ORIGINAL RESEARCH

A study of C-reactive protein in cerebrovascular accident (stroke) in a tertiary care hospital

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ABSTRACT
Background: Stroke is the top cause of death and one of the leading causes of long-term disability all over the world. hsCRP levels evaluated shortly after a stroke have been demonstrated in studies to predict complementary elements of outcome. There's a chance that high hsCRP levels are linked to the severity of cerebral tissue damage. We wanted to see how high hsCRP levels were in people who had a cerebrovascular accident. The goal was to see if there was a link between the level of hsCRP and the severity of the stroke and the outcome.
Material and Methods: Patients hospitalised to a tertiary care hospital's (Narayana Medical College Nellore) medical ward and medical ICU were studied. It was a cross-sectional investigation. The study involved a total of 100 patients who had a stroke and met the study's inclusion and exclusion criteria. hsCRP levels were tested in all patients within 48 hours of admission. Data was entered into a Microsoft Excel database prospectively.
Results: The average age of the patients in the study was 59.12 years. Eighty-eight percent of the patients were between the ages of 40 and 80. Also, values were found to be higher in haemorrhagic stroke (value) than ischemic stroke (value), with a significant difference. In both types of stroke, there was a significant association between hsCRP levels and GCS, with lower GCS scores linked with greater hsCRP levels.
Conclusion: We concluded that hsCRP levels are elevated in both ischemic and hemorrhagic strokes, implying an inflammatory response in acute stroke. Increased hsCRP levels were linked to the degree of the neurological impairment and a worse prognosis.
Keywords: hsCRP, Ischemic Stroke, Haemorrhagic Stroke, Prognostic Marker in Stroke

INTRODUCTION
Stroke is a leading cause of physical, psychological, and mental illness. Stroke has a higher overall illness burden in developing countries, and stroke accounts for a higher proportion of total mortality in low- and middle-income countries. Less developed countries account for two-thirds of all stroke deaths. [1] While stroke is becoming less common in high-income

countries, it is becoming more common in low-income countries. [2] In both high and low income nations, the overall rate of stroke-related mortality is down, but the absolute number of individuals who have had a stroke, stroke survivors, stroke-related fatalities, and the worldwide burden of stroke-related disability is high and rising. [3].

Ischemic stroke accounts for 68 percent of all strokes worldwide, while hemorrhagic stroke accounts for 32 percent. [4] Men are more likely than women to develop the disease. [5,6] Stroke is more prevalent in the elderly, although it can strike anyone at any age. [6]

In India, the stroke prevalence rate is at 1.54 per thousand people, while the death rate is around 0.6 per 1000. The DALYs (disability-adjusted life years) lost per lac are around 597.6. [7] In India, total stroke cases were around 9.30 million in 2004, with about 0.63 million deaths, and total DALYs lost were around 6.36 million. [8].

High blood pressure, cigarette or beedi smoking, a larger abdomen-to-hip ratio, diet, and alcohol consumption are all risk factors for haemorrhagic stroke. [9] Physical inactivity, excessive glucose levels, alcohol, stress from psychological difficulties, cardiovascular causes, and the ratio of apolipoproteins B to A1 are all associated with an increased risk of ischemic stroke. [10]

"Inflammation" has a critical part in the development of atherosclerosis and ischemic events. [11-13] Fibrinogen and hs-CRP, both inflammatory markers, are expected to be sensitive indicators of stroke severity and outcome. Hepatocytes produce [14,15] hs-CRP as an acute phase reactant after tissue injury or infection. Pro-inflammatory mediators such as IL-1, IL-6, TNF, and others regulate [16] hs-CRP expression at the transcription level, with IL6 playing a key role. [13]

With this background in mind, the authors set out to investigate the significance of high-sensitivity CRP (hs-CRP) in stroke patients as a risk and predictive factor in a suburban Indian population attending the hospital.[17]

MATERIAL AND METHODS

This was a descriptive analytical study of 100 patients admitted to a tertiary care hospital's medical ward and medical ICU of Narayana Medical College, Nellore. The research took place over the course of a year, from January 2021 to January 2022. The Narayana Hospital's institutional ethics committee gave their approval. After IEC clearance and informed consent patients with both ischemic and hemorrhagic stroke admitted to the hospital within 72 hours of onset of stroke were included in the study. Patients with TIA, recurrent stroke, or symptoms of active infection such as fever, cough, or burning micturition at the time of admission, as well as those with rheumatological diseases and immunosuppressive medication, were excluded from the trial. Within 48 hours of admission, a detailed history and serum samples were collected for hsCRP determination. Standard guidelines for treatment of ischemic and hemorrhagic stroke were followed. On admission and discharge, patients' GCS scores were evaluated, and the outcome was measured in terms of GCS score at discharge or death. Beckman Coulter's fully automated Latex Agglutination was used to measure hsCRP.

STATISTICAL ANALYSIS

ANOVA and the Mann Whitney test were the statistical tests employed in the investigation. The significance of the difference in hsCRP levels in ischemic vs hemorrhagic stroke was determined using a nonparametric ANOVA (Kruskal Wallis test).

RESULTS

A total of 100 subjects who fulfilled inclusion criteria were included in the study. Mean age of patients enrolled in the study was 59 ±12 years. 88% of the patients were between the ages

40-80 years (Table 1). In the current study, 66 patients were males and 34 subjects were females. Male to female ratio was 1.5:1. Addiction pattern was studied which showed that the most common addiction was tobacco chewing. 60% of patients had no addiction. (Table 2) Hypertension was the most prevalent comorbid condition with 68% of the study subjects having hypertension. The other comorbidities in their order of prevalence were diabetes (22%), ischemic heart disease (10%) and CKD (2%). Ischemic stroke was present in 59.33% of the patients, 36% of the patients had hemorrhagic stroke and 4.67% patients had both ischemic and hemorrhagic stroke.

Average hsCRP level in the current study was 45.12±38.07 mg/L with a median hsCRP value of 30.87 mg/L. The mean hsCRP levels in ischemic stroke patients was 31.68±31.79 mg/L. and the mean hsCRP levels in patients with hemorrhagic stroke was 62.82±27.42 mg/L. The mean hsCRP levels in haemorrhagic stroke was more than that in ischemic stroke and the difference was found to be statistically significant ($p<0.0001$) as shown in table 3.

It was also seen that patients with low GCS scores had higher hsCRP levels and the difference between hsCRP levels in patients with GCS <8 and patients with GCS >8 was statistically significant ($p<0.01$) as shown in table 4.

Mean hsCRP levels were 21.83±23.17 mg/L in survivors and 82.07±25.83 mg/L in non survivors. These values were found to be statistically significant as shown in table 5.

Table 1: Age distribution of subjects

Age (Years)	No. of Patients	Percentage
20-40	7	7
41-60	50	50
61-80	38	38
>80	5	5
Age, Mean±SD	59 ±12	

Table 2: Addiction pattern in study subjects

Addiction	No. of Patients	Percentage
None	60	60
Smoking	8	8
Alcohol	15	15
Tobacco Chewing	17	17

Table 3: hsCRP levels

HsCRP (mg/L)	No. of Patients	Percentage
≤ 3	6	6
>3 -10	14	14

>10-40	36	36
>40	44	44
Mean±SD	45.12±38.07	
Median	30.87 (0.2 to 163)	
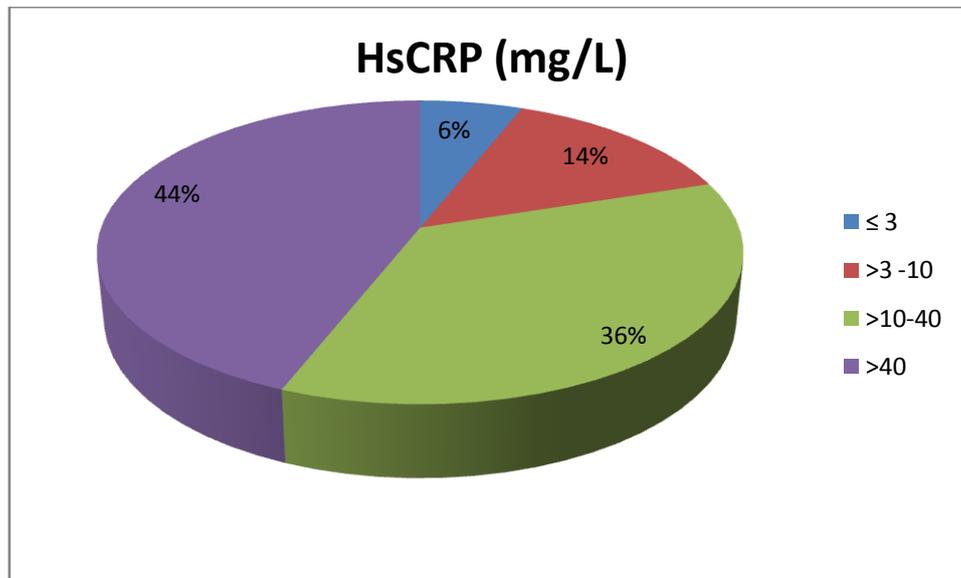
Graph 1: hsCRP levels

Table 4: Correlation between hsCRP and GCS

GCS	Average HsCRP	p value
<8	80.94±27.02	<0.0001 Mann-Whitney T
≥8	21.90±23.29	

Table 5: hsCRP Levels among Survivors and Non Survivors

Variables	HsCRP (mg/L)	p value
Survivor (62)	21.83±23.17	<0.0001 Mann-Whitney T
Non survivor (38)	82.07±25.83	

DISCUSSION

The current study involved 100 IPD patients who had been diagnosed with stroke and was conducted at a tertiary care facility. The current study looked at the relationship between hsCRP levels evaluated within 48 hours of admission and neurologic outcome in terms of discharge or death. The average age of the study participants was 59.12 years, with 88 percent of them being between the ages of 40 and 80. Age is often regarded as a fixed or non-modifiable risk factor for stroke. [18] Pinky Talreja Mishra et al. [19] and Jaydip Ray Chaudhuri et al [20] found similar results in their research.

There was a male preponderance in the current study, with 66 percent of cases being male and 34 percent being female. In this study, the male to female ratio was 1.5:1. Male sex is also considered as a fixed risk factor for stroke. [18] Sujit Kumar et al[21] and Davinder Singh Rana et al[22] also conducted research with a male preponderance and found similar results.

Tobacco (chewing and smoking) was the most common addiction among the patients in our study. Findings from research undertaken by Davinder Singh Rana et al[22] and Jaydip Rai Chaudhuri et al[23] support this. [20] In the current study, the average hsCRP level in the study population was 45.12±38.07 mg/L. This indicates that when a person has a stroke, their hsCRP levels rise.

The levels of hsCRP were found to be linked to death outcomes in the current investigation. The mean hsCRP levels in survivors were 21.8323.17 mg/L, while they were 82.0725.83 mg/L in non-survivors. There was a significant difference in mean hsCRP levels between survivors and non-survivors. The hsCRP level and death had a 0.75 coefficient of connection, which was statistically significant ($p<0.01$). As a result, greater hsCRP levels are linked to a higher risk of death. Similar findings were found by Jayachandra et al.[23] The hsCRP levels of patients who died were higher than those who survived both types of strokes. As a result, there was a link between high hsCRP levels and death. Sujit Kumar et al. found similar results in a research, finding an increased risk of morbidity and mortality in cases with elevated hsCRP levels within 72 hours of stroke. The value of hsCRP in prognosis may be related to the degree of necrosis in the brain parenchyma and partly unknown causes of acute phase reactant intensity. The predictive significance of hsCRP in terms of neurological deficits and fatalities as stroke outcomes allows clinicians to give families of stroke victims realistic expectations. As a result, hsCRP can be evaluated routinely in all stroke patients to provide statistically meaningful prognostic information about the prognosis of the stroke.

CONCLUSION

Acute cerebrovascular accident resulted in an increase in hsCRP levels. In haemorrhagic stroke, the rise in hsCRP was greater than in ischemic stroke. Patients with severe neurological deficits and a GCS score of <8 had considerably higher hsCRP levels. Patients having a higher hsCRP level had a worse prognosis than those with a lower hsCRP level. As a result, the amount of hsCRP can be employed as a predictive marker for stroke patients.

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