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Assessment of Dyslipidemia in Ischemic and Hemorrhagic Stroke in Western Uttar Pradesh

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Abstract

Background: Stroke is one of the major global health problems and the leading cause of adult disability. This study was carried out to compare serum lipid profiles in patients with ischaemic and haemorrhagic stroke. **Material & Methods:** We conducted this study on 130 patients of 18-70-year age group with clinically and radiologically (CT Scan) proven cerebrovascular accident. Detailed clinical evaluation was combined with biochemical and radiological evaluation. **Results:** 76 patients were diagnosed to have ischaemic stroke while 54 had haemorrhagic stroke, showing that ischaemic stroke is more common, being 58.46% when compared to haemorrhagic stroke, which was 41.54%.The mean age for ischaemic stroke was 63.32 years while for haemorrhagic stroke was 58.87 years. Patients were evaluated according to gender and it was found that both ischaemic and haemorrhagic stroke is more common among males. It was found that 30.3% of patients with ischaemic stroke were diabetic while 18.5% of haemorrhagic stroke patients had diabetes. 48.7% of ischaemic stroke patients and 81.5% of haemorrhagic stroke patients had hypertension. It was found that smoking was associated with 51.3% in patients with ischaemic stroke and 40.7% in haemorrhagic stroke. Serum total cholesterol was significantly higher in ischaemic stroke than haemorrhagic stroke group. Mean value of s. HDL cholesterol was 40.24 mg/dl in ischaemic stroke group, 44.98 mg/dl in haemorrhagic stroke group showing s. HDL cholesterol was significantly lower in ischaemic stroke group. Thus, hypercholesterolemia is significantly more associated with ischaemic strokes. Our study showed that s. triglyceride was significantly higher in ischaemic stroke than haemorrhagic stroke group. Our study also shows that s. LDL cholesterol was significantly higher in ischaemic stroke group. **Conclusions:** Ischaemic stroke patients had higher serum total cholesterol, higher S. LDL 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 ischaemic stroke patients.

Keywords:- Dyslipidemia, Risk factors, Ischemic stroke, Hemorrhagic stroke.

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INTRODUCTION

Stroke is defined as rapidly developing clinical signs of focal (or global) disturbance of cerebral functions, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin. It is one of the major global health problems and the leading cause of adult disability. Mortality from strokes is the second leading cause worldwide.[1] Based on neuroimaging findings, recent studies have determined the stroke subtypes and the ratio of cerebral infarct to haemorrhage range as 1.86:1-2.21:1.[2] Cerebral haemorrhage is proportionately much higher in the eastern Indian community than in western countries, where the ratio of infarct to haemorrhage is 5:1. Whereas dyslipidemia is a major risk factor for coronary heart disease (CHD), its role in the pathogenesis of ischaemic stroke is less clear. The discordant results of observational studies might result from the heterogeneity of stroke, since dyslipidemia is less likely to play a major role in the pathogenesis of some ischaemic stroke subtypes (e.g., lacunar and cardioembolic strokes) and elevated LDL-C levels might increase the risk of haemorrhagic stroke.[3]

No study is available locally to compare all the components of serum lipid profiles in ischaemic and haemorrhagic strokes. Therefore, this study was carried out to compare serum lipid profiles in patients with ischaemic and haemorrhagic stroke. This study was done to compare and correlate serum lipid profile of patients with ischaemic and haemorrhagic stroke.

MATERIAL AND METHODS

It was a Cross sectional study done at Saraswathi Institute of Medical Sciences, Hapur. Patients both male and female presenting to the OPD/Casualty or getting admitted in Saraswathi Institute of Medical Sciences were included in this study. Total of 130 patients were included, to detect significant difference.

Inclusion Criteria

All patients age 18-70yrs with clinically and radiologically (CT Scan) proven cerebrovascular accident.

Exclusion Criteria

Patients on lipid lowering therapy (Newly initiated in last two weeks), Brain tumor, Transient ischaemic attack, Head trauma, Patient of cardio-embolic stroke who required active interventions

Duration of study: Eighteen months, September 2019 to February 2021.

Data Collection and Processing: A proforma specially prepared for the purpose of collecting the data including the detailed history, physical examination and investigations. In all patients CBC, LFT, KFT, serum electrolyte, lipid profile and NCCT head were done. After obtaining the informed consent, patient details are obtained. By aseptic precautions, 7 ml venous blood is collected after 8-12 hours of fasting. Blood is collected in sodium EDTA citrate (3.2%) added vacutainer (2ml) and plain vacutainer (5ml).Blood collected in plain vacutainer is processed immediately to obtain serum and following parameters are estimated:

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Serum Cholesterol(Ref value< 200 mg/dl), HDL Cholesterol(40-60 mg/dl), and Serum Triglycerides (> 150 mg/dl) - Estimated by enzymatic method. Serum LDL Cholesterol (Up to 190 mg/dl) and VLDL Cholesterol (14 - 31.8 mg/dl)- Estimated by Friedewald formula. NCCT Head Machine Used: GE Light speed 16 slice SDC 4.7- Non contrast computed tomography (NCCT) was obtained.

Statistics: Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0. Results are expressed as mean ± SD, numbers and percentages. The comparison of normally distributed continuous variables from pre-post treatment 6 months was done using Paired t test. P value of <0.05 was taken as significant.

RESULTS

The present study was conducted in the Department of Medicine, Saraswathi Institute of Medical Sciences, Hapur with the objective to compare serum lipid profile between patients of ischaemic and haemorrhagic strokes. A total of 76 patients in Group A (ischaemic stroke) and 54 patients in Group B (haemorrhagic stroke) were included in the study.

Table 1: Distribution of patients according to age between the groups

Age in years	**Group A (n=76)**		**Group B (n=54)**	
	No.	**%**	**No.**	**%**
<50	4	5.3	10	18.5
50-60	22	28.9	20	37.0
61-70	43	56.6	22	40.7
>70	7	9.2	2	3.7
Mean ± SD	63.32±8.13		58.87±8.19	

Table 2: Distribution of patients according to gender between the groups

Gender	**Group A (n=76)**		**Group B (n=54)**	
	No.	**%**	**No.**	**%**
Male	52	68.4	35	64.8
Female	24	31.6	19	35.2

Table 3: Distribution of patients according to comorbidity between the groups

Comorbidity	**Group A (n=76)**		**Group B (n=54)**		**p-value[1]**
	No.	**%**	**No.**	**%**	
Diabetes					
Present	23	30.3	10	18.5	0.12
Absent	53	69.7	44	81.5	
Hypertension					
Present	37	48.7	44	81.5	0.001*
Absent	39	51.3	10	18.5	

*[1]Chi-square test, *Significant*

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Table 4: Distribution of patients according to smoking habit between the groups

Smoking habit	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Present	39	51.3	22	40.7	0.23
Absent	37	48.7	32	59.3	

[1]*Chi-square test*

Table 5: Comparison of total cholesterol level between the groups

Total cholesterol level	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Abnormal	29	38.2	0	0.0	0.001*
Normal	47	61.8	54	100.0	

[1]*Chi-square test, *Significant*

Table 6: Comparison of triglyceride level between the groups

Triglyceride level	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Abnormal	20	26.3	3	5.6	0.002*
Normal	56	73.7	51	94.4	

[1]*Chi-square test, *Significant*

Table 7: Comparison of HDL level between the groups

HDL level	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Abnormal	51	67.1	20	37.0	0.001*
Normal	25	32.9	34	63.0	

[1]*Chi-square test, *Significant*

Table 8: Comparison of LDL level between the groups

LDL level	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Abnormal	24	31.6	4	7.4	0.001*
Normal	52	68.4	50	92.6	

[1]*Chi-square test, *Significant*

Table 9: Comparison of VLDL level between the groups

VLDL level	Group A (n=76)		Group B (n=54)		p-value[1]
	No.	%	No.	%	
Abnormal	24	31.6	32	59.3	0.002*
Normal	52	68.4	22	40.7	

[1]*Chi-square test, *Significant*

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Table 10: Comparison of lipid profile between the two groups among males

Serum lipid profile	Group A (n=52)	Group B (n=35)	p-value[1]
Serum total cholesterol (mg/dl)	193.31±18.97	152.23±20.58	0.0001*
Serum TG (mg/dl)	134.27±18.81	127.06±12.66	0.06
Serum HDL (mg/dl)	39.92±16.04	42.86±11.41	0.35
Serum LDL (mg/dl)	97.21±10.85	89.74±7.92	0.001*
Serum VLDL (mg/dl)	24.91±6.27	28.72±7.35	0.01*

*[1]Unpaired t-test, *Significant*

Table 11: Comparison of lipid profile between the groups among females

Serum lipid profile	Group A (n=52)	Group B (n=35)	p-value[1]
Serum total cholesterol (mg/dl)	196.29±25.47	148.16±14.96	0.0001*
Serum TG (mg/dl)	142.08±31.32	131.95±19.36	0.22
Serum HDL (mg/dl)	40.92±13.36	48.89±10.46	0.03*
Serum LDL (mg/dl)	95.50±9.13	86.95±8.86	0.004*
Serum VLDL (mg/dl)	26.68±7.63	25.34±8.41	0.58

*[1]Unpaired t-test, *Significant*

Table 12: Comparison of lipid profile between the groups among diabetic patients

Serum lipid profile	Group A (n=23)	Group B (n=10)	p-value[1]
Serum total cholesterol (mg/dl)	187.57±18.32	151.90±11.16	0.0001*
Serum TG (mg/dl)	138.26±20.41	123.50±12.70	0.04*
Serum HDL (mg/dl)	38.52±12.41	41.70±11.13	0.49
Serum LDL (mg/dl)	99.22±11.93	88.40±6.50	0.01*
Serum VLDL (mg/dl)	25.10±7.09	30.29±6.44	0.06

*[1]Unpaired t-test, *Significant*

Table 13: Comparison of lipid profile between the groups among hypertensive patients.

Serum lipid profile	Group A (n=37)	Group B (n=44)	p-value[1]
Serum total cholesterol (mg/dl)	193.30±21.87	149.64±18.05	0.0001*
Serum TG (mg/dl)	137.11±26.05	128.20±13.95	0.06
Serum HDL (mg/dl)	39.65±12.66	45.18±11.66	0.04*
Serum LDL (mg/dl)	96.95±8.77	88.95±8.49	0.001*
Serum VLDL (mg/dl)	26.14±7.35	27.84±7.66	0.31

*[1]Unpaired t-test, *Significant*

Table 14: Comparison of lipid profile between the groups among smokers

Serum lipid profile	Group A (n=39)	Group B (n=22)	p-value[1]
Serum total cholesterol (mg/dl)	198.26±20.72	145.64±13.21	0.0001*
Serum TG (mg/dl)	141.26±23.23	126.86±14.71	0.06
Serum HDL (mg/dl)	42.33±15.00	43.45±10.81	0.04*
Serum LDL (mg/dl)	94.95±9.46	87.09±7.17	0.001*

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Serum VLDL (mg/dl)	25.85±7.43	27.17±7.80	0.31

[1]*Unpaired t-test, *Significant*

Table 15: Correlation of lipid profile with age in Group A and Group B

Serum lipid profile	**Group A (n=39)**		**Group B (n=22)**	
	Correlation coefficient	**p-value[1]**	**Correlation coefficient**	**p-value[1]**
Serum total cholesterol (mg/dl)	0.03	0.76	0.16	0.22
Serum TG (mg/dl)	-0.01	0.89	-0.22	0.09
Serum HDL (mg/dl)	-0.15	0.17	-0.22	0.10
Serum LDL (mg/dl)	-0.02	0.81	-0.06	0.66
Serum VLDL (mg/dl)	-0.04	0.69		

[1]Pearson correlation

Table 16: Comparison of lipid profile among age groups in Group A

Serum lipid profile	**<50**	**50-60**	**61-70**	**>70**	**p-value[1]**
Serum total cholesterol (mg/dl)	182.75±22.88	194.77±23.09	196.49±20.66	185.43±15.53	0.41
Serum TG (mg/dl)	139.75±20.33	135.55±24.29	138.58±24.41	127.43±18.88	0.69
Serum HDL (mg/dl)	50.75±2.21	39.27±15.68	40.42±15.86	36.14±12.32	0.47
Serum LDL (mg/dl)	100.50±6.60	95.36±8.44	97.23±11.60	95.14±9.77	0.76
Serum VLDL (mg/dl)	26.17±10.54	26.47±6.60	24.71±6.90	26.61±3.90	0.74

[1]ANOVA test

Table 17: Comparison of lipid profile among age groups in Group B

Serum lipid profile	**<50**	**50-60**	**61-70**	**>70**	**p-value[1]**
Serum total cholesterol (mg/dl)	148.10±16.49	146.50±17.22	156.59±20.99	143.50±2.12	0.30
Serum TG (mg/dl)	132.90±18.81	130.60±15.22	125.73±14.44	123.50±4.95	0.56
Serum HDL (mg/dl)	44.80±12.75	47.45±10.46	44.14±11.35	30.50±6.36	0.23
Serum LDL (mg/dl)	88.60±9.52	88.90±8.92	88.86±7.86	87.00±2.82	0.99
Serum VLDL (mg/dl)	28.37±7.29	27.56±7.94	26.71±8.49	32.15±0.21	0.79

[1]ANOVA test

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.[1] Cerebral atherosclerosis with atheroma formation is the basic underlying patho-physiologic mechanism in ischaemic stroke. Conflicting results exist in the literature about the correlation between the total plasma cholesterol of patients and the risk of stroke.

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In our study total number of patients included were 130 admitted in Saraswathi Institute of Medical Sciences Hospital, Medicine ward/ICU. Among these 76 were diagnosed to have ischaemic stroke while 54 had haemorrhagic stroke. Thus, showing that ischaemic stroke is more common, being 58.46% when compared to haemorrhagic stroke, which was 41.54%. .Based on neuroimaging findings, recent studies have determined the stroke subtypes and the ratio of cerebral infarct to hemorrhage range as 1.86:1-2.21:1.[2] Hence, cerebral hemorrhage is proportionately much higher in the Eastern Indian community than in Western countries, where the ratio of infarct to hemorrhage is 5:1. A study based on non invasive tests to determine subtypes of ischaemic stroke from a hospital-based registry of Southern India has attributed 41% of strokes to large artery atherosclerosis, 18% to lacunar causes, 10% to cardioembolic causes, and 4% to causes such as Takayasu syndrome, MoyaMoya disease, carotid dissection, hyperhomocysteinemia, anticardiolipin antibody, and protein S deficiency. The rest 27% of the cases of ischaemic stroke were of undetermined origin.[4,5]

In our study when these patients were evaluated for age, it was found that mean age for ischaemic stroke was 63.32 years while for haemorrhagic stroke it was 58.87 years.[6] Thus showing that stroke was more common in age group ranging from 50 to 70 years. Dey SK et al,[7] (2010) showed that both types of stroke were more common after the age of 50 years. In the German dataset[7],similar results were seen where a maximum male preponderance was found for patients aged between 55 and 64 years. The Greater Cincinnati/Northern Kentucky stroke study showsthat mean age at stroke significantly decreased from 71.2 years in 1993/1994 to 69.2 years in 2005 ($p < 0.0001$). The proportion of all strokes under age 55 increased from 12.9% in 1993/1994 to 18.6% in 2005. Regression modeling showed a significant change over time ($p = 0.002$), characterized as a shift to younger strokes in 2005 compared with earlier study periods. Stroke incidence rates in those 20–54 years of age were significantly increased in both black and white patients in 2005 compared to earlier periods.[6]

When patients were evaluated according to gender it was found that both ischaemic and haemorrhagic stroke are more common among males. In our study ischaemic stroke was seen in 68.4% of males and hemorrhagic stroke was seen in 64.8 % of males suggestive of ischaemic stroke being more common. Dey SK et al,[7] (2010) also showed male suffered more than female. Male: Female in ischaemic stroke group was 1.73:1, and in hemorrhagic group was 1.42:1. Thus they concluded the same and support our study. In the study by Cristian Forechet al,[8] proportion of male patients 0.67, whereas patients older than 84 years revealed a strong overbalance of females. Both in China (study done by Liu X, Xu G et al,[9])and India (study by Kaul S, Sunitha P),[5] a strong preponderance of male stroke patients was found for the majority of age categories with a maximum proportionof male patients of 0.82 Apart from demographic factors reflecting gender ratio in the general population and gender-specific stroke incidence rates, sociocultural peculiarities may also play an important role in this context.[8]

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In this study co-morbidities included were diabetes mellitus and hypertension. On evaluation it was found that about one third (30.3%) of patients with ischaemic stroke were diabetic while 18.5% of haemorrhagic stroke patients had diabetes, with no significant difference (p>0.05) between the two groups. However 48.7% of ischaemic stroke patients and 81.5% of haemorrhagic stroke patients had hypertension with significant (p=0.001) difference between the two groups suggestive that hypertension was a significant risk factor in haemorrhagic stroke group.

In our study it was found that smoking was associated with 51.3% patients with ischaemic stroke and 40.7% patients with haemorrhagic stroke and there is no significant (p>0.05) difference between the groups.

Risk factors for hemorrhagic and ischaemic stroke are similar, but there are some notable differences. There are also differences in risk factors among the etiologic categories of ischaemic stroke. Hypertension is a particularly important risk factor for hemorrhagic stroke, though it contributes to atherosclerotic disease that can lead to ischaemic stroke as well.[10] A recent international (22 nation) case-control study (INTERSTROKE) found that 10 modifiable risk factors explained 90% of the risk of stroke and in INTERSTROKE study, hypertension was by far the most important stroke risk factor, using definition of hypertension that included both a history of hypertension as well as a blood pressure measurement of 160/90 mm Hg, the proportion of strokes in the population attributable to hypertension, was 54%.[11] Although this was a case-control study, and thus measurements of blood pressure were likely confounded by recent stroke, the results still imply a major effect of blood pressure on stroke risk, and are consistent with other studies.

The effect of blood pressure was also greater for hemorrhagic than ischaemic stroke.Khan N et al,[12] (2009) observed that most of the patients had multiple risk factors which included: hypertension (65%), smoking (32%), diabetes mellitus (36.3%), dyslipidemia (32.7%), coronary artery disease (9%), obesity (18%), epilepsy (16.3%) and left ventricular hypertrophy (3.6%). On the basis of these findings, it be concluded that hypertension, smoking, dyslipidemia and diabetes mellitus are major risk factors for stroke and might be considered as main targets for primary and secondary prevention of stroke thus supporting our study.

In our study we found mean value of S. total cholesterol was 194.25 mg/dl in ischaemic stroke group and 150.80 mg/dl in hemorrhagic stroke group. Serum total cholesterol was significantly higher in ischaemic stroke than hemorrhagic stroke group (p value= <.05).ON Rai et al,[13] (2017) conducted a study of serum lipid profile in stroke patients in Northern India. Total cholesterol was abnormal in 83% of ischaemic stroke and 17% of hemorrhagic stroke. The findings in our study were also consistent with the findings of this study.

In our study we found mean value of s. HDL cholesterol was 40.24 mg/dl in ischaemic stroke group, 44.98 mg/dl in hemorrhagic stroke group showing s. HDL cholesterol was significantly lower in ischaemic stroke group (p value=<.05). In our study we found that hypercholesterolemia is significantly more

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associated with ischaemic strokes. Also low serum HDL cholesterol is associated with increased risk of ischaemic stroke. Qizilbashet al,[14] 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.

In addition to our study, we have found other studies, which obtained similar results. Ischaemic stroke subjects had significantly higher levels of total cholesterol, LDL, and triglycerides than those in control groups. Furthermore, hemorrhagic stroke subjects exhibited significantly lower levels of total cholesterol, triglyceride and LDL cholesterol than ischaemic stroke subjects. 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. Nerses Sanossianet al,[15] (2007) observed that atherosclerotic stroke is the end result of many different pathological processes in which HDL-C is a critical component. It is being increasingly recognized that low HDL-C is an important risk factor that is highly modifiable in relation to atherosclerosis. Our study also showed serum HDL-C was significantly lower in ischaemic stroke. S. Goya et al,[16] (2000) observed that higher levels of HDL cholesterol were associated with a significant decrease in risk of nonfatal stroke. In contrast, elevated total cholesterol showed a positive association with nonfatal stroke thus supporting our study.

In our study mean value of s. triglyceride was 136.74 mg/dl in ischaemic stroke group and 128.78 mg/dl in hemorrhagic stroke group. Thus it showed that s. triglyceride was significantly higher (p value=.03) in ischaemic stroke group than hemorrhagic stroke group. In our study mean value of s. LDL cholesterol was 96.67 mg/dl in ischaemic stroke subjects, 88.76 mg/dl in hemorrhagic stroke group. Thus it shows that s. LDL cholesterol was significantly higher in ischaemic stroke group (p value= .001). A positive relationship between high serum LDL-cholesterol levels and the risk of ischaemic stroke has been seen in other studies as well. KothaiGnanamoorthy et al,[17] (2016) conducted a study in which mean TC and LDL –C levels were significantly much higher in the ischaemic stroke patients when compared to patients with haemorrhagic stroke. ON Rai et al,[13] (2017) conducted a study of serum lipid profile and LDL cholesterol was abnormal in 86% of ischaemic stroke and 14% of haemorrhagic stroke.

There are certain limitations to this study. Most of the patients were from poor socio-economic background. So many of them could not afford CT even at government rate at the hospital. Some patients could not be included in the study because they died within 3 to 4 hours of hospital admission, so lipid profile estimation could not be done. This is a cross-sectional study so the cause effect relationship could not be obtained.

CONCLUSIONS

We conclude that ischaemic stroke patients had higher serum total cholesterol, higher s. LDL 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

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mortality in ischaemic stroke patients. Hypertension, diabetes mellitus, smoking and dyslipidemia are major risk factor for stroke. Most of the major risk factors for stroke are modifiable and need awareness, regular use of medication and changes in life style for prevention.

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