

Original Research Article

Study of lipid profile in cases of non-diabetic stroke

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ABSTRACT

Background: To study serum lipid profile in non-diabetic patients with stroke and to determine whether there is any significant correlation between them and to compare the serum lipid profile between ischaemic and haemorrhagic group. Design: Case control study.

Methods: The current study was done in the Department of Medicine VIMSAR, Burla, Odisha. Total 100 patients of completed stroke (Ischaemic 63 and haemorrhagic 37) and 30 controls were included in the study. All cases were adult (more than 14 years of age). Patients with suspected embolic stroke, diabetes (Type 1 and 2) and patients on lipid lowering drugs were excluded from the study. Routine investigations and fasting serum lipid profile was done.

Results: 45 patients had elevated serum total cholesterol levels out of which 75.56% had Ischaemic stroke and 24.49% had haemorrhagic stroke. 24 cases had elevated serum Triglyceride levels of which 66.67% had Ischaemic stroke and 29.17% had haemorrhagic stroke. 76.47% of cases having elevated serum LDL cholesterol suffered from Ischaemic stroke where as 20.59% had haemorrhagic stroke.

Conclusions: A statistically positive correlation was found between serum total cholesterol, Triglyceride, LDL levels and the risk of stroke.

Keywords: Dyslipidemia, Lipid Profile, Stroke

INTRODUCTION

Stroke or cerebrovascular accident is defined as an abrupt onset of a neurological deficit that is attributable to a focal vascular cause.¹ Stroke is the second leading cause of death worldwide causing 6.2 million deaths in 2011.¹ Stroke is a common medical emergency. It is also a major cause of long term disability.

Stroke is difficult to treat and the treatment is still not effective. Prevention is the best option but ability to forecast the stroke is challenging making the detailed study of risk factors essential.² The risk factors of stroke include various fixed and modifiable risk factors, notable among them are age, gender, heredity, diabetes mellitus, hypertension, dyslipidemia, smoking, atherosclerosis,

excessive intake of alcohol and other rare causes.² There is good evidence that modification of risk factors will reduce the risk of stroke.^{2,3}

Studies have shown that elevated levels of serum lipids are important risk factors for the development of atherosclerosis which is the precursor of stroke.⁴ Elevated plasma concentration of low density lipoproteins (LDL) and low levels of high density lipoprotein (HDL) concentrations are associated with an increased risk of atherosclerosis.⁴ The relationship between atherosclerosis and elevated serum lipids is well established and aggressive treatment of dyslipidemia decreases the risk of stroke.³ Numerous clinical trials have shown a marked reduction in stroke incidence with use of cholesterol lowering drugs as in case of coronary artery disease, the level of low density lipoprotein (LDL) cholesterol has the

most impact on incidence of stroke but elevated triglyceride (TG) may also confer risk.⁵

Studies of cholesterol levels in stroke patients have revealed results varying from insignificant changes to a moderate elevation. The amount of evidence relating to relation between serum lipids, lipoproteins and cerebrovascular accident is not adequate. The incidence rises steeply with age, and in many lower and middle income countries it is rising in association with less healthy lifestyles, prompted us to undertake this study. Hence the study has been taken up to study lipid abnormalities in non diabetic stroke patients in our setup.

METHODS

The objective of the study was to observe the serum lipid profile in non-diabetic patient with stroke and to determine any significant correlation between abnormal lipid profile and stroke in non-diabetic patients and to compare serum lipid profile between patient of ischaemic and haemorrhagic stroke.

Study design

The present study was conducted on non-diabetic stroke patients admitted to the Department of General Medicine, VIMSAR, Burla, Sambalpur, Odisha, from November 2014 to October 2016 with normal individuals of comparable age and sex served as controls. The type of study is of case-control.

Inclusion criteria

The study included a total of 100 adult cases (more than 14 years of age) of completed stroke. They were divided into two categories: 1. Patients with ischaemic stroke, 2. Patients with haemorrhagic stroke. 30 (Thirty) normal individuals of comparable age and sex served as controls for the study.

Exclusion criteria

Diabetic stroke patients, cerebrovascular accidents associated with head injury or brain tumour, pregnancy, puerperium, patients who were on lipid lowering drugs, patients with suspected emboli of cardiac origin and patients with subarachnoid hemorrhage were excluded from the study.

Data collection

Data was collected with meticulous history, clinical examination with detailed neurological examinations along with appropriate investigations. A structured questionnaire was used to obtain data on family history of diabetes mellitus, history of hypertension, past and present illness, dietary pattern, addiction and medication.

Blood samples are collected for CBC, fasting and post prandial blood sugars, HbA1c, blood urea, serum creatinine, fasting lipid profile (Serum total cholesterol, serum Triglycerides, Serum high density Lipoproteins, Serum very low density Lipoproteins, Serum low density Lipoproteins), serum Electrolytes, ECG, CT scan of brain/MRI of brain.

RESULTS

In the present study, a total of 100 patients with complete stroke were included and 30 cases as control. Among males, the age group 60-69 was mostly affected by ischaemic stroke, and the patients in the age group 40-49 were largely affected by haemorrhagic stroke. Among females, the age group 60-69 was largely affected by ischemic as well as hemorrhagic stroke, which was two decade later than the males.

Table 1: Sex distribution in study population.

| Groups | Male | Female |
|--------------|------|--------|
| Control | 20 | 10 |
| Ischaemic | 41 | 22 |
| Haemorrhagic | 27 | 10 |

Table 2: Age and sex distribution of study population.

| Age group | Control | | Ischaemic | | Haemorrhagic | |
|-----------|---------|----|-----------|----|--------------|----|
| | M | F | M | F | M | F |
| 20-29 | 2 | 0 | 2 | 0 | 0 | 0 |
| 30-39 | 3 | 2 | 3 | 0 | 2 | 0 |
| 40-49 | 4 | 2 | 8 | 3 | 8 | 0 |
| 50-59 | 5 | 3 | 11 | 6 | 7 | 3 |
| 60-69 | 4 | 3 | 12 | 8 | 6 | 6 |
| 70-80 | 2 | 0 | 5 | 5 | 4 | 1 |
| Total | 20 | 10 | 41 | 22 | 27 | 10 |

Out of 100 cases, 63 cases were of ischaemic stroke, of which 41 were male and 22 were female. 37 cases were of haemorrhagic stroke, of which 27 were male and 10 were female and out of 30 control 20 were male and 10 were female (Table 1). The maximum numbers of patients were in the age group 60-69 (Table 2).

Analyzing the distribution of total cholesterol in study population (Table 3) it was found that, 75.56% of patients having elevated serum cholesterol levels (total cholesterol > 240 mg% according to Adult Treatment Panel (ATP) – III guidelines⁶) fall in ischaemic category whereas 24.44% fall in haemorrhagic stroke category. The differences across the groups on the basis of their total cholesterol level was found to be significant (χ^2 -27.514; $p < 0.0001$).

Analyzing serum triglyceride in study population it is observed that 66.67% of patients among elevated serum triglyceride (serum triglyceride >200 mg% according to ATP – III guidelines) had ischaemic stroke and 29.17%

had haemorrhagic stroke. The differences across the groups on the basis of their total serum triglyceride level

was found to be significant (χ^2 -10.691; p -0.0303). (Table 4).

Table 3: Distribution of total cholesterol in study population and their statistical analysis.

| | | Total cholesterol | | | Total | |
|--------------------|----------------------------|----------------------------|---------|-----------------------|--------|--------|
| | | <200 | 200-240 | >240 | | |
| Group | Control | Count | 19 | 11 | 0 | 30 |
| | | % within group | 63.33 | 36.67 | 0.00 | 100.00 |
| | | % within Total cholesterol | 32.76 | 40.74 | 0.00 | 23.08 |
| | Ischaemic | Count | 20 | 9 | 34 | 63 |
| | | % within group | 31.75 | 14.29 | 53.97 | 100.00 |
| | | % within Total cholesterol | 34.48 | 33.33 | 75.56 | 48.46 |
| | Haemorrhagic | Count | 19 | 7 | 11 | 37 |
| | | % within group | 51.35 | 18.92 | 29.73 | 100.00 |
| | | % within Total cholesterol | 32.76 | 25.93 | 24.44 | 28.46 |
| Total | Count | 58 | 27 | 45 | 130 | |
| | % within group | 44.62 | 20.77 | 34.62 | 100.00 | |
| | % within Total cholesterol | 100.00 | 100.00 | 100.00 | 100.00 | |
| Chi-Square test | | | | | | |
| | | Value | df | Asymp. Sig. (2-sided) | | |
| Pearson Chi-Square | | 27.514 | 4 | <0.0001 | | |
| No. of valid cases | | 130 | | | | |

Table 4: Distribution of serum triglyceride in study population and their statistical analysis.

| | | | Serum triglyceride | | | Total |
|--------------------|------------------------|------------------------|--------------------|---------|-----------------------|--------|
| | | | <150 | 150-199 | 200-499 | |
| Group | Control | Count | 15 | 14 | 1 | 30 |
| | | % within group | 50.00 | 46.67 | 3.33 | 100.00 |
| | | % within triglycerides | 27.27 | 27.45 | 4.17 | 23.08 |
| | Ischaemic | Count | 20 | 27 | 16 | 63 |
| | | % within group | 31.75 | 42.86 | 25.40 | 100.00 |
| | | % within triglycerides | 36.36 | 52.94 | 66.67 | 48.46 |
| | Haemorrhagic | Count | 20 | 10 | 7 | 37 |
| | | % within group | 54.05 | 27.03 | 18.92 | 100.00 |
| | | % within triglycerides | 36.36 | 19.60 | 29.17 | 28.46 |
| Total | Count | 55 | 51 | 24 | 130 | |
| | % within group | 42.31 | 39.23 | 18.46 | 100.00 | |
| | % within triglycerides | 100.00 | 100.00 | 100.00 | 100.00 | |
| Chi-Square test | | | | | | |
| | | | Value | df | Asymp. Sig. (2-sided) | |
| Pearson Chi-Square | | | 10.691 | 4 | 0.0303 | |
| No. of valid cases | | | 130 | | | |

Analyzing serum LDL cholesterol within study population (Table 5) it is found that 76.47% of patients having elevated serum LDL cholesterol (serum LDL cholesterol >160 mg% according to ATP – III guidelines) suffered from ischaemic stroke whereas 20.59% had haemorrhagic stroke. The differences across the groups on the basis of their total serum LDL level was found to be significant (χ^2 -22.878; p -0.0008). Analysis of serum HDL shows, 29 cases have low HDL cholesterol levels (serum HDL Cholesterol levels < 40 mg% according to

ATP III guidelines). 21.62% of haemorrhagic stroke patients had low HDL levels as compared to 17.46% of ischaemic stroke patients indicating greater abnormality levels in haemorrhagic stroke patients. The differences across the groups on the basis of their total serum HDL cholesterol level was found to be insignificant (χ^2 -2.968; p -0.2267). (Table 6).

Analyzing the distribution of VLDL cholesterol in the study population, it was found that, 73 cases had high

VLDL cholesterol levels (serum VLDL Cholesterol levels >30 mg% according to ATP III guidelines). 51.35% of haemorrhagic stroke patients had high VLDL levels as compared to 61.90% of ischaemic stroke

patients and among controls 50.00% had high VLDL levels. The differences across the groups on the basis of their total serum VLDL cholesterol level was found to be insignificant (χ^2 -1.654; p -0.4373) (Table 7).

Table 5: Distribution of serum LDL cholesterol in study population and their statistical analysis.

| | | | LDL Cholesterol | | | | Total |
|--------------------|----------------|----------------|-----------------------|---------|---------|--------|--------|
| | | | <100 | 100-130 | 131-160 | >160 | |
| Group | Control | Count | 13 | 12 | 4 | 1 | 30 |
| | | % within group | 43.33 | 40.00 | 13.33 | 3.33 | 100.00 |
| | | % within LDL | 31.71 | 40.00 | 16.00 | 2.94 | 23.08 |
| | Ischaemic | Count | 13 | 10 | 14 | 26 | 63 |
| | | % within group | 20.63 | 15.87 | 22.22 | 41.27 | 100.00 |
| | | % within LDL | 31.71 | 33.33 | 56.00 | 76.47 | 48.46 |
| | Hemorrhagic | Count | 15 | 8 | 7 | 7 | 37 |
| | | % within group | 40.54 | 21.62 | 18.92 | 18.92 | 100.00 |
| | | % within LDL | 36.58 | 26.67 | 28.00 | 20.59 | 28.46 |
| Total | Count | 41 | 30 | 25 | 34 | 130 | |
| | % within group | 31.54 | 23.07 | 19.23 | 26.15 | 100.00 | |
| | % within LDL | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | |
| Chi-Square test | | | | | | | |
| | Value | df | Asymp. Sig. (2-sided) | | | | |
| Pearson Chi-Square | 22.878 | 6 | 0.0008 | | | | |
| No. of valid cases | 130 | | | | | | |

Table 6: Distribution of serum HDL cholesterol in study population and their statistical analysis.

| | | | HDL cholesterol | | Total |
|--------------------|----------------|----------------|-----------------------|--------|--------|
| | | | <40 | ≥ 40 | |
| Group | Control | Count | 10 | 20 | 30 |
| | | % within group | 33.33 | 66.67 | 100.00 |
| | | % within HDL | 34.48 | 19.80 | 23.08 |
| | Ischaemic | Count | 11 | 52 | 63 |
| | | % within group | 17.46 | 82.54 | 100.00 |
| | | % within HDL | 37.93 | 51.48 | 48.46 |
| | Haemorrhagic | Count | 8 | 29 | 37 |
| | | % within group | 21.62 | 78.38 | 100.00 |
| | | % within HDL | 27.59 | 28.71 | 28.46 |
| Total | Count | 29 | 101 | 130 | |
| | % within group | 22.31 | 77.69 | 100.00 | |
| | % within HDL | 100.00 | 100.00 | 100.00 | |
| Chi-Square test | | | | | |
| | Value | df | Asymp. Sig. (2-sided) | | |
| Pearson Chi-Square | 2.968 | 2 | 0.2267 | | |
| No. of valid cases | 130 | | | | |

Lipid profile among female controls and female patients revealed no significant difference except the level of total cholesterol and LDL in patients affected with ischaemic stroke. No significant difference was found among female patient suffering from haemorrhagic stroke and female controls (Table 8).

The comparison of lipid profiles among male controls and male patients suffering from haemorrhagic stroke showed no significant difference. Except for the level of total triglyceride and VLDL in patients affected with ischaemic stroke, significant difference was found while comparing among male patient and male controls (Table 9).

Table 7: Distribution of serum VLDL cholesterol in study population and their statistical analysis.

| | | | VLDL Cholesterol | | Total |
|--------------------|----------------|----------------|-----------------------|--------|--------|
| | | | ≤30 | >30 | |
| Group | Control | Count | 15.00 | 15.00 | 30.00 |
| | | % within group | 50.00 | 50.00 | 100.00 |
| | | % within VLDL | 26.32 | 20.55 | 23.08 |
| | Ischaemic | Count | 24.00 | 39.00 | 63.00 |
| | | % within group | 38.09 | 61.90 | 100.00 |
| | | % within VLDL | 42.10 | 53.42 | 48.46 |
| | Haemorrhagic | Count | 18.00 | 19.00 | 37.00 |
| | | % within group | 48.65 | 51.35 | 100.00 |
| | | % within VLDL | 31.57 | 26.02 | 28.46 |
| Total | Count | 57.00 | 73.00 | 130.00 | |
| | % within group | 43.84 | 56.15 | 100.00 | |
| | % within VLDL | 100.00 | 100.00 | 100.00 | |
| Chi-Square test | | | | | |
| | Value | df | Asymp. Sig. (2-sided) | | |
| Pearson Chi-Square | 1.654 | 2 | 0.4373 | | |
| No. of valid cases | 130 | | | | |

Table 8: Showing comparison of lipid profile between female controls and patients.

| Dependent Variable | Cases (K) | Mean value of K | Mean value of control (L) | Mean Difference (K-L) | P-value |
|--------------------|--------------|-----------------|---------------------------|-----------------------|---------|
| Total cholesterol | Ischaemic | 229.95 | 168.10 | 61.85 | 0.0064 |
| | Haemorrhagic | 205.40 | 168.10 | 37.30 | 0.2408 |
| serum triglyceride | Ischaemic | 167.55 | 119.00 | 48.55 | 0.1082 |
| | Haemorrhagic | 138.60 | 119.00 | 19.60 | 0.7335 |
| HDL | Ischaemic | 46.09 | 41.11 | 4.98 | 0.2302 |
| | Haemorrhagic | 45.11 | 41.11 | 4.00 | 0.2406 |
| LDL | Ischaemic | 147.25 | 104.19 | 43.06 | 0.0241 |
| | Haemorrhagic | 132.23 | 104.19 | 28.04 | 0.3252 |
| VLDL | Ischaemic | 33.73 | 23.60 | 10.13 | 0.1175 |
| | Haemorrhagic | 27.68 | 23.60 | 4.08 | 0.7335 |

Table 9: Showing comparison of lipid profile between male controls and patients.

| Dependent Variable | Cases (K) | Mean value of K | Mean value of control (L) | Mean Difference (K-L) | P-value |
|--------------------|--------------|-----------------|---------------------------|-----------------------|----------|
| Total cholesterol | Ischaemic | 235.93 | 185.50 | 50.43 | 0.0014 |
| | Haemorrhagic | 199.04 | 185.50 | 13.54 | 0.659 |
| serum triglyceride | Ischaemic | 173.00 | 137.45 | 35.55 | 0.1598 |
| | Haemorrhagic | 144.11 | 137.45 | 6.66 | > 0.9999 |
| HDL | Ischaemic | 52.98 | 44.26 | 8.72 | 0.0115 |
| | Haemorrhagic | 49.04 | 44.26 | 4.79 | 0.2494 |
| LDL | Ischaemic | 146.80 | 110.12 | 36.68 | 0.0075 |
| | Haemorrhagic | 120.87 | 110.12 | 10.75 | 0.5467 |
| VLDL | Ischaemic | 34.72 | 27.44 | 7.28 | 0.1553 |
| | Haemorrhagic | 28.95 | 27.44 | 1.51 | > 0.9999 |

Comparison of serum lipid profile between males and females in control group (Table 10), ischaemic group (Table 11) and haemorrhagic group (Table 12) were studied. In all three groups, the mean levels of serum total

cholesterol, triglycerides, HDL, LDL and VLDL were higher in males than in females. There is a trend of increasing cholesterol, triglycerides, HDL, LDL and VLDL in males than that in females.

Table 10: Showing comparison of lipid profile between males and females in control group.

| Dependent variable | Sex | N | Mean | Standard deviation | Std. error of mean | P-value |
|--------------------|-----|----|--------|--------------------|--------------------|---------|
| Total cholesterol | M | 20 | 185.50 | 37.126 | 8.302 | 0.1793 |
| | F | 10 | 168.10 | 35.670 | 11.280 | |
| Serum triglyceride | M | 20 | 137.45 | 51.256 | 11.461 | 0.4030 |
| | F | 10 | 119.00 | 51.489 | 16.282 | |
| HDL | M | 20 | 43.26 | 10.619 | 2.374 | 0.7747 |
| | F | 10 | 41.11 | 8.717 | 2.757 | |
| LDL | M | 20 | 110.12 | 31.739 | 7.097 | 0.7580 |
| | F | 10 | 104.49 | 30.549 | 9.660 | |
| VLDL | M | 20 | 27.44 | 10.402 | 2.326 | 0.4030 |
| | F | 10 | 23.60 | 10.429 | 3.298 | |

Table 11: Showing comparison of lipid profile between males and females in ischemic stroke group.

| Dependent variable | Sex | N | Mean | Standard deviation | Std. error of mean | P-value |
|--------------------|-----|----|--------|--------------------|--------------------|---------|
| Total cholesterol | M | 41 | 235.93 | 64.940 | 10.142 | 0.5352 |
| | F | 22 | 229.95 | 62.376 | 13.299 | |
| Serum triglyceride | M | 41 | 173.00 | 73.224 | 11.436 | 0.7511 |
| | F | 22 | 167.55 | 72.326 | 15.420 | |
| HDL | M | 41 | 52.98 | 12.864 | 2.009 | 0.0353 |
| | F | 22 | 46.09 | 10.014 | 2.135 | |
| LDL | M | 41 | 146.80 | 56.229 | 8.782 | 0.8344 |
| | F | 22 | 147.25 | 56.512 | 12.048 | |
| VLDL | M | 41 | 34.72 | 14.583 | 2.278 | 0.7401 |
| | F | 22 | 33.73 | 14.363 | 3.062 | |

Table 12: Showing comparison of lipid profile between males and females in haemorrhagic stroke group.

| Dependent Variable | Sex | N | Mean | Standard deviation | Std. error of mean | P-value |
|--------------------|-----|----|--------|--------------------|--------------------|---------|
| Total cholesterol | M | 27 | 199.04 | 63.958 | 12.309 | 0.9727 |
| | F | 10 | 205.40 | 76.715 | 24.259 | |
| serum triglyceride | M | 27 | 145.11 | 74.733 | 14.382 | 0.7975 |
| | F | 10 | 138.60 | 72.554 | 22.944 | |
| HDL | M | 27 | 49.04 | 13.621 | 2.621 | 0.6565 |
| | F | 10 | 45.11 | 8.596 | 2.718 | |
| LDL | M | 27 | 120.87 | 46.448 | 8.939 | 0.7194 |
| | F | 10 | 132.23 | 65.123 | 20.594 | |
| VLDL | M | 27 | 28.95 | 15.005 | 2.888 | 0.7843 |
| | F | 10 | 27.73 | 14.481 | 4.579 | |

The mean levels of serum total cholesterol, triglycerides, HDL, LDL and VLDL were higher in male controls as compared to female controls, but was not statistically significant (Table 10).

Comparing the lipid profile in males and females in ischaemic stroke group, it was observed that, the mean levels of serum total cholesterol, triglycerides, HDL, and VLDL were higher in males as compared to females.

The mean of level of LDL in female was found to be higher compared to males. None of the parameters of

lipid profile shows statistical significance except for serum HDL, which was found to be higher in males as compared to females. (Table 11).

Comparing the lipid profile in males and females in haemorrhagic stroke group it was observed that, the mean levels of serum triglycerides, HDL, and VLDL were higher in males as compared to females. The mean of level of LDL and total cholesterol in female was found to be higher as compared to males.

All the differences among males and females have not reached to a level of statistical significance (Table-12).

DISCUSSION

Stroke is a common clinical problem. Current treatment for patients with established stroke is relatively ineffective. Approximately 50% of patients are left with permanent disability. Effective risk factor interventions offer a real hope of reducing stroke morbidity and mortality. Certain risk factors have been consistently identified as significant predictor of stroke outcome, while some are less consistent.

Diabetes Mellitus, because of its common association with dyslipidemia is a common cause of stroke.⁷ However, little is known regarding the clinical pattern, outcome and predictors of early mortality after stroke in patients without diabetes. Dyslipidemia is also one of the major risk factor noted in patients of stroke without diabetes.⁸ In our study thirty controls were normal individuals.

The present study consisted of 100 patients who were admitted to VIMSAR, Burla of which 63 patients were ischemic stroke, 37 patients were of haemorrhagic stroke and 30 individuals were age and sex matched controls.

The relationship between serum cholesterol levels and the risk of stroke is not clear.⁹ A U-shaped relation between the level of serum total cholesterol and the risk of stroke of all types has been proposed, derived from an inverse association with haemorrhagic stroke and a direct association with ischaemic stroke.⁸ Possible differences in the effects of cholesterol at different vascular sites could lead to the complex association between serum cholesterol levels and stroke.² The origin of the Internal Carotid Artery is probably the most common site of atherosclerosis that leads to Transient Ischemic Attack (TIA) or stroke.¹⁰

The patients in our study group were aged between 25 to 80 years. Amongst the males, the age group of 60-69 were most commonly affected by ischaemic stroke whereas age group of 40-49 were most commonly affected by haemorrhagic stroke. In females, the age group 60-69 was largely affected by ischaemic as well as haemorrhagic stroke. In a study by Khan and Rehman, out of 100 patients 71 were males and rest females.¹¹ Fifty nine of these patients were above 60 years and 25 between 40-50 years. In another study of 80 patients by Sreedhar K, Srikant B, Joshi L, Usha G,² 56 were males and rest were females and Males in the age group 50-59 were most commonly affected by ischaemic stroke, whereas male patients in the age group 40-49 were most commonly affected by haemorrhagic stroke. In females the age group remains the same as in our study i.e. 60-69 for both ischaemic and haemorrhagic stroke. The incidence of stroke in females was two decades later than in males in our study but in the study by Sreedhar K, Srikant B, Joshi L, Usha G, it was one decade later.² This could be due to selection bias at a tertiary care centre and hence further epidemiological studies will be needed to

prove this hypothesis. This finding was similar to study by Roquer *et al.*¹² where they found that the mean age of affected patients was higher in women.

The serum total cholesterol levels in 45 patients having either ischaemic or haemorrhagic stroke were high (Total cholesterol >240 mg% according to the Adult Treatment Panel (ATP) – III guidelines of National Cholesterol Education Program (NCEP)). Among the individuals in control group, not a single person had high serum cholesterol. Applying the Chi-square test, it is conclude that the study group is largely affected by abnormal serum total cholesterol levels than that of control group. Benfante et al and Di Mascio et al have found a positive association between serum cholesterol and risk of stroke.^{13,14} Iso *et al* found an inverse relation between cholesterol level and haemorrhagic stroke but a positive association with non haemorrhagic stroke.¹⁵ There was no correlation between serum cholesterol and risk of stroke in a study by Harmsen et al Rastenytė *et al* and Hart CL *et al.*¹⁶⁻¹⁸ found that serum cholesterol levels are not related to risk of death from stroke. The Atherosclerosis Risk in Communities (ARIC) study has concluded that the relation of circulating cholesterol to ischaemic stroke does not resemble its well known relation to coronary artery disease.¹⁹

Among patients having ischaemic and haemorrhagic stroke, serum triglycerides were high in 24 patients (>200 mg% according to ATP – III guidelines), which is significant as p value is < 0.05 by Chi-square test. So, our study finds out a positive relation between triglyceride levels and risk of stroke as compared to control group. Hachinski *et al.* observed a positive correlation of serum triglyceride levels with patients suffering from atherothrombotic strokes and Transient Ischemic attacks (TIA) as compared to control subjects.²⁰ But this type of correlation was not found in the study conducted by Sridharan R *et al.*²¹

Male patients in the age group of 50-59 yrs and female patients in the age group of 60-69 yrs of age suffering from ischaemic stroke had raised levels of serum LDL cholesterol (>160mg% according to ATP – III guidelines). Among haemorrhagic stroke patients, serum LDL cholesterol levels were high in the age group of 40-49 yrs and 50-59 yrs in males and 60-69 yrs among females. Among individuals in control group only a single person had high serum LDL cholesterol levels. Applying the Chi square test the value obtained was statistically significant (p < 0.05). Hence, we conclude that the study group was largely affected by abnormal LDL levels than that of control group. Botet *et al* and Hachinski *et al* in their studies have found positive correlation between LDL Cholesterol levels and risk of ischaemic stroke.^{20,22}

Male patients in the age group of 50-59 yrs and female patients in the age group of 50-59 and 60-69 yrs suffering from ischaemic stroke had low serum HDL cholesterol

levels (<40mg% according to ATP – III guidelines). Among haemorrhagic stroke patients serum HDL cholesterol was low in the age group of 40-49 and 50-59 yrs in males. In our study of HDL cholesterol in stroke patients, we found that the haemorrhagic group patients had greater abnormal levels than ischemic group patients which was greater than the control group. On statistical analysis, the Chi-Square value of 2.968 was greater than the significant value of 0.2267, but the p value > 0.05, which is insignificant and thus we conclude that the experimental group is not largely affected by abnormal HDL levels. Simons *et al* in their study observed that increase in HDL cholesterol is protective in ischemic stroke.²³ The Northern Manhattan Stroke Study group concluded that increased HDL – C levels is associated with reduced risk of ischaemic stroke.²⁴

In patients of ischaemic stroke, serum VLDL levels was high (>30 mg% according to ATP – III guidelines) among males and females in 50-59 yrs age group. Among patients of haemorrhagic stroke, the serum VLDL levels were high in age group of 40-49 in males and 60-69 in females. The study group had higher levels of serum VLDL cholesterol than control group but was not found to be statistically significant (p>0.05).

CONCLUSION

Our study concluded a positive correlation between serum total cholesterol, triglyceride, LDL level and risk of stroke. But it could not establish correlation between serum HDL, VLDL level with the risk of stroke. Dyslipidemia is one of the major risk factors in non diabetic stroke patients. Thus early detection of dyslipidemia and treatment with drugs along with dietary modifications & lifestyle changes can reduce the risk of stroke.

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