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Original Research Article

Prognostic Role of Hypertriglyceridemia in Patients with Stroke of Atherothrombotic Origin

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Abstract

Background: The relationship between dyslipidemia and ischemic stroke (IS) is clearly established, yet the status of hypertriglyceridemia as an independent prognostic factor is debatable. LDL-C and HDL-C have been widely researched, whereas there are fewer studies on the effects of high levels of triglycerides on the severity and recovery of stroke. The purpose of this study is to determine the prognostic value of hypertriglyceridemia in acute ischemic stroke patients of atherothrombotic etiology.

Methods: A cross-sectional analytical analysis was carried out among 107patients with acute ischemic stroke admitted to the Neurology Department of TVMCH. NIHSS score upon admission and discharge was used to measure stroke severity, and modified Rankin Scale (mRS) was utilized to measure functional recovery. Fasting triglyceride levels divided the patients into four groups: <150 mg/dL, 150–250 mg/dL, 250–350 mg/dL, and >350 mg/dL. Statistical models, such as multivariate logistic regression analysis, were used to test associations between triglyceride levels and stroke outcomes.

Result: Increased triglyceride levels correlated with more debilitating strokes on admission (increased NIHSS scores) and worse functional outcomes at discharge (increased mRS scores). Patients with triglycerides >350 mg/dL had the poorest recovery trajectories, suggesting an intense negative effect of hypertriglyceridemia on stroke prognosis.

Conclusion: Hypertriglyceridemia is an important modifiable stroke severity and outcome determinant. Aggressive lipid lowering should be implemented in stroke prevention and rehabilitation guidelines to enhance the outcomes of stroke patients.

Keywords: Hypertriglyceridemia, Ischemic Stroke, Stroke Severity, Prognostic Factor, Triglycerides, Atherothrombosis.

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Introduction

Ischemic stroke (IS) is a major cause of morbidity and mortality globally, with multifactorial pathophysiology due to various vascular risk factors. Dyslipidemia has been known for many years as an important etiology of cerebrovascular diseases, with special reference to low-density lipoprotein cholesterol (LDL-C) and high-density lipoprotein cholesterol (HDL-C). Nevertheless, although numerous studies have been conducted on the role of cholesterol subfractions in stroke pathogenesis, the role of hypertriglyceridemia is still a matter of controversy and relatively under investigated [1,2]. Triglycerides are an important part of lipid metabolism as a vital source of energy. Increased triglyceride levels have, however, been directly linked to endothelial dysfunction, inflammation, oxidative stress, and atherosclerosis, which all play their respective roles in ischemic stroke pathogenesis [4]. Hypertriglyceridemia is believed to enhance the prothrombotic state through effects on platelet aggregation, coagulation factors, and fibrinolysis. These mechanisms indicate the potential association of high triglyceride with atherothrombotic stroke

development, but the prognostic significance of hypertriglyceridemia in patients who have experienced a stroke is uncertain [5,6]. Whereas earlier reports concentrated on cholesterol subfractions, recent data suggest that triglycerides may similarly contribute to cerebrovascular risk. Certain clinical trials have suggested a link between high triglycerides and rising stroke rates, whereas others have not produced a causal relationship. This variability underscores the necessity of further research to conclude whether hypertriglyceridemia is an independent risk factor or rather a marker for other metabolic abnormalities leading to stroke [7,8].

Since the role of hypertriglyceridemia in predicting ischemic stroke remains uncertain, it is crucial to examine its influence on patient outcomes, especially in atherothrombotic stroke, in which lipid metabolism significantly contributes to disease process. Insight into whether hypertriglyceridemia affects early in-hospital recovery would be very useful in terms of risk stratification and therapeutic management of stroke patients. Thus, this research will evaluate the early recovery trends of patients with acute ischemic stroke according to triglyceride levels, which may reveal the prognostic value of hypertriglyceridemia in the treatment of stroke.

Methods

Study Design and Population: The study was designed as a cross-sectional analytical study done in the Neurology Department of TVMCH. All the patients with acute ischemic stroke, as defined by the specified study period, were included in the study. The population of the study was patients between 18 and 80 years of age with a confirmed diagnosis of ischemic stroke by CT or MRI scan. Hemorrhagic stroke, cardioembolic stroke, transient ischemic attacks (TIA), end-stage diseases like cancer, chronic kidney disease (CKD), chronic liver disease (CLD), chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), and pregnant women were excluded to avoid a heterogeneous study population.

Study Period and Sample Size: The study was carried out over a period of August 2023 to December 2024. A total of 107 patients took part in the study. The sample size was calculated with the help of standard statistical formulas to provide enough power for analysis. Patients were recruited consecutively to prevent selection bias and provide a representative sample.

Data Collection and Assessment: All study patients were subjected to thorough clinical assessment upon admission. Diagnosis of acute ischemic stroke was established by neuroimaging methods like CT or MRI. Stroke severity was determined by means of the National Institutes of Health Stroke Scale (NIHSS), Glasgow Coma Scale (GCS), and complete neurological examination. The etiologic stroke classification was established by the TOAST classification system which aids in the classification of ischemic stroke subtypes according to underlying pathophysiological mechanisms.

Demographic and clinical data at baseline, such as age, sex, and appropriate vascular risk factors such as hypertension, diabetes mellitus, chronic alcohol consumption, and smoking history were documented. Standard laboratory workup was carried out, which included a fasting lipid profile. Triglyceride levels were assessed on the day after admission, and the patients were classified into four groups according to triglyceride level: less than 150 mg/dL, 150 to 250 mg/dL, 250 to 350 mg/dL, and more than 350 mg/dL.

Assessment of Functional Outcomes: Patient's functional status was assessed upon discharge through the modified Rankin Scale (mRS), a measure of disability and dependence in daily life. The association between different triglyceride levels and stroke outcomes was examined with statistical analysis to establish whether hypertriglyceridemia had a prognostic effect on recovery.

Statistical Analysis: Descriptive statistics such as means, medians, standard deviations, frequencies, and percentages were applied to summarize patient characteristics. Comparative between-group analyses were carried out through the use of suitable statistical tests like the t-test and likelihood ratio tests. Multivariate logistic regression analysis was carried out in order to measure the independent association of triglyceride levels and functional outcome while adjusting for likely confounding factors like age, sex, and comorbid conditions. Statistical significance was measured by the establishment of a significant level, so that solid conclusions could be made about the effects of hypertriglyceridemia on recovery from stroke.

Results

A total of 107 patients with acute ischemic stroke of atherothrombotic origin were enrolled in the study. The mean age of the cohort was 62.4 ± 10.8 years, with a slight male predominance (62 males, 57.9%).

Baseline vascular risk factors were highly prevalent: hypertension in 54.2% of patients, diabetes mellitus in 38.3%, smoking in 29.9%, and chronic alcohol use in 25.2%. According to TOAST classification, large artery atherosclerosis accounted for 44.8% of cases, small vessel occlusion for 40.2%, and 14.9% were categorized as undetermined/other. These demographic and

etiologic data reflected the typical risk profile for ischemic stroke patients in South Indian clinical settings.

Table 1: Baseline Characteristics of the Study Population (n=107)

Characteristic	Value / Frequency (%)
Mean Age (years)	**62.4 ± 10.8**
Male	**62(57.9%)**
Female	**45(42.1%)**
Hypertension	**58(54.2%)**
Diabetes Mellitus	**41(38.3%)**
Smoking History	**32(29.9%)**
Alcohol Consumption	**27(25.2%)**
Large artery atherosclerosis	**48(44.8%)**
Small Vessel Occlusion	**43(40.2%)**
Undetermined/Other Etiology	**16(14.9%)**

Distribution of Triglyceride Levels: On admission, fasting triglyceride (TG) levels demonstrated a wide distribution. 36 patients (33.6%) had triglyceride <150 mg/dL, 44 patients (41.1%) were between 150–250 mg/dL, 19 patients (17.8%) between 250–350 mg/dL, and 8 patients (7.5%) had levels >350 mg/dL. Thus, nearly one-quarter (25.3%) of the study population fell into the moderate-to-severe hypertriglyceridemia category (>250 mg/dL).

Stroke Severity at Admission: Stroke severity, assessed by NIHSS scores, showed a significant association with triglyceride levels.

Patients with triglyceride <150 mg/dL predominantly presented with mild to moderate strokes (86.1%), whereas those with triglyceride >250 mg/dL exhibited a greater proportion of severe presentations.

Specifically, in the >350 mg/dL group, 50% of patients had NIHSS ≥16, highlighting a trend of progressively worsening neurological status with rising triglyceride levels ($p<0.05$).

Table 2: Distribution of Stroke Severity and Triglyceride Levels

Triglyceride Level (mg/dL)	Number of patients: n (%)	NIHSS <5	NIHSS 5-15	NIHSS 16-25	NIHSS >25
<150	36(33.6%)	13(36.1%)	18(50%)	4(11.1%)	1(2.7%)
150-250	44(41.1%)	12(27.3%)	21(47.7%)	9(20.4%)	2(4.5%)
250-350	19(17.8%)	4(21.1%)	7(36.8%)	6(31.5%)	2(10.5%)
>350	8(7.5%)	1(12.5%)	3(37.5%)	3(37.5%)	1(12.5%)

Functional Outcomes at Discharge: Functional outcomes, measured by the modified Rankin Scale (mRS) at discharge, paralleled admission severity. Among patients with triglyceride <150 mg/dL, two-thirds (66.6%) achieved good functional outcomes (mRS 0–2). In contrast, patients with triglyceride >250 mg/dL had markedly worse outcomes, with 63.2% in the 250–350 mg/dL group and 87.5% in the >350 mg/dL group recording mRS ≥3. Multivariate logistic regression analysis adjusting for age, sex, hypertension, and diabetes confirmed hypertriglyceridemia as an independent predictor of poor functional recovery ($p=0.01$).

Correlation Analyses: Pearson's correlation revealed a positive association between triglyceride levels and both admission NIHSS scores ($r = 0.41$, $p<0.001$) and discharge mRS scores ($r = 0.39$, $p=0.002$). These moderate correlations suggest that higher triglyceride levels are not only linked with stroke severity but also with poorer recovery trajectories during hospitalization.

Hospital Course and Length of Stay: Patients with triglyceride levels >250 mg/dL also demonstrated a longer mean hospital stay (11.2 ± 3.4 days) compared to those with triglyceride <150 mg/dL (7.6 ± 2.8 days). This trend, although not statistically powered to show causality, indicates a possible influence of dyslipidemia on acute care needs and rehabilitation delays.

Taken together, the results demonstrate that hypertriglyceridemia was strongly associated with higher stroke severity, poorer functional recovery, and longer hospital stay, reinforcing its role as a negative prognostic marker in atherothrombotic stroke.

Table 3: Association between Triglyceride Levels and Functional Outcomes (mRS Scores)

Triglyceride Level (mg/dL)	Number of Patients: n(%)	mRS 1-2	mRS 3-4	mRS 5
<150	36(33.6%)	24(66.6%)	9(25%)	3(8.3%)
150-250	44(41.1%)	23(52.3%)	15(34.1%)	6(13.6%)
250-350	19(17.8%)	7(36.8%)	9(47.3%)	3(15.7%)
>350	8(7.5%)	1(12.5%)	4(50%)	3(37.5%)

Graphical Representation of Key Findings

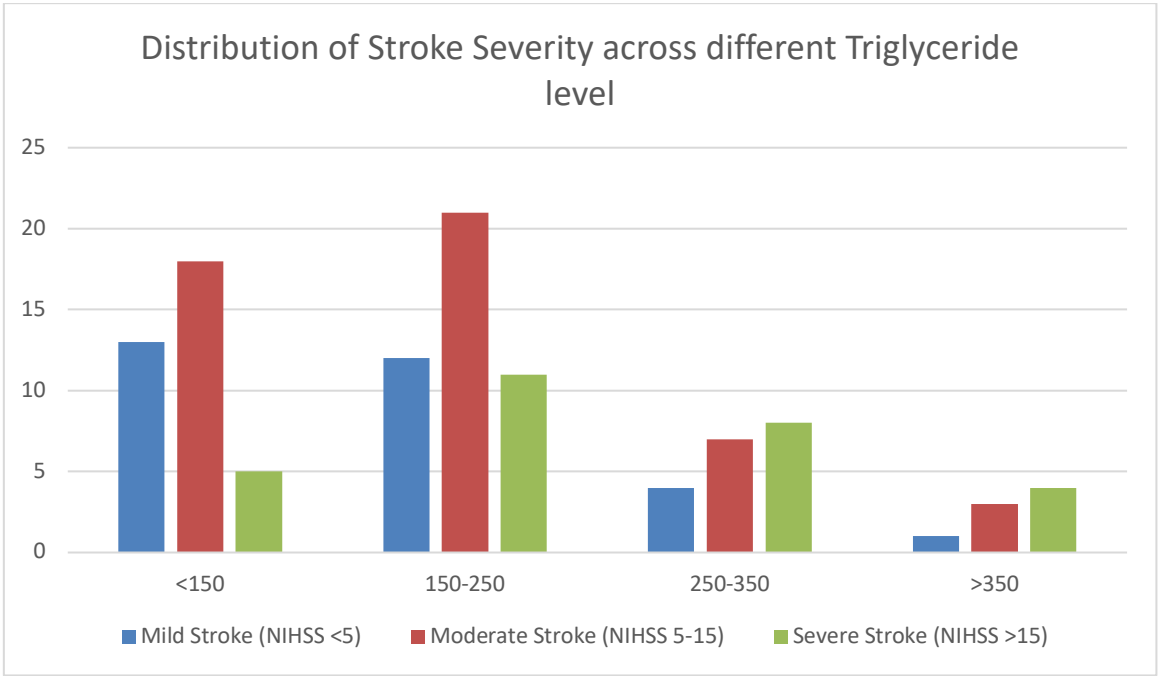

Figure 1: Distribution of Stroke Severity across Different Triglyceride Levels

Figure 1 depicting the distribution of stroke severity across different triglyceride levels demonstrates a clear trend toward more severe strokes with increasing triglyceride levels.

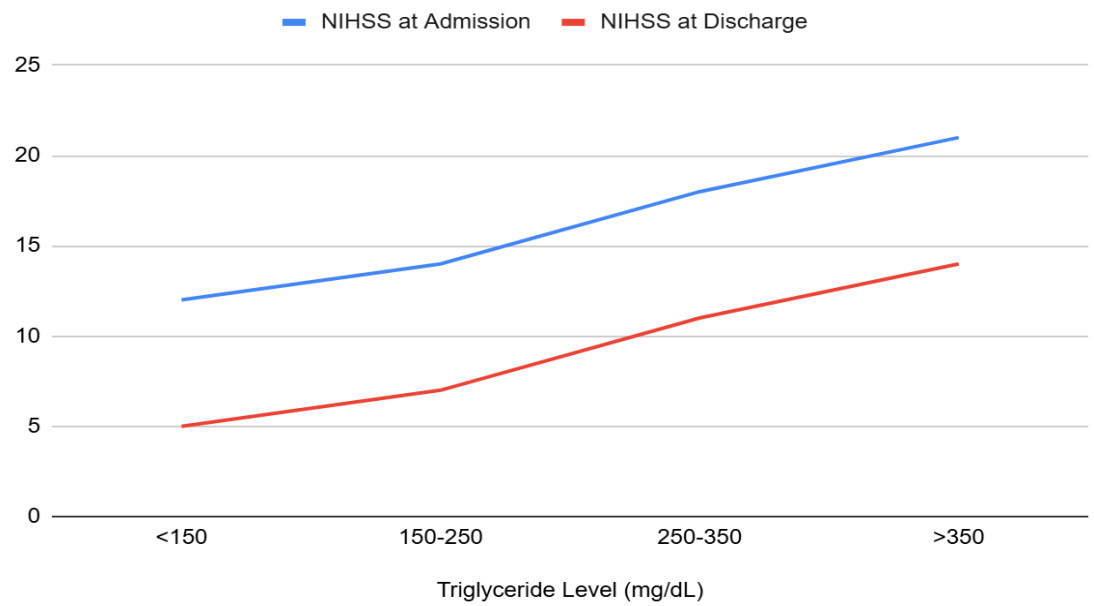

Figure 2: Comparison of NIHSS Scores at Admission and Discharge Across Triglyceride Categories

Additionally, a line graph (Figure 2) comparing NIHSS scores at admission and discharge across triglyceride categories highlights the limited improvement observed in patients with higher triglyceride levels.

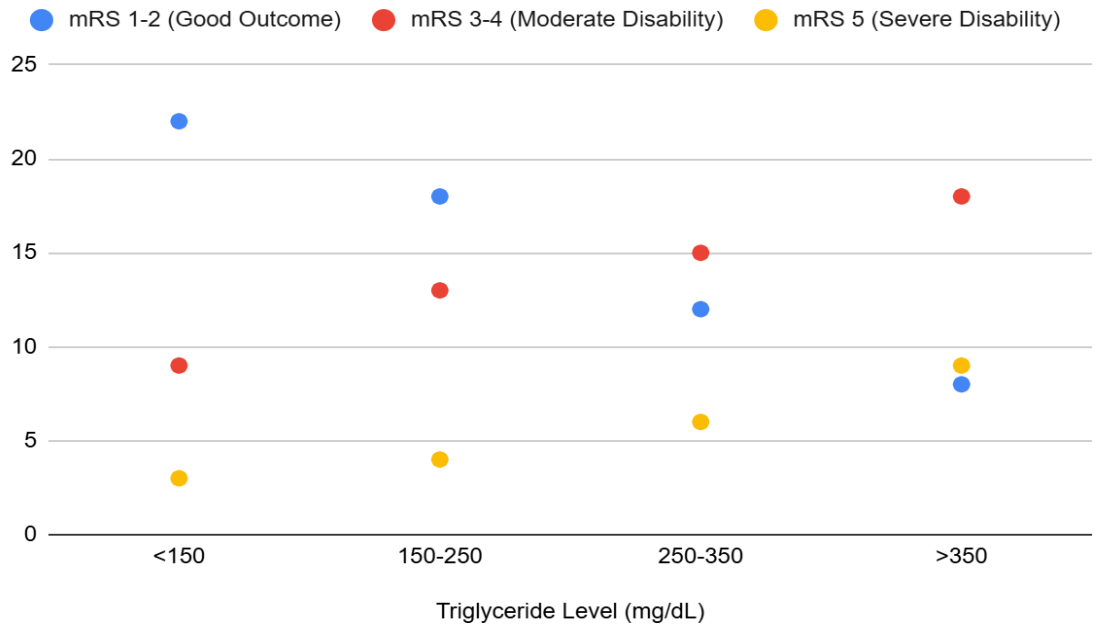

Figure 3: Correlation between Triglyceride Levels and Functional Outcomes (mRS Scores) at Discharge

A scatter plot (Figure 3) analyzing the correlation between triglyceride levels and mRS scores visually reinforces the observed relationship between hypertriglyceridemia and poor functional outcomes.

The results of the study indicated that hypertriglyceridemia was highly correlated with acute ischemic stroke severity and adverse functional recovery. Patients with a triglyceride level above 250 mg/dL presented with more severe admission strokes, had longer hospitalizations, and experienced poorer functional recovery at discharge. These findings call for specific lipid management interventions in patients at risk of ischemic stroke to enhance prognosis and outcomes of recovery.

Discussion

The present study provides compelling evidence that hypertriglyceridemia is significantly associated with both stroke severity and functional outcomes in patients with ischemic stroke of atherothrombotic origin. Patients with triglyceride levels exceeding 250 mg/dL not only presented with more severe neurological deficits on admission but also exhibited poorer functional recovery at discharge, as measured by mRS. These findings highlight hypertriglyceridemia as an important, and potentially modifiable, prognostic factor in stroke management.

This research identifies the close correlation between hypertriglyceridemia and stroke severity, as well as functional recovery among acute ischemic stroke patients. Those with higher triglycerides were admitted with more severe strokes, as shown by NIHSS scores, and had poorer functioning at discharge, as measured through higher mRS scores. These findings are consistent with mounting evidence that hypertriglyceridemia is not only a sign of metabolic dysfunction but also an independent risk factor on cerebrovascular events.

Hypertriglyceridemia has been associated with endothelial dysfunction, enhanced oxidative stress, and a prothrombotic condition, all of which are factors in atherosclerosis and ischemic stroke. This research's findings are consistent with earlier studies that have evinced the vascular pathology role of elevated triglycerides. A paper by Jiménez-Palomares et al. (2011) indicated that a genetic apolipoprotein D deficiency is linked with hypertriglyceridemia and metabolic disorders, further supporting the importance of triglyceride metabolism in the pathogenesis of vascular disease. Their conclusion is that triglyceride increase is more than just a secondary marker of other lipid disorders but also a causative factor for vascular function impairments and insulin resistance, which are likely to worsen stroke prognosis (Jiménez-Palomares et al., 2011) [9].

The findings of this research are also in agreement with those of Stein et al. (1998), who established a high correlation between the level of nonfasting triglycerides and ischemic stroke risk. Their study

found that high levels of triglycerides were predictive of stroke events, regardless of other lipid variables like LDL-C and HDL-C. These observations extend the aforementioned association in demonstrating that triglycerides have an independent role as predictors of recovery from stroke with increased values also being a factor for increasing discharge disability (Stein et al., 1998) [11]. In another association, a major study carried out by Eberly et al. (2003) that involved data in the Multiple Risk Factor Intervention Trial (MRFIT) has reported strong fasting and nonfasting associations for triglyceride levels with coronary heart disease or fatal plus nonfatal ischemic events. Their research underscored the significance of triglycerides in long-term cardiovascular risk estimation, and our results add to this view by showing their effect on acute stroke prognosis (Eberly et al., 2003) [10].

Also, this research supports earlier research that indicates the necessity of focused therapeutic measures for controlling raised triglycerides. Cullen (2000) offered convincing evidence that triglycerides are a separate risk factor for coronary heart disease, highlighting that their function is not limited to cholesterol-related risk factors (Cullen, 2000) [14]. Additionally, Christian et al. (2014) showed that marked decreases in triglyceride levels were required in order to achieve clinically relevant benefits in patients with extreme hypertriglyceridemia, revealing that successful lipid-lowering therapies could have tangible effects on stroke prevention and rehabilitation (Christian et al., 2014) [15].

There is also increasing interest in the relationship between triglycerides and other metabolic factors that play a role in stroke risk. Lai and Hsu (2019) investigated the correlation between hypertriglyceridemia and serum uric acid, hypothesizing that the combined action of these metabolic factors might worsen stroke severity in men. This aligns with the findings of the present study, where patients with elevated triglycerides exhibited worse functional outcomes, potentially due to underlying metabolic disturbances that extend beyond dyslipidemia alone (Lai & Hsu, 2019) [13]. Furthermore, Koba (2013) [12] emphasized the importance of statin therapy in managing atherogenic hypertriglyceridemia, suggesting that lipid-modifying treatment strategies could play a crucial role in reducing stroke-related morbidity and mortality (Koba, 2013).

The conclusions of these observations are that triglycerides can be regarded as an important modifiable risk factor in the management of stroke. Although conventional lipid control has hitherto concentrated on LDL-C and HDL-C, the close correlation of triglyceride levels with the severity of stroke in this study indicates that greater attention needs to be paid to the management of dyslipidemia in cerebrovascular disease. Interventions that aim to decrease triglyceride levels, including lifestyle changes, dietary interventions, and drug therapy, can potentially have a positive effect not just on stroke prevention but also on recovery outcomes in stroke survivors.

Overall, this study presents strong evidence that hypertriglyceridemia adversely affects the severity and functional recovery of acute ischemic stroke patients. The findings are consistent with earlier work establishing the involvement of triglycerides in vascular disease and reinforce the value of integrating triglyceride control into stroke prevention and recovery planning. Additional research is indicated to identify mechanistic pathways between triglycerides and stroke outcome and to define the optimal therapeutic strategies for countering their effects on cerebrovascular well-being.

Conclusion

This research emphasizes the important prognostic value of hypertriglyceridemia in acute ischemic stroke of atherothrombotic etiology, showing its correlation with greater stroke severity at admission and worse functional recovery at discharge. Patients with elevated triglyceride levels had more severe neurological impairment, as indicated by greater NIHSS scores, and had worse outcomes on the mRS scale, supporting the adverse effect of hypertriglyceridemia on stroke prognosis. These results concur with existing literature highlighting the importance of triglycerides in vascular disease and reinforce the requirement for holistic lipid management strategies that extend beyond routine LDL-C and HDL-C measurement. Since triglycerides are modifiable, specific interventions like lifestyle adjustments and pharmacotherapy could be critical in enhancing stroke outcomes. Additional studies are needed to clarify the mechanisms underlying the association between hypertriglyceridemia and ischemic stroke severity and to maximize treatment regimens for improved cerebrovascular health.

References

1. Liang HJ, Zhang QY, Hu YT, Liu GQ, Qi R. Hypertriglyceridemia: A Neglected Risk Factor for Ischemic Stroke? J Stroke. 2022 Jan;24(1):21-40. doi: 10.5853/jos.2021.02831. Epub 2022 Jan 31. PMID: 35135057; PMCID: PMC8829486.
2. Bansal S, Buring JE, Rifai N, Mora S, Sacks FM, Ridker PM. Fasting compared with nonfasting triglycerides and risk of cardiovascular events in women. JAMA. 2007 Jul 18;298(3):309-16. doi: 10.1001/jama.298.3.309. PMID: 17635891.

3. Lisak M, Demarin V, Trkanjec Z, Basić-Kes V. Hypertriglyceridemia as a possible independent risk factor for stroke. Acta Clin Croat. 2013 Dec;52(4):458-63. PMID: 246 96996.
4. Freiberg JJ, Tybjaerg-Hansen A, Jensen JS, Nordestgaard BG. Nonfasting triglycerides and risk of ischemic stroke in the general population. JAMA. 2008 Nov 12;300(18):21 42-52. doi: 10.1001/jama.2008.621. PMID: 19001625.
5. Antonios N, Angiolillo DJ, Silliman S. Hypertriglyceridemia and ischemic stroke. Eur Neurol. 2008;60(6):269-78. doi: 10.1159/000 157880. Epub 2008 Sep 27. PMID: 18824854.
6. Nordestgaard LT, Christoffersen M, Afzal S, Nordestgaard BG, Tybjærg-Hansen A, Frikke-Schmidt R. Triglycerides as a Shared Risk Factor between Dementia and Atherosclerotic Cardiovascular Disease: A Study of 125 727 Individuals. Clin Chem. 2021 Jan 8;67(1):245-255. doi: 10.1093/clinchem/hvaa269. PMID: 33418579.
7. Hoshino T, Ishizuka K, Toi S, et al. Prognostic role of hypertriglyceridemia in patients with stroke of atherothrombotic origin. Neurology. 2022;98(16):e1660-e1669. doi:10.1212/WNL. 0000000000200112.
8. Shin DW, Lee KB, Seo JY, Kim JS, Roh H, Ahn MY, Lee JS. Association between Hypertriglyceridemia and Lacunar Infarction in Type 2 Diabetes Mellitus. J Stroke Cerebrovasc Dis. 2015 Aug;24(8):1873-8. doi: 10.1016/j.jstrokecerebrovasdis.2015.04.030. Epub 2015 May 23. PMID: 26004860.
9. Jiménez-Palomares M, Cózar-Castellano I, Ganfornina MD, Sánchez D, Perdomo G. Genetic deficiency of apolipoprotein D in the mouse is associated with nonfasting hypertriglyceridemia and hyperinsulinemia. Metabolism. 2011 Dec;60(12):1767-74. doi: 10.1016/j.metabol.2011.04.013. Epub 2011 May 31. PMID: 21632073.
10. Eberly LE, Stamler J, Neaton JD; Multiple Risk Factor Intervention Trial Research Group. Relation of triglyceride levels, fasting and nonfasting, to fatal and nonfatal coronary heart disease. Arch Intern Med. 2003 May 12;163(9):1077-83. doi: 10.1001/archinte.1 63.9.1077. PMID: 12742806.
11. Stein JH, Rosenson RS. Treatment of severe hypertriglyceridemia lowers plasma viscosity. Atherosclerosis. 1998 Apr;137(2):401-5. doi: 10.1016/s0021-9150(97)00285-2. PMID: 9622283.
12. Koba S. [Statin therapy for atherogenic hypertriglyceridemia]. Nihon Rinsho. 2013 Sep;71(9):1655-60. Japanese. PMID: 24205730.
13. Lai YJ, Hsu CY. Is serum uric acid a predictive factor for stroke in men with hypertriglyceridemia? Bratisl Lek Listy. 2019;120(4):316-319. doi: 10.4149/BLL_2019_043. PMID: 31023056.
14. Cullen P. Evidence that triglycerides are an independent coronary heart disease risk factor. Am J Cardiol. 2000 Nov 1;86(9):943-9. doi: 10.1016/s0002-9149(00)01127-9. PMID: 11053704.
15. Christian JB, Arondekar B, Buysman EK, Jacobson TA, Snipes RG, Horwitz RI. Determining triglyceride reductions needed for clinical impact in severe hypertriglyceridemia. Am J Med. 2014 Jan;127(1):36-44.e1. doi: 10.1016/j.amjmed.2013.09.018. Epub 2013 Oct 8. PMID: 24384100.