ROLE OF MULTIDETECTOR COMPUTED TOMOGRAPHY IN EVALUATION OF CEREBROVASCULAR ACCIDENTS IN PATIENTS WITH HIGH CHOLESTEROL LEVEL

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Abstract

Introduction: *Cerebrovascular accidents (CVAs), another name for strokes, are a serious public health issue and a leading cause of morbidity and mortality worldwide. These events are brought on by an abrupt stop in the blood supply to the brain. High cholesterol is a significant modifiable risk factor, particularly for ischemic strokes. Multidetector computed tomography (MDCT) is crucial for the prompt and precise diagnosis of stroke. Better outcomes and quicker action are made possible by this.*

Objective: *To assess how multidetector computed tomography can be used to diagnose cerebrovascular incidents in high-cholesterol patients.*

Materials and Methods: *This four-month descriptive cross-sectional study was carried out at DHQ Hospital in Sheikhupura. Using a non-probability convenient sampling strategy, 59 patients with elevated cholesterol and a clinically suspected CVA were chosen. A HITACHI whole-body CT system was used to perform brain CT scans, and Microsoft Excel 2016 and SPSS version 25.0 were used to analyze the data.*

Results: *29 (49.2%) of the 59 patients were female, and 30 (50.8%) were male. Sixty-one percent were between the ages of 51 and 70. Clinically, the most common complaints were headache (76.3%), vertigo (72.9%), and altered consciousness (59.3%). Radiologically, 33 patients (54.9%) had lacunar infarcts, 25 patients (42.4%) had ischemic brain injury, 14 patients (23.7%) had acute infarcts, 18 patients (30.5%) had periventricular microvascular disease, and 6 patients (10.2%) had hemorrhagic strokes.*

INTRODUCTION

Strokes, also known as cerebrovascular accidents (CVAs), are one of the main causes of death and permanent disability in the globe. The World Health Organization states that strokes are a major cause of death and morbidity worldwide, especially in low- and middle-income nations where timely diagnosis and treatment are still difficult to obtain [1]. A stroke is usually caused by either hemorrhage from a ruptured vessel or ischemia from vascular blockage, which both cause an abrupt loss of brain function [2].

Hypercholesterolemia is one of the main modifiable risk factors for ischemic stroke. Atherosclerotic plaque formation is accelerated by elevated low-density lipoprotein (LDL) levels, which also promote arterial narrowing and occlusion, making people more vulnerable to cerebral infarction [3,4]. Cholesterol-associated strokes are significantly more common in populations with poor dietary habits, sedentary lifestyles, and limited screening programs [5].

Whether a stroke is hemorrhagic or ischemic, a timely and precise diagnosis is essential to starting the right treatment. In the assessment of acute stroke, multidetector computed tomography (MDCT) has become a crucial diagnostic technique. Within minutes of a patient's arrival, it enables quick non-invasive brain imaging, differentiates between infarcts and bleeds, and finds anomalies in the vessels, cerebral edema, and mass effect [6,7]. In environments with limited resources, where magnetic resonance imaging (MRI) may not be easily accessible, MDCT is particularly useful due to its accessibility and diagnostic yield [8].

There is no local data on the effectiveness of MDCT in assessing CVAs, particularly in high-cholesterol individuals, despite the vital significance of early identification. By evaluating the radiological results of such patients using MDCT in a tertiary care context, this study seeks to close that gap.

Literature Review:

The quick imaging capabilities and high diagnostic accuracy of multidetector computed tomography (MDCT) have made it a crucial tool in the acute evaluation of cerebrovascular accidents. Its usefulness in distinguishing between ischemic and hemorrhagic stroke subtypes has been highlighted by numerous research.

In a hospital-based investigation, Kumar et al. found that 69% of all stroke cases assessed by CT were ischemic, while 21% were hemorrhagic. This finding supports the notion that ischemic stroke predominates in clinical presentations [1]. Further confirming the crucial significance of CT in early detection, Sinha et al. looked at the CT imaging profile of stroke patients and found that ischemic infarcts were present in 63% of cases [2].

In a clinical audit of 237 patients, Ali et al. found that only 15% of patients had hemorrhagic strokes, although 56% of patients had infarctions apparent on CT scans. This result highlights the value of CT in detecting ischemia patterns, especially in high-risk groups such people with high cholesterol [3]. Ischemic lesions were discovered in 68.6% of stroke victims, according to a study conducted by Abbas et al. in a tertiary care center in Pakistan. This finding supports the global trend seen in other developing nations [4]. In order to rule out stroke mimics and detect consequences such brain edema, midline displacement, or hydrocephalus, CT imaging is also essential. In almost 85% of patients assessed, Hameed et al. showed that MDCT effectively distinguished between different forms of stroke and directed suitable treatment approaches in emergency situations [5].

Even though magnetic resonance imaging (MRI) has been shown to be reliable in neuroimaging, its restricted availability and high cost sometimes prevent its usage in emergency situations. In contrast, MDCT provides a quick and widely available option, which is crucial in the crucial hours after a stroke occurs when choosing between thrombolysis and neurosurgical intervention is urgent [6].

One of the most frequent findings in CT-based stroke evaluations is lacunar infarcts, which can result from small-vessel blockage in patients with hyperlipidemia, according to studies [7, 8].

Material and Methods:

For four months, from January to April 2025, the Department of Radiology at DHQ Hospital Sheikhupura carried out this descriptive cross-sectional study. The institutional review board's ethical permission was acquired before data collecting started. Assessing the diagnostic utility of

multidetector computed tomography (MDCT) in the diagnosis of cerebrovascular accidents (CVAs) in individuals with increased serum cholesterol levels was the main goal.

Study Population and Sampling

The study comprised 59 patients who had verified elevated cholesterol levels and presented with stroke-like symptoms. Non-probability convenient sampling was used to choose the patients. Patients of all sexes and all age groups who had high LDL (≥130 mg/dL) or total cholesterol (≥200 mg/dL) and clinical symptoms suggestive of a cerebrovascular accident (CCA), such as unilateral weakness, facial drooping, slurred speech, vertigo, or altered consciousness, were eligible for inclusion.

The study excluded patients with a history of recent trauma, known brain tumors, previous cerebrovascular intervention, or those who were contraindicated for CT scanning.

Clinical Assessment and Imaging

Emergency physicians performed the initial clinical evaluation, which included a neurological examination and a vital sign assessment. Patients received non-contrast brain CT utilizing an HITACHI whole-body MDCT scanner once it was determined that it was clinically appropriate. Axial brain images with a 5 mm slice thickness were part of the CT protocols, and they were rebuilt in the coronal and sagittal planes for in-depth examination.

Experienced radiologists interpreted CT images, and the results were documented on a uniform proforma.

Acute infarction, hemorrhage, lacunar infarct, ischemic brain damage, and periventricular microvascular disease were among the radiological markers evaluated.

Data Collection and Variables

Radiological results, clinical symptoms (e.g., headache, vertigo, limb weakness, altered consciousness), and demographic information (e.g., age, gender) were recorded. According to latest lipid profile data, cholesterol levels were verified.

Statistical Analysis

Microsoft Excel 2016 and the Statistical Package for the Social Sciences (SPSS) version 25.0 were used to enter and analyze the data. Frequencies and percentages for categorical variables (gender, age group, clinical symptoms, and radiological findings) were reported using descriptive statistics. Where appropriate, means ± standard deviations were used to express continuous variables.

Results:

A total of 59 patients were included in the study, all of whom had elevated cholesterol levels and clinical suspicion of cerebrovascular accident (CVA).

Demographic Characteristics

The gender distribution was nearly equal with 30 (50.8%) males and 29 (49.2%) females. The most frequently affected age group was 51–70 years, accounting for 36 (61.0%) patients.

Table 1: Age and Gender Distribution

Variable	Frequency (n)	Percentage (%)
Gender - Male	30	50.8%
Gender - Female	29	49.2%
Age 31–50 years	9	15.3%
Age 51–70 years	36	61.0%
Age 71–90 years	14	23.7%

Clinical Features

The most commonly reported clinical symptoms included headache in 45 (76.3%) patients, vertigo in

43 (72.9%), and altered state of consciousness (ASOC) in 35 (59.3%) patients. Right-sided and left-sided weakness were reported in 22 (37.3%) and 20 (33.9%) patients, respectively.

Table 2: Clinical Presentation

Symptom	Frequency (n)	Percentage (%)
Headache	45	76.3%
Vertigo	43	72.9%
Altered consciousness (ASOC)	35	59.3%
Right-sided weakness	22	37.3%
Left-sided weakness	20	33.9%

Radiological Findings

MDCT imaging revealed that the most common radiological finding was lacunar infarct in 33 (55.9%) patients. This was followed by ischemic brain injury in 25 (42.4%) cases, acute infarct in 14 (23.7%), periventricular microvascular disease in 18 (30.5%), and hemorrhagic stroke in 6 (10.2%).

Table 3: CT Scan Findings

Radiological Diagnosis	Frequency (n)	Percentage (%)
Lacunar Infarct	33	55.9%
Ischemic Brain Injury	25	42.4%
Acute Infarct	14	23.7%
Periventricular Microvascular Disease	18	30.5%
Hemorrhagic Stroke	6	10.2%

These results indicate a predominance of ischemic over hemorrhagic strokes in patients with elevated cholesterol levels. Lacunar infarcts, commonly linked to small vessel disease associated with hyperlipidemia, were the most frequent finding.

Discussion:

The present study evaluated the diagnostic utility of multidetector computed tomography (MDCT) in assessing cerebrovascular accidents (CVAs) in patients with high cholesterol. Our findings confirm that ischemic strokes, particularly lacunar infarcts, are significantly more prevalent than hemorrhagic events in this patient population. These results are in alignment with global data that report ischemic strokes as constituting up to 80–85% of all stroke cases [9].

The most affected age group in our study was 51–70 years, accounting for over 60% of the cases. This demographic trend is supported by studies such as one by Pandian et al., who observed the peak stroke incidence in patients over 50 years old [10]. Age-related vascular degeneration and cumulative exposure to risk factors like hypertension and hypercholesterolemia may explain this predisposition [11]. Moreover, the near-equal gender distribution in our study supports previous findings indicating that stroke risk is similarly significant in both men and women, though outcomes may vary by sex [12,13].

Clinically, headache, vertigo, and altered consciousness were the most commonly reported symptoms. These non-specific presentations often delay diagnosis and treatment, particularly in resource-limited settings [14]. CT imaging helps overcome these limitations by rapidly identifying the presence and type of stroke. In our cohort, lacunar infarcts were the most frequent radiological diagnosis, present in more than half of the cases. This supports the hypothesis that small-vessel occlusion—often due to long-standing hyperlipidemia—is a major mechanism in high-cholesterol patients [15].

Ischemic brain injuries and acute infarcts were also prominent findings, further emphasizing the strong association between hyperlipidemia and cerebral

atherosclerosis. Prior studies have noted that elevated low-density lipoprotein (LDL) levels are strongly predictive of large- and small-vessel cerebrovascular occlusions [16,17]. In contrast, hemorrhagic strokes were observed in only 10.2% of patients, consistent with data indicating their lower incidence but higher mortality risk [18].

The presence of periventricular microvascular disease in a significant proportion of patients is noteworthy. Such findings have been linked with chronic small-vessel ischemia, particularly in patients with longstanding dyslipidemia, diabetes, and hypertension [19]. These radiological changes are associated with an increased risk of future strokes and cognitive decline [20].

Overall, MDCT demonstrated excellent utility in the rapid, non-invasive diagnosis of stroke type and location. In settings where MRI is not readily accessible, MDCT remains the first-line imaging modality, offering essential information for early clinical decision-making.

Discussion:

This study demonstrates that multidetector computed tomography (MDCT) is a valuable diagnostic tool in the rapid evaluation of cerebrovascular accidents (CVAs) among patients with high cholesterol levels. The predominance of ischemic strokes, particularly lacunar infarcts linked to small-vessel disease, underscores the strong association between hypercholesterolemia and ischemic brain injury. MDCT effectively distinguishes between ischemic and hemorrhagic strokes, facilitating timely and appropriate clinical management. Given its accessibility and diagnostic accuracy, MDCT remains indispensable, especially in resource-limited settings where MRI is less available. Early identification of stroke subtype through MDCT can improve patient outcomes by guiding prompt interventions tailored to the underlying pathology.

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