Relation of Lipid Profile with ischemic Stroke

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Relation of Lipid Profile with ischemic Stroke

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ABSTRACT

Objective: *to evaluate correlation of blood total cholesterol (TC), high-density lipoprotein (HDL), triglycerides, and the TC:HDL ratio as risk factors for ischemic stroke.*

Methods: *After ethical approval from hospital ethical board this case control study was conducted in the department of neurology Nishtar Hospital, Multan Duration of study was two years from October 2022 to Sept 2023. A total of 600 patients were included in the study after obtaining written consent from patients. After completion of data collection, data was entered in computer software SPSS version 23 and analyzed for continuous and categorical variables. Continuous/numerical variables were presented as mean and SD and categorical variables were presented in form of numbers and percentages. Independent t-test and chi-square test were applied to see significance of data. P value less than or equal to 0.05 was considered as significant.*

Results: *Overall, 600 patients were included in this study. The study comprised of two equal groups, 50% (n=300) in each, i.e. cases and controls. The controls had mean TC, HDL and triglycerides 220.76±4.29 mg/dL, 54.02±4.45 mg/dL and 153.99±2.68 mg/dL respectively. The TC:HDL ratio was 5.48±1.41 and 4.09±1.22 for cases and controls respectively. The mean differences between TC, HDL, triglycerides and TC: HCL ratios were statistically significant among both groups.*

Conclusion: *Results of our study revealed that significant difference was observed between cases and controls regarding the levels of Total cholesterol , HDL, triglycerides and TC:HDL ratio. Cases of ischemic stroke were found with high levels of TC, Tridlycerides, And TC:HDL ratio and low HDL , this difference was found statistically significant with P value 0.001. so it was concluded that hyperlipidemia has significant relation with ischemic stroke.*

Keywords: *Ischemic Stroke, Total cholesterol, High density lipids, Triglycerides*

1. INTRODUCTION

Stroke is a debilitating illness that affects hundreds of people worldwide, leading to both morbidity and mortality. The incidence of ischemic stroke is on the rise in Asian countries, particularly in Pakistan, which bears a significant burden in terms of financial costs, resource expenditure, health services, and workforce. However, the exact incidence and epidemiology of stroke in Pakistan remain unclear due to a lack of extensive literature. There is a pressing need for detailed studies that accurately represent the epidemiology, risk factors, and current needs regarding stroke in Pakistan. In contrast, the incidence of stroke in the United States is approximately 700,000 per year, making it the third leading cause of mortality, with an economic burden of around fifty billion dollars annually for managing stroke and related morbidities.

Among the risk factors for stroke, elevated total cholesterol and low levels of high-density lipoprotein (HDL) are well-established contributors to the obstruction of coronary arteries, leading to coronary artery disease or coronary heart disease. Numerous observational studies have been conducted to explore the role of lipid levels in the risk of cerebral and vascular diseases. A recent meta-analysis on this topic revealed that clinical trials focused on early lipid-lowering interventions did not show additional benefits in reducing the risk of stroke. However, outcomes from statin interventions demonstrated a significant decrease in the incidence of ischemic stroke. Statins work by altering cholesterol levels in the blood serum, thereby helping to prevent ischemic stroke, according to previous international data. Recently, conflicting international observations regarding the relationship between serum lipid levels, ischemic stroke, and ischemic heart disease have sparked a new debate.

The correlation between lipid profiles and ischemic stroke has not been extensively studied in our population, and local lipid-lowering guidelines are currently based on international data due to a lack of local research on this subject. In this study, we investigated total cholesterol, high-density lipoprotein (HDL), triglycerides, and the TC:HDL ratio as risk factors for ischemic stroke. This data will contribute to establishing local guidelines and provide a foundation for future research on this topic.

2. METHODOLOGY

After obtaining ethical approval from the hospital's ethical board, this case-control study was conducted in the Department of Neurology and Neurosurgery at Lahore General Hospital, Punjab Institute of Neurosciences, Postgraduate Medical Institute, and Ameeruddin Medical College in Lahore. The study spanned two years, from October 2015 to October 2017, and included a total of 600 patients, all of whom provided written consent. Non-probability consecutive sampling was employed, and the sample size was calculated using the WHO sample size calculator with a 95% confidence interval, 80% study power, and proportions of hyperlipidemia in the case group (21.7%) and the control group (15.7%). Stroke was defined as a focal neurological deficit with sudden onset due to a vascular mechanism and was diagnosed both clinically and through radiological investigations, including computed tomography (CT) and magnetic resonance imaging (MRI).

The study population was divided into two categories: cases and controls. The case group consisted of 300 patients enrolled from the inpatient department who presented with neurological deficits. A comprehensive history was taken from these patients, including information on smoking, diabetes, hypertension, and alcohol use. Blood

samples were collected for hyperlipidemia and other baseline investigations. Only patients confirmed to have had a stroke after complete laboratory testing and diagnosis were included in this group.

The control group consisted of patients enrolled from the outpatient department of medicine who presented with hypertension, diabetes, and a history of smoking and alcohol use. Blood samples from these patients were also collected for hyperlipidemia and other laboratory investigations.

After data collection was completed, the information was entered into SPSS software version 24 for analysis of both continuous and categorical variables. Continuous or numerical variables, such as age, BMI, total cholesterol (TC), HDL, and triglycerides, were presented as mean and standard deviation (SD). Categorical variables, including gender, diabetes, hypertension, alcohol use, and exercise, were presented as numbers and percentages. An independent t-test and chi-square test were applied to assess the significance of the data, with a p-value of less than or equal to 0.05 considered statistically significant.

3. RESULTS

A total of 600 patients were included in this study, divided into two equal groups of 300 each: cases and controls. The mean age and BMI of the cases were 57.33±4.19 years and 23.14±2.38 kg/m², respectively, while the mean age and BMI of the controls were 57.04±4.64 years and 23.21±2.06 kg/m², respectively.

In the case group, the distribution of tobacco use was as follows: 38.3% (115) had never used tobacco, 45.7% (137) were past users, 6% (18) were current users with less than 20 cigarettes per day, and 10% (30) were current users with 20 or more cigarettes per day. In the control group, 36.3% (109) had never used tobacco, 45.7% (137) were past users, 7.7% (23) were current users with less than 20 cigarettes per day, and 10.3% (31) were current users with 20 or more cigarettes per day.

History of hypertension (HTN) was noted in 54% (162) of the cases and 25.3% (76) of the controls. Diabetes was present in 10.7% (32) of the cases and 3% (9) of the controls. Alcohol use in the case group was distributed as follows: 30.4% (91) consumed alcohol daily, 40.3% (121) weekly, 14% (42) monthly, and 15.3% (46) rarely or never. In the control group, 26.7% (80) consumed alcohol daily, 40.6% (122) weekly, 15% (45) monthly, and 17.7% (53) rarely or never.

Regarding exercise, in the case group, 43.7% (131) exercised two or more times per week, 28.3% (85) exercised less than two times per week, and 28% (84) did not exercise at all. In the control group, 47.7% (143) exercised two or more times per week, 29.7% (89) exercised less than two times per week, and 22.6% (68) did not exercise.

History of hyperlipidemia was observed in 26.3% (79) of the cases and 16.3% (49) of the controls. The differences in the history of hypertension, diabetes, and hyperlipidemia between the groups were statistically significant (Table 1).

The mean total cholesterol (TC), HDL, and triglycerides in the case group were 235.13±4.25 mg/dL, 47.94±5.60 mg/dL, and 194.20±4.38 mg/dL, respectively. In the control group, the mean TC, HDL, and triglycerides were 220.76±4.29 mg/dL, 54.02±4.45 mg/dL, and 153.99±2.68 mg/dL, respectively. The TC:HDL ratio was 5.48±1.41 in the case group and 4.09±1.22 in the control group. The mean differences in TC, HDL, triglycerides, and TC:HDL ratios between the groups were statistically significant (Table 2).

Table. 1
Baseline characteristics of the study groups

Characteristics	Cases(n=300)	Controls (n=300)	P value.
Age (years)	57.33±4.19	57.04±4.64	0.422
BMI* (kg/m^2)	23.14±2.38	23.21±2.06	0.701
Tobacco use			
Never	38.3% (n=115)	36.3% (n=109)	0.853
Past	45.7% (n=137)	45.7% (n=137)	
Current <20/day	6% (n=18)	7.7% (n=23)	
Current ≥ 20/day	10% (n=30)	10.3% (n=31)	
History of HTN*	54% (n=162)	25.3% (n=76)	0.000
Diabetes	10.7% (n=32)	3% (n=9)	0.000
Alcohol use			
Daily	30.4% (n=91)	26.7% (n=80)	0.727
Weekly	40.3% (n=121)	40.6% (n=122)	
Monthly	14% (n=42)	15% (n=45)	
rare/never	15.3% (n=46)	17.7% (n=53)	
Exercise			
≥2 times per week	43.7% (n=131)	47.7% (n=143)	0.316
<2 times per week	28.3% (n=85)	29.7% (n=89)	
Rarely/never	28% (n=84)	22.6% (n=68)	
History of hyperlipidemia	26.3% (n=79)	16.3% (n=49)	0.003

*BMI indicates body mass index; *HTN, hypertension.P<0.05 is considered as significant.

Table. 2
Exposure variables in both groups

Characteristics	Cases(n=300)	Controls (n=300)	P value.
TC* mg/dL	235.13±4.25	220.76±4.29	0.000
HDL* mg/dL	47.94±5.60	54.02±4.45	0.000
Triglycerides mg/dL	194.20±4.38	153.99±2.68	0.000
TC:HCL ratio	5.48±1.41	4.09±1.22	0.000

* total cholesterol; *high-density lipoprotein;P<0.05 is considered as significant.

4. METHODOLOGY

An overall increase in cholesterol, or hyperlipidemia, can be fatal for healthy individuals, putting them at risk for conditions ranging from minor illnesses to serious ischemic strokes. Individuals with a history of hypertension, diabetes, smoking, and alcohol use are particularly vulnerable to these risks. In our study, we compared the incidence of hyperlipidemia in cases (patients with ischemic stroke) with controls (patients with smoking, hypertension, and diabetes but without ischemic stroke). The results revealed that while increased HDL and triglycerides are not risk factors for stroke, elevated total cholesterol is an alarming sign.

In a study by Iso H et al., it was reported that an increase in total serum cholesterol is associated with nonhemorrhagic stroke, which is consistent with our findings. Another study by Leppälä JM et al. in 1999 found an association between a 5% increase in total cholesterol and ischemic stroke, but this was only observed in smokers; other factors such as alcohol use and comorbid conditions like hypertension and diabetes were not associated with increased risk. These results are also comparable to our findings.

A study conducted by Koren-Morag N et al. found that an increase in total cholesterol is associated with stroke as well as other cardiac and vascular diseases. In contrast, an observational study by Shahar E et al. on patients without coronary artery disease reported no association between stroke and serum lipids. The results of both studies are comparable to our findings, highlighting the significance of our study while also indicating some inconsistencies in the association between cholesterol levels and stroke.

A study conducted by Wannamethee SG et al. in 2000 reported that HDL may be protective against stroke, especially non-fatal stroke. Similarly, Sacco RL et al. found that increased HDL levels are protective against ischemic stroke in elderly patients. Additionally, Sacco reported that in patients with coronary heart disease, high-density lipoprotein (HDL) is inversely related to ischemic stroke, meaning that low HDL levels are a risk factor for coronary heart disease in adults.

Some trials on reductase inhibitors have shown that reducing cholesterol levels is associated with a decreased incidence of ischemic strokes and cardiovascular diseases, indicating that lipid-related phenomena are common to both conditions. Another study by Kinosian et al. found that the TC:HDL ratio is an important risk factor for coronary heart disease, highlighting the need for prevention in patients. Given the similar mechanisms involved, this ratio is also a risk factor for ischemic stroke. The results of these studies are comparable to our findings.

5. CONCLUSION

Our study revealed a significant difference between cases and controls in the levels of total cholesterol, HDL, triglycerides, and the TC:HDL ratio. Patients with ischemic stroke had higher levels of total cholesterol, triglycerides, and the TC:HDL ratio, along with lower levels of HDL. This difference was statistically significant, with a p-value of 0.001, leading us to conclude that hyperlipidemia is significantly associated with ischemic stroke.

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