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Original Article

Comparison of Serum Lipid Levels between Ischemic and Haemorrhagic Stroke Patients: An Observational Study

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Abstract:

Stoke is the leading cause of adult disability and the second leading cause of mortality. The incidence of stroke has decreased in the developed world but increased in developing countries like Bangladesh. Association between serum lipid levels and stroke is controversial and regional data is limited. In this study, we aimed to compare the difference in serum lipid levels among ischemic stroke (IS) and hemorrhagic stroke (HS) patients. This cross-sectional observational study was conducted at Bangabandhu Sheikh Mujib Medical College Hospital, Faridpur, from February to June, 2021. Admitted 50 consecutive IS patients, and 50 HS patients were enrolled. After clinical and radiological confirmation, detailed history was taken and 8 hours of fasting blood sample for serum lipid profiling were collected. Data were analyzed to observe the difference in lipid levels between the two groups. Among the 100 stroke patients mean age of the IS and HS groups was 67.62 ± 8.33 and 65.14 ± 9.43 years, respectively. Males were predominant in both groups, and the majority of them had a history of hypertension. Mean serum total cholesterol (TC) was above the normal range in IS group (5.28 ± 2.18 mmol/L), and serum high density lipoprotein (HDL) was lower in IS group (0.82 ± 0.28 mml/L), and both differences were statistically significant between the IS and HS groups. This study found that patients with IS had a higher incidence of abnormal TC and HDL levels. Preventive measures using lipid-lowering agents can be considered for high-risk patients.

Key words: Ischemic stroke, Hemorrhagic stroke, Lipid profile.

Introduction:

Rapid loss of brain function due to a disturbance in blood supply to the brain caused either by ischemia or hemorrhage is called stroke, also referred to as cerebrovascular accident (CVA)[1,2]. Stroke is considered as one of the major global health problems[3,4]. It is the leading cause of disability and functional impairment in adults and is accountable for the second leading cause of mortality[1,3,5]. Around 1 in 3 patients with nonfatal stroke face disability, and around 15-30% of the survivors become permanently disabled[3,6].

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Research suggests that the incidence and mortality rate of strokes differ greatly among various populations[3,4]. In the developed world, the incidence decreased by nearly 10% between 1990 and 2010 as opposed to the 10% increase in the developing countries[1,7].

In 2021, a nationwide survey in Bangladesh had found that the prevalence of stroke is more than 11 per thousand, and the prevalence is much higher in the elderly, in males, and more than three-fourth is ischemic stroke[8].

Risk factors of stroke can be divided into modifiable and non-modifiable factors. Age, gender, ethnicity, and family history are some of the non-modifiable factors, while hypertension, diabetes, smoking, physical inactivity, cardiac disease, and some others have been found to be modifiable factors[1,3,4,9]. However, the relationship between serum lipid levels with the development of stroke has been a subject of debate for a long time.

The lipids in the serum including cholesterol, triglyceride, low-density lipoprotein (LDL), very low density lipoprotein (VLDL), and high-density lipoproteins (HDL) play an important role in maintaining vital functions of the body[10]. Although the abnormal increase of blood cholesterol has a linear association with the development of cardiovascular diseases[1,10], the association with stroke resulted in controversial results in different studies[1,3,10–12]. On the other hand, some studies have found an inverse relationship between the level of serum cholesterol and hemorrhagic stroke[10,12].

The difference in serum lipid levels in subtypes of stroke is essential for guiding lipid lowering preventive therapy[4]. But the evidence from studies comparing serum lipid levels in ischemic and hemorrhagic stroke in Bangladesh is insufficient. This study was conducted to compare the differences in serum lipid profiles in subgroups of strokes that may help develop preventive management guidelines for local patients.

Materials and Methods:

This cross-sectional observational study was conducted at the Department of Medicine, Bangabandhu Sheikh Mujib Medical College Hospital (BSMMCH), Faridpur, from February to June, 2021. During this period, 50 consecutive eligible patients with ischemic stroke and 50 eligible patients with hemorrhagic strokes were included in this study by non-probability consecutive sampling. Stroke was diagnosed clinically by the history of the patient and a thorough neurological examination by an expert neurologist in the ward, and then the clinical diagnosis was confirmed by a CT scan of the brain or MRI. Written informed consent from the attending guardian was taken before including the patient in the study. A detailed history of the patient including demography, comorbidities, and past medical and drug history were collected using a pre structured questionnaire. Blood samples after 8 hours of overnight fasting for serum lipid profiling (TG, TC, LDL, and HDL) for all cases were collected in the following morning after admission. The sera were analyzed by enzymatic colorimetric method using a chemistry autoanalyzer. All information was recorded in a preformed data collection form. Patients who took lipid lowering agents in the last six months before the stroke were excluded from the study.

All data were checked and cleaned before analysis as per requirement. For statistical analysis; SPSS (IBM Corp. Released 2012.IBM SPSS Statistics for Windows, Version 21.0. Armonk, NY: IBM Corp.) was used. Descriptive analysis was done for qualitative variables such as age and sex. Differences between the groups were analyzed using two-sample t-test. A difference of $p < 0.005$ was considered significant.

Ethical permission for the study was obtained from the Ethical Review Board of Bangabandhu Sheikh Mujib Medical College.

Results:

A total of 100 stroke patients (50 ischemic strokes and 50 hemorrhagic strokes) were included in this study. The demographic variables of the patients are described in Table I. The mean age of presentation in each group was more than 65 years. The majority of them were male and had a history of hypertension.

Table I: Distribution of patients according to demographic variable (n=100).

Characteristics	Ischemic stroke n = 50	Hemorrhagic stroke n = 50
Age (years), mean ± SD	67.62 ± 8.33	65.14 ± 9.43
Male sex, n (%)	33 (66.0)	38 (76.0)
Background		
Hypertension, n (%)	40 (80.0)	43 (86.0)
Diabetes, n (%)	18 (36.0)	21 (42.0)
Smoking, n (%)	28 (56.0)	25 (50.0)
Past stroke, n (%)	17 (34.0)	19 (38.0)
Ischemic heart disease, n (%)	21 (42.0)	16 (32.0)

The mean total cholesterol of patients with ischemic stroke was 5.28 ± 2.18 mmol/L whereas, in patients with hemorrhagic stroke, it was 4.02 ± 1.42 mmol/L. Serum HDL level was higher among the patients with hemorrhagic stroke than patients with ischemic stroke. Serum LDL level was higher in both groups (Table II).

Table II: Comparison of serum lipid profile in patients in ischemic and hemorrhagic stroke

Lipid profile (normal value)	Ischemic stroke Mean ± SD	Hemorrhagic stroke Mean ± SD
AgeSerum total cholesterol (<5.2 mmol/L)	5.28 ± 2.18	4.02 ± 1.42
Serum triglyceride (0.4-2.3 mmol/L)	1.42 ± 0.41	1.35 ± 0.38
Serum HDL (>0.9 mmol/L)	0.82 ± 0.28	1.21 ± 0.18
Serum LDL (<3.4 mmol/L)	4.46 ± 0.42	4.55 ± 0.38
Serum VLDL (0.26-1.03 mmol/L)	0.88 ± 0.38	0.72 ± 0.30

**LDL: Low density lipoprotein; VLDL: Very low density lipoprotein; HDL: High density lipoprotein*

Table III shows the comparison of abnormal serum lipid profiles among the two groups of stroke patients. In ischemic stroke, 40% of the patients had abnormal total cholesterol levels compared to 8% in hemorrhagic stroke patients and the difference was significant. There was no significant difference in the serum triglyceride, LDL, and VLDL levels. However, patients with ischemic stroke had significantly higher-level of abnormal serum HDL level percentage than hemorrhagic stroke.

Table III: Table III: Comparison of abnormal lipid profile in ischemic and hemorrhagic stroke

	n (%) of patients with abnormal value Ischemic stroke	Hemorrhagic stroke	
Lipid profile	**n = 50**	**n = 50**	**p value**
Serum total cholesterol	20 (40)	4 (8)	<0.001
Serum triglyceride	5 (10)	6 (12)	0.374
Serum HDL	18 (36)	3 (6)	<0.001
Serum LDL	6 (12)	3 (6)	0.147
Serum VLDL	5 (10)	11 (22)	0.263

** LDL: Low density lipoprotein; VLDL: Very low density lipoprotein; HDL: High density lipoprotein*

Discussion:

A total of 100 stroke patients were investigated in this study, 50 of them had ischemic stroke and the other 50 of them had a hemorrhagic stroke. The first-ever nationwide survey in Bangladesh has reported that the prevalence of stroke is 11.39 per thousand which was previously found to be 3 per thousand[8]. This study revealed that the burden of stroke in Bangladesh is approximately 4 times higher than what was previously reported. Understanding the role of different modifiable factors in developing stroke is essential for adopting local preventive measures.

As in the survey by Mondal et al[8], most of the patients were of advanced age, male, and had a history of coronary diseases. Evidence suggests that the risk of stroke doubles per decade after the age of 55 years[10,13]. Subjects in our study were age and sex matched.

Conflicting findings exist regarding the association between plasma cholesterol and the risk of stroke[3]. Earlier studies have shown a positive relationship between cholesterol and nonhemorrhagic stroke however, other studies and reviews have found dyslipidemia as a risk factor for stroke[14–17]. In our study, we compared the serum lipid profiles of ischemic and hemorrhagic stroke patients. Unlike other studies, where some found positive association[18] of serum triglyceride levels with stroke and some found no association[11,19]. We also have found no significant difference in the number of patients with abnormal serum triglyceride levels among the ischemic and hemorrhagic stroke patients but there was a significant difference of abnormal total cholesterol level among the two groups.

Serum HDL has a protective effect of triggering the flux of cholesterol from peripheral cells to liver[20,21]. It is well recognized that HDL has a protective effect against ischemic stroke[10,22]. Many studies have found an inverse relationship between ischemic stroke and serum HDL levels[3]. However, Russman et al. in a study done in 2009 have observed that during an acute ischemic stroke, the serum HDL level decreases significantly[23]. In our study, we also have found a significant difference between the two groups. In the ischemic stroke group, a much higher number of patients had abnormal serum HDL levels than patients with hemorrhagic stroke. Some studies have found an association between increased serum LDL levels with ischemic stroke, but in our study, we haven't found any significant difference either in LDL or VLDL levels.

A meta-analysis by Goldstein in 2007 reported that statin therapy can result in a nearly 30% reduction in stroke-related mortalities, especially for ischemic stroke[24]. The low level of serum total cholesterol and high level of serum HDL may be protective against hemorrhagic stroke, but also may pose a higher risk for ischemic stroke. In the light of the above findings, screening and lipid lowering therapy can be initiated for high-risk groups.

Conclusion

Our findings suggest that the patients with ischemic stroke had a significantly higher abnormal serum total cholesterol and lower HDL level than patients with hemorrhagic stroke. Further study of evaluating the lipid lowering agents among the high-risk patients of stroke is recommended to evaluate their effectiveness as preventive measures.

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