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Lipid Profile in Stroke Patients Presenting in Emergency Department

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LINK MEDICAL INTERFACE

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ABSTRACT

Background: Dyslipidemia is a significant modifiable risk factor associated with stroke, contributing to increased morbidity and mortality worldwide. The high prevalence of lipid abnormalities in stroke patients highlights the need for targeted preventive strategies.

Objective: To investigate the prevalence of dyslipidemia and its association with different stroke types among patients presenting in the emergency department.

Methods: A prospective cross-sectional study was conducted on 440 acute stroke patients at the Emergency Department of CMH Rawalpindi from January 2022 to December 2023. Stroke was confirmed using CT imaging, and lipid profiles were assessed through serum analysis. Participants were categorized into ischemic and hemorrhagic stroke groups. Data were analyzed using SPSS version 25, with $p < 0.05$ considered statistically significant.

Results: Of 440 patients (mean age: 50.83 ± 11.97 years), 314 (71.4%) were male and 126 (28.6%) females. Ischemic stroke was found in 347 (78.9%), and hemorrhagic stroke in 93 (21.1%) patients. Hypertriglyceridemia was more prevalent in ischemic stroke (66.3%) than in hemorrhagic stroke (46.2%) ($p < 0.001$). Hypertension was significantly higher in hemorrhagic stroke (86%) compared to ischemic stroke (43.2%) ($p < 0.001$).

Conclusion: Dyslipidemia is highly prevalent among stroke patients, with distinct patterns in ischemic and hemorrhagic stroke, needing early lipid management for stroke prevention.

INTRODUCTION

Stroke is a major global health burden with significant socioeconomic impacts, affecting millions of individuals and their families each year. The condition is estimated to be responsible for approximately 4.5 million deaths worldwide annually, with an even greater number of survivors left in a state of severe disability, often requiring long-term care and rehabilitation (1). Epidemiological data suggest that stroke prevalence and its associated morbidity are substantially higher in developing regions like South Asia, where the limited healthcare resources exacerbate its impact (2). While stroke occurs in both genders, recent studies indicate that men are at a slightly higher risk compared to women, and the probability of experiencing a stroke rises considerably with age (3). In Pakistan, stroke patients often present at a younger age compared to their counterparts in Western countries, with the condition being associated with poor clinical outcomes and increased mortality (4).

Stroke can be classified into two main subtypes: ischemic and hemorrhagic. Ischemic stroke, caused by an obstruction of blood flow to the brain, accounts for the majority of cases, while hemorrhagic stroke results from bleeding within the brain tissue or surrounding areas (5). The management and prevention of stroke require a thorough understanding of both modifiable and non-modifiable risk factors. Key modifiable risk factors include hypertension, diabetes, dyslipidemia, smoking, and obesity, which are strongly associated with an increased risk of stroke and adverse outcomes (6). Dyslipidemia, defined as an abnormal level of lipids in the blood, has emerged as one of the most critical modifiable risk factors for ischemic stroke, contributing to the formation of atherosclerotic plaques that can obstruct cerebral blood vessels (7). Research has proved a strong link between dyslipidemia and stroke, with some studies reporting its prevalence in as high as 65% of stroke patients (8). Additionally, the management of lipid disorders through therapeutic interventions, such as statin therapy, has been shown to significantly reduce the incidence of recurrent stroke and improve long-term prognosis (9).

In the South Asian context, particularly in Pakistan, dyslipidemia is a prevalent yet underreported contributor to the rising burden of stroke. Studies conducted in local populations indicate a substantial prevalence of dyslipidemia among stroke patients, with figures ranging from 31% to 51%, underscoring the need for targeted screening and management strategies (10). Early identification and intervention for dyslipidemia in high-risk individuals can play a crucial role in reducing stroke-related morbidity and mortality. However, the lack of population-specific data and comprehensive risk factor assessments hampers the development of effective public health

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policies. This study aims to address these gaps by investigating the prevalence of dyslipidemia among stroke patients presenting to emergency departments in Pakistan, thereby providing insights into the regional epidemiology of stroke and highlighting potential avenues for prevention and treatment (11).

The aim of the current study is to assess the prevalence of dyslipidemia in patients presenting with acute stroke at a tertiary care hospital and to analyze the correlation between dyslipidemia and the type of stroke, as well as its association with other common comorbidities such as hypertension and diabetes mellitus. By evaluating lipid profile patterns in stroke patients, this study seeks to contribute to a better understanding of stroke pathophysiology and support the development of evidence-based strategies for risk factor modification and secondary prevention. Addressing dyslipidemia through lifestyle modifications and pharmacological interventions may significantly reduce the burden of stroke and improve outcomes for affected individuals, particularly in resource-constrained settings like Pakistan, where stroke management remains a challenge due to limited access to specialized care (12). This research, therefore, aims to add to the growing body of literature on stroke epidemiology in South Asia and pave the way for more focused preventive measures aimed at reducing the burden of dyslipidemia and its complications (13).

MATERIAL AND METHODS

The study was designed as a prospective cross-sectional investigation, conducted on patients presenting with acute stroke at the Emergency Department of Combined Military Hospital (CMH) Rawalpindi between January 2022 and December 2023 after obtaining approval from the Institutional Ethical Review Committee (ERC Approval No: 180/07/2021) and in compliance with the Declaration of Helsinki. All patients aged 18 years or older, irrespective of gender, who presented with acute stroke confirmed through clinical evaluation and radiological evidence using computed tomography (CT) scans were included. A written informed consent was obtained from each participant or their legal guardians before enrollment in the study. Patients with strokes resulting from vascular or space-occupying lesions, prior surgery, trauma, hematological disorders, and pregnancy were excluded from the study.

A non-probability consecutive sampling technique was employed to recruit participants in this investigation. The sample size was calculated using the WHO calculator, keeping a 95% confidence level, a 5% margin of error, and the assumption that raised total cholesterol is present in 42% of ischemic stroke patients (11). Although the estimated sample size was 375, a total of 440 patients were included to enhance the generalizability of the results.

The study employed a structured data collection tool, designed specifically for this research, to document relevant demographic, clinical, and laboratory parameters, including lipid profile, CT scan findings, and the presence of comorbid conditions such as hypertension and diabetes mellitus.

All patients underwent a detailed clinical assessment upon presentation, which included a comprehensive medical history covering previous strokes, transient ischemic attacks (TIA), myocardial infarctions, angina, atrial fibrillation, smoking status, alcohol consumption, and the use of any medications. Stroke was diagnosed based on the presence of acute neurological deficits consistent with stroke and confirmed through CT imaging of the brain. Blood samples were obtained from each patient following standard phlebotomy protocols, and a 10 ml sample was used to perform a complete lipid profile, including measurements of serum cholesterol and triglycerides. Dyslipidemia was defined as having a serum total cholesterol level greater than 6 mmol/L or a serum triglyceride level exceeding 2 mmol/L, regardless of whether the patient was on lipid-lowering therapy or not. Patients were then categorized into two groups based on the type of stroke: Group A comprised ischemic stroke patients, and Group B consisted of hemorrhagic stroke patients, as confirmed by imaging studies.

The collected data were entered and analyzed using SPSS version 25.0. For quantitative variables, such as age, serum cholesterol, and triglycerides, mean and standard deviation were calculated. For categorical variables, including gender, presence of hypertension, diabetes mellitus, hypertriglyceridemia, and hypercholesterolemia, frequencies and percentages were decided. The chi-square test was employed to evaluate the association between categorical variables and the type of stroke. A p-value of less than 0.05 was considered statistically significant for all comparisons.

The study ensured strict adherence to ethical guidelines throughout its execution, with participants' confidentiality maintained by anonymizing personal data. No identifying information was disclosed at any stage of the research process, and patients retained the right to withdraw from the study at any point without repercussions. The findings from this study aim to provide insights into the prevalence of dyslipidemia among stroke patients and its potential role as a modifiable risk factor in this population.

RESULTS

A total of 440 patients who presented with acute stroke were included in the study. Out of these, 314 (71.4%) were male, and 126 (28.6%) were female. The ages of the participants ranged from 21 to 82 years, with a mean age of 50.83 ± 11.97 years. The distribution of comorbidities in the study population indicated that 230 (52.3%) patients were hypertensive, while 248 (56.4%) were diabetic. Dyslipidemia was observed in a significant proportion of the participants, with hypertriglyceridemia present in 273 (62%) patients and hypercholesterolemia in 101 (23%) patients.

The distribution of demographic characteristics and comorbidities is summarized in Table 1 below. The type of stroke was classified into two categories based on imaging findings: ischemic stroke was present in 347 (78.9%) patients, while 93 (21.1%) patients had a hemorrhagic stroke. A comparison of the prevalence of different groups is presented in Table 2 below.

Table 1: Demographic Characteristics and Comorbidities of Study Participants

Variable	Frequency (n)	Percentage (%)
Gender		
Males	314	71.4
Females	126	28.6
Hypertension		
Hypertensive	230	52.3
Normotensive	210	47.7
Diabetes Mellitus		
Diabetic	248	56.4
Non-Diabetic	192	43.6
Lipid Profile		
Hypertriglyceridemia	273	62.0
Normal Triglycerides	167	38.0
Hypercholesterolemia	101	23.0
Normal Cholesterol Levels	339	77.0

Table 2: Comparison of Comorbidities and Lipid Profile Between Ischemic and Hemorrhagic Stroke Patients

Variable	Group A: Ischemic Stroke (n=347)	Group B: Hemorrhagic Stroke (n=93)	p-value
Hypertriglyceridemia	230 (66.3%)	43 (46.2%)	$p < 0.001$
Hypercholesterolemia	83 (23.9%)	18 (19.4%)	$p = 0.2$
Hypertension	150 (43.2%)	80 (86.0%)	$p < 0.001$
Diabetes Mellitus	194 (55.9%)	54 (58.1%)	$p = 0.4$

comorbidities between ischemic and hemorrhagic stroke. The results indicated a statistically significant association between hypertriglyceridemia and hypertension with the type of stroke, with both conditions being more prevalent among ischemic stroke patients ($p < 0.001$ for each). However, there was no significant difference in the prevalence of hypercholesterolemia and diabetes mellitus between ischemic and hemorrhagic stroke groups ($p = 0.2$ and $p = 0.4$, respectively). Further analysis of the data revealed that patients with ischemic stroke were more likely to have hypertriglyceridemia compared to those with hemorrhagic stroke (66.3% vs. 46.2%).

In contrast, hypertension was significantly higher in hemorrhagic stroke patients (86%) compared to ischemic stroke patients (43.2%). The findings are consistent with existing literature that highlights the differential role of these risk factors in the pathogenesis of different stroke types. The overall prevalence of dyslipidemia, particularly hypertriglyceridemia, was noted to be alarmingly high in the study population, indicating the need for early detection and management of lipid abnormalities in patients at risk of stroke. These findings underscore the importance of targeted interventions and public health strategies aimed at controlling dyslipidemia to prevent the occurrence of stroke and its associated complications in vulnerable populations.

DISCUSSION

The current study evaluated the prevalence of dyslipidemia among patients presenting with acute stroke and examined its association with different stroke types. The findings revealed a high frequency of hypertriglyceridemia and hypercholesterolemia in the study population, with hypertriglyceridemia being significantly more prevalent in patients with ischemic stroke compared to those with hemorrhagic stroke. These results are in line with previously reported studies that identified dyslipidemia as a significant modifiable risk factor for ischemic stroke (9). In a study by Arvanitis et al., it was shown that dyslipidemia, specifically elevated triglycerides, strongly correlates with ischemic stroke, which supports the findings of the present study (9). This relationship can be attributed to the role of high triglyceride levels in promoting atherosclerotic changes, which are a major contributor to cerebral ischemic events (12).

The high prevalence of hypertension and diabetes mellitus in the studied cohort further corroborates their established role as key risk factors for stroke. Hypertension, in particular, was markedly more common in hemorrhagic stroke patients, reflecting the well-documented association between elevated blood pressure and the risk of intracranial hemorrhage due to vessel rupture (15). These findings are supported by Turana et al., who reported that hypertension increases the risk of both ischemic and hemorrhagic strokes, but its impact on hemorrhagic stroke is significantly higher (7).

The elevated blood pressure induces microaneurysms and vascular fragility, predisposing individuals to intracerebral hemorrhage (16). In contrast, the lack of a significant association between hypercholesterolemia and stroke subtype in the current study may reflect variations in population characteristics, genetic predisposition, or differential responses to lipid-lowering therapies, as indicated by a similar study conducted by Khan et al., which reported variable results depending on the lipid profile component being analyzed (14).

The strengths of this study include its prospective design and the inclusion of a relatively large sample size, which enhances the generalizability of the findings. Additionally, the study comprehensively assessed the lipid profile and other vascular risk factors, providing valuable insights into the interplay between dyslipidemia and stroke. However, several limitations should be considered when interpreting

the results. Firstly, the study was conducted at a single center, which may limit the external validity of the findings. Future multicenter studies involving diverse populations are warranted to confirm the results and establish robust associations. Secondly, the cross-sectional design precludes the establishment of a causal relationship between dyslipidemia and stroke. Longitudinal studies are required to determine the temporal relationship and assess the impact of lipid-modifying interventions on stroke outcomes. Thirdly, other potential risk factors, such as smoking, alcohol consumption, and obesity, were not evaluated in the current study, which could have confounded the observed associations.

The study highlights the need for early identification and management of dyslipidemia in individuals at high risk of stroke. Screening for lipid abnormalities should be an integral component of stroke prevention strategies, particularly in settings like Pakistan, where the burden of stroke is high and healthcare resources are limited. Implementing community-based screening programs and raising awareness about lifestyle modifications, such as diet and physical activity, could significantly reduce the prevalence of dyslipidemia and, consequently, the risk of stroke. Furthermore, the findings support the incorporation of intensive lipid-lowering therapies, such as statins, in the management of ischemic stroke patients, as demonstrated by Khadka et al., who reported that statin therapy reduced the incidence of recurrent strokes (19).

Overall, this study adds to the growing body of evidence on the role of dyslipidemia in stroke pathogenesis and provides a basis for targeted interventions. Despite the study's limitations, the observed high prevalence of dyslipidemia in stroke patients underscores the urgent need for healthcare providers to prioritize lipid management in clinical practice. Future research should focus on exploring the impact of specific lipid components, such as low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol, on stroke risk and evaluating the effectiveness of various pharmacological and non-pharmacological interventions in reducing stroke incidence.

CONCLUSION

The study demonstrated that dyslipidemia, particularly hypertriglyceridemia, is highly prevalent among stroke patients and significantly associated with ischemic stroke, while hypertension remains a strong predictor of hemorrhagic stroke. Early detection and management of dyslipidemia, alongside rigorous control of hypertension, could potentially reduce the burden of stroke in populations with high prevalence rates like Pakistan. Incorporating regular lipid screening and targeted therapeutic interventions in stroke prevention protocols is essential to mitigate the disease's impact and improve overall healthcare outcomes. Implementing these strategies would not only decrease morbidity and mortality but also alleviate the socioeconomic strain associated with chronic stroke care.

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