

Effects of Serum Cholesterol Level on Severity of Acute Ischaemic Stroke

Priya V Sutar¹, Adarsh²

¹Associate Professor, Department of General Medicine, Great Eastern Medical School, Srikakulam, Andhra Pradesh, India. ²Resident, Department of General Medicine, Great Eastern Medical School, Srikakulam, Andhra Pradesh, India

Abstract

Background: In recent years, dyslipidemia has become a contentious risk factor for ischemic stroke. Statins are a well-established secondary preventive measure for stroke, nevertheless. The contradictory result that lower mortality following a stroke is associated with greater serum TC levels has also been highlighted by several research. However, a number of investigations were unable to show that elevated TC levels in stroke patients had such a positive predictive impact. The objective is to assess how blood cholesterol levels affect stroke severity as determined by infarct volume. **Material and Methods:** Between 2023 and 2025, this prospective observational study was carried out at the GEMS Hospital in Srikakulam, India. **Results:** The study included 100 consecutive patients, 64 (64.0%) of whom were men. Thirty-five (35.0%) of the patients had hypercholesterolemia. When serum cholesterol levels and infarct volume were compared using MRI, 27 patients (37.5%) with modest stroke severity (infarct volume ≤ 70 ml) had hypercholesterolemia, but the majority (62.5.8%) did not. In the major stroke group (infarct volume ≥ 70 ml), hypercholesterolemia was present in 28.6% of patients compared to those without (71.4%). Although the results suggested that hypercholesterolemia was more common in patients with higher stroke severity, the association was not statistically significant ($P > 0.05$). **Conclusion:** The severity of the stroke as determined by the infarct volume was shown to be inversely correlated with serum cholesterol levels.

Keywords: TC- Total Cholesterol.

Received: 20 May 2026

Revised: 10 June 2026

Accepted: 30 June 2026

Published: 03 July 2026

INTRODUCTION

Neurological impairments and incapacity brought on by strokes place a significant strain on healthcare systems.^[1] Lipids, particularly cholesterol, play a complex role in the pathophysiology of cerebrovascular disease. A well-known risk factor for atherosclerosis and cardiovascular disease, elevated low-density lipoprotein cholesterol (LDL-C) causes carotid and cerebral atherosclerotic plaques to form.^[2] These plaques predispose to thromboembolic events, thereby contributing to ischemic stroke risk. Conversely, by enhancing endothelial function, lowering vascular inflammation, and encouraging reverse cholesterol transfer, high-density lipoprotein cholesterol (HDL-C) provides beneficial vascular benefits.^[2] Recently, there has been much debate regarding dyslipidemia as a risk factor for ischemic stroke.^[3-6] Nonetheless, statin use for secondary stroke prevention is well-established and supported by prior research. The contradictory finding that greater serum TC levels are associated with decreased stroke mortality has also been highlighted by a number of studies.^[7,8] However, a number of studies were unable to show that elevated TC levels in stroke patients had such a positive predictive impact.^[8,9] Heterogeneity both within and between study populations may help to explain these contradictory results.^[10,11] Since cholesterol may have distinct effects on ischemic stroke and hemorrhagic stroke,^[12] it is important to assess the results in a more homogeneous sample (e.g. those with first-time ischemic stroke).

Aims and objectives

This study's main objective is to assess how blood cholesterol

levels affect the infarct volume, a measure of stroke severity.

MATERIALS AND METHODS

This comparative prospective observational study was carried out in GEMS & Hospital Srikakulam, Andhra Pradesh between 2023 and 2025. Ethics approval is obtained on 10th April 2026, 03/IEC/GEMS&H/2026. Study includes 100 patients aged > 18 years admitted within 24 hours of onset of acute ischemic stroke as confirmed by imaging. Pregnant and lactating women were excluded from study.

The WHO's definition of stroke was used to define the cases. Baseline demographic details including age, sex, residence and occupation along with clinical history such as risk factors, comorbidities, prior medication use, and family history of stroke or dyslipidaemia, were recorded using a structured proforma. The JNC 8 recommendations were used to determine whether a person had a history of hypertension, was taking antihypertensive medication, had diabetes, had a history of smoking, or had consumed hazardous amounts of alcohol. If there were signs of

Address for correspondence: Dr. Priya V Sutar,
Associate Professor, Department of General Medicine, Great Eastern Medical School,
Srikakulam, Andhra Pradesh, India.
E-mail: priyavish17@rediffmail.com

DOI:
10.21276/amt.2026.v13.i2.796

How to cite this article: Sutar PV, Adarsh. Effects of Serum Cholesterol Level on Severity of Acute Ischaemic Stroke. Acta Med Int. 2026;13(2):923-926.

cardiac disease in the history or on the EKG or echocardiography, it was taken into consideration.

Laboratory tests were collected, including blood glucose, liver function tests, renal function tests, and a fasting lipid profile (total cholesterol, LDL, HDL, and triglycerides).

A CT scan and an MRI of the brain were performed on each of the study's participants. Infarct volume was calculated by using 3D slicer tool. The volume of <70 ml was considered as small and ≥70 ml considered as large stroke. The National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) defined hyperlipidemia as total cholesterol ≥ 200 mg/dL, LDL-C ≥ 130 mg/dL, HDL-C < 40 mg/dL in males and < 50 mg/dL in women, or triglycerides > 150 mg/dL.

Statistical Analysis: Data from the questionnaires was entered in MS Excel 2016 and analysed using SPSS software version 20.

For quantitative variables, comparisons between two groups were made using the unpaired t-test (Independent samples t-test). The Chi-square test or Fisher's exact test, if applicable, were used for bivariate analysis of qualitative variables. A statistically significant p-value was defined as less than 0.05.

RESULTS

We included 100 consecutive patients admitted to the ward and ICU who fulfilled the inclusion criteria. There were 64(64%) males and 36 (36%) females. Most of our patients belonged to the age group of 50-79 years. Hypertension was present in 62 (62%) followed by hypercholesterolemia (35%), smoking (34%), and diabetes (29%) which also contributed significantly as major risk determinants. A history of alcohol consumption was noted in 28% of the participants, while coronary artery disease was the least common associated risk factor seen in 15% of the cases. [Table 1]

Table 1: Demographics and comorbidities

	No	Percentage
AGE		
< 60	58	58.0
≥ 60	42	42.0
MALE	64	64.0
FEMALE	36	36.0
HTN	62	62.0
DM	29	29.0
SMOKING	34	34.0
ALCOHOL	28	28.0
HYPERCHOLESTEROLEMIA	35	35.0
CARDIAC COMORBIDITIES	15	15.0

Infarct volume on MRI of ≥70 ml, considered as a large volume was seen in 28 (28.0%) patients. In the remaining 72 (72.0%) patients, a small infarct volume < 70 ml was seen. Among patients with minor stroke severity (infarct volume ≤ 70 ml), hypercholesterolemia was seen in 27(37.5 %), while the majority (62.5.8%) did not have it. In the major stroke group (infarct volume ≥70 ml), hypercholesterolemia was

present in 28.6% of patients compared to those without (71.4%)

Although the results suggested that hyperlipidaemia was more common in patients with higher stroke severity, the association was not statistically significant (P > 0.05). [Table 2].

Table 2: Correlation between Hyperlipidaemia and Stroke Severity

Infarct volume	Hypercholesterolemia		Total
	YES	NO	
≤ 70 ML	27(37.5 %)	45(62.5%)	72(72%)
≥ 70 ML	8 (28.6 %)	20(71.4%)	28(28%)
TOTAL	35(35%)	65(65%)	100(100%)
CHI SQUARE = 0.706		P VALUE=0.40	

DISCUSSION

In this study, by comparing the mean cholesterol levels with the infarct volume, we have assessed the relationship between serum cholesterol levels and the severity of stroke.

Of the 100 patients who were admitted with acute ischemic stroke, 64% were men, and the majority were between the ages of 50 and 70. Hypertension was present in 52% of patients followed by hypercholesterolemia (35%), smoking (34%), and diabetes (29%). A history of alcohol consumption was noted in 28% of the participants, while coronary artery disease was the least common associated risk factor seen in 15% of the cases.

Serum cholesterol level and stroke: In the present study, the majority of patients had a small infarct volume (<70 ml)

comprising 72% of the study population, whereas large infarcts (≥70 ml) were observed in 28%. This distribution highlights that smaller infarcts were more common in the study population, though a significant proportion still presented with large-volume strokes.

Though hyperlipidemia is a known prevalent risk factor for stroke, many trials and studies have failed to show strong association between the two. Previously published studies have given controversial report on how hypercholesterolemia affects stroke and post stroke outcomes.^[13,14] In an earlier study it was reported that elevated levels of cholesterol (>200mg/dl) were associated with increase in incidence of stroke.^[15] Also, in clinical trials and registries, it was noted that up to 60% of stroke patients had increased level of cholesterol.^[16] This result is

comparable with our study. However, there was no correlation between the incidence of stroke and cholesterol levels in the Framingham cohort.^[17] Some studies have even reported a protective effect of hyperlipidemia in stroke patients by reducing mortality rates.^[18,19] In a study conducted by Iso et al,^[20] the serum cholesterol levels under 4.14 mmol/L (80 mg/dl) were associated with increased risk of fatal intracranial hemorrhage, whereas the levels above 7.23 mmol/L (279.5 mg/dl) increased the risk of death from ischemic stroke.

Here, we assessed the infarct volume and compared it to the amount of serum cholesterol. Higher infarct volumes were associated with lower mean cholesterol levels, and vice versa. Our study finding is consistent with the study done by Olsen et al,^[21] where 513 patients were evaluated for serum cholesterol levels and severity of stroke measure based on Scandinavian Stroke Scale. This study demonstrated that the development of a small stroke was favored by increased cholesterol levels. Higher cholesterol levels were found to be a contributing factor in the development of small-vessel disease, which in turn led to a less severe stroke and hence a reduced death rate. Our study findings are also consistent with Sridharan P et al,^[22] who also evaluated infarct volume in relation to serum cholesterol levels. In their study, patients with larger infarcts (>70 ml) had a mean cholesterol level of 218.7 mg/dL, while those with smaller infarcts (<70 ml) showed slightly higher cholesterol values (223.8 mg/dL). Their study similarly demonstrated that smaller infarcts predominated, which parallels the 72% smaller infarcts observed in the present study.

The majority of research on cholesterol and stroke in the literature has assessed the effect of hyperlipidemia on long-term mortality and stroke incidence. However, crucial elements including the initial lesions' location, size, and kind of stroke are not routinely assessed.

CONCLUSION

This study highlights that acute ischemic stroke predominantly affects individuals in the late middle to elderly age groups, has a pronounced male predominance and a high prevalence of vascular risk factors such as diabetes, smoking, dyslipidemia, and hypertension. In this investigation, we discovered an inverse relationship between the severity of the stroke and blood cholesterol levels. Clinicians should incorporate lipid indicators into total risk classification and be cognizant of the prognostic implications of lipid burden.

Limitation: This is a prospective, single-centre study. There are limited number of subjects in this study. We have looked into the infarct volume; however, we have not classified different subtype of stroke in this study.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Feigin VL, Norrving B, Mensah GA. Global Burden of Stroke. *Circ Res.* 2017 Feb 3;120(3):439-448. Doi: 10.1161/CIRCRESAHA.116.308413. PMID: 28154096.
2. Campbell BCV, De Silva DA, Macleod MR, Coutts SB, Schwamm LH, Davis SM, Donnan GA. Ischaemic stroke. *Nat Rev Dis Primers.* 2019 Oct 10;5(1):70. Doi: 10.1038/s41572-019-0118-8. PMID: 31601801.
3. Amarenco P. Hypercholesterolemia, lipid-lowering agents, and the risk for brain infarction. *Neurology.* 2001; 57: S35-S44.
4. Goldstein LB, Adams R, Alberts MJ, Appel LJ, Brass LM, Bushnell CD, Culebras A, DeGrabba TJ, Gorelick PB, Guyton JR, Hart RG, Howard G, Kelly-Hayes M, Nixon JV, Sacco RL. Primary prevention of ischemic stroke: a guideline from the American Heart Association/American Stroke Association Stroke Council. *Stroke.* 2006; 37: 1583-1633.
5. Castelli WP, Anderson K, Wilson PW, Levy D. Lipids and coronary heart disease: the Framingham Study. *Ann Epidemiol.* 1992; 2: 23-28.
6. Nam B-H, Kannel W, D'Agostino RB. Search for an optimal atherogenic lipid risk profile: from The Framingham Study. *Am J Cardiol.* 2006; 97: 372-375.
7. Wolf PA, Kannel WB, Verter J. Current status of risk factors for stroke. *Neurol Clin.* 1983; 1: 317-343.
8. Kagan A, Popper JS, Rhoads GG. Factors related to stroke incidence in Hawaiian Japanese men: the Honolulu Heart Study. *Stroke.* 1980; 11: 14-21.
9. Prospective Studies Collaboration. Cholesterol, diastolic blood pressure, and stroke: 13 000 strokes in 450 000 people in 45 prospective studies. *Lancet.* 1995; 346: 1647-1653.
10. Iso H, Jacobs DR, Wentworth D, Neaton JD, Cohen JD, for the MRF Research Group. Serum cholesterol levels and six-year mortality from stroke in 350,977 men screened for the Multiple Risk Factor Intervention Trial. *N Engl J Med.* 1989; 320: 904-910.
11. Brott T, Adams HP, Olinger CP, Marler JR, Barsan WG, Biller J, et al. Measurements of acute cerebral infarction: a clinical examination scale. *Stroke.* 1989;20(7):864-70.
12. van Swieten JC, Koudstaal PJ, Visser MC, Schouten HJ, van Gijn J. Interobserver agreement for the assessment of handicap in stroke patients. *Stroke.* 1988;19(5):604-
13. Lee E, Ryan S, Birmingham B, March R, Ambrose H, Moore R, et al. Rosuvastatin pharmacokinetics and pharmacogenetics in white and Asian subjects residing in the same environment *Clin Pharmacol Ther.* 2005;78:330-41
14. Menet R, Bernard M, El-Ali A. Hyperlipidemia in stroke pathobiology and therapy: Insights and perspectives *Front Physiol.* 2018;9:488 doi:10.3389/fphys.2018.00488
15. Leppälä JM, Virtamo J, Fogelholm R, Albanes D, Heinonen OP. Different risk factors for different stroke subtypes: Association of blood pressure, cholesterol, and antioxidants *Stroke.* 1999;12:2535-40
16. ElAli A, Doepfner TR, Zechariah A, Hermann DM. Increased blood-brain barrier permeability and brain edema after focal cerebral ischemia induced by hyperlipidemia: Role of lipid peroxidation and calpain-1/2, matrix metalloproteinase-2/9, and RhoA overactivation *Stroke.* 2011; 42:3238-44
17. Castelli WP, Anderson K, Wilson PW, Lewy D. Lipids and risk of coronary heart disease. The Framingham Study *Ann Epidemiol.* 1992;2:23-8
18. Jimenez-Conde J, Biffi A, Rahman R, Kanakis A, Butler C, Sonni S, et al. Hyperlipidemia and reduced white matter hyperintensity volume in patients with ischemic stroke *Stroke.* 2010;3:437-42
19. Shigematsu K, Watanabe Y, Nakano H. Kyoto Stroke Registry Committee. Influences of hyperlipidemia history on stroke outcome; a retrospective cohort study based on the Kyoto Stroke Registry

- BMC Neurol. 2015;15:44.
20. Iso H, Jacobs DR, Wentworth D, Neaton JD, Cohen JD. Serum cholesterol levels and six-year mortality from stroke in 350 977 men screened for the Multiple Risk Factors Interventional Trial N Engl J Med. 1989;320:904–10
 21. Olsen TS, Christensen RHB, Kammergaard LP. Higher total serum cholesterol levels are associated with less severe strokes and lower all-cause mortality Stroke. 2007;38:2646–51
 22. Shridharan, Priyanka¹; Nair, Radhika^{1, 2} Gorthi, Sankar P³ Effects of Serum Cholesterol on Severity of Stroke and Dosage of Statins on Functional Outcome in Acute Ischemic Stroke Neurology India 71(5): p 923-927, Sep–Oct 2023.