

Original Research Article

Ischemic and hemorrhagic stroke: a comparative evaluation of lipid profile

Nipun Saprou^{1*}, Roma Singh²

¹Department of Neurology, ²Department of Pathology, Government Medical College and Super Speciality Hospital, Jammu, Jammu and Kashmir, India

Received: 01 March 2021

Revised: 22 March 2021

Accepted: 31 March 2021

***Correspondence:**

Dr. Nipun Saprou,

E-mail: nipunsaprou2131@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: The scientific community often sees association of blood lipid levels with the risk of cardiovascular disease. Strong association has often been found between high levels of low density lipoproteins (LDL) and the development of atherosclerosis while elevated levels of high density lipoproteins (HDL) are understood to play protective role. This study was conducted to compare lipid profile among ischemic and hemorrhagic stroke patients.

Methods: This observational study was conducted in Department of Neurology, Medanta, Medicity Gurugram, where 50 patients' cases of infarct and 50 cases of hemorrhagic stroke were studied during: April 2020 to October 2020. All patients with clinically and radiologically proved cerebrovascular accident were included in the study.

Results: Mean total cholesterol (TC) for hemorrhagic and ischemic stroke was 175.2 mg/dl and 192.4±41.6 mg/dl respectively. Deranged LDL among subjects with ischemic stroke was 32%. Deranged LDL was seen in 76% of patients reporting ischemic stroke. The mean values for triglycerides (TG) stood at 122±34.6 mg/dl and 141±43.3 mg/dl for hemorrhagic and ischemic stroke respectively. It was seen that the risk of developing ischemic stroke increased with rise in total cholesterol and LDL value. Lipid derangement thus formed an important risk factor for stroke.

Conclusions: A significant association is found between raised LDL, abnormal HDL and ischemic stroke, however, a significant rise in total cholesterol level was found in case of both the groups. It is very apparent that patients under high risk should be regularly screened for serum lipid profile.

Keywords: Ischemic stroke, Hemorrhagic stroke, High density lipoprotein, Low density lipoprotein, Total cholesterol, Triglycerides

INTRODUCTION

The term stroke is applied to a sudden focal neurological deficit, specifically caused by cerebrovascular disease which designates any abnormality of the brain resulting from a pathological process of blood vessels, including occlusion of the lumen by embolus or thrombus, rupture of a vessel, an altered vessel wall permeability, or increased viscosity or other change in the quality of the blood flowing through cerebral vessels.¹ Stroke has become a major global health problem and it is also a

major cause of mortality, morbidity and disability in developed and developing world. Stroke is a predisposing factor for epilepsy, falls, depression, etc, and is a leading cause of functional impairments, with 20% of survivors requiring institutional care for at-least 3 months and as many as 30% get disabled permanently.² The scientific community is unanimous on the association of blood lipid levels with the risk of cardiovascular disease. Strong association has often been found between high levels of serum cholesterol-especially of low density lipoproteins and the development of atherosclerosis while elevated

levels of high density lipoproteins (HDL) cholesterol are understood to play protective role.³ Several clinical trials showed an association between high concentrations of serum cholesterol and ischemic stroke.⁴ But there are studies and especially some case control studies on the subject which examined cholesterol, assuming it a risk factor, but have produced negative findings. Some prospective studies also have failed to show a direct and strong association between cholesterol levels and stroke. Some studies have demonstrated an inverse relation between total cholesterol and death from hemorrhagic stroke.⁵ Therefore, the association between abnormal lipid profile and stroke may not be as straight forward as for coronary heart disease. There is an established effect of serum lipid levels on short term mortality due to strokes. Therefore the present study was planned to determine the difference in lipid profile among ischemic and hemorrhagic stroke patients, compare them and establish some relation to fill up such known gaps. It will also be a useful precedence to take up more of such comparisons and clinical assessments.

METHODS

This observational comparative study was conducted in Department of Neurology, Medanta, Medicity Gurugram. 100 stroke patients admitted in Medanta, where 50 patients are cases of infarct and remaining 50 cases of hemorrhagic stroke during a period: April 2020 to October 2020, selected by way of 'random sampling'. Detailed history was taken. General physical examination, detailed systemic examination and investigations were carried out. All patients with clinically and radiologically proved cerebrovascular accident were included in the study. Written informed consent was taken from the patients. Ethical approval was taken from hospital review board. Patients having head injury, transient ischemic attack, brain tumor, subdural hematoma, subarachnoid hemorrhage, patient on hypolipidemic drugs, old myocardial infarction, and patients refused for consent were excluded from the study.

5ml of venous sample were collected from anterior cubital vein after 8 hrs of overnight fasting. Samples were centrifuged at 40C for 15 minutes after incubation of 20 minutes for extraction of serum and serum was analyzed for estimation of serum lipid profile including total cholesterol, triglyceride, LDL cholesterol and HDL-cholesterol by using fully automatic analyzer. The data was analyzed using SPSS-19 version (SPSS for windows), to ascertain mean, standard deviation and p value. A p value of <0.05 was considered significant.

Established normal values of high density lipoprotein (HDL), low density lipoprotein (LDL), total cholesterol (TC), triglycerides (TG), were taken for statistical comparison (Table 1).

RESULTS

Among the subjects studied, 68% were male and only 32% were females. Mean age came out to be 57.82 Years. It was apparent from the initial stages of the study that most of the subjects were hypertensive with more than 60% having it as co-morbidity in each group. More than 12% subjects were diabetic as well (Table 2).

Table 1: Normal values of various lipid variables, under given demographic conditions.

Lipid profile variables	Normal values	Units
Total cholesterol	125 to 200	mg/dl
High density lipoprotein	>40	mg/dl
Low density lipoprotein	<100	mg/dl
Triglycerides	<150	mg/dl

Table 2: Distribution of study subjects.

Variable	Hemorrhagic stroke (n=50)	Ischemic stroke (n=50)	P value
Males / Females	33/17	35/15	>0.05
Mean age in years	57.20	58.44	>0.05
Hypertension %	76	60	<0.05*
Diabetes %	12	14	>0.05

*significant

Table 3: Comparison of mean TC (mg/dl) among study subjects.

Group	N	Mean±SD
Hemorrhage stroke	50	175.2±50.1
Ischemic stroke	50	192.4±41.6

t. test:3.006; p = 0.008

Table 4: Comparison of mean LDL (mg/dl) among study subjects.

Group	N	Mean±SD
Hemorrhage stroke	50	106.4±25.8
Ischemic stroke	50	133.2±28.2

t. test: 2.623; p = 0.017

In this study, mean TC for hemorrhagic and ischemic stroke were 175.2 mg/dl and 192.4±41.6 mg/dl respectively. This difference between the two groups for TC was found statistically significant (p<0.05) (Table 3) (Figure 1). Deranged TC among subjects with hemorrhagic stroke was 18% and subjects with ischemic stroke was 38%, with p<0.05 (statistically significant) (Table 7). As regards the values of TG was concerned, the mean values for TG stood at 122±34.6 mg/dl and 141±43.3

mg/dl for hemorrhagic and ischemic stroke respectively. The difference turned out to be statistically significant ($p < 0.05$) (Table 6).

Table 5: Comparison of mean HDL (mg/dl) among study subjects.

Group	N	Mean±SD
Hemorrhage stroke	50	39.6±7.8
Ischemic stroke	50	36.2±6.3

t. test: 1.835; $p = 0.034$

Table 6: Comparison of mean TG (mg/dl) among study subjects.

Group	N	Mean±SD
Hemorrhage stroke	50	122±34.6
Ischemic stroke	50	141±43.3

t. test: 2.120; $p = 0.046$

Deranged LDL among subjects (mean value falling significantly above the normal value of 100 mg/dl in each group) with hemorrhagic stroke was 10% and subjects with ischemic stroke were 32%. Deranged LDL was statistically significant between hemorrhagic and ischemic

stroke, with 76% of patients reporting ischemic stroke had deranged HDL as well. Deranged TG among subjects with hemorrhagic stroke was 20% and subjects with ischemic stroke were found to be 26% (Table 4 and 7). And, in total, 11 of Ischemic Stroke patients and 22 of hemorrhagic stroke patients clearly showed hyperlipidemia.

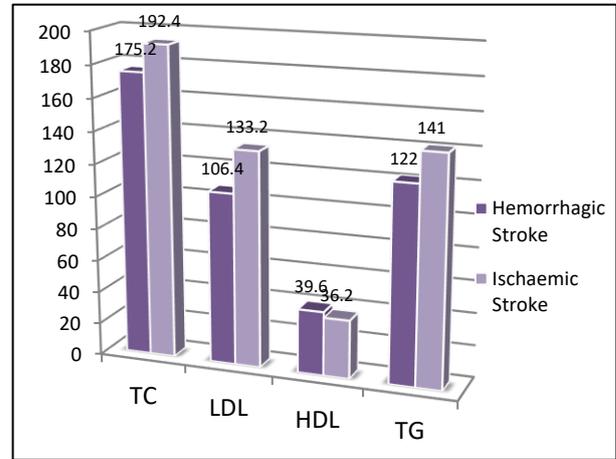


Figure 1: Study subjects and mean values of lipid profile variables.

Table 7: Distribution of study subjects according to lipid profile.

Variable/Tests	Hemorrhagic stroke %		Ischaemic stroke %		P value
	Normal	Deranged	Normal	Deranged	
LDL	90	10	68	32	<0.05*
HDL	44	56	24	76	<0.05*
TG	80	20	74	26	>0.05
TC	82	18	62	38	<0.05*

* $P < 0.05$

DISCUSSION

Many risk factors including smoking, diabetes, hypertension and dyslipidemia for Coronary artery disease and stroke. But unlike in CAD the evidence for the role of these risk factors in stroke is less convincing. Among the risk factors smoking and hypertension are said to be the most important ones. The influence of diabetes on burden of stroke is more controversial. It includes high lipid profile

Ischemic stroke is basically including the pathogenic mechanisms that include the involvement of large artery as atherosclerosis in extra-cranial and large intracranial arteries followed by embolism from the heart and intracranial small-vessel disease. Transient ischemic attacks with no clinical or imaging trace and it reverses completely and dramatically in minutes or up to 1 hr. In a study done by Togha et al, risk of developing ischemic stroke increased as the total cholesterol and LDL value rose.⁶

Lipid derangement thus formed an important risk factor for stroke. Definitely, a strong association has been found

between high levels of serum cholesterol- mainly of low-density lipoprotein (LDL) cholesterol and the development of atherosclerosis, and elevated levels of HDL also seem to play a protective role. A significant association is found between raised LDL, abnormal HDL and ischemic stroke, which was similar to the finds of Singh et al.⁷

There is also a significant association between raised serum total cholesterol and Ischemic Stroke, quite in line with the findings of Choudhury et al, who found ischemic stroke patients showing higher levels of mean serum cholesterol (190 ± 35 mg/dl) as compared to mean serum cholesterol levels of hemorrhagic stroke patients (151 ± 29 mg/dl), while our study also showed an association of Ischemic Stroke with raised values of TC (192.4 ± 41.6 mg/dl) and some higher values on TC among Hemorrhagic patients as well (175.2 ± 50.1 mg/dl).⁸

Xiaoying et al who studied lipid profile, found positive association between LDL-C and triglyceride and ischemic strokes among adults; while our study also showed association of Ischemic Stroke with raised values of TC (192.4 ± 41.6 mg/dl), LDL (133.2 ± 28.2 mg/dl) as well as TG (141 ± 43.3 mg/dl), however Nagswa et al showed no

relationship between TC and ischemic stroke, which could be due to their lower percentage of atherothrombotic infarction and higher percentage of cardioembolic infarction which are both subtypes of cerebral infarction.^{9,10}

Hyperlipidemia was present in 16% patients of stroke and was the 3rd most risk factor stroke in the study by Khan et al, while Chaudhary et al showed hyperlipidemia in 21% of all 200 patients of stroke, while in our study 22% of hemorrhagic stroke patients and 40% of ischemic stroke patients showed hyperlipidemia.^{8,11}

And finally in our study, the lipid profile derangement seems to be affecting more in ischemic stroke than hemorrhagic stroke, but a larger sample size will be required to prove it conclusively; thus, the limitations of this present study was its relatively smaller sample size.

CONCLUSION

There is a strong evidence to suggest an association between high concentrations of serum cholesterol and ischemic stroke. Risk of developing ischemic stroke increased as the total cholesterol and LDL value rose. A significant association is found between raised LDL, abnormal HDL and ischemic stroke, however, a significant rise in total cholesterol level was found in case of both the groups. More studies will be required for clinical assessments like that of 'Very low density lipoprotein cholesterol (VLDL-C)', but this study will be a useful precedence. It is very apparent that patients under high risk should be regularly screened for serum lipid profile.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kwah LK, Diong J. National Institute of health stroke scale. J Physiother. 2014;60:61-5.
2. Donkor SE. Stroke in the 21st century: A snapshot of the burden, epidemiology and quality of life. Stroke Res Treat. 2018;3:3238165.
3. Hyperlipidemia is a risk factor for CVD. Prim Care. 2013;40:195-211.
4. Lindstorm E, Boysen G, Nyboe J. Influence of total cholesterol, high density lipoprotein cholesterol, and triglyceride on risk of cerebrovascular disease. BMJ. 1994;309:11-5.
5. Singh G, Saleem M. Comparative evaluation of lipid profile in ischemic and hemorrhagic stroke-A Case control study. Int J Contemporary Med Surg Radiol. 2019;2:61-4.
6. Togha M, Gheni MR, Ahmadi B. Lipid profile in cerebrovascular accidents. Iran J Neurol. 2011;10:1-4.
7. Singh V, Bajia KK, Ram C. Comparative lipid profile study between ischemic and hemorrhagic stroke. Int J Res Med Sci. 2020;8(2):544-8.
8. Chaudhury SR, Gosh S, Kar D. Comparative lipid profile study between ischemic and hemorrhagic stroke. J Chem Pharm. Res. 2014;6(11):20-7.
9. Xiaoying Gu, Yunzhi Li, Shuohua Chen, Yang X. Association of lipids with ischemic and hemorrhagic stroke. Stroke. 2019;12:3376-84.
10. Nagasawa SY, Okamura T, Iso H, Tamakoshi A. Evidence for cardiovascular prevention from observational cohorts in japan research group. Relationship between serum cholesterol level and cardiovascular disease stratified by sex and age group: a pooled analysis of 65594 individuals from 10 cohort studies in japan. J Am Heart Assoc. 2012;12:243-56.
11. Khan J, Attique-ur-rehman, Ali SA, Jielani A. Frequency of hypertension in stroke patients presenting at Ayub teaching hospital. J Ayub Med Coll Abbottabad. 2006;18:59-61.

Cite this article as: Saprou N, Singh R. Ischemic and hemorrhagic stroke: a comparative evaluation of lipid profile. Int J Clin Trials 2021;8(2):121-4.