



**ORIGINAL RESEARCH PAPER**

**Health Science**

**LEVELS OF C-REACTIVE PROTEINS IN CVA PATIENTS AND ITS CORRELATION WITH LIPID PARAMETERS**

**KEY WORDS:** CRP, CVD, Lipid Profile, TG, LDL, HDL

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**ABSTRACT**

Stroke, a leading cause of mortality and morbidity globally, results from sudden brain cell death due to inadequate blood flow. Each year, approximately 20 million people experience a stroke, with developing countries accounting for 85% of stroke-related deaths. High-sensitivity C-reactive protein (hs-CRP), a marker of low-grade vascular inflammation, predicts the risk of first ischemic stroke. This study aims to estimate serum CRP levels in patients with cerebrovascular accidents (CVA) and compare them with healthy controls. It also examines the difference in serum CRP levels between hemorrhagic and ischemic strokes. A case-control study was conducted at Maulana Azad Medical College, New Delhi, including 60 acute stroke patients and 60 age- and sex-matched healthy controls. Exclusion criteria involved known cardiac emboli sources, past vascular diseases, active infections, and specific medical conditions. Serum CRP and lipid profiles were measured using standard enzymatic methods, and data were analyzed using SPSS version 20. Stroke patients exhibited significantly higher serum CRP levels ( $6.56 \pm 2.59$  mg/l) compared to controls ( $1.86 \pm 0.82$  mg/l,  $p < 0.001$ ). Additionally, lipid parameters (TC, TG, LDL, VLDL) were elevated in stroke patients. Ischemic stroke patients had higher CRP levels ( $8.16 \pm 2.08$  mg/l) than hemorrhagic stroke patients ( $4.18 \pm 2.41$  mg/l,  $p < 0.001$ ). Elevated serum CRP levels are significantly associated with cerebrovascular accidents, particularly ischemic strokes. hs-CRP serves as a valuable predictive marker for stroke risk, highlighting the role of inflammation in stroke pathophysiology. Further research is essential to explore the clinical applications of CRP measurements in stroke management and prevention.

**INTRODUCTION**

Stroke or cerebrovascular accident is the sudden death of brain cells due to inadequate blood flow. Stroke is one of the leading causes of mortality and morbidity worldwide. Approximately 20 million people each year will suffer from stroke and of this 5 million people will not survive. (1) Developing countries accounts for 85% of global deaths from stroke. Stroke is also a leading cause of impairment, with 20% survivors requiring institutional care upto 3 months and 15-30% being permanently disabled. (2)

C reactive protein (CRP) is produced by liver. The presence of acute inflammation with tissue destruction within the body stimulate its production. The CRP typically rises within 6 hours of the start of inflammation, allowing the inflammation to be confirmed. (3)

There are two types of CRP, which could be measured. The standard CRP is used to access how active inflammation is in such chronic problem as arthritis; to asses for a new infection; and to monitored response to treatment to these conditions. The other type of CRP is high sensitivity CRP (hs-CRP). (4) This substance is considered as a marker of low grade vascular inflammation, which is a key factor in development and rupture of atheromatus plaque. (5).

The acute phase protein hsCRP in particular has been the most extensively studied marker of inflammation. (6) It is a novel plasma marker of atherothrombotic disease. Elevated plasma CRP are not disease specific but sensitive level of markers which are produced in response to tissue injury, infectious agents, inflammation. hsCRP predicts the first cardiovascular events in several populations. It was the only inflammatory marker that independently predicted the risk of stroke. (7) hsCRP level when measured prior to the onset of clinical disease, may be an independent predictor of the first ischemic stroke. nfection and inflammation play a vital role in pathophysiology of atherosclerosis. (8) hsCRP is a sensitive marker of inflammation and tissue injury in the arterial wall.

Recent data suggest that hsCRP is an inflammatory marker for coronary artery disease and as well as potent and strongest predictor in cardiovascular disease in men and women. (9)

**Aims and Objectives**

To estimate serum CRP in patients suffering from cerebrovascular accidents and compare these with healthy control groups. Also to find out any difference in serum CRP levels between hemorrhagic and ischemic cerebrovascular accident/stroke cases.

**MATERIALS AND METHODS**

A case control study was carried out in Department of Biochemistry, Maulana Azad Medical College, New Delhi.

Sixty cases of acute stroke admitted to Medicine ward RIMS were selected for this study irrespective of sex and socioeconomic status. Patients with cerebrovascular accidents within 48 hours of onset were included in this study. Sixty age and sex matched apparently healthy individuals were selected as controls.

**Exclusion Criteria**

Subjects with following conditions were excluded from the study:

1. Patients with a known or possible cardiac source of emboli (atrial fibrillation, valvular heart disease, patients receiving anticoagulant treatment)
2. Duration of symptoms more than 48 hours
3. Past history of vascular disease (previous stroke, angina, myocardial infarction, revascularizations, peripheral vascular disease)
4. Patients receiving drugs affecting serum uric acid levels (diuretics, analgesics, lipid lowering drugs)
5. Active infections
6. Malignancies; renal or liver diseases, thyroid dysfunctions, chronic inflammatory bowel diseases.
7. Signs and clinical evidence of acquired in hospital infection.
8. Severe medical or psychiatric illness
9. History of gout: taking antigout medicines
10. Subjects taking antioxidant vitamins.

All cases and controls were aged 18 years and above. Detailed history of each individual case was recorded. General physical and systemic examination were carried out and the type of CVA was confirmed by clinical examination, special

investigations like NCCT brain.

A written informed consent was taken from all the subjects. About 5ml venous blood was collected after overnight fasting from anterior cubital vein after maintaining a standard sterilized condition from each of the control and CVA patients. In CVA group, blood samples were collected when patients were presented for evaluation and before initiation of medical therapy. Serum obtained from this blood was used to estimate C-reactive proteins and lipid profile (Total Cholesterol- TC, triglyceride - TC, low density lipoprotein - LDL, very low density lipoprotein- VLDL, and high density lipoprotein- HDL)

hsCRP was measured enzymatically by solid phase direct sandwich method (10), using ELISA kit from CALBIOTECH, USA. Serum lipid profile estimation was done by Enzymatic Colorimetric Test with lipid clearing factor (LCF) by using kits marketed by Human Gesellschaft fur Biochemica und Diagnostica mbH through its Indian branch supply.

Statistical analysis was performed using SPSS version 20. Data was expressed as Mean ± SD. Statistical tests like 2-test, independent t-test, ANOVA (F-test) and correlation coefficient 'r' were applied whenever found suitable and necessary. The P-value less than 0.05 was considered significant.

Study was approved by the institutional ethical committee, regional Institute of Medical Sciences, Imphal. Written informed consent was obtained from all individuals participating in this study after explaining nature of the study to them and confidentiality was maintained.

**RESULTS**

**Table 1: Level Of Serum CRP And Lipid Parameters Among Cases And Controls**

parameter	Controls (n = 60)	CVA cases (n = 60)	t	P-value
Serum CRP (mg/l)	1.86 ± 0.82	6.56 ± 2.59	13.55	<0.001
TC	168.67 ± 29.49	235.26 ± 49.55	8.9	<0.001
TG (mg/dl)	149.85 ± 23.14	217.11 ± 56.38	8.5	<0.001
LDL (mg/dl)	93.03 ± 25.19	155.09 ± 49.91	8.6	<0.001
VLDL (mg/dl)	29.96 ± 4.63	43.42 ± 11.28	8.5	<0.001
LDL (mg/dl)	54.33 ± 5.18	36.74 ± 9.42	12.7	<0.001

**Table :2 Distribution Of CRP According To Sex Of Patients**

	Cases CRP			Controls CRP		
	No.	Mean ± SD (mg/l)	Range (mg/l)	No.	Mean (mg/l)	Range (mg/l)
Male	34	7.74 ± 2.44 b***	2.4 - 12.8	34	2.04 ± 0.86	0.80 - 4.00
female	26	5.11 ± 1.98	5.11 - 1.98	26	1.4 ± 0.78	0.30 - 3.50
total	60	6.84 ± 2.63 a***	4.4 - 12.5	60	1.86 ± 0.82	0.30 - 4.00

a\*\*\* p<0.001, comparison between total mean ± SD level of control and CVA cases

b\*\*\* p<0.001, comparison between mean ± SD level of males and females of CVA cases.

**Table 3:No. Of CVA Cases At Different CRP Levels**

CRP levels (mg/l)	Male (%)	Female (%)	Total	Percentage
<1	0 (0)	0 (0)	0	0
1-3	3 (4.33)	7 (10.33)	10	16.67
>3	30 (49.67)	20 (33.67)	50	83.33

**Table 4: Serum CRP In Different Types Of CVA And Controls**

parameter	Controls (n = 60)	Hemorrhagic stroke (n = 28)	Ischemic stroke (n = 32)
CRP (mg/dl)	1.86 ± 0.82	4.18 ± 2.41a***	8.16 ± 2.08a***, b***

a\*\*\* p<0.001 comparison between cases and controls

b\*\*\* p<0.001 comparison between Ischemic stroke and hemorrhagic stroke

**Table 5: Mean ± Sd (mg%) Of TG, TC, LDL, VLDL, HDL At Different Levels Of CRP**

CRP (mg/dl)	No.	TC	TG	LDL	VLDL	HDL
<1	0	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
1 – 3	7	188.27 ± 28.52	161.14 ± 39.76	106.31 ± 22.13	31.12 ± 7.89	49.32 ± 5.63
> 3	53	218.52 ± 46.11	212.83 ± 55.16	154.43 ± 48.87	41.21 ± 10.37	23.15 ± 6.74

**DISCUSSION**

The pathophysiology of CVA or stroke is complex and it involves both the inflammatory and oxidative pathways. Mean ± SD age for CVA patients were found to be 58.35 ± 11.54 years in this study. Naik M et al (6) also found mean age of 58.27 years in their study.

In present study it was observed that majority of CVA cases (55%) belonged to middle class socio economic status but some recent research from china by Xu F et al (7) indicates that higher socio – economic status and family income are clearly correlated with stroke risk.

In this study it was observed that CVA patients had higher values of lipid parameters (Total cholesterol – TC, Triglycerides- TG, Low density lipoproteins – LDL, Very low density lipoproteins – VLDL and High density lipoproteins – HDL). The difference in the serum lipid profile (mean ± SD) between control and study group was statistically significant. These findings are in accordance with the findings of studies done by Cynthia A et al (11), Das p et al (B) and Long T et al (12) that the high cholesterol levels have been inconsistently associated with stroke. (table - 1)

Patients in this study showed higher levels of CRP levels (6.84 ± 2.63 mg/dl) when compared with controls (1.86 ± 0.82 mg/dl). This difference was statistically significant (p<0.001). These findings are in accordance with the findings of Chaudhuri JR et al (13) and Kocer A et al (14), who also found higher values of CRP among CAV patients as compared to controls. (table – 1)

As shown in table -2, comparison of mean ± SD (mg/l) of CRP levels among males and females shows significant difference in CVA cases (7.74 ± 2.44 mg/l vs 5.11 ± 1.98 mg/l, p<0.001). This result is similar to findings by Yamada S et al (15) and Tracy RP et al (16). The sex difference in CRP is controversial. In contrast to the above findings, study by Ridker PM et al (17) showed that females had higher levels than males. The reasons for these discrepancies are unclear but it may be because males are more likely than females to be current smokers and also the body mass index is lower in females than that of males in this ethnic group of studied population.

When patients were distributed according to serum CRP levels (table-3), it was evident that maximum number of patients (50 cases) were seen above 3mg/l, followed by 10 cases between 1 – 3 mg/l. this showed that majority of CVA cases have serum CRP at higher range.

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