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Research Article

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Comparative lipid profile study between ischemic and hemorrhagic stroke

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ABSTRACT

To determine the frequency of dyslipidemias in patients with stroke and to compare the lipid levels in ischemic and hemorrhagic stroke patients. Patients with diagnosis of stroke comprising 50 consecutive patients each of ischaemic and haemorrhagic strokes were included in the study while patients on lipid lowering therapy were excluded from study. To determine the subtype of stroke, clinical examination followed by CT scan of brain was done. A serum sample after 8 hours of overnight fasting was taken on the next day of admission for both groups of patients. Total serum cholesterol, triglycerides, LDL-cholesterol, VLDL-cholesterol and HDL-cholesterol was determined, using enzymatic colorimetric method. SPSS software was used for calculation of % R of 95% confidence interval (CI). It was noted in our study that fasting serum lipid profile analysis of 50 ischemic stroke patients revealed raised serum total cholesterol in 21 patients with mean serum cholesterol of 190±35mg/dl where as only 5 patients among hemorrhagic CVA showing raised serum cholesterol with overall mean of 151±29mg/dl. Serum HDL was found to be low in 16 patients i.e. 32% of Ischemic stroke with mean value of 42.4±6mg/dl whereas only 6% of Hemorrhagic stroke patients showing low serum HDL with mean value of 45.4±5mg/dl. Abnormal serum triglyceride level was found to be distributed similarly in Ischemic & Hemorrhagic stroke with mean value of 137±30mg/dl & 125±30mg/dl respectively. High serum LDL was found in 6% & 4% of ischemic & hemorrhagic stroke with mean value of 102±21mg/dl & 93±17mg/dl respectively. Hypercholesterolemia and low HDL-cholesterol was seen significantly more in ischemic CVA group.

INTRODUCTION

Stroke is one of the major global health problems. It is the leading cause of adult disability. Mortality from strokes is the second leading cause worldwide.[1] The scientific community recognizes the association between blood lipids levels and risk of cardiovascular disease.[2] Strong association has been found between high levels of serum cholesterol – especially of low-density lipoprotein (LDL) cholesterol – and the development of atherosclerosis, while elevated levels of high-density lipoprotein (HDL) cholesterol seem to play a protective role.[2] Various studies have been done on dyslipidemias and the findings indicate that dyslipidemia is prevalent worldwide, and places an enormous burden on the health care system. The metabolic consequences associated with changes in diet and lifestyle has increased the number of hyperlipidemic individuals who are at risk of a number of adverse effects such as stroke. The relationship of serum lipids and lipoproteins with cerebrovascular disease are being studied along with many other risk factors as in coronary heart disease.[3,4] Several clinical trials showed an association between high concentrations of serum cholesterol and ischaemic stroke.[3,5]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 generally failed to show a direct and strong association.[6-8]Some demonstrated an inverse relation between total cholesterol and death from haemorrhagic stroke.[9] Therefore, the association between cholesterol and stroke may not be as straight forward as for coronary heart disease. Serum lipid levels have an established effect on short term mortality due to strokes.[10] It is important to evaluate the difference in serum lipid levels in subtypes of strokes to guide lipid-lowering therapy which can reduce incidence of stroke and related mortality by adapting primary and secondary preventive measures.[11,12] Therefore, the present study was designed to know

1. To determine the prevalence of dyslipidemia in CVA patients
2. To determine difference between serum lipid profile in patients with ischemic and haemorrhagic stroke.(if any)

EXPERIMENTAL SECTION

1. **Study area**: Department of general medicine, BSMC&H, BANKURA
2. **Study population**: Those admitted in BSMC&H (indoor)
3. **Study period:** Approximately two year
4. **Sample size:** Approximately 50 in each group
5. **Sample design:** Having had informed consent for participation from the patient and/or patient care giver, the patient was included in the study according to following criteria.

INCLUSION CRITERIA:
All patients aged > 45yr with clinically and radiologically proved cerebrovascular accident.

EXCLUSION CRITERIA:
• Brain tumour
• Head trauma
• Transient ischemic attack
• Demyelination
• Subdural hematoma
• Diabetes mellitus
• Previously on lipid lowering drugs
• Neoplastic and collagen vascular disease
• Previously diagnosed A-V malformation
• Previously diagnosed arrhythmia
• Secondary hyperlipidemia
• Previous myocardial ischemia or infarction

STUDY DESIGN: Comparative study
Collection: Serum samples were obtained after 8 hours of overnight fasting, on the next morning after admission. Venous blood samples were collected into plain tubes. Samples were centrifuged at 4 ^{0}c for 15 minutes after incubation of 20 minutes for extraction of serum. The sera were analyzed for serum lipid profile including total cholesterol, triglyceride, LDL-cholesterol and HDL-cholesterol by enzymatic colorimetric method using chemistry auto-analyser. The data was analysed using SPSS version 20.0 and Microsoft mathematic calculator. Rational descriptive statistics; frequencies and percentages were computed for presentation of qualitative variables like gender, age, CT scan brain findings, ECG and quantitative variables as lipid profile. Mean values of the cholesterol, triglyceride, LDL-cholesterol, HDL-cholesterol and VLDL-cholesterol was determined. Frequency percentage of abnormal lipid profile in both groups of patients of ischemic and haemorrhagic stroke, were determined and compared using proportion test for any significant difference taking p-value of < 0.05 as significant.

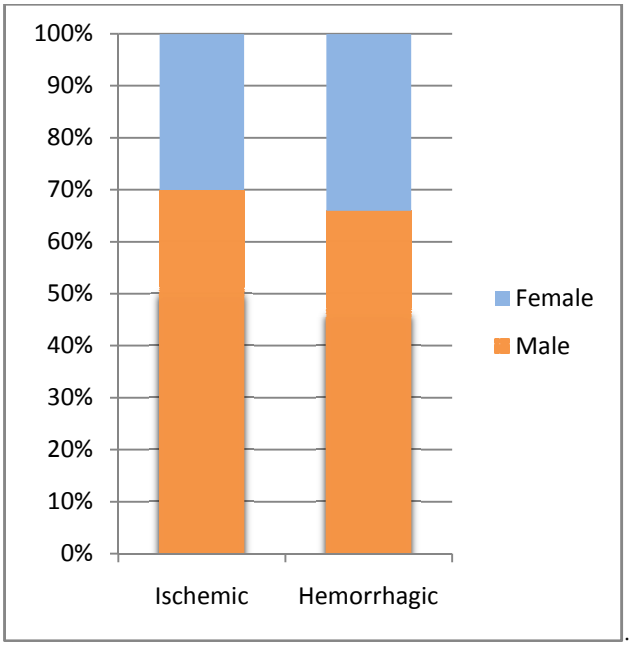
RESULTS

A total of 100 patients were studied. Majority of the ischemic stroke patients were relatively older (mean age 62 ±12 years) to sufferers of hemorrhagic stroke (mean age 55±14 years) as shown in table-I.

Table- I: Demographic data

Stroke type	No. of pt	Mean age	Male	Female
Ischemic	50	62±10	35(70%)	15(30%)
Hemorrhagic	50	57.4±7.3	33(66%)	17(34%)

Chart 1: Male & female preponderance

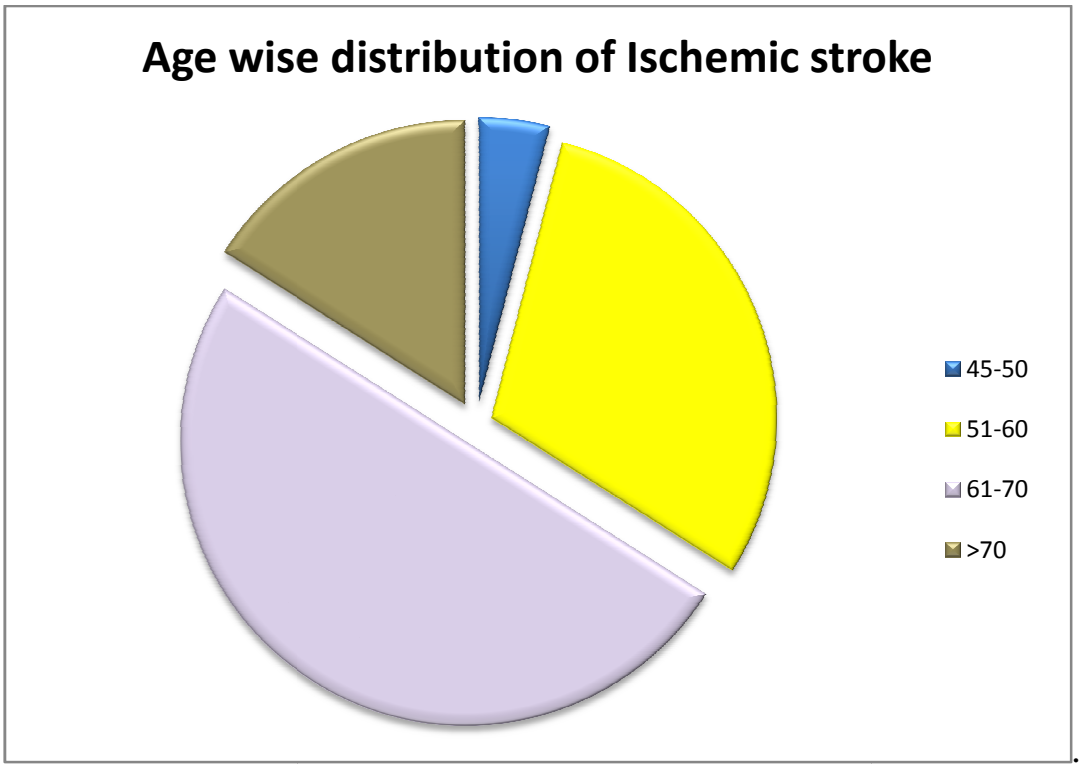


There is increased preponderance of male affected with stroke in both ischemic and hemorrhagic stroke.

Table 2: Age wise distribution of stroke patient

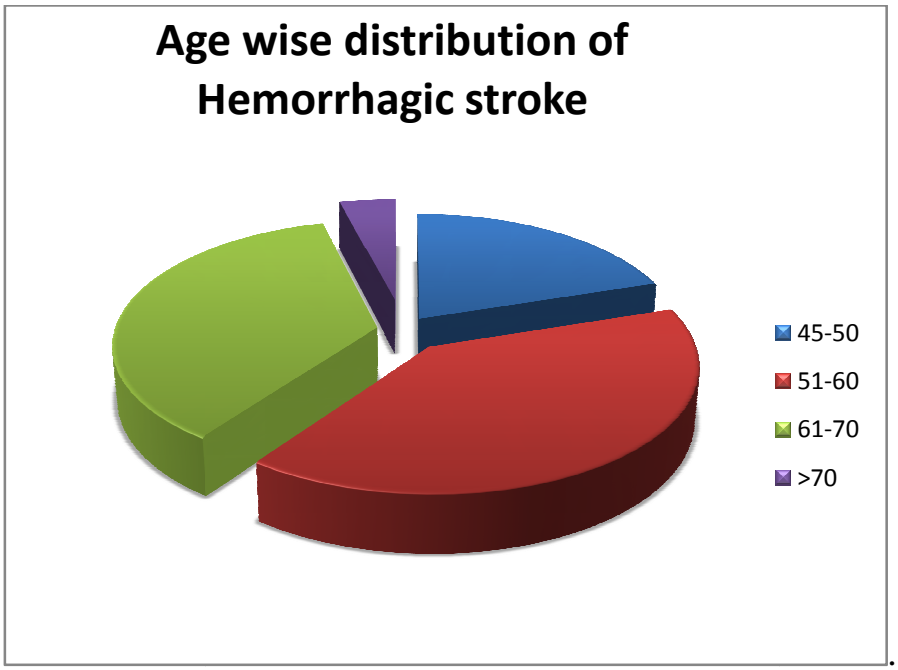
Age group	45-50	51-60	61-70	>70
Ischemic	2(4%)	15(30%)	25(50%)	8(16%)
Hemorrhagic	10(20%)	20(40%)	18(36%)	2(4%)

Chart 2



Above chart showing that most of the ischemic CVA patients in the study population are in the age group of 61-70 years.

Chart 3



Above chart showing that most of the hemorrhagic CVA patients in study population are in the age group of 51-60 years.

Chart 4: Comparison of the age of patients with ischemic and Hemorrhagic stroke

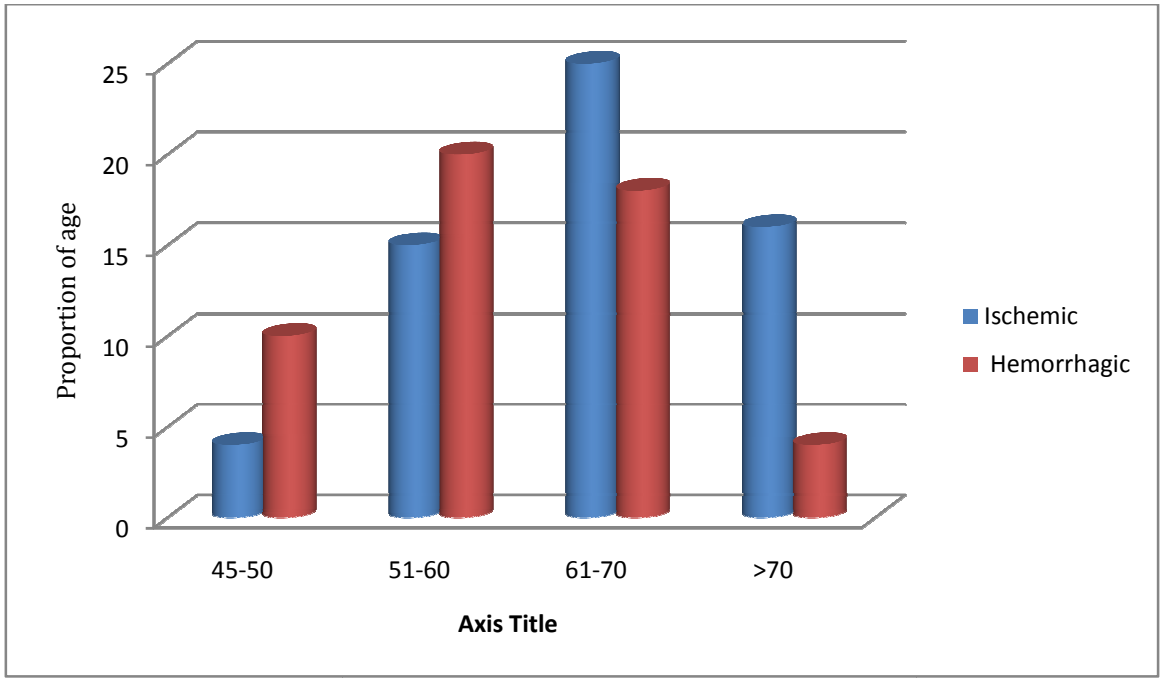
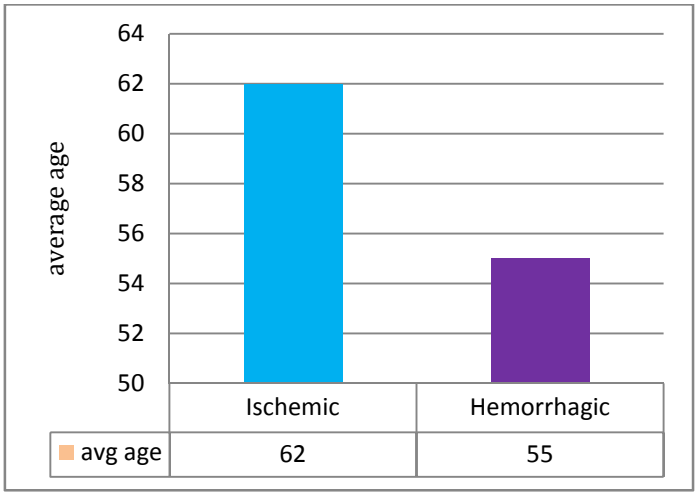


Chart 5: Comparison of average age of Ischemic & Hemorrhagic stroke



In this study, 68 (68%) were male patients and 32(32%) were female patients, and 70% of the ischemic group and 66% of the hemorrhagic group were male. Male patients account for a large proportion in both ischemic and hemorrhagic groups.

The mean age for the ischemic group was 62±10 years, which was higher than that of the hemorrhagic group (57.4±7.3years).

Table 6: showing comparison of lipid profile between Ischemic and Hemorrhagic stroke

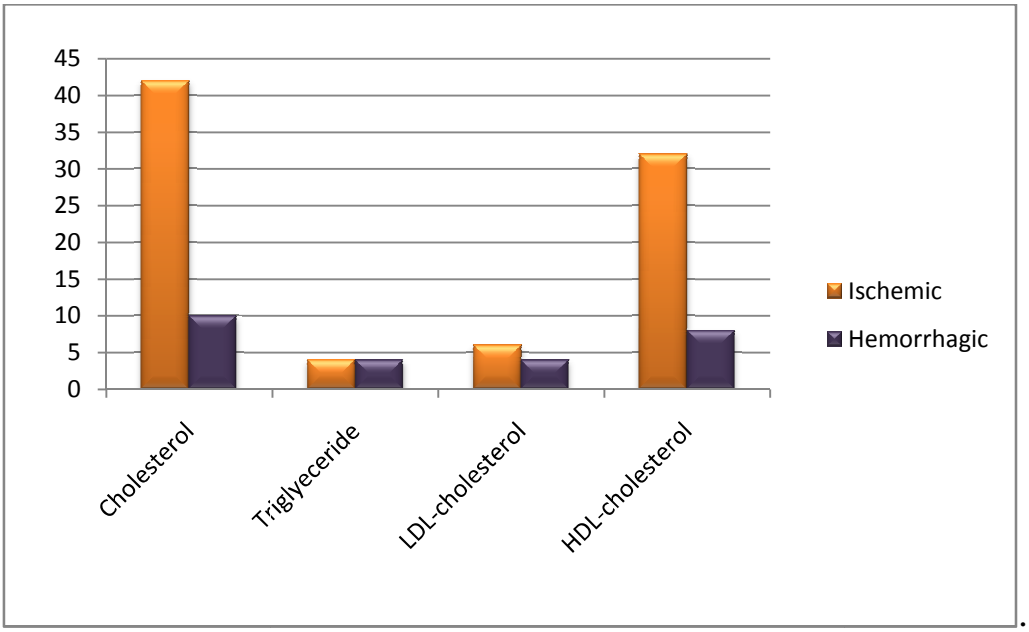
Lipid profile	Ischemic stroke	Hemorrhagic stroke
Total cholesterol <200 mg/dl	190±35	151±29
Triglyceride <200mg/dl	137±30	125±30
LDL-cholesterol <130mg/dl	102±21	93±17
HDL-cholesterol ≥40mg/dl	42.4±6	45.4±5

Table 7: showing Table showing comparison of percentage of patient having abnormal lipid profile

	% of cases with abnormal value		
Lipid profile	Ischemic CVA	Hemorrhagic CVA	P value
Cholesterol	42	10	P = 0.0006
Triglyceride	4	4	P = 0.6098
LDL-Cholesterol	6	4	P = 1.0000
HDL-cholesterol	32	6	P = 0.0022

- It was noted in our study that fasting serum lipid profile analysis of 50 ischemic stroke patients revealed raised serum total cholesterol in 21 patients with mean serum cholesterol of 190±35mg/dl where as only 5 patients among hemorrhagic CVA showing raised serum cholesterol with overall mean of 151±29mg/dl. So there is significant difference between two groups with p value 0.0006.(<0.05)
- Serum HDL was found to be low in 16 patients i.e. 32% of Ischemic stroke with mean value of 42.4±6mg/dl whereas only 6% of Hemorrhagic stroke patients showing low serum HDL with mean value of 45.4±5mg/dl. There is significant difference between 2 groups.
- Abnormal serum triglyceride level was found to be distributed similarly in Ischemic & Hemorrhagic stroke with mean value of 137±30mg/dl & 125±30mg/dl respectively.
- High serum LDL was found in 6% & 4% of ischemic & hemorrhagic stroke with mean value of 102±21mg/dl & 93±17mg/dl respectively.

Chart 13: Comparison of lipid profile between ischemic & hemorrhagic stroke



DISCUSSION

Stroke is a clinical syndrome characterized by rapidly developing symptoms and/or signs of focal and at times global loss of cerebral functions, with symptoms lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin.[13] Cerebral atherosclerosis with atheroma formation is the basic underlying patho-physiologic mechanism in ischemic stroke[14]. Conflicting results exist in the literature about the correlation between the total plasma cholesterol of patients and the risk of stroke. Qizilbash et al. in a review of 10 studies examining the relationship between serum total cholesterol and subsequent stroke concluded that there was a significant association however, other studies were less conclusive[15,16]. In addition to research published by our team,[11] we have found four case and control studies carried out in China, which obtained similar results: CI patients had significantly higher levels of total cholesterol, LDL, and triglycerides than those in control groups. Furthermore, CH subjects exhibited significantly lower levels of total cholesterol and LDL.[18]

In our study
Dyslipidemia is associated with both types of stroke. However hypercholesterolemia is significantly more associated with ischemic CVA. Low HDL-cholesterol is significantly more prevalent in ischemic CVA group in our study.

- Hyperlipidemia was present in 16% patients of stroke and was the 3rd most common risk factor for stroke in the study by Khan et al., while, the present study showed hyperlipidemia in 21% of all 200 patients of stroke[17,18].

- There is no established biological mechanism that explains these results, but cholesterol is known to have effects on the vasculature and is essential for normal membrane fluidity. Rabbits fed a high cholesterol diet have larger experimentally induced infarcts associated with an increase in platelet deposition in the thrombus at the infarct. All of these effects suggest that, a higher serum cholesterol concentration would predispose to stroke with a poor outcome.[19] It has now been established that, the serum cholesterol measurements within the first 48 hours are identical to those after three months, although a fall in concentration does occur between these times.[20] Earlier studies showed a positive relation between serum total cholesterol and non-haemorrhagic strokes with an inverse association to intracranial haemorrhage.[21] The present study also showed a positive association with ischemic stroke while, no association was seen with haemorrhagic stroke.

- Association between concentrations of serum triglycerides and the risk of stroke is also overshadowed. Some studies led to negative results whereas others showed a positive association with high serum triglyceride concentrations.[22] Copenhagen City Heart Study showed a log linear association between serum triglyceride concentrations and non-haemorrhagic stroke while no association was found of high plasma triglyceride concentration as a risk factor for both types of stroke in this study.[8]

- Serum HDL-cholesterol has anti-atherogenic properties with ability to trigger the flux of cholesterol from peripheral cells to the liver and thus having a protective effect.[23]

- There is an inverse association between HDL-cholesterol and ischemic stroke in the present study as 31% patients of ischemic stroke had below than normal serum HDL-cholesterol. However, recently it has been observed that serum HDL-cholesterol levels decrease significantly at the time of acute ischemic stroke and it may be an acute phase reactant or nascent biomarker of acute stroke susceptibility.[24]

- A positive relationship between high serum LDL-cholesterol levels and the risk of ischemic stroke has been seen as well. However, no such association was seen in this study.

- These counter-intuitive effects of serum lipids cannot be taken at face value without considering possible sources of bias in this study. A hospital population was examined and referrals were admitted selectively for severity of the symptoms and requiring immediate nursing and hospital care. On the other hand, a community study is likely to miss those patients who die within 24 hours of the onset of stroke. Moreover, the serum concentrations may reflect the severity of stroke, rather than the premorbid concentration. In this study, blood samples were collected within 24 hours and there was no follow-up data on those patients to indicate the effect of stress or nutrition, but studies have shown that serum cholesterol measurements within the first 48 hours remain identical to those after three months.[25]

Limitation of study:
There are certain limitations to this study.
- This is a hospital and indoor based study, so the data may not represent the whole population. Hospital admission depends upon availability of transport, and availability of hospital bed.
- Most of the patients were from poor socio-economic background. So many of them couldn't afford all investigation even at govt rate at hospital such as CT scan, MRI, holter monitoring.
- Few patient parties discharged the patient on risk bond against medical advice so there is lack follow up in some cases.
- Some patient died within 3-4 hr of hospital admission, so lipid profile estimation couldn't be done.
- This is a prevalence study so the cause effect relationship couldn't be obtained.
- Sample size is small 50 in each group, so there is difference of prevalence from general population.
- Control population is not compared with study population.

CONCLUSION

We conclude that ischemic stroke patients had higher serum total cholesterol and lower HDL-cholesterol levels in comparison to haemorrhagic stroke. High risk patients of stroke may be screened using serum lipid profile and further studies are suggested to evaluate the effect of lipid lowering therapy in terms of morbidity and mortality in ischemic stroke patients.

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