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**Research Article**

# Comparison of fasting lipid profile in ischemic and haemorrhagic stroke patients of a tertiary care hospital

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## ABSTRACT

**Background:** Stroke is one of the leading causes of death and disability in India. Dyslipidaemia as a risk factor for cerebrovascular accidents have been explored in various studies and have been definitely established with the findings of many landmark trials. The relation of circulating cholesterol to ischemic stroke does not resemble its well-known relation to coronary heart disease and hence needs to be explored in detail.
**Methods:** 72 patients with a first ever diagnosis of cerebrovascular disease whose onset was within the preceding three days were enrolled in the study. Lipid profile abnormalities were documented in these patients and they were followed up for 30 days.
**Results:** The mean age was 60.7 ± 11.0 years in the ischemic group and 52.3±10.2 years in the haemorrhagic group (P=0.004). The mean total cholesterol (TC) levels and the mean LDL – cholesterol (LDL – C) levels were higher in the ischemic stroke patients and these differences were statistically very significant. (183.7± 34.5 versus 148.5±30.6, P = 0.0002, 118.7±26.7 versus 81.4±22.0, P = 0.0001) The differences in the mean triglycerides (TG), mean HDL – cholesterol (HDL – C) and mean VLDL – cholesterol (VLDL – C) levels were not statistically significant between the two groups.
**Conclusions:** In this study, the mean TC and LDL – C levels were significantly much higher in the ischemic stroke patients when compared to patients with haemorrhagic stroke. The findings from this small study suggest that there may be a limit to the lowering of LDL – Cholesterol levels. Some studies have shown that lower levels are associated with increased risk of haemorrhagic stroke rather than ischemic stroke, though conclusive evidence is still lacking.

**Keywords:** Stroke, Cerebrovascular accident, Lipid profile, LDL - C, Ischemic stroke, Haemorrhagic stroke

## INTRODUCTION

A stroke, or cerebrovascular accident, had been defined as the abrupt onset of a neurological deficit that is attributable to a focal vascular cause. WHO has defined stroke as a "rapidly developed clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than vascular origin".[1] Stroke is one of the leading causes of death and disability in India. The estimated adjusted prevalence rate of stroke range varied between 84 - 262/100,000 in rural and 334 – 424 /100,000 in urban areas. The incidence rate varies 119 – 145/100,000 based on the recent population based studies. The mortality rates also varied from 24.5% to 42% across various centres in India.[2] This shows the great magnitude of the

problem that exists in India with a significant lack of dedicated stroke units needed for management of such patients.

Dyslipidaemia as a risk factor for cerebrovascular accidents have been explored in various studies and have been definitely established with the findings of many landmark trials. The recommendations of 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults clearly states that there exist sufficient data to show that lipid lowering therapies are indicated in secondary prevention in patients with clinically evident atherosclerotic cardiovascular diseases.[3] However what has not been conclusively established is the actual relationship between the magnitude of dyslipidaemia and the development of stoke. The ARIC study concluded that the relation of circulating cholesterol to ischemic stroke does not resemble its well-known relation to coronary heart disease and that either the pathogenesis of a substantial proportion of ischemic strokes does not involve classic atherosclerotic mechanisms or the effect of plasma lipids on atherogenesis is substantially different in the intracranial vascular bed.[4] Varbo et al published data drawn from the Copenhagen City Heart study that showed stepwise increasing levels of non – fasting triglycerides were associated with increasing risk of ischemic stroke while increasing cholesterol levels were not in men and women with single exception.[5] In the Israeli Ischemic Heart Disease Project, it was shown that ethnicity was an independent risk factor for outcomes following cerebrovascular diseases and that the risk was stated to be higher among those hailing from Afro – Asian background when compared to an European ethnicity.[6] It is in this background that the study was planned to address the lack of available data regarding dyslipidaemia in stroke patients from south India.

## METHODS

This study was aimed at establishing the pattern of dyslipidaemia present among patients admitted in the medical wards of a tertiary care hospital with a diagnosis of cerebrovascular disease. After obtaining approval from the Institutional Review Board and Institutional Ethics Committee, the study was carried out in accordance with International Conference of Harmonisation – "Good Clinical Practices" guidelines.

Patients were eligible for participating in the study if they were admitted in the hospital with a first ever diagnosis of cerebrovascular disease whose onset was within the preceding three days. Cerebrovascular disease was defined as new onset of focal neurological deficit evident clinically with supportive evidence on neuroimaging study. Patients were ineligible for the study if they were already on treatment for dyslipidaemia or had onset of symptoms prior to three days or had a previous episode of cerebrovascular disease. The study period was planned for three months and a total of 78 patients satisfying the criteria were found to be eligible. All patients were invited to take part in the study after explaining the details of the study. Patient or their legal representative provided informed written consent to take part in the study. Six patients declined to take part and hence, the final study population was 72.

All patients received standard medical care as determined by the admitting physician and modified as per the laboratory and radiological investigations in consultation with the neurologist. The fasting lipid profile of all patients was taken after 10 – 12 hour overnight fasting on the morning of the immediate day following admission. All patients were regularly followed up till discharge and reports of the investigations were collected and tabulated. The results were analysed with the help of appropriate statistical tests for parametric and non-parametric variables using Graphpad Prism 6 software.

## RESULTS

A total of 72 patients were enrolled in this study. There were 47 males and 25 females in the study. The patients were divided into two groups. The patients in the Haemorrhagic stroke group were 20 and the patients in the Ischemic stroke group were 52. The age – sex distribution of patients is shown in Table 1.

**Table 1: Age-sex distribution of patients.**

| Age group (years) | Males | Females |
|---|---|---|
| 30 – 39 | 1 | 3 |
| 40 – 49 | 10 | 2 |
| 50 – 59 | 18 | 7 |
| 60 – 69 | 11 | 4 |
| 70 – 79 | 7 | 7 |
| 80 – 89 | 0 | 2 |

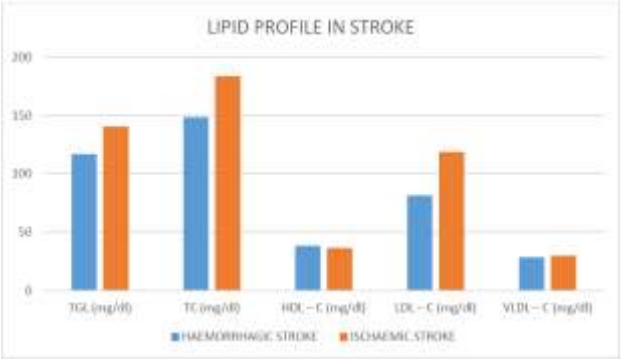


**Figure 1: Mean values of lipid profile in stroke patients.**

The mean age was 60.7±11.0 years in the ischemic group and 52.3±10.2 years in the haemorrhagic group (Table 2) and this difference was statistically significant (P=0.004). The mean total cholesterol (TC) levels and the mean LDL – cholesterol (LDL – C) levels were higher in the

ischemic stroke patients and these differences were statistically very significant. (183.7±34.5 versus 148.5±30.6, P=0.0002, 118.7 ± 26.7 versus 81.4±22.0, P=0.0001). The differences in the mean triglycerides (TG), mean HDL – cholesterol (HDL – C) and mean VLDL – cholesterol (VLDL – C) levels were not statistically significant between the two groups.

The associated comorbid conditions and habits are given in Table 3. Systemic hypertension was more commonly associated with haemorrhagic stroke than ischemic stroke and this association was statistically significant (P=0.0075). All other comorbid conditions did not reveal statistically significant association.

**Table 2: Lipid parameters of the stroke patients.**

| Variables | Haemorrhagic stroke (n = 20) | Ischaemic stroke (n = 52) | P value |
|---|---|---|---|
| Age (in years) | 52.3±10.2 | 60.7±11.0 | 0.0042 |
| TGL (mg/dl) | 116.9±31.4 | 140.7±56.0 | 0.77 |
| TC (mg/dl) | 148.5±30.6 | 183.7±34.5 | 0.0002 |
| HDL–C (mg/dl) | 38.2±8.3 | 36.4±8.7 | 0.447 |
| LDL–C (mg/dl) | 81.4±22.0 | 118.7±26.7 | 0.0001 |
| VLDL–C (mg/dl) | 28.4±8.5 | 29.7±11.0 | 0.633 |

**Table 3: Comorbid conditions of the stroke patients.**

| Variables | Haemorrhagic stroke (n = 20) | Ischaemic stroke (n = 52) | P value |
|---|---|---|---|
| Diabetes mellitus | 7 | 26 | 0.2988 |
| Systemic hypertension | 16 | 22 | 0.0075 |
| COPD | 6 | 11 | 0.5371 |
| Smoking | 8 | 23 | 0.7959 |
| Alcohol | 12 | 22 | 0.1987 |

## DISCUSSION

The patients in our study group were aged between 32 to 80 years. Patients in the age group 50-70 years were most commonly affected by ischemic stroke whereas patients in the 40-60 years age group were most commonly affected by haemorrhagic stroke. Fifty five percent (55%) of the patients belong to the age group of 50-70 years and this group consisted predominantly of males. Also among the total participants of this study there were 47 males and 25 females which accounts to 72% and 28% respectively. These findings are similar to the findings from the Mumbai and Trivandrum registries which showed a mean age of 66 and 67 years respectively.[7,8] The sex distribution also favoured the males in the Mumbai study while in the Trivandrum study the crude incidence rate favoured women. In a study from Bangalore, the sex ratio was 2:1 favouring the males which was similar to the findings of the present study.[9]

In this study, the mean TC and LDL – C levels were significantly much higher in the ischemic stroke patients when compared to patients with haemorrhagic stroke. (183.7± 34.5 versus 148.5±30.6 and 118.7±26.7 versus 81.4±22.0). This is similar to the findings of Garcia et al who also showed that the patients with cerebral infarction had higher levels of total – cholesterol and LDL – Cholesterol when compared to patients with cerebral haemorrhage. They also showed that triglyceride levels were also markedly elevated which was not found in this study.[10] These findings however differ from that of Togha et al who found that among Iranian men in a similar age group, there was no significant differences in the relationship between lipid parameters and type of stroke. The only significant association was between triglycerides, which showed elevated levels among patients with ischemic stroke.[11] The association between TC and type of stroke was also shown from the multicentre EUROSTROKE project which showed that 1mmol/L of increase in TC was associated with Odds Ratio (OR) of 0.8 (95% CI 0.61 to 1.05) for haemorrhagic stroke and OR of 1.06 (95% CI 0.94 to 1.19) for ischemic stroke, though the analysis from the EUROSTROKE project does not support the presence of an association between total cholesterol and fatal, non-fatal, haemorrhagic and ischaemic stroke.[12]

These findings have been correlated in studies from India also. In a study from Kolkata, it was found that patients with ischemic stroke had higher levels of TC and LDL – C when compared to patients with haemorrhagic stroke (190 ±35mg/dl vs 151±29mg/dl and 102±21mg/dl versus 93±17mg/dl respectively) which is similar to the findings in this study.[13] One other study showed that there is highly significant alteration in serum LDL – C levels and triglyceride levels in patients with stroke with no significant alteration in TC and HDL – C levels.[14]

It was also observed that type 2 diabetes mellitus and systemic hypertension were the most commonly associated conditions seen in stroke patients. In this study, systemic hypertension was seen in 80% of patients with haemorrhagic stroke and only in 42.3% of patients with ischemic stroke. This was similar to the findings of Togha et al but slightly different from that of Garcia et al.[10,11]

## CONCLUSION

The findings from this small study suggest that there may be a limit to the lowering of LDL – cholesterol levels. Some studies have shown that lower levels are associated with increased risk of haemorrhagic stroke rather than ischemic stroke, though conclusive evidence is still lacking. Further large scale studies are needed in the Indian population to find out the magnitude of this

problem of dyslipidaemia in patients with ischemic and haemorrhagic stroke. It is also necessary to identify risk factors early and propose appropriate interventions which will prevent the morbidity and mortality associated with stroke.

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