e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(10); 574-578

Original Research Article

Correlation between Serum Triglyceride Levels and Severity of Stroke in Patients Admitted in a Tertiary Care Hospital of Central India

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Received: 25-07-2024 / Revised: 23-08-2024 / Accepted: 25-09-2024

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Conflict of interest: Nil

Abstract:

Background: Stroke is a leading cause of morbidity and mortality, with varying degrees of severity based on multiple risk factors. Serum triglyceride (TG) levels, which are known to be associated with cardiovascular disease, may have a role in stroke severity, but this relationship remains underexplored, especially in the Indian population.

Aim and Objective: To investigate the correlation between serum triglyceride levels and stroke severity in patients admitted to a tertiary care hospital in Central India.

Materials and Methods: This cross-sectional observational study was conducted at Gandhi Medical College and Hamidia Hospital, Bhopal, over 12 months. A total of 96 patients diagnosed with acute stroke (within seven days of onset) were included. Data on patient demographics, medical history, and stroke severity (assessed by the NIHSS) were collected. Fasting serum triglyceride levels were measured within 48 hours of admission. Statistical analysis was performed using descriptive statistics and appropriate tests to evaluate correlations between TG levels and stroke severity.

Results: The mean age of the study population was 60.05 years (SD 10.85); 68.8% were male and 31.2% female. Hypertension was present in 67.7% and diabetes mellitus in 24% of patients. The mean TG level was 117.84 mg/dl (SD 46.3), with 72.9% of patients having TG levels <150 mg/dl. The mean total cholesterol was 170.51 mg/dl, HDL 34.31 mg/dl, and LDL 157.47 mg/dl. The mean NIHSS score was 14.09 (SD 6.975). Patients with TG levels ≥150 mg/dl had significantly lower NIHSS scores (mean 12.00, SD 5.52) compared to those with TG levels <150 mg/dl (mean 14.87, SD 7.32) ($p = 0.044$). Lower triglyceride levels were associated with higher stroke severity, although the chi-square test showed no significant association between TG levels and NIHSS score categories ($p = 0.264$).

Conclusion: The study suggests an inverse correlation between serum triglyceride levels and stroke severity, with higher TG levels potentially associated with less severe strokes. While the exact mechanisms remain unclear, these findings contribute to the growing evidence that lipid profiles, particularly triglycerides, may play a role in stroke prognosis. Further research is needed to explore the potential protective effects of higher TG levels in stroke patients.

Keywords: Stroke, Serum Triglycerides, NIHSS, Stroke Severity, Lipid Profile, Central India, Acute Stroke

Introduction

Stroke is a leading cause of morbidity and mortality worldwide, representing a significant public health burden, particularly in developing nations like India. [1,2] In recent years, India has experienced a rise in stroke incidence due to lifestyle changes, increased prevalence of non-communicable diseases, and inadequate healthcare access. [3] Strokes can broadly be categorized into ischemic and hemorrhagic types, with ischemic stroke accounting for approximately 80% of all cases. [2, 3] While numerous risk factors, such as hypertension, diabetes mellitus, smoking, and hyperlipidemia, are well-documented, the role of serum triglycerides (TG) in stroke pathogenesis remains a subject of debate. [4]

Triglycerides are a type of fat (lipid) found in the blood, and elevated levels have been associated

with cardiovascular diseases, including stroke.[5] However, the relationship between TG levels and stroke severity is not fully understood, especially in the Indian population. [6, 7] Given the increasing burden of stroke in Central India, understanding the correlation between serum triglycerides and stroke severity can provide insights into risk stratification, prognosis, and potential therapeutic interventions.

This study investigates the significance of serum triglyceride levels in stroke patients admitted to a tertiary care hospital in Central India. Additionally, it seeks to explore whether serum TG levels correlate with stroke severity at the time of hospital admission, which could help refine clinical assessment and improve patient outcomes.

Materials and Methods

This cross-sectional observational study was conducted over 12 months in the Department of Medicine at Gandhi Medical College and associated hospitals (Hamidia Hospital) in Bhopal, Madhya Pradesh, India. The study aimed to investigate the significance of serum triglyceride levels and their correlation with stroke severity in patients diagnosed with acute stroke. A total of 96 patients diagnosed with acute stroke within seven days of symptom onset, either clinically or via CT scans, were enrolled in the study and admitted to the general medicine department.

Inclusion and Exclusion Criteria

The study's inclusion criteria required patients or their relatives to provide informed consent for participation. Patients diagnosed with acute stroke within the specified time frame were included. Conversely, the exclusion criteria eliminated patients with non-acute strokes, space-occupying lesions, cortical venous thrombosis, or those below 18 years of age.

Methodology

Following approval from the Institutional Ethics Committee, the study commenced. Patients presenting with signs and symptoms of stroke were clinically assessed and subsequently referred for radiological investigations (CT scan or MRI) to differentiate between hemorrhagic and ischemic strokes. Once the diagnosis was confirmed and the inclusion criteria were met, the severity of the stroke was assessed using the National Institutes of Health Stroke Scale (NIHSS).

Each patient's detailed medical history and examination, including vital signs and laboratory investigations, were recorded. Investigations included a complete blood count (CBC), renal function tests (RFT), liver function tests (LFT), and triglyceride levels.

The stroke severity was categorized based on NIHSS scores: mild stroke (NIHSS < 8), moderate stroke (NIHSS 8-16), and severe stroke (NIHSS > 16). Blood samples for triglyceride measurement were collected after a fasting period of 9 to 12 hours within 48 hours of admission. The normal range for serum triglycerides was established as 0.11 to 1.60 mmol/L for individuals up to age 30, with upper limits increasing to 1.83 mmol/L at age 50 and 2.17 mmol/L at age 60.

The investigations performed in this study included a Complete Blood Count (CBC), Renal Function Tests (RFT), Liver Function Tests (LFT), a lipid profile focusing on serum triglycerides, and imaging studies such as CT Brain and MRI Brain to assess stroke diagnosis and severity.

Statistical Analysis

Data analysis was performed using Epi Info Version 6 software. Frequency distribution and cross-tabulation were employed to prepare the tables. Quantitative variables were expressed as means and standard deviations, while categorical data were presented as percentages. Microsoft Office was used to create graphs. The Student's t-test was applied to compare means, and the Chi-square test was used for categorical data comparison. A p-value of < 0.05 was considered statistically significant.

Results

The age distribution of the patients showed that the majority were between 46-60 years and 61-75 years, both groups comprising 43.8% of the total. Only 6.3% of the patients were ≤45 years old, and another 6.3% were aged ≥76 years. The mean age of the patients was 60.05 years, with a standard deviation (SD) of 10.85. Male patients had a mean age of 58.74 years (SD = 11.69), while female patients had a mean age of 62.93 years (SD = 8.17). Among the 96 patients, 66 (68.8%) were male and 30 (31.2%) were female, indicating a predominance of male patients in the study.

The distribution of patients by age and gender showed that all were male among the younger age group (≤45 years). In the 46-60 years group, 48.5% were male, while 33.3% of females fell in this group. Among patients aged 61-75, 33.3% were male and 66.7% were female. In the ≥76 years group, all were male. The chi-square test indicated a statistically significant difference in age distribution between males and females ($\chi^2 = 11.775$, $p = 0.008$).

A total of 65 patients (67.7%) had a history of hypertension, while 31 patients (32.3%) did not. Among the study population, 23 patients (24.0%) had a history of diabetes mellitus, while 73 patients (76.0%) were non-diabetic. Triglyceride levels were categorized into <150 mg/dl and ≥150 mg/dl. Of the total patients, 70 (72.9%) had triglyceride levels <150 mg/dl, while 26 (27.1%) had levels

≥150 mg/dl. The mean triglyceride level was 117.84 mg/dl with an SD of 46.3 mg/dl. Most patients, 85.4%, had total cholesterol levels ≤200 mg/dl, while 14.6% had levels ≥201 mg/dl. The mean total cholesterol level was 170.51 mg/dl with an SD of 28.58 mg/dl. Regarding HDL levels, 67.7% of patients had HDL levels <40 mg/dl, while 32.3% had levels ≥40 mg/dl. The mean serum HDL level was 34.31 mg/dl with an SD of 7.64 mg/dl. Low-density lipoprotein (LDL) levels showed that 55.2% of patients had LDL levels ≥160 mg/dl, 25% had levels between 130-159 mg/dl, 12.5% had levels between 100-129 mg/dl, and 7.3% had levels <100 mg/dl. The mean LDL level was 157.47 mg/dl with an SD of 34.63 mg/dl.

A history of smoking was present in 55 patients (57.3%), while 41 patients (42.7%) did not report smoking. Of the patients, 30 (31.3%) had a history of coronary artery disease (CAD), while 66 (68.7%) did not(results).

Stroke severity was assessed using the National Institutes of Health Stroke Scale (NIHSS). Of the 96 patients, 19.8% had an NIHSS score <8, 44.8% had scores between 8-16, and 35.4% had scores >16. The mean NIHSS score was 14.09, with an SD of 6.975(results).

When examining the correlation between triglyceride levels and stroke severity, patients with triglyceride levels <150 mg/dl had a distribution of NIHSS scores as follows: 63.2% had scores <8, 69.8% had scores between 8-16, and 82.4% had scores >16. In contrast, among patients with triglyceride levels ≥150 mg/dl, 36.8% had scores <8, 30.2% had scores between 8-16, and 17.6% had scores >16. The chi-square test did not show a significant association between triglyceride levels and NIHSS score ($\chi^2 = 2.665$, $p = 0.264$)(results).

A comparison of the mean NIHSS score based on triglyceride levels showed that patients with triglyceride levels <150 mg/dl had a higher mean NIHSS score (14.87, SD = 7.32) compared to those with triglyceride levels ≥150 mg/dl (12.00, SD = 5.52). This difference was statistically significant ($t = 1.814$, $p = 0.044$), suggesting that higher triglyceride levels were associated with lower stroke severity(results).

Table 1: Distribution of Patients Based on Triglyceride Levels and Stroke Severity

TG Level (mg/dl)	NIHSS <8	NIHSS 8-16	NIHSS >16	Total Patients (%)
<150	12 (63.2%)	30 (69.8%)	28 (82.4%)	70 (72.9%)
≥150	7 (36.8%)	13 (30.2%)	6 (17.6%)	26 (27.1%)
Total	19 (100%)	43 (100%)	34 (100%)	96 (100%)

A comparison of mean triglyceride levels across NIHSS score categories showed that patients with NIHSS scores <8 had the highest mean triglyceride level (130.58 mg/dl, SD = 38.97), followed by those with scores of 8-16 (121.74 mg/dl, SD = 47.02), and those with scores >16 (105.79 mg/dl, SD = 47.59). This difference was statistically significant ($F = 8.886$, $p = 0.000$), indicating a relationship between lower triglyceride levels and higher stroke severity(results).

Table 2: Comparison of Mean NIHSS Scores Based on Triglyceride Levels

TG Level (mg/dl)	Number of Patients	Mean NIHSS Score	Standard Deviation (SD)	t-statistic	p-value
<150	70	14.87	7.32	1.814	0.044
≥150	26	12.00	5.52		

Discussion

This study aimed to investigate the significance of serum triglyceride levels in acute stroke patients and their correlation with stroke severity. The research, conducted at Gandhi Medical College and Hamidia Hospital in Bhopal, included 96 patients diagnosed with acute stroke either clinically or through CT scans within seven days of symptom onset. Data collection involved demographic details, medical history, stroke severity (using the NIHSS score), and fasting triglyceride level measurement. Statistical analysis was performed to explore potential associations between these variables.

Patient Demographics

The mean age of the study population was 60.05 years (SD 10.85), with males having a slightly lower mean age (58.74 years) than females (62.93 years). Of the total sample, 68.8% were male, and 31.2% were female. A significant association between age and gender was observed (p=0.008), with younger patients predominantly male. This pattern aligns with findings from several other studies. Jain et al.[8] reported a median age of 74 years in their study, with 55.4% males, while Ghafoor et al. [9] found that 63% of their stroke patients were male, with a mean age of 63.7 years.

Medical History

The study population demonstrated a high prevalence of comorbid conditions, with 67.7% having hypertension and 24.0% having diabetes mellitus. Comparatively, Ghafoor et al. [9] found that 66% of stroke patients had hypertension, and 54% had diabetes, a higher rate of diabetes than observed in our study. Other studies, such as those by Dhanju et al. [10] and Chhari et al. [11], also reported hypertension and diabetes as common comorbidities in stroke patients, further corroborating the high prevalence of these conditions in stroke populations. This highlights the significance of addressing comorbidities like hypertension and diabetes in stroke management.

Lipid Profile

The lipid profile analysis in this study revealed a mean triglyceride level of 117.84 mg/dl, with 72.9% of patients having levels below 150 mg/dl. Additionally, 85.4% of patients had total cholesterol levels below 200 mg/dl, and 67.7% had HDL levels below 40 mg/dl. The mean LDL level was 157.47 mg/dl. Similar findings have been reported in other studies. Jain et al. (2013) observed a median cholesterol level of 4.58 mmol/L and triglyceride levels of 1.38 mmol/L. Studies like those by Hutanu et al. [12] and Chhari et al. [11] noted significantly higher cholesterol levels in ischemic stroke patients compared to hemorrhagic stroke patients. Interestingly, higher triglyceride levels were associated with better stroke outcomes in several studies, such as those by Ghafoor et al. [9], supporting the potential protective role of triglycerides in stroke severity.

Lifestyle and Cardiovascular Risk Factors

In this study, 57.3% of patients had a history of smoking, and 31.3% had a history of coronary artery disease (CAD). Ghafoor et al. [7] noted that 27% of their patients were current or recent smokers, while Chhari et al. [11] reported a higher prevalence of tobacco addiction (63.5%) in ischemic stroke patients. Smoking remains a critical modifiable risk factor in stroke prevention, as evidenced by consistent findings across various studies. Similarly, CAD was a prevalent comorbidity in our study population, reinforcing its established role as a risk factor for stroke(results).

Stroke Severity

The average stroke severity in this study, measured by the NIHSS score, was 14.09. Although no significant direct association was found between triglyceride levels and stroke severity, an interesting trend emerged: patients with higher triglyceride levels (≥150 mg/dl) tended to have lower NIHSS scores, indicating less severe strokes. This suggests a potential protective effect of higher triglyceride levels, a phenomenon noted in several other studies. Jain et al. [8] found that lower triglyceride levels were significantly associated with worse NIHSS scores and poorer outcomes at three months. Similarly, Ghafoor et al. [9] observed better recovery in patients with higher triglyceride levels. A study by Hutanu et al. [12] also reported lower triglyceride levels in patients with poor outcomes and severe strokes.

Furthermore, the analysis in this study revealed significant differences in mean triglyceride levels across different NIHSS score groups, with lower triglyceride levels correlating with higher stroke severity. This complex relationship between triglycerides and stroke severity warrants further investigation, as it could have important implications for stroke prognosis and management. Studies by Raghu et al. [13] and Dhanju et al. [10] similarly noted that lower triglyceride levels were associated with more severe strokes, supporting the findings of this study.

The study's strengths include its specific focus on the relationship between serum triglyceride levels and stroke severity, using the NIHSS score for objective measurement. Its findings, suggesting a potential inverse relationship between higher triglyceride levels and lower stroke severity, may have clinical relevance. However, the study's limitations include a small sample size of 96 patients, a cross-sectional design that prevents establishing causality, and being a single-centre study, which may limit its generalizability. Additionally, it lacks adjustment for confounding factors such as diet or medication use and focuses mainly on triglycerides, overlooking other lipid parameters.

Conclusion

This study highlights a potential inverse relationship between triglyceride levels and stroke severity, with higher triglyceride levels being associated with less severe strokes. While the exact mechanisms underlying this relationship are not fully understood, these findings add to a growing body of evidence suggesting that lipid profiles, particularly triglycerides, may play a role in stroke outcomes. Future research should focus on further elucidating the complex interplay between lipid metabolism and stroke severity, potentially leading to novel therapeutic strategies for stroke prevention and treatment.

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