Lipid profile in cerebrovascular disease patients and its relation between thrombotic stroke patients and hemorrhagic stroke patients

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Abstract

Background: Globally second most common cause of deaths is stroke. Dyslipidemia is one modifiable risk factor of stroke. Dyslipidemia should be evaluated in thrombotic and hemorrhagic stroke sub-types so as to throw some light on treatment which will correct the dyslipidemia and thus contribute in reducing incidence of stroke.

Objectives: To study the lipid profile in stroke patients and compare it within thrombotic and hemorrhagic types

Methods: Hospital-based case-control study was carried out among 50 patients (age 40-80 years of either sex) who were diagnosed as cerebrovascular accident (CVA) and equal number of age and sex matched individuals as controls (without CVA after confirmation). Diagnosis was done by CT scan brain. Concentrations of total cholesterol (TC), triglycerides (TG), low density lipoproteins (LDL), high density lipoproteins (HDL), very low-density lipoproteins (VLDL), apolipoprotein A (Apo-A), apolipoprotein B (Apo-B) were determinedfor all cases and controls using standard methods.

Results: Cases and controls were comparable for mean age ($p > 0.05$). Pulse rate, systolic blood pressure, diastolic blood pressure and random blood sugar were significantly higher in cases compared to controls ($p < 0.05$). TC, TG, LDL, Apo-B were significantly higher in cases compared to controls ($p < 0.05$). HDL Apo-A were significantly higher in controls compared to cases ($p < 0.05$). TC, LDL, Apo-B were significantly higher in thrombotic stroke group compared to hemorrhagic stroke group ($p < 0.05$).

Conclusion: All parameters of lipid profile were deranged in stroke patients. Overall lipid profile was deranged in thrombotic stroke group compared to hemorrhagic stroke group.

Keywords: Cerebrovascular disease; Stroke; Hypertension; Dyslipidemia; Diabetes Mellitus;

Introduction

Cerebrovascular accidents (CVA) or stroke is a worldwide problem and second most common cause of death and most common factor that leads to disability.[1] It has been estimated that around fifteen million people globally have stroke which is non-fatal but a leading cause for the disability, functional impairment. Nearly one fifth of them need institutional care and around 15-30% land in permanent type of disability.[2]

The occurrence of new cases and death rates vary from place to place. Western countries have witnessed a decline in the incidence of stroke due to changing lifestyles. Stroke has modifiable and non-modifiable risk factors.[3]

Studies have been done to study the association between dyslipidemia and CVA. Various clinical trials have shown raised serum cholesterol as an important risk factor for CVA.[2-5]

On the contrary, some case control studies have shown that cholesterol is not a risk factor for CVA and cohort studies were not able to show direct association. Even reverse was demonstrated in few studies. Hence there may not be a straightforward relation between serum cholesterol and CVA as seen in coronary heart disease. We should be able to understand the differences in the lipid levels in thrombotic and hemorrhagic stroke. This knowledge will help guide appropriate treatment to reduce incidence and mortality due to CVA.[5]

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CVA is defined as the, "Abrupt onset of a neurological deficit that is attributable to a focal vascular cause. If the neurological signs and symptoms last for <24 hours, it is called as a Transient Ischaemic Attack (TIA) and if they exceed 24 hours, then it is called as stroke."[6]

Lipid parameters like Total Cholesterol (TC), Low Density Lipoprotein (LDL) cholesterol, High Density Lipoprotein (HDL) Cholesterol and Triglycerides (TG) are considered to be associated with ischemic type of stroke as they are linked with atherosclerosis. Lipoproteins has got the protein components which are called as apolipoproteins which are further divided as Apolipoprotein B (Apo B) and Apolipoprotein A1 (Apo A1). Atherogenicity is represented by Apo B and anti-atherogenicity is represented by Apo A1.[7]

These two parameters and their ratio the ApoB/ ApoA1 are now considered as more important than TC. Atherogenicity is better reflected by Apo-B compared to LDL.[8]

In the present study an attempt has been made to study the lipid profile of CVA patients and compared it with controls as well as lipid profile has been compared between the thrombotic and hemorrhagic types of stroke.

Material and Methods

Study period: The study was carried out from January 2013 to December 2013

Source of data: The patients admitted at Navodaya Medical College Hospital and Research Center, were taken for the study who were diagnosed with cerebrovascular accident as per inclusion criteria of the study in one year.

Study design: The present study is the hospital-based case control study.

Ethical considerations: Institution Ethics Committee permission was obtained before the initiation of the data collection for the present study. Informed consent was taken from all eligible participants. Appropriate treatment was given.

Inclusion criteria:

1. Cases with confirmed CVA contacted within 24 hours of incident aged 40-80 years
2. Controls free from CVA aged 40-80 years

Exclusion criteria:

1. Cases with congenital heart disease, ischemic heart disease, atrial fibrillation, valvular heart disease, cardiomegaly on chest x-ray, patients taking anticoagulants, anti-platelet drugs, hypolipidemic drugs were excluded
2. Controls with diabetes, hypertension, previous history of stroke/TIA and who were on anticoagulants, antiplatelet drugs, hypolipidemic drugs, steroids and Oral contraceptive pills were excluded from the study

Sample size: 50 cases and 50 age and sex matched controls were taken for the present study

Protocol of the study: For every case and control selected, the clinical data and results of routine investigations were collected and recorded. In both cases and controls lipid profile estimations were done at Clinical Biochemistry Laboratory by collecting fasting samples.

Serum lipid estimation: Each sample of serum was analysed for Total Cholesterol (TC), Triglycerides (TG), High Density Lipoprotein (HDL), Low Density Lipoprotein (LDL), Apolipoprotein A1 (APO A), APO Lipoprotein B (APO B), as per the standard guidelines

Statistical analysis: The data was expressed as mean and standard deviation. Unpaired t test was used and p value less than 0.05 was considered as statistically significant.

Results:

Table 1: Comparison of parameters between cases and controls

Variable	Group	N	Mean+SD	t value	p value	Significance
Age (years)	Cases	50	60.56+10.22	1.179	0.2411	Not significant
	Controls	50	58.08+10.80			
Pulse rate (beats/min)	Cases	50	83.18+10.91	5.1886	0.0001	Significant
	Controls	50	73.66+7.02			
Systolic blood pressure (mmHg)	Cases	50	146.14+29.16	6.1444	0.0001	Significant
	Controls	50	118.84+11.69			
Diastolic blood pressure (mmHg)	Cases	50	86.80+12.86	7.803	0.0001	Significant
	Controls	50	71.56+5.03			
Glasgow Coma Scale	Cases	50	13.64+3.05	3.153	0.002	Significant
	Controls	50	15+0			
Random blood sugar (mg/dl)	Cases	50	129.62+66.33	2.464	0.0154	Significant
	Controls	50	104.92+24.96			

Both cases and controls were comparable for mean age ($p > 0.05$). pulse rate, systolic blood pressure, diastolic blood pressure and random blood sugar were significantly higher in cases compared to controls ($p < 0.05$). Glasgow coma scale score was significantly less in cases compared to controls ($p < 0.05$)

Table 2: Comparison of lipid profile among cases and controls

Variable	Group	N	Mean+SD	t value	p value	Significance
Total cholesterol (mg/dl)	Cases	50	245.96+52.38	6.658	<0.0001	Significant
	Controls	50	185.98+36.24			
Triglycerides (mg/dl)	Cases	50	193.68+68.39	5.163	0.0001	Significant
	Controls	50	127.72+59.01			
High density lipoprotein (mg/dl)	Cases	50	32.80+10.49	7.071	<0.0001	Significant
	Controls	50	51.80+15.84			
Low density lipoprotein (mg/dl)	Cases	50	179.10+49.89	9.316	<0.0001	Significant
	Controls	50	112.98+5.41			
Very low-density lipoprotein (mg/dl)	Cases	50	38.67+14.08	5.053	0.0001	Significant
	Controls	50	25.54+11.80			
Apolipoprotein A	Cases	50	90.36+23.04	10.57	<0.0001	Significant
	Controls	50	158.86+39.61			
Apolipoprotein B	Cases	50	180.22+46.84	9.664	<0.0001	Significant
	Controls	50	106.54+26.69			

Total cholesterol, triglycerides, low density lipoproteins and Apolipoprotein B were significantly more in cases compared to controls ($p <0.05$). high density lipoproteins, and Apolipoprotein A were significantly more in controls compared to cases ($p <0.05$).

Table 3: Comparison of lipid profilebetween hemorrhagic & thrombotic group

Variable	Group	N	Mean+SD	t value	p value	Significance
Total cholesterol (mg/dl)	Haemorrhagic	9	188.44+50.96	4.214	0.0001	Significant
	Thrombotic	41	258.59+43.98			
Triglycerides (mg/dl)	Haemorrhagic	9	159.67+56.64	1.678	0.100	Not Significant
	Thrombotic	41	201.15+69.08			
High density lipoprotein (mg/dl)	Haemorrhagic	9	46.22+13.90	5.269	0.0001	Significant
	Thrombotic	41	29.85+6.84			
Low density lipoprotein (mg/dl)	Haemorrhagic	9	129.11+45.85	3.731	0.001	Significant
	Thrombotic	41	190.07+44.09			
Very low-density lipoprotein (mg/dl)	Haemorrhagic	9	31.01+13.25	1.846	0.071	Not Significant
	Thrombotic	41	40.36+13.85			
Apolipoprotein A	Haemorrhagic	9	91.33+12.69	0.139	0.890	Not significant
	Thrombotic	41	90.15+24.80			
Apolipoprotein B	Haemorrhagic	9	130.1+36.52	4.067	0.0001	Significant
	Thrombotic	41	191.22+41.62			
	Thrombotic	41	1.58+0.59			

Total cholesterol was significantly more in thrombotic group compared to hemorrhagic group ($p < 0.05$) but triglycerides, apolipoprotein A and very low-density lipoproteins were not significantly different between these two groups ($p > 0.05$). high density lipoproteins were significantly lower in thrombotic group compared to hemorrhagic group ($p < 0.05$); low density lipoproteins were significantly more in thrombotic group compared to hemorrhagic group ($p < 0.05$); apolipoprotein B was significantly more in thrombotic group compared to hemorrhagic group ($p < 0.05$).

Discussion

The mean age of cases was 60.56 years, and that of controls group was 58.08 years and their difference is statistically not significant ($p>0.05$).The 5thand 6thdecade individuals were more likely to get affected with stroke accounting for 30% and 40% respectively. In the present study, the mean age of thrombotic group was 60.34±9.90 years, and that of hemorrhagic group was 61.56±12.19 years. In this study, the mean age found to be higher when compared to the mean age in the study done by Garg RK et al. 9The mean age of controls was 54.08±2.4 years which is comparable to mean age of controls in the study done by Garg RK et al.[9]

This study indicated that males are more affected than females. Male: Female ratio 4:1. The male: female ratio in patients with thrombotic stroke was 4.12:1. This is not comparable to study done by Garg RK et al[9] where among patients with thrombotic stroke males were more in number than females (male: female ratio 2.16:1). The male: female ratio among controls was 1.5:1, which is comparable to male: female ratio of the same group in study done by Garg RK et al.[9] The male: female ratio in patients with haemorrhagic stroke was 8:1. This is not comparable to study done by Garg RK et al[9] where among patients with hemorrhagic stroke males were more in number than females (male: female ratio 1.8:1).

In this study the common presenting features among the cases were Hemiplegia (commonest), Aphasia, Cranial Nerve Palsy and Altered Sensorium. Others symptoms like headache, vomiting, and seizures were seen in minority of patients. Among the patients who had cranial nerve palsy, all of them had facial nerve involvement.

Comparison of the lipid profile among the cases and controls showed highly significant p value ($p<0.0001$) with total cholesterol, triglycerides, high density lipoprotein, low density lipoprotein, Apolipoprotein A,Apolipoprotein B, and very low-density lipoprotein.

Between comparison of parameters within the cases i.e. between thrombotic stroke patients and hemorrhagic stroke patients, showed that p value was significant with pulse rate, systolic and diastolic blood pressure and Glasgow coma scale which were high in hemorrhagic stroke group than thrombotic stroke group. In the present study high blood pressure was the major cause of hemorrhagic stroke. GCS score was less than 15 in most of the hemorrhagic stroke

patients whereas most of the thrombotic patients had normal GCS score.

In this study, the comparison of all the components of lipid profile within the cases i.e. between thrombotic stroke patients and hemorrhagic stroke patients showed that total cholesterol, LDL, Apolipoprotein B were on the higher side in thrombotic stroke patients. In this study, the comparison of all the components of lipid profile within the cases i.e. between thrombotic stroke patients and hemorrhagic stroke patients showed that HDL, Apolipoprotein A and lipoprotein (a) are on the higher side in hemorrhagic stroke patients. It was observed that Apolipoprotein B was higher in thrombotic patients whereas lipoprotein (a) was on the higher side in the hemorrhagic patients. There was significant difference between the lipid profiles of the both groups. The significance was found with total cholesterol (TC), HDL, LDL, Apo B, and lipoprotein (a). Comparison was done among the various studies with the present study. In the present study, patients with stroke had high mean serum cholesterol in comparison to controls that was statistically highly significant (p<0.001). Thrombotic patients had much higher values than the hemorrhagic patients. These values were similar to study done by Garg RK et al.[9]

Togha M et al 10 compared 65 hemorrhagic stroke patients with 193 cases of thrombotic stroke. They noted that only TG values were significantly higher in thrombotic group. The prominent risk factors for development of thrombotic stroke were increasing age, LDL and TC. In the present study, patients with stroke had high mean serum triglycerides in comparison to controls that was statistically highly significant (p<0.001) and same observation was made in Garg RK etal.[9]

The thrombotic group had much higher values than the hemorrhagic group. These values are similar to the study done by Garg RK et al. 9 In the present study, patients with stroke had high mean serum VLDL in comparison to controls that was statistically highly significant (p<0.001). VLDL was significantly high in all cases compared with controls. VLDL was much higher than thrombotic group than hemorrhagic group. Patients with stroke had low mean serum HDL in comparison to controls that was statistically highly significant (p<0.001). HDL levels were low in all patients than controls but it was not significantly low in thrombotic group than hemorrhagic group. The thrombotic group had much higher values than the hemorrhagic group. These values are similar to the study done by Garg et al.[9]

In the present study, patients with stroke had high mean serum LDL in comparison to controls that was statistically highly significant (p<0.001) and same observation was made in Garg et al.[9] The thrombotic group had much higher values than the hemorrhagic group. These values were similar to the study done by Garg et al.[9] Thrombotic patients had much higher values than the hemorrhagic patients. These values were similar to study done by Garg RK et al.[9] In our study, patients with stroke had high mean serum Apolipoprotein B in comparison to controls that was statistically highly significant (p<0.001) which is similar to the study done by Shilpasree AS et al.[11]

In the present study, patients with stroke had high serum Apolipoprotein A in comparison to controls that was statistically highly significant (p<0.001), same findings were present as Shilpasree et al[11]. When the comparison of lipid profile between thrombotic and hemorrhagic groups in present and related studies was made, it was found that Patients with stroke had high mean total cholesterol levels in comparison to controls that was statistically highly significant (p<0.001) which are comparable to Garg RK et al. 9and Mahmood A et al 5studies. In the present study, the hemorrhagic group had high mean total cholesterol in comparison to controls and low mean total cholesterol in comparison to the thrombotic group that was statistically highly significant (p<0.001) i.e. thrombotic group were having high total cholesterol levels than the hemorrhagic group which is comparable to Mahmood A et al[5]. In the present study, thrombotic group were having lower HDL levels than the hemorrhagic group which is comparable to Mahmood A et al[5]. In the study done by Mahmood A et al 5, both hemorrhagic group and thrombotic group had high levels of LDL levels which is comparable to the present study.

In the present study, the hemorrhagic group had high mean serum VLDL in comparison to controls and low mean serum VLDL in comparison to the thrombotic group which is comparable to Mahmood A et al 5and Grag RK et al.[9] García SG et al[12] has found that elevated levels of total cholesterol(TC), LDL and triglycerides (TG) are associated with occurrence of atheromatous CI (Cerebral Ischemia), while low total cholesterol levels and high triglycerides levels are associated with the CH (cerebral haemorrhage) occurrence. This conclusion is comparable to the present study.

Jasim MAH et al[13] have found that high level of triglyceride is linked to atherosclerosis. This conclusion is comparable to the present study. Mahmood A et al[5] has found that Ischaemic stroke patients had high serum total cholesterol and lower HDL-cholesterol levels as compared to hemorrhagic

stroke. This conclusion is comparable to the present study. Cynthia A 14 showed a significant association of 56% between dyslipidemia and stroke. Although high LDL is usually held responsible for cerebrovascular accidents, our study showed a significant proportion of patients with low HDL. In the present study 38 (76%) patients had showed a significant association between Dyslipidemia and stroke.

Conclusion: Cerebrovascular accidents are more common in the age group of 5th and 6th decade. Males are more affected than females. The thrombotic stroke is more common than hemorrhagic stroke. Higher lipid parameters are present in these patients. Apo B, Apo A1 can be used as predictors of stroke along with traditional lipid profile components. Total Cholesterol, LDL, Apolipoprotein B are on the higher side in thrombotic stroke patients. HDL, Apolipoprotein A are on the higher side in hemorrhagic stroke patients.

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