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Study and comparison of fasting lipid profile in diabetic & non-diabetic stroke patients

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Abstract

Background: Stroke is a global health problem. It is the leading cause of adult disability and the second leading cause of mortality worldwide. Mortality from strokes is the second leading cause worldwide. The disorder in carbohydrate metabolism leads to disorder in lipid metabolism and vice versa. Present study was aimed to compare fasting lipid profile in diabetic & non-diabetic stroke patients. **Material and Methods:** Present study was descriptive observational study, conducted in patients of age > 18 years, either gender, confirmed cases of stroke. **Results:** Among 100 patients of stroke, majority from 61-70 years age group (35%), with male to female ratio of 2.03:1. Ischemic stroke was commonly seen in our study with 75% cases and hemorrhagic was 25%. Prevalence of hypertension in our study was 59% and diabetes was 56%. Prevalence of tobacco chewing was 57%, smoking 20% and alcohol consumption was 34%. Prevalence of overweight was 6% and that of obesity was 89% Left side involvement was predominant in ischemic stroke patients i.e., 48% whereas right side involvement was predominant in hemorrhagic stroke patients i.e. 48%. TC was elevated in 20% cases, TG in 52%, LDL in 14% and VLDL in 49% cases. There is strong association of diabetic stroke with TC, TG and reduced HDL in our study. Mean total cholesterol, HDL, VLDL, LDL in diabetic patients significantly different than of non-diabetic patients. Statistically significant difference ($p<0.05$) in mean values of Total cholesterol, Triglycerides & LDL in ischemic stroke patients as compared to hemorrhagic stroke patients. **Conclusion:** Mean TC, LDL and VLDL and mean reduced HDL were significantly higher in diabetic stroke as compared to non-diabetic stroke patients in our study.

Keywords: diabetes mellites, stroke, lipid profile, cholesterol, LDL, VLDL

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INTRODUCTION

The World Health Organization (WHO) definition of stroke is: "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin".[1] The pathological background for stroke may either be ischemic or hemorrhagic disturbances of the cerebral blood circulation. Thrombotic cerebral infarction results from the atherosclerotic obstruction of large cervical and cerebral arteries, with ischemia in all or part

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of the territory of the occluded artery.[2]

Stroke is a global health problem. It is the leading cause of adult disability and the second leading cause of mortality worldwide. Mortality from strokes is the second leading cause worldwide.[3] About 15 million people suffer from non-fatal strokes leading to disability in about a third of patients. It is a leading cause of functional impairments, with 20% of survivors requiring institutional care after three months and 15-30% being permanently disabled.[4]

Ischemic stroke accounts for 50%-85% of all strokes worldwide.[5] Hemorrhagic stroke are due to subarachnoid hemorrhage or intracerebral hemorrhage; they account for 1%-7% and 7%-27% respectively of all cases of stroke worldwide.[5] Hyperlipidemia is an important modifiable risk factor of stroke.[6] In diabetes many factors affect blood lipid levels, because of the relationship between carbohydrates and lipid metabolism. The disorder in carbohydrate metabolism leads to disorder in lipid metabolism and vice versa. Present study was aimed to compare fasting lipid profile in diabetic & non-diabetic stroke patients.

MATERIAL AND METHODS

Present study was descriptive observational study, conducted in Department of Medicine, Vilasrao Deshmukh Government Medical College, Latur, India. Study duration was of 18 months (From January 2020 to June 2021). Study approval was obtained from institutional ethical committee.

Inclusion criteria

- Patients of age > 18 years, either gender, confirmed cases of stroke patients presenting to Medicine OPD and IPD, willing to participate in present study

Exclusion criteria

- All type 1 diabetes mellitus patients.
- Patients with history of head injury and space occupying lesions.
- Patients with renal failure.
- Patients with systemic infections and CNS infections
- Patients with liver failure.
- Those not willing to give consent
- Those CVA patients who are on lipid lowering agent

Study was explained to patients in local language & written consent was taken for participation & study. After obtaining informed consent, detailed history, clinical examination, lab investigation (RBS, Lipid profile), radiological investigations reports (CT brain/MRI brain) were entered in the proforma specially designed for this study. Patient related details collected in terms of Age and sex of the patient, Clinical features – a) weakness- right or left hemiparesis or hemiplegia, b) cranial nerve involvement c) speech involvement-dysarthria or aphasia d) altered sensorium, e) other features-seizures, gait disturbances, Presence of Hypertension/ Diabetes mellitus Dyslipidemia/ Obesity, Association with smoking or tobacco/Alcoholism.

A venous blood sample was collected in the morning after overnight fast of 12 hours. The blood sample was collected in plain bulb; serum was obtained and was subjected to test. The lipid profile (total cholesterol, serum triglycerides, HDL cholesterol, VLDL cholesterol, LDL cholesterol) with the use of fully automated analyzer Erba MannheimXL 640 in laboratory.

Lipid estimation was done as follows. Serum Total Cholesterol was estimated by enzymatic cholesterol oxidase method CHOD-PAP (Cholesterol Oxidase-Peroxidase-4-aminophenazone) method. Serum triglyceride levels were estimated by lipase/ GPO- PAP (glycero phosphate oxidase-peroxidase-4-aminophenazone) method. Estimation of HDL cholesterol was done using direct enzymatic colorimetric method. VLDL cholesterol

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concentration was obtained by dividing Sr. triglyceride concentration by 5. LDL cholesterol concentration was obtained by using Friedewald formula : LDL = TC — HDL — (TG/5) mg/dl Where all values are expressed in mg/dl.

National Cholesterol Education Programme (NCEP)[7] guidelines were used for definition of dyslipidemia as follows : Hypercholesterolemia-serum cholesterol levels ≥200 mg/ dl ≥5.2 mmol/l). Hypertriglyceridemia-serum triglyceride levels ≥150 mg/ dl (≥1.7 mmol/l). Low HDL cholesterol-HDL cholesterol levels ≤40 mg/dl (≤1.04 mmol/l). High LDL cholesterol-LDL cholesterol levels ≥130 mg/dl (≥3.4 mmol/l) calculated using the Friedewald equation.

Data was collected and compiled using Microsoft Excel, analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables. Difference of proportions between qualitative variables were tested using chi-square test or Fisher exact test as applicable. P value less than 0.05 was considered as statistically significant.

RESULTS

In present study, 100 patients of stroke were studied. Majority of them were from 61-70 years age group (35%) followed by from above 70 years (28%) & mean age of the study population was 63.47±10.21 years. 67% were males and 33% were females, with male to female ratio of 2.03:1. Ischemic stroke was commonly seen in our study with 75% cases and hemorrhagic was 25%. Prevalence of hypertension in our study was 59% and diabetes was 56%. Prevalence of tobacco chewing was 57%, smoking 20% and alcohol consumption was 34%. Prevalence of overweight was 6% and that of obesity was 89%

Table 1: General characteristics

	No. of patients	**Percentage**
Age groups (in years)		
<40	3	3.0
41-50	12	12.0
51-60	22	22.0
61-70	35	35.0
>70	28	28.0
Mean age (mean±SD)	63.47 ± 10.21	
Gender		
Male	67	67.0
Female	33	33.0
Stroke type		
Hemorrhagic	25	25.0
Ischemic	75	75.0
Risk factors		
Tobacco chewing	57	57.0
Smoking	20	20.0
Alcohol	34	34.0
DM	56	56.0
Hypertension	59	59.0
BMI grades		
Normal	5	5.0
Overweight	6	6.0

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Obese	89	89.0

Left side involvement was predominant in ischemic stroke patients i.e., 48% whereas right side involvement was predominant in hemorrhagic stroke patients i.e. 48%.

Table 2: Distribution according to side of CVA

Side involved	**Ischemic stroke**		**Hemorrhagic stroke**		**Total**	**p**
	N0	**%**	**N0**	**%**		
BILATERAL	7	9.3	6	24.0	13	0.083 (Not significant)
LEFT SIDE	36	48.0	7	28.0	43	
RT SIDE	32	42.7	12	48.0	44	
Total	75	100.0	25	100.0	100	

TC was elevated in 20% cases, TG in 52%, LDL in 14% and VLDL in 49% cases.

Table 3: Distribution according to lipid profile in stroke patients

		Frequency	**Percent**
Total cholesterol	Normal	80	80.0
	Elevated	20	20.0
Triglycerides	Normal	48	48.0
	Elevated	52	52.0
HDL	Reduced	54	54.0
	Normal	46	46.0
VLDL	Normal	51	51.0
	Elevated	49	49.0
LDL	Normal	86	86.0
	Elevated	14	14.0

35.7% diabetic stroke patients had elevated TC as compared to 0% non- diabetic stroke patients ($p<0.05$). 25% diabetic stroke patients had elevated LDL as compared to 0% non-diabetic stroke patients ($p<0.05$). 58.9% diabetic stroke patients had reduced HDL as compared to 29.5% non-diabetic stroke patients ($p<0.05$). There is strong association of diabetic stroke with TC, TG and reduced HDL in our study.

Table 4: Lipid profile in Diabetic and Non-Diabetic stroke patients

		Diabetic (n-56)		**Non-Diabetic (n-44)**		**p value**
		Number	**Percent**	**Number**	**Percent**	
TC	Normal	36	64.3	44	100.0	0.0001 Highly Significant
	Elevated	20	35.7	0	0.0	
TG	Normal	26	46.4	22	50.0	0.72 Not Significant
	Elevated	30	53.6	22	50.0	
HDL	Reduced	23	41.1	31	70.5	0.003 Highly Significant
	Normal	33	58.9	13	29.5	
VLDL	Normal	26	46.4	25	56.8	0.32 Not Significant
	Elevated	30	53.6	19	43.2	
LDL	Normal	42	75.0	44	100.0	0.0001 Highly Significant
	Elevated	14	25.0	0	0.0	

Mean total cholesterol in diabetic patients was 205.23±33.31 and in non- diabetic patient was 146.05±17.21, difference was found to be statistically highly significant ($p<0.05$). Mean triglyceride in diabetic patients was 165±49.44 and in non-diabetic patient was 165.41±64.26, the difference was not found to be statistically significant ($p<0.05$). Mean HDL in diabetic patients was 39.63±3.6 and in non-diabetic patient was 37.95±3.09, the

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difference was found to be statistically highly significant (p<0.05). Mean VLDL in diabetic patients was 33.15±7.62 and in non-diabetic patient was 29.10±5.11, the difference was found to be statistically highly significant (p<0.05). Mean LDL in diabetic patients was 116.71±38.23 and in non-diabetic patient was 75.25±16.17, the difference was found to be statistically highly significant (p<0.05).

Table 5: Comparison of lipid profile between diabetic and non-diabetic stroke patients

	Diabetic (n-56)	**Non-Diabetic (n-44)**	**p value**
Total cholesterol	205.23 ± 33.31	146.05 ± 17.21	0.0001 Highly Significant
Triglycerides	165 ± 49.44	165.41 ± 64.26	0.971 Not Significant
HDL	39.63 ± 3.60	37.95 ± 3.09	0.015 Significant
VLDL	33.15 ± 7.62	29.10 ± 5.11	0.003 Significant
LDL	116.71 ± 38.23	75.25 ± 16.17	0.0001 Highly Significant

18.7% ischemic stroke patients and 24% of hemorrhagic stroke had elevated TC with no significant difference between two groups (p>0.05). 56% ischemic stroke patients and 40% of hemorrhagic stroke had elevated TG with no significant difference between two groups (p>0.05). 48% ischemic stroke patients and 52% of hemorrhagic stroke had elevated VLDL with no significant difference between two groups (p>0.05). 16% ischemic stroke patients and 8% of hemorrhagic stroke had elevated LDL with no significant difference between two groups (p>0.05).

Table 6: Prevalence of dyslipidemia according to type of stroke

		Ischemic (n-75)		**Hemorrhagic (n-25)**		**p value**
		Number	**Percent**	**Number**	**Percent**	
TC	Normal	61	81.3	19	76.0	0.56
	Elevated	14	18.7	6	24.0	Not significant
TG	Normal	33	44.0	15	60.0	0.17
	Elevated	42	56.0	10	40.0	Not significant
HDL	Reduced	36	48.0	18	72.0	0.04
	Normal	39	52.0	7	28.0	Significant
VLDL	Normal	39	52.0	12	48.0	0.72
	Elevated	36	48.0	13	52.0	Not significant
LDL	Normal	63	84.0	23	92.0	0.31
	Elevated	12	16.0	2	8.0	Not significant

In present study, we noticed statistically significant difference (p<0.05) in mean values of Total cholesterol, Triglycerides & LDL in ischemic stroke patients as compared to hemorrhagic stroke patients, while mean values of HDL & VLDL were comparable & difference was found to be statistically not significant (p<0.05).

Table 7: Comparison of lipid profile between ischemic and hemorrhagic stroke patients

	Ischemic (n-75)	**Hemorrhagic (n-25)**	**p value**
Total cholesterol	183.27 ± 38.57	166.96 ± 43.32	0.047 Significant
Triglycerides	168.36 ± 55.68	155.64 ± 57.56	0.049 Significant
HDL	39.05 ± 3.59	38.40 ± 3.08	0.421 Not significant
VLDL	31.06 ± 5.16	32.3 ± 10.65	0.438 Not significant
LDL	104.92 ± 37.45	79.13 ± 27.19	0.002 Significant

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DISCUSSION

Hyperlipidemia is not as well established as risk factors for first or recurrent stroke in contrast to what seen in cardiac diseases.[8] Several clinical trials showed an association between high concentration of serum cholesterol and ischemic stroke.[0] On the other hand, case control studies of stroke which examined cholesterol as a risk factor have generally produced negative findings and prospective studies have failed to show a direct and strong-association. Some demonstrated an inverse relation between total cholesterol death from hemorrhagic stroke.[9,10]

Therefore, the association between cholesterol and stroke may not be as straight forward as for coronary heart ds. Serum lipid levels have an established effect on short term mortality due to strokes.[10] Dyslipidemia is a major contributing determinant in the development of ischemic heart diseases, stroke, and other vascular diseases. Earlier studies have documented that dyslipidemia account for 47% of ischemic heart diseases and 26% of strokes.[10]

Insulin resistance is the primary defect in patients with type 2 diabetes mellitus. The cluster of lipid abnormalities associated with type 2 diabetes is defined by a high concentration of Triglycerides and small dense LDL and a low concentration of HDL cholesterol. Hypertriglyceridemia is the product of increased hepatic secretion of VLDL and delay in clearance of triglyceride rich lipoproteins, which is due to increased levels of free fatty acids and glucose required for triglyceride production.[11]

Age is an important risk factor for stroke. The mean age of stroke onset in India (i.e., 63 years).[12] Hakim Mohammad Shafi[13] studied 100 subjects (59 males and 41 females), mean age of the subjects was 57.41±12.4 years with a male: female ratio of 1.44:1. In study by Deshpande JJ et al.,[14] average age of patients was 60 ± 4.56 years, male and Female ratio was 1.25. Onkar Nath Rai et al.,[15] reported that males were (59.0%) more commonly affected with stroke as compared to females (41.0%). Maximum incidence of stroke was observed in those aged above 60 years (29%). Our study findings are consistent with the findings of above-mentioned authors.

In present study, TC was elevated in 20% cases, TG in 52%, LDL in 14% and VLDL in49% cases and reduced HDL in 54% cases. Our findings are almost comparable with study by Qizilbash N et al.,[16] among 4737 people aged 45-69 years, prevalence of dyslipidemia was 63.4% (CI 95%: 62.0-64.9%). The prevalence of high TG, low HDL-C, high LDL-C, and high cholesterol level was 28.8%, 42.3%, 13.4%, and 13.4%, respectively.

Gonmei Z et al.,[18] reported overall prevalence of high cholesterol (≥200mg/dl), high triglyceride (≥150 mg/dl), low HDL cholesterol (male -<40 mg/dl; female - <50 mg/dl), and high LDL cholesterol (≥130 mg/dl) was 20.39%, 45.63%, 64.08%, and 17.31%, respectively.

Onkar Nath Rai et al.,[15] reported abnormal lipid values in 54 patients. Out of which increased non-HDL cholesterol was found in 53% patients. Increased LDL cholesterol was found in 35% patients followed by increased triglycerides in 34% patients. Increased total cholesterol was present in 30 patients.

Dyslipidemia is a primary major risk factor for coronary artery disease (CAD) and ischemic stroke. It causes insulin resistance which results in increased levels of plasma triglycerides and low-density lipoprotein cholesterol (LDL-C) and a decreased concentration of HDL-C, as an important risk factor for peripheral vascular disease, stroke, and CAD.[18,19] Although there are no studies that evaluated trends in hypercholesterolemia in rural populations, review of previous studies shows increasing trends in these populations also. The prevalence of total cholesterol >200 mg/dl in early 1990s was 16% and has increased to 25–35% in more recent Andhra Pradesh Rural Health Initiative and India Migration Study.[20]

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In our study, mean TC, TG, and LDL was significantly higher in ischemic stroke as compared to hemorrhagic stroke patients in our study ($p<0.05$).

Nirmala AC et al.,[11] studied 176 patients of ischemic and hemorrhagic stroke patients showed that among infarct group 123 out of 145 had deranged profile and among bleed group 24 out of 32 had deranged lipid profile. Analysis of lipid profile among both the group revealed that the most common value deranged in the infarct group is increased LDL which is deranged in 58.6% of patients and the second most common value deranged being increased total cholesterol which was deranged in 57.2%. Among the bleed group the most common deranged value was increased LDL which was deranged in 78.1% of patients and the second most common deranged value being increased total cholesterol which was deranged in 56.3% of patients. HDL values were decreased in 22.4% of non- diabetes patients and 27.3% in Diabetes patients.

Eyal Shahar et al.,[21] studied 14,175 people and found inconsistent associations between ischemic stroke and each of the5 lipid factors. A significant correlation was shown between ischemic and hemorrhagic stroke with increased LDL cholesterol and total cholesterol. Aclan Ozder et al.,[22] conducted a study on 132 patients with T2DM, significantly higher mean serum levels of TC, TG and LDL and significantly lower mean serum levels of HDL were noted in patients with diabetes.

Across the studies, there was high prevalence of overweight, hypertension, and lipid abnormalities. Age- and sex adjusted trends showed significant increases in mean body mass index, fasting glucose, total cholesterol, HDL cholesterol and triglycerides (quadratic and log- linear regression, $p<0.001$). Categorical trends showed increase in overweight and obesity ($p<0.05$) while insignificant changes were observed in truncal obesity, hypertension, hypercholesterolemia and diabetes. On the other hand, the prevalence of hypertriglyceridemia increased.

CONCLUSION

There is strong association of diabetic stroke with TC, TG and reduced HDL in our study. Mean TC, TG, and LDL were significantly higher in ischemic stroke as compared to hemorrhagic stroke patients in our study. Mean TC, LDL and VLDL and mean reduced HDL were significantly higher in diabetic stroke as compared to non-diabetic stroke patients in our study.

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