ORIGINAL RESEARCH PAPER
Volume - 15 | Issue - 08 | August - 2026 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE STUDY OF EVALUATION OF C – REACTIVE PROTEIN IN PATIENTS OF ISCHEMIC STROKE

Medicine

Dr. Aher Sangeeta	M.D, DHA , Professor (Addl), Dept. Of Medicine, T.N.M.C
Dr Suraj Rathod	M.D, Lecturer, Dept. Of Medicine, T.N.M.C
Dr. Akansha Kumar	M.D, Sr. Resident, R.M.C
Dr Anushka Kumar	Resident, NKP Salve & L.M. Hospital

ABSTRACT

Background: Stroke continues to be a major public health concern, contributing significantly to the global burden of disease. Accounting for approximately 12 million new cases and over 6.5 million deaths annually, stroke has become the second leading cause of mortality and the third leading cause of disability-adjusted life years (DALYs) worldwide, surpassing many other non-communicable diseases [1,2]. Among the various types of strokes, ischemic stroke resulting from arterial occlusion constitutes nearly 80% to 85% of all cases. C-reactive protein is an inflammatory marker. Numerous observational and prospective studies have highlighted the prognostic significance of CRP in ischemic stroke. Elevated CRP levels in the acute phase have been associated with larger infarct volumes, more severe neurological deficits, increased risk of early neurological deterioration, and worse functional outcomes, as measured by tools such as the National Institutes of Health Stroke Scale (NIHSS) and the modified Rankin Scale (mRS) [11–13]. There is evidence of the prognostic importance of C-reactive protein (CRP) in ischemic stroke. In this study, we assessed the prognostic values of CRP in ischemic stroke and predicting outcomes. **Materials And Methods: Aims** - To evaluate the role of CRP in acute ischemic stroke **Objectives:** The objective of the study will be to evaluate CRP levels in patients of acute ischemic stroke and whether it could be used as prognostic marker in acute ischemic stroke. **Study Design and Setting:** This is a prospective, descriptive observational study which was conducted in the Department of General Medicine at a tertiary care centre in Mumbai. A minimum of 60 patients were enrolled in the study in age group between 30 to 80 years presenting with symptoms suggestive of acute ischemic stroke. The diagnosis was confirmed by computed tomography (CT) or magnetic resonance imaging (MRI) showing evidence of cerebral ischemia. Patients with first ever acute ischemic stroke, were examined considering all inclusion and exclusion criteria. **Results:** In the present study, the distribution of C-reactive protein (CRP) levels among the 60 patients showed that a majority, 36 (60.0%), belonged to the high CRP group (>3 mg/L). The moderate CRP group (1–3 mg/L) included 13 (21.7%) patients, while the low CRP group (<1 mg/L) comprised 11 (18.3%) patients. This predominance of elevated CRP values suggests that most patients with acute ischemic stroke in the study cohort had a significant inflammatory response at presentation **Conclusion**: In the present study, a statistically significant association was observed between CRP group and NIHSS stroke severity ($p < 0.001$). Among patients with low CRP (<1 mg/L), all 11 (100%) had minor stroke in contrast to the 36 patients in the high CRP group (>3 mg/L), only 1 (2.8%) had minor stroke, while the majority had moderate (13; 36.1%), moderate to severe (12; 33.3%), or severe (10; 27.8%) strokes. This pattern demonstrates a clear trend: higher CRP levels were associated with greater stroke severity at presentation, and this association was highly significant statistically. The CRP level is significantly higher in ischemic stroke and its elevation between 12-72 hours of symptom onset is a bad prognostic indicator.

KEYWORDS

C-reactive protein, Ischemic stroke.

INTRODUCTION:

Stroke is the second common cause of death and fourth leading cause of adult disability in world. Researchers found a protein in the study of patients with cardiovascular and cerebrovascular disease which was named as C- reactive protein. CRP is a systemic inflammatory marker that is produced in large amounts by hepatocytes in response to IL-1, IL-6 and TNF factor

C-reactive protein (CRP is a prognostic marker of ischemic stroke is used for evaluating pathological inflammation and has been studied in relationship to the progression of atherosclerosis. CRP, being widely available and affordable, presents a promising candidate. However, current literature on its utility in Indian populations remains scarce,

In light of these gaps, the present study seeks to evaluate the association between serum CRP levels and stroke severity, as well as clinical outcomes, in patients presenting with acute ischemic stroke..

MATERIALS AND METHODS

Aim: This studyIS done to assess the clinical value of Serum C-Reactive protein (CRP) in patients with acute ischemic stroke

Objectives: The objective of the study will be to evaluate CRP levels in patients of acute ischemic stroke and whether it could be used as prognostic marker in acute ischemic stroke.

Study Design and Setting: This prospective, descriptive observational study was conducted in the Department of General Medicine at a tertiary care centre in Mumbai. The study duration was 18 months, and patients were assessed, investigated, and treated as per existing clinical protocols without altering the standard of care.

Study Population: Patients aged 30 to 80 years presenting with symptoms suggestive of acute ischemic stroke were considered for inclusion. The diagnosis was confirmed by computed tomography (CT) or magnetic resonance imaging (MRI) showing evidence of cerebral ischemia

Sample Size: A minimum of 60 patients were enrolled in the study based on the Cochran formula for sample size estimation

Inclusion Criteria

- Male and female patients aged between 30 and 80 years
- Presentation with sudden onset of global or focal neurological deficit lasting for more than 24 hours
- Neuroimaging (CT or MRI) showing ischemia

Exclusion Criteria

- History of cardiac disease such as myocardial ischemia, myocarditis, or valvular heart disease
- Prior history of stroke or transient ischemic attack (TIA)
- Presence of autoimmune or collagen vascular diseases

Data Collection Procedures

Informed consent was obtained from all eligible patients or their legally authorized representatives (LAR) in cases where the patient was unconscious. Approval from the Institutional Ethics Committee was secured before commencement of recruitment.

For each participant, demographic data (age, sex), clinical history (hypertension, diabetes, smoking, alcohol use), and details of stroke presentation were recorded. **Neurological assessment** was conducted using the National Institutes of Health Stroke Scale (NIHSS) on admission to determine stroke severity. Imaging studies (CT or MRI) were performed to confirm the diagnosis, assess infarct location, and

evaluate extent of ischemic damage.

Laboratory investigations
included complete blood count, renal function tests, lipid profile ,electrocardiogram (ECG), and serum C-reactive protein (CRP) levels. CRP values were classified as low (<1 mg/L), moderate (1–3 mg/L), and high (>3 mg/L) for analysis

Statistical Analysis:
Data were analyzed using SPSS version 27.0 and Microsoft Excel from Microsoft Office 365. Descriptive statistics were presented as means, standard deviations, and proportions. Inferential analysis was conducted using the Chi-square test, Student's t- test, and simple logistic regression, with a p-value of ≤0.05 considered statistically significant.

NIHSS Scoring System
The National Institutes of Health Stroke Scale (NIHSS) as used in this study to assess the neurological severity of acute ischemic stroke at the time of admission. It is a validated, standardized tool comprising 13 items that evaluate different components of neurological function. Each item was scored based on observed deficits, and the cumulative score was used to classify stroke severity.

RESULTS AND OBSERVATIONS
The results of the present study are organized into five main domains: demographic and socioeconomic characteristics; clinical presentation and comorbid conditions; functional assessments and neurological findings; laboratory and inflammatory markers; and in-hospital outcomes with complication profiles.

In the present study cohort of 60 patients, 31 (51.7%) were male and 29 (48.3%) were female. Table 1.

In the present study, the age distribution of the sixty participants spanned from 31 to 80 years. The youngest bracket (31–40 years) accounted for 5 participants (8.3%). This distribution indicates a progressive increase in patient numbers with advancing age, peaking in the seventh and eighth decades, before a relative tapering in the younger segments.

Table 1: Distribution of Age Groups

Age Groups	No of Patient	Percent
31 to 40 Years	5	8.30%
41 to 50 Years	12	20%
51 to 60 Years	10	16.70%
60 to 70 Years	14	23.30%
71 to 80 Years	19	31.70%
Total	60	100%

Prevalence of Comorbidities
In the present study cohort of 60 patients, 34 (56.7%) followed a non-vegetarian diet, whereas 26 (43.3%) adhered to a vegetarian diet.
In the present study cohort of 60 patients, 24 (40.0%) presented with hemiparesis, 20 (33.3%) with slurred speech, and 16 (26.7%) with facial deviation

In the present study cohort of 60 patients, 24 (40.0%) presented with Hypertension and dyslipidaemia emerged as the leading comorbid conditions,

In the present study cohort of 60 patients, 30 (50.0%) reported alcohol use and 30 (50.0%) did not; smoking was reported by 29 (48.3%) and absent in 31 (51.7%).

In the present study cohort of 60 patients, 39 (65.0%) were on antihypertensives, 39 (65.0%) on antiplatelets, 38 (63.3%) on statins, and 34 (56.7%) on antidiabetics; no patient (0 [0.0%]) was taking other medications.

In the present study, the distribution of C-reactive protein (CRP) levels among the 60 patients showed that a majority, 36 (60.0%), belonged to the high CRP group (>3 mg/L). The moderate CRP group (1–3 mg/L) included 13 (21.7%) patients, while the low CRP group (<1 mg/L) comprised 11 (18.3%) patients. This predominance of elevated CRP values suggests that most patients with acute ischemic stroke in the study cohort had a significant inflammatory response at presentation **Table 2.**

Table 2.: Distribution of C-reactive Protein (CRP) Levels

CRP Group	No of Patient	Percent
<1 mg	11	18%
1–3 mg	13	21.70%
>3 mg	36	60.00%
Total	60	100%

In the present study, the distribution of C-reactive protein (CRP) levels among the 60 patients showed that a majority, 36 (60.0%), belonged to the high CRP group (>3 mg/L). The moderate CRP group (1–3 mg/L) included 13 (21.7%) patients, while the low CRP group (<1 mg/L) comprised 11 (18.3%) patients. This predominance of elevated CRP values suggests that most patients with acute ischemic stroke in the study cohort had a significant inflammatory response at presentation

In the present study, the mean NIHSS score was 14.83 ± 10.95, and the mean CRP value was 4.09 ± 2.80 mg/L. Pearson correlation analysis revealed a statistically significant positive correlation between NIHSS score and CRP value ($p < 0.001$). This indicates that higher levels of C-reactive protein were associated with greater stroke severity at presentation.

CRP and stroke severity were strongly linked: all patients with low CRP (<1 mg/L) had only minor strokes, whereas those with higher CRP (1–3 mg/L and >3 mg/L) clustered in the moderate-to-severe range ($p<0.001$). This gradient was mirrored by a robust positive correlation between continuous CRP values and NIHSS, reinforcing CRP's alignment with the extent of neurological deficit. **Table 3**

Table 3: Pearson Correlation Between NIHSS Score and CRP

Pearson Correlation	Mean ± SD	P-value
NIHSS Score	14.83 ± 10.95	<0.001*
CRP Value (mg/L)	4.09 ± 2.80	

In the present study, the mean NIHSS score was 14.83 ± 10.95, and the mean CRP value was 4.09 ± 2.80 mg/L. Pearson correlation analysis revealed a statistically significant positive correlation between NIHSS score and CRP value ($p < 0.001$). This indicates that higher levels of C-reactive protein were associated with greater stroke severity at presentation. The strong positive association supports the potential role of CRP as a prognostic marker in acute ischemic stroke, with increasing CRP levels reflecting more severe neurological impairment.

DISCUSSION
In the present study cohort of 60 patients, the mean age was 60.48 ± 12.31 years (median 62; IQR 47.25–71.75), reflecting a predominance of older adults with a moderately wide age spread which was comparable with David curb et al,[1] which showed mean age among cases 58.1±5.7yrs and among controls 55.8±5.4yrs,

Agarwal et al,[2] having shown 65.3±9.07yrs and 65.3±8.88yrs, Dhamija R K et al,[3] showing 56.48yrs and 54.20yrs, respectively among the cases and the controls, Natalia Rose et al,[4] showing 69.7yrs.

Inflammatory and neurological measures showed a mean CRP of 4.09 ± 2.80mg/L (median 4.09; IQR 1–6.5) and a mean NIHSS score of 14.83 ± 10.95 (median 10; IQR 5–20), indicating a substantial inflammatory response and moderate stroke severity. Symptom duration prior to presentation was brief, with a mean of 2.37 ± 1.13 days (median 2; IQR 1–3), suggesting timely healthcare engagement in most cases.

Anuradha Bharosay et observed that disability was associated with higher concentrations of IL-6 and hsCRP in plasma and early neurological deterioration was too observed in cases with high levels of hsCRP and IL-6.

Mahapatra SC et al{10} observed CRP value 76 mg/dl in 64 patients out of 80 total thrombotic stroke patients ($p<0.001$).

In the present study, a statistically significant association was observed between CRP group and NIHSS stroke severity ($p < 0.001$). Among patients with low CRP (<1 mg/L), all 11 (100%) had minor stroke, and none presented with moderate, moderate to severe, or severe stroke. In contrast, of the 36 patients in the high CRP group (>3 mg/L), only 1 (2.8%) had minor stroke, while the majority had moderate (13; 36.1%),

moderate to severe (12; 33.3%), or severe (10; 27.8%) strokes. In the moderate CRP group (1–3 mg/L), all 13 (100%) presented with moderate stroke, and none experienced minor, moderate to severe, or severe strokes. This pattern demonstrates a clear trend: higher CRP levels were associated with greater stroke severity at presentation, and this association was highly significant statistically.

M.A. Shoaeb, M.A. Shehata{12} et al in their study classified Severity of stroke by using NIHSS, there was a strong positive correlation between disease severity assessed by NIHSS and Serum CRP level, was positively correlated.

Mario Di Napoli et al13 studied, the risk of CRP in 72% of patients (p=0.0001) out of 473 first ever ischemic stroke patients and suggested CRP as an independent marker of underlying chronic inflammatory process in atherosclerosis

CRP Group and Stroke Severity

The association remained highly significant statistically ($p < 0.001$), indicating that patients with higher CRP values tended to experience greater stroke severity and had worse outcomes, with mortality observed only in the presence of moderate or higher severity. These findings suggest that both elevated CRP and increased NIHSS scores were strongly linked to poorer prognosis in acute ischemic stroke. significant elevation of the levels of the C reactive protein among the cases compared to the controls which was comparable to the study done by Agarwal et al,[13] which showed 25±24.78 among the cases and 4.00±1.48 among the controls. J David curb et al,[1] showed values of 14.3 among the cases and 11.6 among the controls which was comparable with our study, Natalia S Rose et al,[4] showed the values of 5.8±7.8 among the cases.

Our study showed 85% of the cases had elevated C reactive protein and 15 % of the controls had the elevated values which was comparable to the study done by Dhamaja R K et al,[3] which showed 77.3% of the cases had raised values and 12.54% of controls had elevated values, S C Mahapatra et al,[10]

The strong positive association supports the potential role of CRP as a prognostic marker in acute ischemic stroke, with increasing CRP levels reflecting more severe neurological impairment.

Summary

1. Our study showed that the C reactive protein was elevated in patients diagnosed with stroke when it was compared with the control group
2. Our study also showed that elevated C reactive protein was associated with the poor outcome in patients with acute ischemic stroke and is poor prognostic indicator.
3. Our study also showed that the mortality in the study group of patients who died with acute ischemic stroke in them all had elevated values of C reactive protein

CONCLUSION

CRP is a very useful marker to assess the severity of the disease and for prognosis of the disability in patients with acute ischemic stroke.

REFERENCES

1. Reddy A, Warad VGet all A Study of C - reactive protein in Acute Ischemic Stroke. Ann. Int. Med. Den. Res. 2020; 6(2):ME34-ME39.
2. Curb JD, Abbott RD et all .C-reactive protein and the future risk of thromboembolic stroke in healthy men. Circulation. 2003 Apr 22;107(15):2016-20
3. Agarwal MP, Singh NR, Kaur IR. C-Reactive Protein in acute cerebral infarction. JAPI. 2003 Dec;51.
4. Dhamija RK, Arora S et all . Study of genetic, metabolic and inflammatory risk factors in patients of acute ischemic stroke. Indian Journal of Clinical Biochemistry. 2008 Apr 1;23(2):136-43.
5. Rost NS, Wolf PA, Kase CS, et all .Plasma concentration of C-reactive protein and risk of ischemic stroke and transient ischemic attack: the Framingham study. Stroke. 2001 Nov 1;32(11):2575-9.
6. Kristensen B et al. Epidemiology and etiology of ischemic stroke in young adults aged 18-44 years in Northern Sweden. Stroke 1997; 28: 17021709
7. Tsong-Hai Lee et al. Etiologic study of young ischemic stroke in Taiwan. Stroke 2002; 33: 1950-1955
8. 7 Neeralagi S, Chandrashekar K, Pasha A, et al. C – Reactive Protein – A marker to predict the outcome of patients with acute ischemic stroke. J. Evid. Based Med. Healthc. 2019; 6(6), 357-360. DOI:10.18410/jebmh/2019/74
9. Bharosay A, Saxena K, Varma M, et al. Correlation between Proinflammatory serum markers: high sensitivity C-reactive protein, interleukin-6 with disability score in acute ischemic stroke. Indian J Clin Biochem 2011;26(3):279-282.
10. Mahapatra SC, Pillai PK, Hui PK, et al. C-reactive protein in thrombotic stroke. JAPI 2002;50:1512.
11. Rathore HS. Role of C-reactive protein estimation in early diagnosis of cortical and lacunar infarct. JAPI 2002;50:1516.
12. Shoaeb MA, Shehata M et al. CRP in cerebrovascular stroke: prognostic implications. The Egyptian Journal of Critical Care Medicine 2014;2(1):43-52.
13. Di Napoli M, Papa F. Inflammation, hemostatic markers and antithrombotic agents in relative to long-term risk of new cardiovascular events in first-over ischemic stroke patients. Stroke 2002;33(7):1763-