VOLUME - 12, ISSUE - 06, JUNE - 2023 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

A STUDY OF C - REACTIVE PROTEIN IN CEREBROVASCULAR STROKE -A HOSPITAL BASED CASES SERIES STUDY

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ABSTRACT

Introduction: CRP has been shown in numerous studies to be a predictor of cerebrovascular events. Hence, high CRP is a marker for future cerebrovascular events, but it is unknown when to evaluate CRP in connection to the beginning of the qualifying event. We evaluated CRP levels as an early prognostic, marker of functional outcome following cerebrovascular stroke in an effort to get further insight. **Materials and methods:** Fourty patients who presented with acute ischemic stroke were enrolled into the study. That the stroke was an ischemic one was confirmed by CT scan. As soon as the patients were admitted within 48 hours of onset of stroke, serum samples were taken for CRP estimation. Detailed history and serum samples were taken for CRP estimation within 48 hours of admission. Patients' Glasgow outcome scale (GOS) was reviewed on admission and at discharge and outcome was assessed in terms of GOS at discharge or death. The serum CRP level was correlated with the functional recovery of patients after 4 weeks using the GOS. **Results:** We found majority of our stroke patients were aged between 41 to 60 years, males and had hypertension.The mean CRP levels was 21.96 13.17 mg/L in survivors and 79.05 21.56 mg/L in non survivors. These values were found to be statistically significant as when student's t-test was applied ($p<0.05$) **Conclusion:** CRP upon discharge has a better correlation with subsequent outcomes and may be more useful for risk categorization.

KEYWORDS : C Reactive Protein, Stroke, Ischemic stroke, Prognostic marker.

INTRODUCTION:

One of the most prevalent and deadly disorders is cerebrovascular illness. The second most prevalent cause of mortality worldwide is a stroke. [1] It is one of the most prevalent neurologic diseases that can be fatal and devastating. Around 6.15 million fatalities worldwide occur each year as a result of cerebrovascular disease. According to several Indian research, the prevalence rate of stroke varies depending on the region and the time of study from 40 to 470/100000 people. In India, stroke is a significant cause of illness and mortality.[2]

Prior research has shown that inflammation is crucial to the pathogenesis of stroke. Systemic inflammatory processes have an impact on patients' prognosis and stroke susceptibility.[3] Long-term arterial inflammation, plaque rupture, thrombosis, and eventual brain ischemia or infarction are the causes of stroke development. Inflammation and the pathophysiology of atherothrombotic stroke are strongly linked, according to mounting research in recent years. In various disorders, including ischemic stroke, acute phase proteins have been shown to perform roles during both acute and chronic inflammatory processes.[4]Even low-grade infections can increase certain acute phase reactants, which in turn may contribute to the inflammatory process seen in atherosclerotic lesions and eventually lead to the development of ischemia symptoms.[5]

Atherothrombosis is largely influenced by inflammation, and various cardiovascular disorders have been researched with the measurement of inflammatory markers including C-Reactive Protein, an acute phase reactant that signals low-grade systemic inflammation.[6] The predictive significance of CRP in ischemic stroke is becoming more and more clear.[7] Also, it has been discovered that CRP is a potent but largely non-specific risk factor for fatal stroke in aged people.[8]

By inducing tissue factor, the start of the extrinsic pathway of coagulation, in monocytes, CRP, a sensitive metre of inflammation, causes vascular thrombosis.[9]It has been discovered that elevated CRP levels are associated with a greater chance of developing first-ever cardiovascular, cerebral, and peripheral vascular disorders.[10]

CRP has been shown in numerous studies to be a predictor of cerebrovascular events. Hence, high CRP is a marker for future cerebrovascular events, but it is unknown when to evaluate CRP in connection to the beginning of the qualifying event. In several researches, the functional outcome was not considered; only the association between CRP and mortality was examined. We evaluated CRP levels as an early prognostic, marker of functional outcome following cerebrovascular stroke in an effort to get further insight.

METHODOLOGY

After receiving approval from the institutional ethical committee, a hospital-based cross-sectional study was carried out. The study was carried out in the General medicine department at tertiary care centre. Sample size was calculated using Medcalc software at 95% confidence interval, 80% power of the study,the correlation co-efficient of serum CRP and NIHSS was 0.54 so, the calculated sample size was 38 and rounded to 40.

The study was conducted for 2 months. All patients who presented within 48 hours of onset of stroke and who gave informed consent to participate in the study were included. Patients aged more than 70 years;subarachnoid haemorrhage, subdural haemorrhage and intracerebral haemorrhage were excluded with the aid of CT scan. Patients with evidence of active infection and neoplastic conditions at the time of study were also excluded.

Fourty patients who presented with acute ischemic stroke were enrolled into the study. That the stroke was an ischemic one was confirmed by CT scan. As soon as the patients were admitted within 48 hours of onset of stroke, serum samples were taken for CRP estimation.

Detailed history and serum samples were taken for CRP estimation within 48 hours of admission. Standard guidelines for treatment of cerebrovascular stroke were followed. Patients' Glasgow outcome scale (GOS) was reviewed on admission and at discharge and outcome was assessed in terms of GOS at discharge or death. The serum CRP level was correlated with the functional recovery of patients after 4

weeks using the GOS. Patients with score of 4 and 5 were included in the good outcome and patients with score of 1, 2, 3 were included in the poor outcome category.

The Statistical Package for Social Sciences (SPSS), 21 version, was used to analyze the collected data. Student's t-tests for quantitative variables and χ^2 test for categorical variables were used to assess the associations. All significance tests used a 5% level of significance.

RESULTS

In this the study 40 patients were enrolled and were evaluated. The mean age of study participants was 60.32 years with SD 7.4 years. Table 1 shows the demographic and co-morbidities distribution in our study subjects. We found majority of our stroke patients were aged between 41 to 60 years, males and had hypertension.

Table 1: Demographic and co-morbidities distribution of study participants

		Frequency	Percentage
Age (Years)	20 to 40 years	3	7.5%
	41 to 60 years	21	52.5%
	61 to 80 years	14	35%
	>80 years	2	5%
Gender	Males	26	65%
	Females	14	35%
Co-morbidities	Hypertension	24	60%
	Diabetes	12	30%
	Dyslipidemia	6	15%
	Coronary artery disease	5	12.5%

Table 2 shows the demographic and co-morbidities comparison with CRP levels. We found that majority of males (73.1%) had high CRP (>3mg/L) compared to females (21.4%). There was statistically significant association between gender and CRP levels when chi-square test was applied ($p<0.05$)

Table 2: Comparison of characteristics and CRP in study subjects.

		High CRP (> 3.0 mg/L)	Low CRP (≤ 3.0 mg/L)	p value
Age (Years)	20 to 40 years	0	3 (16.7%)	0.119
	41 to 60 years	11 (50%)	10 (55.6%)	
	61 to 80 years	9 (40.9%)	5 (27.8%)	
	>80 years	2 (9.1%)	0	
Gender	Males	19 (86.4%)	7 (38.9%)	0.002
	Females	3 (13.6%)	11 (61.1%)	
Co-morbidities	Hypertension	14 (63.6%)	10 (55.6%)	0.604
	Diabetes	5 (22.7%)	7 (38.9%)	0.267
	Dyslipidemia	4 (18.2%)	2 (11.1%)	0.533
	Coronary artery disease	4 (18.2%)	1 (5.6%)	0.23

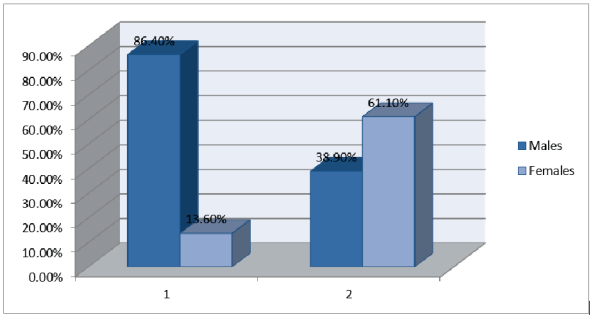

Figure 1: Bar graph showing association of gender and CRP in study subjects.

Table 3 shows the Glassgow outcome scale variables with CRP levels.GOS score of 4 or 5, is labelled favourable outcome, and GOS with 1, 2 or 3 was unfavourable outcome. We had majority of patients with high CRP (>3mg/L) had unfavourable outcome (90.9%) and none in low CRP group (≤ 3.0mg/L) and this was statistically significant when ch-square test was applied ($p<0.05$)

Table 3: Comparison of GOS and CRP in study subjects.

GOS group	High CRP (> 3.0mg/L)	Low CRP (≤ 3.0mg/L)	P value
Favourable	2 (9.1%)	18 (100%)	<0.001
Unfavourable	20 (90.9%)	0	
Total	22 (100%)	18 (100%)	-

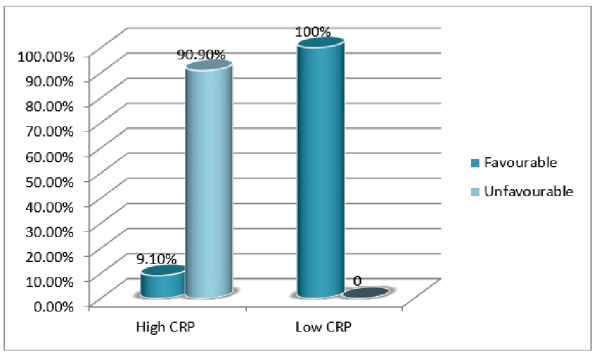

Figure 2:Bar graph showing association of GOS and CRP in study subjects

Table 4 shows that the mean CRP levels was 21.96 13.17 mg/L in survivors and 79.05 21.56 mg/L in non survivors. These values were found to be statistically significant as when student's t-test was applied ($p<0.05$)

Table 4: CRP comparison with survival of study subjects

Survival	Mean±S.D.	P value
Death	79.05±21.56	<0.001
Alive	21.96±13.17	

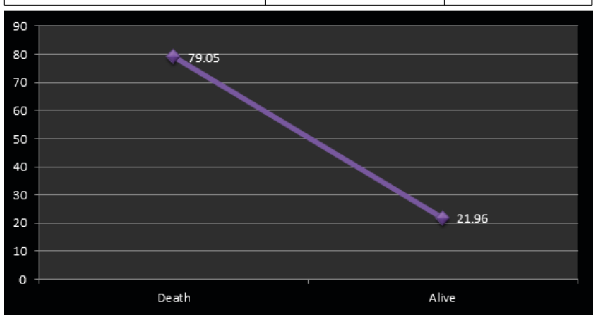

Figure 3: Line graph showing mean CRP in survival status of study subjects

DISCUSSION

One of the main causes of disability in both developed and developing nations is stroke. Usually, 6 hours after inflammation starts, the CRP rises. Atherosclerotic plaques are initiated, form, and burst due to inflammation. Several inflammatory mediators, including cytokines, free radicals, and proteases, are secreted as a result of the recruitment of immune cells like macrophages and T-cells into the atherosclerotic plaques. It ultimately encourages thrombosis and plaque rupture. Immune cells like neutrophils and macrophages are stimulated to mobilise and migrate into the brain in response to brain injury, whether it is ischemia or hemorrhagic. They cause a response of systemic inflammation. We set out to evaluate the early blood CRP level at admission as a biomarker for determining the severity of

stroke and the short-term prognosis for stroke patients. The patients who participated in the study had an average age of 60.32±7.4 years, with 87.5% of them falling between the ages of 40 and 80. Age is typically seen as a fixed or non-modifiable risk factor for stroke.[11] Studies by Dhamija RK et.al.[12], Mishra PT et al.[13], Chaudhuri JR et al.[14], Kumar S et al.[15],Rana D et al.[16]and Jayachandra et al.[17] produced similar results.

With 65% of cases being men and 35% being women, men predominated in the current study. Another established risk factor for stroke is male sex.[11] Studies conducted by Roquer J et.al.[18], Kumar Set al.[15], Rana D et al.[16], and According to Jayachandra et al.[17], men predominated.

In the current study, diabetes mellitus (30%) and hypertension (60%) were the two most prevalent comorbidities. This is consistent with earlier investigations done by Wakugawa Y et al.[19], Chaudhuri JR et al.[14] and Jayachandra et al.[17]Nevertheless, diabetes mellitus was the most prevalent comorbidity in the study carried out by Mishra PT et al.[13], followed by hypertension.

We discovered that lower GOS scores were linked to greater CRP levels. According to our research, greater CRP levels are linked to serious neurological deficits and consequently worse outcomes. Similar results were found by Mishra PT et.al.[13], Jayachandraet al.[17], Lal R et al.[20], and Rana DS et.al.[16]

CRP levels and outcomes in terms of death were associated in the current investigation. The mean CRP levels were 21.96±13.17 mg/L for survivors and 21.96±13.17 mg/L for non-survivors. The mean CRP levels of survivors and non-survivors varied significantly. Similar findings were found in the work of Jayachandraet al.[17]

According to a study by Huang Yet al.[21], patients with acute ischemic stroke who have elevated CRP levels are at an increased risk of dying from any cause within three months. Similar findings were found in a research by Kumar S et al.[15], which demonstrated a higher risk of morbidity and mortality in stroke patients with elevated CRP levels within 72 hours of the onset of stroke. In order to give statistically significant predictive information about the course of stroke, CRP can therefore be routinely evaluated in all stroke patients.

CONCLUSION

Stroke rates were notably higher in the male population of older patients (>50 years), those with diabetes, hypertension, and smokers. Those with hypertension and smokers both had elevated CRP levels. Individuals with aberrant TC, TG, LDL, and HDL had CRP levels that were noticeably high. CRP levels at admission are a key factor in deciding whether to continue with treatments. CRP upon discharge has a better correlation with subsequent outcomes and may be more useful for risk categorization.

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