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Association of High Non HDL Cholesterol Level in Ischemic Stroke Patients Presenting at Lady Reading Hospital Peshawar

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ABSTRACT

Background: Ischemic stroke is an important cause of mortality and long term disability worldwide. Dyslipidaemia, especially raised non-high-density lipoprotein cholesterol, may contribute in development of cerebrovascular diseases through atherosclerotic changes in blood vessels. **Objective:** To determine the frequency of high non-high-density lipoprotein cholesterol in patients presenting with ischemic stroke. **Study Design:** Cross sectional study. **Duration and Place of Study:** This study was conducted from 24th November 2024 to 24th May 2025 at the Department of General Medicine, Lady Reading Hospital. **Methodology:** A total of 176 patients with ischemic stroke aged 30 to 75 years were included in the study. High non-high-density lipoprotein cholesterol was labelled at value ≥130 mg/dl. Data were analysed using Statistical Package for Social Sciences version 23. Mean and standard deviation were calculated for quantitative variables, while frequencies and percentages were calculated for qualitative variables. **Results:** Mean age of patients was 57.25 ± 11.95 years and mean non-high-density lipoprotein cholesterol level was 127.58 ± 21.70 mg/dl. High non-high-density lipoprotein cholesterol level was present in 68 (38.6%) patients. Significant association was observed with age >50 years (p<0.001), diabetes 31 (55.4%) (p=0.002), and hypertension 53 (44.5%) (p=0.020). **Conclusion:** High non-high-density lipoprotein cholesterol level was frequently observed in ischemic stroke patients and showed significant association with older age, diabetes and hypertension.

INTRODUCTION

Ischemic stroke is among the major causes of deaths and disabilities in many countries. The condition arises due to obstruction of the blood vessels that transport blood into the brain leading to a decrease in oxygen supply to brain tissue.[1] The condition can cause muscle weakness, trouble speaking, facial asymmetry, and loss of consciousness based on the region of the brain that has been affected.[2] Numerous risk factors are connected to ischemic stroke, including high blood pressure, diabetes, tobacco use, obesity, and lipid disorders. Timely diagnosis and treatment are crucial since failure to treat the condition may cause permanent brain injury in patients.[3]

Dyslipidemia is characterized by the presence of an abnormal amount of lipids in blood serum with elevated levels of total cholesterol, low density lipoprotein cholesterol, and triglyceride, while the level of high-density lipoprotein cholesterol is low.[4] Dyslipidemia is one of the major preventable risk factors in the development of cardiovascular and cerebrovascular disease. Dyslipidemia is associated with atherosclerosis through the process of fat deposition in the blood vessel lining that leads to narrowing and reduction in blood flow.[5] Non-HDL cholesterol represents the entire panel of atherogenic lipoprotein particles and is believed to be more predictive in some cases than LDL cholesterol.[6]

Higher non-HDL cholesterol levels have been shown in various researches to be correlated with a higher risk of ischemic stroke. Non-HDL cholesterol is capable of increasing the rate at which atheromas are formed in the blood vessels of the brain, which increases vascular inflammation, thus leading to decreased cerebral perfusion.[7] Those with elevated non-HDL cholesterol are more prone to suffering from vascular problems and recurrent strokes.[8] The process of measuring non-HDL cholesterol is quite easy and could yield useful information on the health of the cardiovascular and cerebrovascular systems. Identification and management of elevated non-HDL cholesterol through behavioral changes and lipid lowering measures could reduce the likelihood of ischemic strokes.[9]

Ischemic stroke is emerging as an important public health issue owing to its high prevalence and mortality rates around the world. Dyslipidemia, particularly increased non-HDL cholesterol levels, could have an important role in the pathogenesis of atherosclerosis and

cerebral vascular diseases. Early diagnosis of patients with high non-HDL cholesterol levels would be crucial for the prevention and management of ischemic stroke cases. However, there are no studies in this area using the local population. Therefore, this study is being conducted to determine the frequency of non HDL cholesterol level in patients presenting with ischemic stroke.

Methodology

This cross-sectional study was conducted at the General Medicine Department of Lady Reading Hospital from 24th November 2024 to 24th May 2025. Ethical approval was taken from the Ethical Review Board of the hospital. The sample size was calculated by using WHO sample size calculator while taking anticipated frequency of high non HDL cholesterol level as 34% in patients with ischemic stroke,[10] confidence level 95%, and absolute precision 7%, due to which the required sample size was calculated as 176 patients.

Inclusion Criteria

Patients of both genders with age ranging from 30 to 75 years and diagnosed cases of ischemic stroke were included in the study. Ischemic stroke was considered as sudden onset focal neurological deficit lasting for more than 24 hours with findings including hemiparesis, hemiplegia, and facial droop along with CT scan brain findings showing loss of gray-white matter differentiation, hypodensity, loss of sulci, and effacement of cerebral ventricles.

Exclusion Criteria

Patients having head trauma, brain tumours, pregnant or lactating women, and patients already taking lipid lowering medications were excluded from the study.

Written informed consent was obtained from all enrolled patients before data collection. The purpose and benefits of the study were explained to all participants and confidentiality was assured. Demographic details including age, gender, education status, marital status, occupation, residence and socio economic status were recorded. History regarding smoking, hypertension, and diabetes was also documented. Complete clinical examination and assessment were performed under supervision of a consultant having minimum 5 years post-fellowship experience. Venous blood sample was taken from all patients for laboratory evaluation of lipid profile and non HDL cholesterol level was calculated by subtracting HDL cholesterol from total cholesterol level and values were recorded in mg/dl. After completion of evaluation, high non HDL cholesterol level was labelled when non HDL cholesterol value was ≥130 mg/dl (3.37 mmol/L) on blood investigation.

Data analysis was carried out by using IBM SPSS version 23. Numerical variables including age and non HDL cholesterol level were presented as mean ± SD. Categorical variables including gender, smoking, hypertension, diabetes, education status, marital status, occupation status, residence, socio economic status and high non HDL cholesterol level were presented as frequencies and percentages. Effect modifiers including age, gender, smoking, hypertension, diabetes, education status, marital status, occupation status, residence, and socio economic status were controlled through stratification. Post-stratification Chi-square test or Fisher exact test was applied and p value ≤0.05 was considered statistically significant.

RESULTS

The study enrolled 176 ischemic stroke patients with a mean age of 57.25 ± 11.95 years and a mean BMI of 29.09 ± 2.83 kg/m^2. The mean Non-HDL Cholesterol level were 127.58 ± 21.70 mg/dl. Majority of the patients were male 134 (76.1%) while female was 42 (23.9%). Regarding socioeconomic status, most patients belongs to middle class 89 (50.6%), followed by lower class 69 (39.2%) and upper class 18 (10.2%). In terms of education, illiterate patients were slightly more 96 (54.5%) as compared to literate 80 (45.5%). Diabetes were present in 56 (31.8%) patients whereas 120 (68.2%) had no diabetes. Hypertension was found in 119 (67.6%) of the patients and 57 (32.4%) were normotensive. Smoking was reported in 46 (26.1%) patients while 130 (73.9%) were non-smokers. Most of the patients were from urban areas 94 (53.4%) and 82 (46.6%) were from rural areas. Regarding marital status, 154 (87.5%) were married and 22 (12.5%) were single (Table-I).

Table I

Patient Demographics

Demographics	Mean ± SD / n (%)
Age (Years)	57.25 ± 11.95
BMI (Kg/m^2)	29.09 ± 2.83
Non-HDL Cholesterol (mg/dl)	127.58 ± 21.70
Gender	
Male n (%)	134 (76.1%)
Female n (%)	42 (23.9%)
Socioeconomic Status	
Upper Class n (%)	18 (10.2%)
Middle Class n (%)	89 (50.6%)
Lower Class n (%)	69 (39.2%)
Education Status	
Literate n (%)	80 (45.5%)
Illiterate n (%)	96 (54.5%)
Diabetes	
Yes n (%)	56 (31.8%)
No n (%)	120 (68.2%)
Hypertension	
Yes n (%)	119 (67.6%)
No n (%)	57 (32.4%)
Smoking	
Yes n (%)	46 (26.1%)
No n (%)	130 (73.9%)
Residence	
Urban n (%)	94 (53.4%)
Rural n (%)	82 (46.6%)
Marital Status	
Married n (%)	154 (87.5%)
Single n (%)	22 (12.5%)

High Non-HDL Cholesterol level was found in 68 (38.60%) of the ischemic stroke patients whereas 108 (61.40%) had normal Non-HDL Cholesterol levels (Table-II).

Table II

Frequency of High Non-HDL Cholesterol Level Among Ischemic Stroke Patients

High Non-HDL Cholesterol	Frequency	%age
Yes	68	38.60%
No	108	61.40%
Total	176	100%

The association of high Non-HDL Cholesterol with age group were found to be statistically significant, as patients aged >50 years had considerably higher frequency of high Non-HDL Cholesterol 61 (46.2%) as compared to those aged ≤50 years 7 (15.9%), (p<0.001). Diabetes shown a significant association with high Non-HDL Cholesterol, as it were more frequent among diabetic patients 31 (55.4%) than non-diabetics 37 (30.8%), (p=0.002). Hypertension were also significantly associated, with hypertensive patients having higher frequency of high Non-HDL Cholesterol 53 (44.5%) as compared to normotensive patients 15 (26.3%), (p=0.020) (Table-III).

Table III

Association of High Non-HDL Cholesterol Level with Demographic Factors

Demographic Factors	Subgroups	High Non-HDL Cholesterol		p-value
		Yes n (%)	No n (%)	
Age (years)	≤50	7 (15.9%)	37 (84.1%)	<0.001*
	>50	61 (46.2%)	71 (53.8%)	
Gender	Male	54 (40.3%)	80 (59.7%)	0.419*
	Female	14 (33.3%)	28 (66.7%)	
Socioeconomic Status	Upper Class	7 (38.9%)	11 (61.1%)	0.487*
	Middle Class	38 (42.7%)	51 (57.3%)	
	Lower Class	23 (33.3%)	46 (66.7%)	
Education Status	Literate	36 (45.0%)	44 (55.0%)	0.113*
	Illiterate	32 (33.3%)	64 (66.7%)	
Diabetes	Yes	31 (55.4%)	25 (44.6%)	0.002*
	No	37 (30.8%)	83 (69.2%)	
Hypertension	Yes	53 (44.5%)	66 (55.5%)	0.020*
	No	15 (26.3%)	42 (73.7%)	
Smoking	Yes	22 (47.8%)	24 (52.2%)	0.136*
	No	46 (35.4%)	84 (64.6%)	
Residence	Urban	34 (36.2%)	60 (63.8%)	0.472*
	Rural	34 (41.5%)	48 (58.5%)	
Marital Status	Married	57 (37.0%)	97 (63.0%)	0.242*
	Single	11 (50.0%)	11 (50.0%)	
BMI (Kg/m^2)	≤25	3 (20.0%)	12 (80.0%)	0.167**
	>25	65 (40.4%)	96 (59.6%)	

*Chi-Square Test **Fischer Exact Test

DISCUSSION

This study was conducted to determine the association of high Non-HDL Cholesterol level in ischemic stroke patients. Total 176 patients were enrolled and high Non-HDL Cholesterol were found in 68 (38.60%) of the ischemic stroke patients, which suggest that raised Non-HDL Cholesterol is a considerable risk factor in such patients. Non-HDL Cholesterol contains all atherogenic lipids, and an increase causes a rise in the deposition of plaques and thickening of the arterial walls, culminating in the development of cerebral ischemia. Diabetic subjects were also significantly correlated with high Non-HDL Cholesterol (p=0.002), whereby 31 (55.4%) of the diabetic group had an increase compared to 37 (30.8%) of non-diabetic subjects. In the presence of diabetes, there is resistance to insulin causing excessive synthesis of VLDL and poor clearance of triglycerides, hence the elevation in Non-HDL Cholesterol. Hypertensive subjects showed significant correlation with high Non-HDL Cholesterol (p=0.020), with 53 (44.5%) of hypertensive subjects being raised compared to 15 (26.3%) of normotensive subjects. Both conditions have common pathological processes involving endothelial dysfunction and oxidative stress that accelerate the formation of atherosclerosis and stroke.

High Non-HDL Cholesterol were found in 68 (38.60%) of the ischemic stroke patients in present study. This finding were comparable to Abid *et al.* [11] who reported hyperlipidaemia frequency of 37.1% in ischemic stroke patients from Southern Punjab, suggesting that dyslipidaemia burden in this region remains considerably high. Similarly, Khan *et al.* [12] reported dyslipidaemia in 39.42% of ischemic stroke patients from Pakistan, which is very close to present study findings and further supports that Non-HDL Cholesterol elevation is a frequent metabolic abnormality among such patients. However, Ammad *et al.* [13] reported much higher frequency of hyperlipidaemia 79% and Mustafa *et al.* [14] found dyslipidaemia in 55% patients, both being higher than present study. This difference may be because those studies used broader lipid parameters and different diagnostic criteria for dyslipidaemia rather than specifically Non-HDL Cholesterol.

Regarding age, patients aged >50 years had significantly higher frequency of high Non-HDL Cholesterol 61 (46.2%) as compared to younger patients 7 (15.9%), (p<0.001). This were supported by Ejaz *et al.* [15] who also reported increasing dyslipidaemia prevalence with advancing age, rising from 40% in age ≤45 years to 68% in age >65 years (p=0.02). Ageing leads to decreased lipoprotein lipase activity and impaired hepatic lipid clearance, which results in accumulation of atherogenic lipoproteins and raised Non-HDL Cholesterol levels.

Diabetes were significantly associated with high Non-HDL Cholesterol in present study, as 31 (55.4%) diabetic patients had raised levels compared to 37 (30.8%) non-diabetics (p=0.002). This finding were consistent with Ejaz *et al.* [15] who reported dyslipidaemia in 75% of diabetic stroke patients compared to 54% in non-diabetics. Insulin resistance in diabetic state promotes hepatic overproduction of VLDL particles and impairs triglyceride-rich lipoprotein clearance, which collectively raises Non-HDL Cholesterol.

Hypertension were significantly associated with high Non-HDL Cholesterol, with 53 (44.5%) hypertensive patients having raised levels compared to 15 (26.3%) normotensive patients (p=0.020). This were similarly observed by Ejaz *et al.* [15] where hypertensive patients had higher dyslipidaemia frequency 68% compared to normotensive 41%. Both hypertension and dyslipidaemia

shares common pathophysiological mechanism of endothelial dysfunction and oxidative stress, which accelerates atherogenesis and increase stroke susceptibility. Sharma *et al.* [16] also demonstrated significant Non-HDL Cholesterol abnormalities in ischemic stroke patients ($p<0.05$), further supporting the notion that raised atherogenic lipoproteins plays an important role in cerebrovascular disease, consistent with present study findings.

This research has some limitations that should be taken into account while analyzing its results. First, it was an isolated center research carried out within the confines of just one health facility; therefore, its results cannot be generalized to the whole population. Secondly, there were too few participants for the sample size which might have decreased the power of the study statistically. Thirdly, because it was a cross sectional research, the cause and effect link between increased Non-HDL Cholesterol and ischemic stroke could not be confirmed. Fourthly, some other confounding variables like physical activity level or lipid lowering agents were not taken into consideration.

CONCLUSION

This investigation has concluded that having a high Non-HDL Cholesterol level is fairly common among ischemic stroke patients and is a significant modifiable risk factor for cerebrovascular disease. It was also noted that aging, diabetes, and hypertension are significantly correlated with high levels of Non-HDL Cholesterol among such patients.

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