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Original Research Article

Comparative analysis of the Serum Lipid Profile in Patients with Ischemic and Hemorrhagic Strokes: A Cross-sectional Study

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Abstract

Background: A stroke, also called a brain attack, happens when a blood vessel that supplies or drains blood to and from the brain is blocked, leaks, or both. This damages the brain, making it difficult to move, feel, speak, see, and sometimes even cause's death. The purpose of this study is to compare the serum lipid levels of persons with ischemic versus hemorrhagic stroke and identify the risk variables.

Methods: From September 2025 to February 2026, a comparative cross-sectional study was carried out at the Department of General Medicine, JLNMCH, Bhagalpur, and Bihar. A total of one hundred patients were recruited and split into two groups. Three milliliters of blood were extracted and forwarded to the institutional laboratory for a fasting lipid profile. An autoanalyzer was used to perform an enzymatic analysis of the blood samples. SPSS ver. 24 was used to analyze all of the collected data.

Results: The mean total cholesterol (TC) was 227.20±16.47 mg/dl in ischemic stroke patients and 203.5±16.8 with a P=<0.001 in hemorrhagic stroke patients. With a value of p<0.001, the total mean HDL was determined to be 36.10±4.29. The mean LDL was 145.18±16.98 in ischemic stroke patients and 131.96±12.12 in hemorrhagic stroke patients (p-value<0.001). The mean TG was 203.18±57.74 mg/dl in ischemic stroke patients and 164.67±53.25 (p=0.001) in hemorrhagic stroke patients.

Conclusion: This study concluded that the mean TC, HDL, LDL, and TG of the patients was 215±20.42 mg/dl, 37.77±4.47 mg/dl, t 138.57±16.11 mg/dl, and 183.93±58.55 mg/dl respectively. This study further concluded that is substantial correlation exists between the serum lipid profile of adults and the type of stroke.

Keywords: Ischemic Stroke, Hemorrhagic Stroke, Serum Lipid Profile.

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Introduction

Any abnormality of the brain resulting from a pathological process of blood vessels, such as occlusion of the lumen by embolus or thrombus, rupture of a vessel, altered vessel wall permeability, increased viscosity or other change in the quality of the blood flowing through cerebral vessels, is referred to as a stroke. This term is used to describe a sudden focal neurological deficit, specifically caused by cerebrovascular disease.[1]

In both the developed and developing worlds, stroke is a leading cause of death, illness, and disability and has emerged as a major worldwide health concern. Stroke is a major source of functional impairments, with 20% of survivors needing institutional care for at least three months and up to 30% becoming permanently incapacitated. It is also a risk factor for epilepsy, falls, depression, and other conditions.[2] Regarding the correlation between blood lipid levels and the risk of cardiovascular disease, the scientific community is in agreement. High levels of serum cholesterol, particularly low density lipoproteins, have frequently been linked to the development of atherosclerosis, whereas raised levels of high density lipoproteins (HDL) cholesterol are thought to have a protective effect.[3]

High serum cholesterol levels have been linked to ischemic stroke in a number of clinical investigations.[4] However, other research on the

topic, particularly certain case control studies, looked at cholesterol under the assumption that it was a risk factor, but the results were unfavorable. Additionally, a direct and significant correlation between cholesterol levels and stroke has not been demonstrated by several prospective investigations. According to certain research, there is a negative correlation between total cholesterol and hemorrhagic stroke mortality.[5]

As a result, the link between an aberrant lipid profile and stroke might not be as clear-cut as it is for coronary heart disease. Serum lipid levels have a known impact on stroke-related short-term mortality.

Material and Methods

This comparative cross-sectional study, conducted in the Department of General Medicine at Jawaharlal Nehru Medical College and Hospital in Bhagalpur, Bihar, between September 2025 and February 2026, included all patients diagnosed with ischemic and hemorrhagic stroke (by operational definition) between the ages of 25 and 70, regardless of gender. The disease lasted less than seven days.

After providing informed written consent outlining the goal of the trial, a total of 100 patients who met the eligibility requirements—50 with ischemic stroke and 50 with hemorrhagic stroke—were enrolled. A consultant radiologist with at least three years of post-fellowship experience reported CT scans from the radiology department to determine if an ischemic or hemorrhagic stroke was present.

Age (in years), gender, smoking status, hypertension, diabetes mellitus, and length of sickness were among the demographic details recorded. The stroke caused by ischemia Patients were classified as clinically presenting if they had any one of the following symptoms: low GCS (< 12/15), weakness of any limb (upper or lower) power grade < 5, loss or slurred speech and vision impairment that is persistent beyond 24 hours PLUS CT-brain showing hypodense area, or hemorrhagic stroke. The patient's BMI was determined by measuring their height and weight. According to the operational criteria, the patient was classified as either obese or non-obesity. Three milliliters (3 ml) of blood were drawn and sent for fasting lipid profile to the institutional laboratory. The blood samples were analyzed enzymatically using an autoanalyzer.

All the obtained information was noted on the proforma specifically designed for the study data was assessed using SPSS version 23. Quantitative data (age, BMI, duration of illness (days), and fasting serum lipid levels) were described using mean and standard deviation. Qualitative data [gender, smoking status, hypertension, diabetes mellitus, obesity, and dyslipidemia] were described as frequency and percentages. Fasting lipid levels between the Hemorrhagic stroke and Ischemic stroke groups were compared using an independent sample t-test. The data was stratified concerning age groups, Obesity, smoking status, hypertension, and diabetes mellitus to see the effect of serum lipid levels. The independent T-test was applied after the stratification of samples.

Results

Of the patients, 27 (27%) were female and 73 (73%) were male. The patients had a 2.7:1 male to female ratio. Males represent 39 (78%) of the patients with ischemic stroke and 34 (68%) of the patients with hemorrhagic stroke. Similarly, 11 (22%) of the patients with ischemic stroke and 16 (32%) of the patients with hemorrhagic stroke were female. [Table 1]

Table 1: Distribution of gender between types of stroke with percentage

Type of Stroke				
		Ischemic Stroke n(%)	**Hemorrhagic Stroke n(%)**	**Total n(%)**
Gender	Male	39	34	73
		78.0%	68.0%	73.0%
	Female	11	16	27
		22.0%	32.0%	27.0%
	Total	50	50	100
		100%	100%	100%

The participants' ages were determined to be 59.29±8.11 years. The average age of patients with ischemic stroke was 59.74±7.23 years, whereas the average age of patients with hemorrhagic stroke was 58.84±8.95 years. (Table 2)

Table 2: Statistical calculations of age & type of stroke

	Statistics of age and type of stroke		**Value**
Age	Mean ± Standard Deviation		59.29±8.11
	Minimum		42
	Maximum		70
	Type of stroke	**Ischemic**	**Hemorrhagic**
	No. of cases	50	50
	Mean ± SD	59.74 ± 7.23	58.84 ± 8.95

BMI (Kg/m^2)	No. of cases	50	50
	Mean ± SD	26.70 ± 3.89	26.56 ± 4.10

The mean BMI was 26.70±3.89 kg/m2 for ischemic stroke patients and 26.56±4.10 kg/m^2 for hemorrhagic stroke patients.

In this study, 59 patients (59%) had obesity. Thirty-one (62%) patients with ischemic stroke and twenty-eight (56%) patients with hemorrhagic stroke had obesity. The average length of illness was 2.74±1.31 days for ischemic stroke patients and 2.98±1.28 days for hemorrhagic stroke patients. The patients' mean TC was 215.±20.42 mg/dl, their mean HDL was 37.77±4.47 mg/dl, their mean LDL was 138.57±16.11 mg/dl, and their mean TG was 183.93±58.55 mg/dl.

The mean TC was 227.20±16.47 mg/dl in ischemic stroke patients and 203.54±16.89 mg/dl in hemorrhagic stroke patients (p-value=<0.001). The mean HDL was 36.10±4.03 mg/dl in ischemic stroke patients and 39.44±4.29 mg/dl in hemorrhagic stroke patients (p-value=<0.001). (Table 3)

Table 3: Comparison of co-morbidities between types of stroke

		Type of stroke			
Parameters		**Ischemic stroke**	**Hemorrhagic stroke**	**Total**	**p-value**
Smoking	Yes (n)	27	24	51	0.548
	%	54%	48%	51%	
	No (n)	23	26	49	
	%	46%	52%	49%	
Hypertension	Yes (n)	33	32	65	0.834
	%	66%	64%	65%	
	No (n)	17	18	35	
	%	34%	36%	35%	
Diabetes mellitus	Yes (n)	34	32	66	0.673
	%	68%	64%	66%	
	No (n)	16	18	34	
	%	32%	36%	34%	

The mean LDL was 145.18±16.98 mg/dl in ischemic stroke patients and 131.96±12.12 mg/dl in hemorrhagic stroke patients (p-value<0.001). The mean TG was 203.18±57.74 mg/dl in ischemic stroke patients and 164.67±53.25 mg/dl in hemorrhagic stroke patients (p-value=0.001). (Table 4)

Table 4: Comparison of serum lipid profile between types of stroke

	Types of stroke	**No. of cases**	**Mean±SD**	**p-value**
Total cholesterol (TC)	Ischemic	50	227.20±16.47	<0.001
	Hemorrhagic	50	203.54±16.89	
High density Lipoprotein (HDL)	Ischemic	50	36.10±4.03	<0.001
	Hemorrhagic	50	39.44±4.29	
Low density Lipoprotein (LDL)	Ischemic	50	145.18±16.98	<0.001
	Hemorrhagic	50	131.96±12.12	
Triglyceride (TG)	Ischemic	50	203.18±57.74	0.001
	Hemorrhagic	50	164.67±53.25	

Table 5: Comparison of serum lipid profile between types of stroke stratified by hypertension

Lipid Profile	**Hypertension**	**Type of stroke**	**Mean+SD**	**p-value**
Total cholesterol (TC	Yes	Ischemic	229.03±16.49	<0.001
		Hemorrhagic	205.47±17.49	
	No	Ischemic	223.65±16.35	<0.001
		Hemorrhagic	200.11±15.66	
High density Lipoprotein (HDL)	Yes	Ischemic	35.61±4.54	0.001
		Hemorrhagic	39.66±4.45	
	No	Ischemic	37.06±2.65	0.096
		Hemorrhagic	39.05±4.09	
Low density Lipoprotein (LDL)	Yes	Ischemic	144.25±17.47	0.013
		Hemorrhagic	134.41±13.24	
	No	Ischemic	147.00±16.36	<0.001
		Hemorrhagic	127.61±8.51	

Triglyceride (TG)	Yes	Ischemic	183.06±34.76	0.106
		Hemorrhagic	164.98±52.47	
	No	Ischemic	242.25±73.05	0.001
		Hemorrhagic	164.11±56.16	

When the forms of stroke classified by age groups were compared with the serum lipid profile, a statistical difference was found. that is, p-value <0.05. The forms of stroke classified by obesity and the serum lipid profile were found to differ statistically significantly. that is, p-value <0.05. [Table 5]

Discussion

Among all chronic diseases, stroke is a major cause of impairment and has been recognized as a chronic health condition.[6, 7] There are a number of related symptoms and problems that must be evaluated and contrasted. Accordingly, the mean TC in our study was 227.20±16.47 mg/dl in ischemic stroke patients and 203.54±16.89 mg/dl in hemorrhagic stroke patients (p-value=<0.001).

The mean HDL was 36.10±4.03 mg/dl in ischemic stroke patients and 39.44±4.29 mg/dl in hemorrhagic stroke patients (p-value=<0.001). The mean LDL was 145.18±16.98 mg/dl in ischemic stroke patients and 131.96±12.12 mg/dl in hemorrhagic stroke patients (p-value<0.001). The mean TG was 203.18±57.74 mg/dl in ischemic stroke patients and 164.67±53.25 mg/dl in hemorrhagic stroke patients (p-value=0.001).[8]

According to the results of our investigation, there was a consistent correlation between hemorrhagic stroke and LDL-C, HDL-C, and TG.[9] Compared to hemorrhagic stroke, ischemic stroke patients had lower HDL cholesterol and higher serum TC, according to a study done on stroke patients. In order to determine the type of management therapy for stroke patients, the study recommended testing and screening ischemic stroke patients based on serum lipid levels.[10] According to one study, patients with ischemic stroke had significantly higher mean total cholesterol and LDL-C values than those with hemorrhagic stroke. "(183.7±34.5 versus 148.5±30.6, P = 0.0002, 118.7±26.7 versus 81.4±22.0, P = 0.0001)" [11] There was no statistically significant difference between the two groups' mean TG, mean HDL-cholesterol (HDL-C), and mean VLDL-cholesterol (VLDL-C) values.[12]

In a study with 50 patients in both the ischemic and hemorrhagic stroke groups (N = 100), the mean serum cholesterol was 151±29 vs. 190±35 mg/dl, the mean serum HDL was 45.4±5 vs. 42.4±6 mg/dl, the mean serum LDL was 93±17 vs. 102±21 mg/dl, and the mean serum TG levels were 125±30 vs. 137±30 mg/dl, respectively.[13] In contrast, a number of studies carried out in Japanese populations found no correlation between total cholesterol (TC) and ischemic stroke; however, secondary prevention may be necessary for some other independent factors that affect the type of stroke and prevent the patient's health condition from deteriorating and causing the cardiac infarction.[14] Serum levels of TG, HDL-C, and TC did not significantly correlate with ischemic strokes.[15]

The results of our investigation are at odds with some of the earlier research.[16–17] Therefore, it is recommended that further research be conducted using a bigger sample size and improved methodology in order to assess the results of our study. Future research is advised should be conducted in multi-centered environments.

Conclusion

The study found that the patients' mean levels of TC, HDL, LDL, and TG were 215.±20.42 mg/dl, 37.77±4.47 mg/dl, 138.57±16.11 mg/dl, and 183.93±58.55 mg/dl, respectively. This study also found a significant association between the type of stroke and an adult's serum lipid profile.

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