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Original Research Article

Study of Serum Lipid Profile in Ischemic and Hemorrhagic Stroke Patients

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Abstract:

Background: Based on the disruption of blood flow, strokes can be divided into two categories: ischemic and hemorrhagic. The association between serum lipid profile and type of stroke is still unknown, despite the fact that serum lipids are well-known risk factors for atherosclerosis. Conflicting findings from earlier research have been published about the contribution of dyslipidemia to various forms of stroke. This study compared the serum lipid profiles of patients who had hemorrhagic stroke (HS) to ischemic stroke (IS).

Methods: On the first day of admission, 201 patients with IS and HS who had not taken any lipid-reducing medication and had been admitted to the medicine ward of Darbhanga Medical College and Hospital, Laheriasarai, Bihar, between October 2022 and September 2023, were assessed. These individuals had measurements of their serum lipid profile, which included triglycerides (TG), total cholesterol (TC), low-density lipoprotein-cholesterol (LDL-C), and high-density lipoprotein-cholesterol (HDL-C).

Results: Of the participants, 51.2% were women and 48.8% were men. When comparing IS patients to HS patients, the serum TG level was noticeably greater in IS patients. The results demonstrated a strong correlation between the kind of stroke and HDL-C serum levels.

Conclusion: The findings showed a strong correlation between the kind of stroke and the lipid profile.

Keywords: Ischemic Stroke, Hemorrhagic Stroke, Serum Lipid.

Introduction

The body uses cholesterol for a variety of essential processes, such as cell integrity and maintenance, bile acid production, and the creation of steroid hormones. On the other hand, an excessive rise in blood cholesterol levels can lead to a number of issues, including coronary artery blockage and narrowing in various body regions. As a result, it is acknowledged as one of the main reasons why people become ill and die.

In this context, research by Freiberg et al. demonstrated that by measuring the cholesterol levels of children and adults, it is possible to forecast mortality linked to cardiovascular illnesses in the ensuing 30 years. [1] Additionally, there are shared risk factors for thrombotic stroke and cardiovascular disease.

There is established correlation between these illnesses, meaning that having one can raise the chance of having another. [2] The risk of cardiovascular disease is strongly correlated with elevated blood cholesterol levels; however, the association between cholesterol levels and the risk of stroke is yet unknown.

There is evidence that a patient's history of hyperlipidemia (HLP) and poor functional outcomes are significantly correlated in hemorrhagic stroke (HS) patients. [3] While there is a direct correlation between total cholesterol (TC) and ischemic stroke (IS), other research has identified an inverse relationship between TC and HS. [4]

In this context, a five-year study by Bonaventure et al. involving 8393 men and women revealed that a higher triglyceride (TG) level was linked to a higher risk of is-chemic events, whereas a lower TG level was linked to a higher risk of heart attacks (HS). Also linked to a twofold risk of HS was a low serum TG level. An association between HS in men and elevated blood pressure and lowered cholesterol was seen in another investigation. [5] Overall, conflicting findings have been reported by several studies in this field, and the connection between dyslipidemia and stroke remains unresolved. [6]

Material and Methods

A total of 201 patients with IS, intracerebral hemorrhage (ICH), or subarachnoid hemorrhage (SAH) were assessed on the first day of admission to the medicine ward of Darbhanga Medical College and Hospital, Laheriasarai, Bihar, for this descriptive study, which was conducted between October 2022 and September 2023. Patients' history was collected and the ward was physically examined, with the aim of collecting samples. The stroke cases were sampled using a census sampling technique. Patients who used lipid-lowering medications within the last six months were not allowed to participate in the trial in order to match the samples.

Every stroke patient received a checklist, and the necessary data was gathered. Within 24 hours of the onset of clinical symptoms, a CT scan and brain MRI in the emergency room confirmed the kind of stroke diagnosis. Fasting state measurements were made of the serum lipids, which included TG, TC, LDL-C, and HDL-C (high-density lipoprotein-cholesterol). Using commercial kits, we used an enzymatic photometric technique in the lab to assay these lipids. For the measurements of TC, TG, HDL-C, and LDL-C, the total precision was 1.62, 1.53, 1.24, and 1.2, respectively, based on the coefficient of variation (CV%).

By measuring descriptive statistics and applying complimentary statistical techniques, statistical analyses were carried out in SPSS version 21 (SPSS Inc., Chicago, IL, USA) and Microsoft Excel 2020 (Microsoft Corporation, Seattle, WA, USA). Tukey's post hoc test was used after the independent samples t-test and one-way ANOVA were used to assess differences between the groups. A P value of less than 0.05 was considered statistically significant.

Results

A total of 201 stroke patients who had not recently undergone anti-lipid medication treatment were chosen for this investigation.

In total, the IS group comprised 153 (76.1%) patients, the ICH group comprised 40 (19.9%) patients, and the SAH group comprised 8 (4%) individuals. Table 1 displays the patients' initial features. Findings indicated that lobar stroke was the most often occurring site of ischemic stroke (48.3%), with basal ganglia and internal capsule coming in second and third, respectively (20.9%), largely in hemorrhagic strokes.

Thalamus involvement and the lobar area were shown to be the least common sites of engagement.

Table 1: Demographic and Clinical Variables of patients with Ischemic and Hemorrhagic Stroke (IS and HS)[a]

Variables	Number (%)
Gender	
• Male	98(48.8)
• Female	103(51.2)
Type	
• Ischemic	153(76.1)
• Intracranial Hemorrhage	40(19.9)
• Subarchnoid hemorrhage	8(4)
Location	
• Lobar	97(48.3)
• Cerebellum	17(8.5)
• Brainstem or pons	13(5.5)
• Thalamus	22(10.9)
• Basal ganglia and internal capsule	42(20.9)
• Thalamus with basal ganglia or internal capsule	7(3.5)
• Lobar with thalamus	3(1.5)
Backgrounds	
• Hypertension	128(63.6)
• Diabetes	68(33.8)
• Hyperlipidemia	39(19.4)
• Past stroke	72(35.8)
• Atrial fibrillation	49(24.3)
• Ischemic heart disease	64(31.8)

[a]Distribution of gender, type, location, and background of stroke in patients with ischemic and hemorrhagic stroke is presented as number (Percentage). Gender-wise, lobar strokes were seen in 50% of men and 46.6% of women, and basal ganglia and internal capsule involvement were seen in 17.3% of men and 24.3% of women. The results showed that the most common types of strokes were basal ganglia and internal capsule strokes in women, and lobar stroke in men. Serum levels of

TC (P = 0.009), LDL-C (P = 0.024), and HDL-C (P = 0.009) were significantly correlated with gender; that is, women had greater serum levels of these parameters than men. Furthermore, women were found to have higher TG levels and older ages than men, albeit these differences were not statistically significant (TG: P = 0.453; age: P = 0.133) (Table 2).

Table 2: Comparison of Age and Serum Lipid Profile by Gender[a,b]

Variables	Male		Female		P value
Age (Y)	69.5	14.62	72.5	12.93	0.133
Total triglyceride (TG) mg/dl	122.07	55.77	128.06	57.38	0.453
Total cholesterol (TC) mg/dl	175.80	43.10	192.4	46.15	0.009[d]
LDL-C mg/dl	115.28	38.57	128.10	41.21	0.024[c]
HDL-C mg/dl	36.03	10.17	39.90	10.64	0.009[d]

[a]Values are expressed as mean ±SD.

[b]The groups were compared using independent *t*-test.

[c]Indicate a significant difference between the groups (P < 0.05).

[d]Indicate a significant difference between the groups (P < 0.01). Table 3 compares age and serum lipid profile with respect to kind of stroke. The patients' ages ranged from 23 to 95 years, meaning there was no discernible difference in age across the groups.

Additionally, there was a significant difference (P < 0.01) in the levels of TG and HDL-C between patients with IS and ICH. When comparing the IS group to the ICH group, the TG level was significantly higher, and the HDL-C level was much higher in the ICH group.

Table 3: Comparison of Age and Serum Lipid Profile by Stroke Type[a,b]

Variables	IS		ICH		SAH		P value
Age (Y)	71.41	13.91	71.55	12.54	54.75	21.23	0.123
Total triglyceride (TG) mg/dl	130.62	59.25	101.32	35.63	156.75	81.44	0.007[c]
Total cholesterol (TC) mg/dl	183.58	46.02	184.47	36.63	234	82.84	0.674
LDL-C mg/dl	121.01	40.25	122.80	33.74	161.50	90.30	0.698
HDL-C mg/dl	36.86	10.22	42.55	11.47	41.25	6.84	0.007[c]

Abbreviations: ICH, intracranial hemorrhage; IS, ischemic stroke; SAH, subarachnoid hemorrhage.

[a]Values are expressed as mean_SD.

[b]The groups were compared using one-way ANOVA.

[c]Indicate a significant difference between IS and ICH (P < 0.01).

Discussion

The association between the type of stroke (IS, ICH, and SAH) and the serum lipid profile was examined in the current study. Based on the results of CT scans and MRIs, 201 stroke patients who did not get anti-lipid medication treatment were included in this study following a neurologist's evaluation.

Comparing the IS group to the ICH group, there was a substantial increase in the serum level of TG. Additionally, a substantial correlation between the kind of stroke and blood HDL-C levels was found (Table 3). Research indicates that a cholesterol level below 160 mg/dL is linked to an increased risk of myocardial infarction or stroke, but not of lacunar infarction. [7] There appears to be an inverse correlation between transient ischemic attack and small stroke and HDL-C level, according to certain research. Additionally, it has been shown that there is a direct correlation between the advancement of carotid artery atherosclerosis and cholesterol and LDL-C levels, and an inverse correlation with HDL-C levels. [8] In general, prior research has yielded contradictory findings on the involvement of dyslipidemia in different forms of stroke, and these conclusions are still up for debate.

In the current study, 76.1% of patients had IS, 19.9% had ICH, and 4% had SAH, according to the type of stroke and gender. Also, 71.8% of women and 80.6% of men received an IS diagnosis, whereas 24.3% of women and 15.3% of men received an ICH diagnosis. Our findings are partly compatible with the neurology literature's classification of stroke subtypes, which states that at least 75% of stroke cases are IS and 25% are hemorrhagic [9].

Additionally, data suggests that the number of stroke cases is rising in a manner that is related to age. The greatest known risk factor for stroke which is also unpredictable is age. [10] According to the findings of a study conducted in Babol, Iran by Ah-madiAhangar et al., the incidence of stroke nearly doubled every ten years after the age of fifty-five. [11] The average age of stroke, according to our data, was 71 years (62.5 years for males and 72.5 years for women).

The average age of stroke was re-reported to be 73.4 years in the Netherlands and 73.1 and 79.7 years for men and women, respectively, in Sweden. [8] Furthermore, the average age of stroke was found to be 70.32 years for men and 64.25 years for women in a study by Iranmanesh et al [12]; our findings are in line with these findings. Our study found that 52% of stroke patients were female and 48% were male; this conclusion is consistent with Iranmanesh et al study, which found that 55% of patients were female and 45% were male.

Furthermore, Zhang et al. found that a low level of HDL-C and a high TC-to-HDL-C ratio were linked to an elevated risk of IS in both males and females in a study involving 3914 stroke patients (3085 cases of IS, 497 cases of ICH, and 332 cases of SAH). Additionally, among men, there was a positive correlation between TC and IS risk. Conversely, a positive association was observed between the elevated risk of IS and the TC-to-HDL-C ratio, and an inverse relationship was observed between the TC level and ICH in women. [13]

Our study of the literature yielded no information about the relationship between gender and the location of stroke.9 The current study findings, however, demonstrated a strong correlation between gender and the serum levels of TC, LDL-C, and HDL-C in stroke patients; put another way, women had higher serum levels of all three parameters than males. Women also had greater mean age of stroke occurrences and serum TG levels; however the differences were not statistically significant. Tohidi et al. demonstrated a gender-dependent correlation between the occurrence of IS and serum lipid levels. The results demonstrated a direct correlation between IS and the levels of TC, LDL-C, and HDL-C in women with IS. [14]

Additionally, our findings demonstrated a strong correlation between the kind of stroke and the serum levels of TG and HDL-C. Comparing the IS group to the ICH group, the IS group's serum TG level was noticeably greater. This discovery aligns with the findings of a study conducted by Saadatnia et al. [15] An increased risk of ischemia events was linked to an elevated level of TG, according to a different study conducted by Bonaventure et al. Contrarily, and in line with our findings, a lower level of TG was linked to a higher risk of HS. [5] Furthermore, a direct correlation between the serum levels of TG and IS was found by Freiberg et al [1] On the other hand, TG, HDL-C, and TC serum levels did not significantly correlate with IS in a study conducted by Willey et al. [16] Our findings showed a strong correlation between the kind of stroke and the serum level of HDL-C. The ICH group had a considerably greater HDL-C level than the IS group. On the other hand, no correlation was found between the type of stroke and the serum levels of TC and LDL-C.

Only the results regarding the HDL-C level are compatible with our findings. Saadatnia et al. showed greater serum levels of LDL-C and HDL-C in patients with HS, compared to individuals with IS. [15] Our findings are also consistent with a study conducted by Mortazavi-Moghadam et al. on the HDL-C level in IS and HS patients. However, our results are not in line with the findings of the relationship between TC level and IS and HS. There was no discernible correlation between the kind of stroke and the TC level. The preventive role of atherosclerosis in preventing heart attacks may be indicated by the high level of HDL-C and low level of TC in HS patients. [17]

Furthermore, Uddin et al. observed that elevated serum levels of TC and LDL-C are concerning risk factors for IS, although serum levels of TG have no effect on IS18; we did not discover any evidence of this in our investigation. Moreover, research investigation by Sacco et al. on 905 control participants and 539 IS patients found that a higher HDL-C level was linked to a lower incidence of IS. Furthermore, it was established that HDL-C had a protective effect against atherosclerotic stroke as opposed to non-atherosclerotic stroke. [19]

Conclusion

According to our research, there may be a correlation between a higher TG level and a higher risk of IS and a lower TG level with a higher risk of HS. The kind of stroke and the LDL-C or TC levels did not significantly correlate. Nonetheless, a noteworthy correlation was observed between the serum lipid profile and gender. Additional samples and longer-term evaluations are required to validate our results.

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