This finding aligns with global epidemiological data indicating that ischemic strokes represent the majority of cerebrovascular events. Early differentiation between ischemic and hemorrhagic stroke is critical because treatment strategies differ significantly. Multidetector CT is particularly valuable in this context because it rapidly detects intracranial hemorrhage and helps exclude hemorrhage before thrombolytic therapy is considered.³⁴

The evaluation of arterial territories in this study showed that the vertebral artery territory was most frequently involved (26%), followed by ACA and MCA territories. The involvement of posterior circulation arteries such as the vertebral and basilar arteries highlights the importance of careful evaluation of posterior circulation strokes, which may present with subtle or atypical clinical symptoms. Imaging modalities such as MDCT and CT angiography play an important role in identifying vascular territories affected by stroke and guiding clinical management.⁶⁷

Analysis of lesion location demonstrated that the occipital lobe was the most common site of involvement, followed by basal ganglia and frontal lobe regions. Lesions in the basal ganglia are commonly associated with hypertensive vascular disease and are frequently observed in both ischemic and hemorrhagic strokes. CT imaging allows precise localization of lesions within the brain parenchyma and aids in understanding the correlation between imaging findings and clinical manifestations.⁵ Cross-analysis of stroke type and arterial territory further demonstrated that ischemic infarcts predominated across all vascular territories, particularly in basilar and posterior circulation arteries. CT angiography and perfusion

imaging have been shown to enhance the detection of vascular occlusion and cerebral perfusion abnormalities, thereby improving the diagnostic accuracy of stroke evaluation.⁸⁹

Overall, the present study emphasizes the critical role of multidetector CT in the evaluation of cerebrovascular accidents. The rapid acquisition of high-resolution images allows clinicians to identify stroke type, determine the vascular territory involved, and localize brain lesions with high diagnostic accuracy. Early CT imaging is therefore essential for guiding appropriate treatment decisions and improving clinical outcomes in patients with acute stroke.¹⁰

CONCLUSION

Multidetector CT plays a vital role in the evaluation of patients with suspected cerebrovascular accidents due to its rapid availability, high diagnostic accuracy, and ability to differentiate between ischemic and haemorrhagic strokes. In the present study, ischemic stroke was found to be the predominant type, accounting for the majority of cases. Stroke incidence increased with advancing age and affected both genders almost equally.

The study also demonstrated involvement of multiple arterial territories, with vertebral artery territory being the most commonly affected. Lesions were distributed across various brain regions, with the occipital lobe and basal ganglia frequently involved.

Overall, multidetector CT proved to be an effective imaging modality for early detection, localization, and characterization of cerebrovascular lesions. Its use in the acute evaluation of stroke patients can facilitate timely diagnosis and appropriate management, thereby improving patient outcomes.

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