Biomedical & Pharmacology Journal Vol. **2**(2), 357-362 (2009)

Derangement of lipid profile in stroke patients

RANJIT PATIL[1] and UPLABDHI RAGHUWANSHI[2]

[1]Medical Biochemistry Department, Dr. Ulhas Patil Medical College, Jalgaon, (India).
[2]Maharashtra University of Health Sciences, Nashik, B.J. Medical College, Pune (India).

(Received: September 05, 2009; Accepted: October 27, 2009)

ABSTRACT

A reduction of/disruption in blood flow to the brain is the primary cause of a stroke. Low LDL-c and high HDL-c – is the key to control damage for ischemic stroke. The present study aims at – (1) The effect of derangement of lipid profile in stroke (CVA) patients; and (2) The effect of stroke on derangement of lipid profile; both on 1st and 7th day. The study included 25 patients of stroke whose 12 – 14 hr fasting samples were obtained, within 24 hours of admission, i.e. on 1st and 7th day. The measured lipid profile levels (TC, HDL-c, TG, LDL-c, & VLDL-c were compared to the normal range (130 to 250 mgs/dL, 30 to 70 mgs/dL, 70 to 170 mgs/dL, upto 110 mgs/dL, & < 40 mgs/dL, respectively). It was found that measured mean value of serum TC was 190.24 mgs/dL, HDL-c = 38.68 mgs/dL, TG = 147.32 mgs/dL, LDL-c = 122.48 mgs/dL, & VLDL-c = 29.48 mgs/dLwith corresponding normal values on the 1st day, which on the 7th day showed decreased levels for 158.16 mgs/dL, 35.68 mgs/dL, 128.88 mgs/dL, 97.36 mgs/dL, & 25.64 mgs/dL, correspondingly. In conclusion since all lipid parameters showed a considerable decrease on 7th day, as the stroke severity decreased, it could be proportionally linked with the severity of stroke. Thus stroke causes a significant derangement in lipid parameters. Individuals with low HDL-c should be considered a group at high risk of stroke, whereas direct relationship has been observed with levels of TC, LDL-c, TG, & VLDL-c (comparing 1st day with control).

Key words: Total Cholesterol; High-density lipoprotein cholesterol; Triglyceride; Low-density lipoprotein cholesterol; Very low density lipoprotein cholesterol; Cerebrovascular Accident; Stroke

INTRODUCTION

Stroke is a syndrome characterized by acute onset of neurologic deficit that persists for at least 24 hours, reflects focal involvement of the CNS. Amongst the leading neurologic disorder stroke is the 3rd most cause of death, disability, and health-care expenditure.[7]

Strong correlations between plasma lipids concentrations and the risk of stroke have never been clearly established. The present study attempts to associate this; specifically showing the derangement caused in the lipid profile patterns in the CVA patients and also the effect of stroke on this derangement (on the 1st day, i.e. of admission after an acute onset, and on 7th day of stroke). Hyperlipidemia is an independent risk factor for ischemic stroke (Gorelick & B etal (1997)). The present study establishes the role of lipids as a factor in stroke risk.

MATERIAL AND METHODS

Clinical material

The present work on, "Derangement of Lipid Profile in Stroke Patients", was done in the Department of Medical Biochemistry, in association with the Department of Medicine, Gandhi Medical College, Hamidia Hospital, Bhopal, Madhya Pradesh. The present study comprised of 25 patients of CVA (20 males & 05 females), which

were randomly selected from the emergency wards of medicine department, and 25 healthy subjects (15 males & 10 females), during the year 2004-05. All were in the age group 30-55 years and 56 & above years.

Inclusion criteria

All types of stroke patients, particularly cerebrovascular accident (CVA), were included irrespective of etiology.

Exclusion criteria

Patients suffering from diabetes, hypertension, myocardial infarction, and cases of unconsciousness, fever, & vomiting.

Methods

Biochemical parameters included serum TC, HDL-c, TG, LDL-c, & VLDL-c which were estimated colorimetrically using appropriate wavelength filters. The 12-14 hr fasting samples (approximately 5 ml of whole blood) of patients were taken within 24 hrs of admission, i.e. on the 1st day and then again on the 7th day during the period of hospitalization. For invitro quantitative determination of activity of lipid fractions in serum following kit methods were implemented. Kits were manufactured by Sigma diagnostics (India) Pvt. Ltd., Baroda. The data were statistically analyzed using 't-test'.

Lipid	Method	Wavelength	Formula	Normal
Parameter		(nms)		Value (mgs/dL)
TC	Enzymatic (CHE, CHO, & POD)	505 (green)	$\frac{A\ (T)}{A\ (S)} * 200$	130 – 250
HDL-c	PTA Precipitation & Enzymatic Method	505 (green)	$\frac{A\ (T)}{A\ (S)} * 100$	30 – 70 [Males = 30 – 63] [Females = 35 – 75]
TG	GPO-POD Enzymatic Method	520	$\frac{A\ (T)}{A\ (S)} * 200$	70 – 170
LDL-c	Friedewald's Formula [Friedewald WT, etal (1972)] [4]	—	TC – HDL-c – TG/5 (mg%)	Upto 110
VLDL-c	—	—	TG/5	< 40

RESULTS

[A] Control Group –

Values of lipid profile in control group (table 1)

Mean ± SD TC was reported to be 159.36 ± 15.865 mgs/dL while the other parameters included HDL-c, TG, LDL-c, & VLDL-c which were 54.12 ± 8.93, 110.8 ± 51.87, 86.29 ± 22.7, & 22.152 ± 10.5 mgs/dL respectively.

[B.] Morbid Group –

Mean Values ± SD in Morbid Group on the Day of Admission (table 2)

Mean ± SD values of TC, HDL-c, TG, LDL-c, & VLDL-c was reported to be 190.24 ± 52.24, 38.68 ± 11.8, 147.32 ± 46.81, 122.48 ± 36.23, 29.48 ± 9.439, respectively. On statistical analysis of the above data versus the control group highly significant ($p < 0.001$) values were found for HDL-c & LDL-c whereas for TC ($p < 0.01$), TG ($p < 0.01$),

Table 1: Mean values ± SD of lipid profile in control group

[A] Control Group –

Biochemical Parameter	Range [Max-Min] (mgs/dL)	Mean ± SD
TC	195 – 136	159.36 ± 15.865
HDL-c	74 – 40	54.12 ± 8.931
TG	261 – 55	110.8 ± 51.873
LDL-c	169 – 61	86.29 ± 22.678
VLDL-c	52.2 – 11	22.152 ± 10.493

Table 2: Mean values ± SD in morbid group on the day of admission

[B] Morbid Group –

Biochemical Parameter	Range [Max-Min] (mgs/dL)	Mean ± SD
TC	398 - 143	190.24 ± 52.24*
HDL-c	88 - 25	38.68 ± 11.8***
TG	280 - 110	147.32 ± 46.81*
LDL-c	254 - 85	122.48 ± 36.23***
VLDL-c	56 - 20	29.48 ± 9.439**

* $p < 0.01$ (significant); ** $p < 0.02$ (significant); & *** $p < 0.001$ (highly significant) [on comparing control group values vs values of 1st day of admission of morbid group]; df = 48.

Table 3: Mean values ± SD in morbid group on 7th day of admission

Biochemical Parameter	Range [Max-Min] (mgs/dL)	Mean ± SD
TC	278 - 124	158.16 ± 33.65**
HDL-c	63 - 22	35.68 ± 7.93****
TG	245 - 87	128.88± 38.505***
LDL-c	171 - 68	97.36 ± 20.122*
VLDL-c	49 - 17	25.64 ± 7.739****

* $p < 0.01$ (significant); ** $p < 0.02$ (significant); ***$p < 0.05$ (significant); **** $p > 0.05$ (insignificant) [when 1st day values were compared to values of 7th day of admission in morbid group]; df = 48.

& VLDL-c ($p < 0.02$) the t-value were found to be significant.

Mean Values ± SD in Morbid Group on 7th Day of Admission (table 3)

Mean ± SD values of TC, HDL-c, TG, LDL-c, & VLDL-c, on 7th day of admission in morbid group, were found to be decreased to 158.16 ± 33.65, 35.68 ± 7.93, 128.88 ± 38.505, 97.36 ± 20.122, 25.64 ± 7.739, respectively. On statistical analysis between 1st day values versus 7th day, significant relationship was obtained for TC ($p < 0.02$), TG ($p < 0.05$), & LDL-c ($p < 0.01$), whereas for HDL-c & VLDL-c p was insignificant ($p > 0.05$).

DISCUSSION

[A] Control Group – Values of lipid profile in control group

TC was reported at a value of (max – min) 195 – 136 mgs/dL [159.36 ± 15.865] which was in accordance with average mean TC values of various studies conducted by Gardner (1929).[5] Other parameters included mean HDL-c, TG, LDL-c, & VLDL-c (54.12 ± 8.93, 110.8 ± 51.87, 86.29 ± 22.7, & 22.152 ± 10.5) respectively, which were in accordance with the study conducted by Kiran Hasija & Hardeep K Bagga (2005).[6]

[B.] Morbid Group – Mean Values ± SD in Morbid Group on the Day of Admission

Lindenstrom, *et al.,* (1994) showed that the association between plasma cholesterol and risk of non-hemorrhagic event is not log linear; only relatively high cholesterol concentrations are associated with significantly increased risk.[3] Some more studies found positive association with ischemic stroke {Quiziblash N, *et al.,*(1991)}[10] which was in accordance with the present study ($p < 0.01$) when compared with control group. The predictive power of low HDL-c concentrations in serum for CAD, independently of other risk factors, has been well demonstrated in numerous epidemiological studies involving populations [Assmann & Schulte (1992)].[1] The present study demonstrated mean HDL-c value of 38.68 ± 11.8 (ranged from 88 – 25 mgs/dl) on admission. A highly significant variation was found between HDL-c and stroke ($p < 0.001$). Pasty BM (2004) reported only a marginally

significant association between LDL-c and ischemic stroke, however in the present study it was reported to be highly significant ($p < 0.001$).[9] Shieh SM, etal (1985) reported significantly higher VLDL-c levels ($p < 0.01$) while in the present study the variation was significant with mean value of 29.48 ± 9.439 mgs/dL (max – min = 56 – 20 mgs/dL).[13] Accoding to Taggart H, etal (1979) HDL-c values were significantly lower in stroke subjects aged < 65 years.[14] Rossner S, etal (1978) demonstrated normal mean TC concentrations which was the result of slight increase in VLDL-c and a concomitant HDL-c reductions (age < 55).[11] According to Mendez I, etal (1987) both serum TC and TG levels are initially decreased in patients aged 50 – 69 years with cerebral infarction, whereas only cholesterol is decreased in patients aged 60 – 69 years with TIA (on comparing 1st, 7th, and after 3 months values).[8] Scherle CE, etal (1998) demonstrated no difference in levels of TC, HDL-c, LDL-c, & VLDL-c (between 3 weeks and 6 months after the initial stroke); average age being 64.5 years.[12] Forty five years or older for men and 55 years or older for women have been categorized as on the risk factors for CHD in addition to LDL-c.

Mean Values ± SD in Morbid Group on 7th Day of Admission

All the values showed a considerable decrease on the 7th day of stoke. The values of HDL-c, & VLDL-c, though were found to be decreased on 7th day, but didn't show a very much compatible difference. Therefore it could be concluded that TC, TG, & LDL-c tends to fall on 7th day whereas no significant conclusion could be drawn out for values of HDL-c ($p > 0.05$) & VLDL-c ($p > 0.05$). Hence it can be said that stroke causes particular derangement in the values of lipid profile, which tends to decrease as the severity of stroke decreases.

Comparison of 1st Vs 7th day

The present study demonstrated a considerable decrease in values on 7th day as compared to 1st day. Mean TC value was 158.16 ± 33.65 (278 – 124), were lower on 7th day and were in accordance with the study by Mendez I, etal (1987). According to Mendez I, etal serum TC, LDL-c in cerebral infarction patients (50 – 69 years) were lowest on 7th day; intermediate on 1st day, and highest at 3 months, whereas VLDL-c and HDL-c changed a little; however, the present study demonstrated HDL-c and VLDL-c to be insignificant. The 1st day mean fasting HDL-c of cerebral infarction patients was significantly lower in subjects aged 50 – 59 years than in those aged 60 – 69 years (23 ± 3 Vs 42 ± 5 mgs/dl). Similarly, according to Aull S, etal (1996) TC and LDL-c levels of group B patients (levels determined within 49 – 168 hours after an acute event) were significantly lower than group A levels (12 – 48 hours).[2] The present study demonstrated significant association for both TC and LDL-c when 1st day was statistically analyzed versus 7th day.

The present study demonstrated a significant variation for TG ($p < 0.05$) when 1st day values were statistically correlated with 7th day values. V Hachinski, etal (1996) demonstrated that elevated TG and LDL-c levels were significantly independent risk factors in patients with proven athero-thrombotic cerebrovascular disease manifesting as stroke or TIA.[15] Plasma TC was significantly higher among patients with thromboembotic strokes and TIAs than among control subjects. This is in accordance with the present study. Therefore, the study showed specific derangement in all lipid parameters (due to the effect of stoke) with all parameters found to be decreased on the 7th day, which is in accordance with the study by Aull S, etal (1996); Mendez I, etal (1987), which demonstrated that lipids tend to temporarily fall after an acute stroke. The phenomenon is probably not strictly related to inadequate nutrition that might result from the conservative early management of dysphagia because the same phenomenon has been seen in patients with many acute neurologic conditions. Thus to conclude, in the followup study a significant variation was seen for LDL-c, TC, and TG when compared with values on 1st day of admission. These variations could be the result of conservative treatment, the patients underwent for the proceeding seven days. However, no significant change was seen in the values of VLDL-c and HDL-c.

CONCLUSIONS

All the values showed a considerable decrease on the 7th day as stroke severity decreased.

Therefore, all the lipid parameters were found to be proportionally linked with stroke severity. These variations could be the result of conservative treatment, the patients underwent for the proceeding 7 days. Therefore, stroke was found to cause a significant derangement in all the lipid parameters while comparing the 1st day Vs 7th day values (which was shown to be increased on the 1st day with considerable decrease on 7th day).

TC, TG, and LDL-c should be considered to be significant risk factors for stroke. VLDL-c and HDL-c values couldn't draw out any significant conclusion. However a larger study with more population of similar clinical background is needed to be planned to establish the role of low HDL-c as a risk factor in stroke; also predicting the role of stroke in causing the derangement of lipid profile.

REFERENCES

1. Assmann G, Schulte H. Relation of high-density lipoprotein cholesterol and triglycerides to incidence of atherosclerotic coronary artery disease (the PROCAM experience). *Amm J Cardiol* **70**: 733-737 (1992).
2. Aull S, Lalouschek W, Schnider P, Sinzinger H, Uhl F, Zeiler K. Dynamic changes of plasma lipids and lipoproteins in patients after transient ischemic attack or minor stroke. *Am J Med* Sep **101**(3): 291-8 (1996).
3. E Lindenstrom etal. Influence of total cholesterol, high density lipoprotein cholesterol, & triglycerides on risk of cerebrovascular disease: The Copenhagen City heart study. *BMJ* **309**: 11-15 (1994).
4. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of LDL-c in plasma, without use of preparative ultracentrifuge. *Clin Chem.*, **18**: 499-502 (1972).
5. Gardner JA & Gainsborough H. Studies on the cholesterol content of normal human plasma. *Biochem Jr* **21**: 130-140 (1929).
6. Kiran Hasija & Hardeep K Bagga. Alterations of serum cholesterol and serum lipoprotein in breast cancer of women. *Ind J of Clin Biochem* **20**(1): 62 (2005).
7. Li SC, Schoenberg BS, Wang C, et al. Cerebrovascular disease in the People's Republic of China: epidemiologic and clinical features. *Neurology.,* **35**: 1708-13 (1985).
8. Mendez I, Hachinski V, and Wolf B. Serum lipids after stroke. *Neurol* **37**(3): 507-11 (1987).
9. Pasty BM, Anderson M, Kronmal RA, Tracy RP, etal. The association between lipid levels and the risks of incident myocardial infarction, stroke, and total mortality: The Cardiovascular Health Study. *J Am Geriatr Soc*. **52**(10): 1639-47 (2004).
10. Quiziblash N, Josh L, Warlow C, Mann J. Fibrinogen and lipid concentrations as risk factors for transient ischemic attacks and minor ischemic strokes. *BMJ* **303**: 605-9 (1991).
11. Rossner S, Kjellin KG, Mettinger KL, Siden A, Soderstrom CE. Normal serum cholesterol but low HDL-cholesterol concentrations in young patients with ischemic cerebrovascular disease. *Lancet* **1**: 577-9 (1978).
12. Scherle CE, Nasiff A, Begueria RA, Perez-Nellar J, etal. Lipids and lipoproteins in a group of patients with ischemic cerebrovascular disease. *Rev Neurol* **27**(159): 804-8 (1998).
13. Shieh SM, Shen MM, Tsai WJ, Shiuan LR, etal. Serum lipids and lipoprotein abnormalities in patients with thrombotic stroke – with exploring the protective role of HDL subfractions. *Proc Natl Sci Counc Repub China B*. **9**(4): 298-304 (1985).
14. Taggart H, Stout RW. Reduced high density

lipoprotein in stroke: relationship with elevated Triglyceride and hypertension. *Eur J Clin Invest* **9**(3): 219-21 (1979).

15. V. Hachinski, C. Graffagnino, M. Beaudry, G. Bernier, C. Buck, A. Donner, J.D. Spence, G. Doig, and B.M. Wolfe. Lipid and stroke: a paradox resolved. *Archives of Neurology* **53**(4) (1996).