

# A STUDY OF HIGH SENSITIVE-C REACTIVE PROTEIN IN ACUTE ISCHEMIC AND HEMORRHAGIC STROKE PATIENTS

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## ABSTRACT

**Aim:** The aim of the present study was to assess levels of High Sensitivity C-reactive Protein in patients with Acute Ischemic and Hemorrhagic Stroke.

**Methods:** The present descriptive Prospective Observational Study was conducted on 100 CT/MRI confirmed cases of Stroke admitted in Medicine Dr. DY Patil Medical College Hospital and Research Centre, Pimpri, Pune during the period from October 2020 to September 2022.

**Results:** The Mean Age group of study participants was  $61.74 \pm 11.28$  with 5% in 18-40 years, 6% in 41-50, 31% in 51-60, 41% in 61-70, 15% in 71-80 and 2% were above 80. There were 32% were females and 68% males. In our study 33 patients had right side hemiparesis and 6 patients on right side had hemiplegia, 47 patients had left side hemiparesis, 12 patients had hemiplegia 2 had monoparesis. There were 10% cases had cranial nerve involvement in our study. In Hemorrhagic Pattern of Stroke there were 92% hypertensives and in Non-Hemorrhagic Ischemic type 77%. There are 84.6% of diabetics in hemorrhagic subjects and 67.5% in ischemic subjects. The data showed 22% patients had Hs-CRP levels  $<10$  and 78% had CRP levels  $>10$ .

**Conclusion:** Our Study showed that HS-CRP are elevated and can be considered as independent risk factors of Stroke.

**Keywords:** stroke, high sensitivity, CRP

## INTRODUCTION

Infections and inflammation play a vital role in the pathophysiology of atherosclerosis.<sup>1,2</sup> High sensitive C-reactive protein (hsCRP) is a sensitive marker of inflammation and tissue injury in the arterial wall.<sup>3,4</sup> CRP is a glycoprotein produced by the liver and plays a vital role in the development of atherosclerotic disease in cardiac and cerebral circulation.<sup>5,6</sup>

Stroke is the leading cause of death worldwide and one of the main causes of long term disability. According to WHO, 15 million people suffer from stroke each year. About 87% of the strokes are due to ischemia. There has been evidence about inflammatory processes involved in cerebral ischemia.<sup>7-9</sup> Each year more than 5 million people die as a consequence of stroke and at least 1 in 6 patients who survive will suffer another stroke in the next 5 years.<sup>10</sup> Stroke is defined as sudden onset loss of global or focal cerebral function persisting for more than 24 hours.<sup>11</sup> Stroke is defined as an abrupt onset of neurological deficit that is attributable to a focal vascular cause. Thus, the definition of stroke is clinical and laboratory and imaging studies are used to support the diagnosis. When the blood flow is quickly restored, the brain tissue can recover fully and the patient's symptoms are only transient: this is called a transient ischemic attack (TIA). Inflammation has an important role in development of atherosclerosis and during ischemic event. Inflammatory markers such as hsCRP have been reported as predictable marker for stroke severity and outcome.<sup>12</sup> C- Reactive Protein is a annular pentameric protein found in plasma whose circulating concentrations rise in response to inflammation. It is an acute phase protein of hepatic origin that increases following interleukin – 6 secretion by macrophages & T cells. CRP is synthesised in the liver<sup>13</sup> in response to factors released by macrophages and adipocytes.<sup>14</sup> HsCRP is an acute phase reactant produced by liver under the control of interleukin-6. A growing body of evidence supports the concept that local & systemic inflammation plays a role in initiation & progression of atherosclerosis & it's complications. Acute stroke develops as a result of sudden interruption of focal cerebral blood flow. The cause of stroke is embolic or thrombotic occlusion in 70-80% of the patients with severe symptoms.<sup>15</sup> Intracerebral haemorrhage causes about 10% of acute stroke but is more common in low income countries.<sup>16</sup> Increased CRP levels are accepted as a sensitive but not specific marker of acute inflammatory response. Increased risk of death in stroke is linked with elevated levels of CRP within 72 hours of stroke.

The high-sensitivity C-reactive protein, also known as hs-CRP, is a type of acute-phase reactant that is gaining popularity as a potential new marker for coronary artery disease and other conditions associated with the cardiovascular system. According to the inflammation theory of atherosclerosis, CRP is not only a marker of inflammation, but it also has a nature that is proinflammatory, proatherosclerotic, and prothrombotic.<sup>17</sup>

The aim of the present study was to assess levels of High Sensitivity C-reactive protein in patients with Acute Ischemic and Hemorrhagic Stroke.

## **MATERIALS AND METHODS**

The present descriptive Prospective Observational Study was conducted on 100 CT/ MRI confirmed cases of Stroke admitted in Medicine Dr. DY Patil Medical College Hospital and Research Centre, Pimpri, Pune during the period from October 2020 to September 2022.

### **Inclusion criteria**

- 1) All patients who presented with onset of stroke and who gave informed consent to participate in the study were included.
- 2) Any patient above 18 years diagnosed as acute stroke on CT/MRI/Clinical findings

### **Exclusion criteria**

1. Age less than 18 years
2. Patients with previous history of stroke
3. Patients with past history of previously diagnosed with congenital heart disease, valvular heart disease.
4. Patients with any active infection
5. Patients who do not give consent to the study

### **METHODOLOGY:-**

The study was conducted after taking permission from institutional ethics committee. Patients with a diagnosis of stroke clinically and confirmed by CT or MRI scan for evidence stroke were taken up for the study. The detailed history and physical examination was done on every patient as per the proforma.

### **Investigations:-**

Each Patient was evaluated with

- HS-CRP
- COMPLETE BLOOD COUNT
- CT/MRI BRAIN
- ECG
- CAROTID ARTERY DOPPLER
- LIPID PROFILE

### **HS-CRP Evaluation**

- A Sample was taken within 24 hours of admission for evaluation
- Specimen: Serum or EDTA plasma. Volume: 0.5 – 1.0 ml.
- Method: Nephelometric method
- Instrument: ACL TOP CTS 300

Assessing Functional Outcome:- On the Seventh day patient was assessed for functional outcome using Glasgow Outcome Scale

### **SCORE DESCRIPTION**

1. Death
2. Vegetative State
3. Severe Disability-Patient depends upon others to carry out routine activities.

4. Moderate Disability – Patient carries out routine activities on his own but various degrees of dysphasia, hemiparesis, ataxia as well as cognitive and memory impairments are present.

5. Good Recovery Patient can carry out routine activities with minor deficits<sup>123</sup>

**Statistical Analysis:** All of the collected information was input into a spreadsheet (Microsoft Excel 2010) and then transferred to the data editor in SPSS 20. (SPSS Inc., Chicago, Illinois, USA). Percentages, averages, and standard deviations were all computed as part of the descriptive statistics. The study made use of an independent samples t-test, Chi Square for statistical significance. Specifically, the CI and p-value were established at 95% and 5%, respectively.

## RESULTS

Table 1: Patient characteristics

Age	Frequency	Percentage
18-30	3	3
31-40	2	2
41-50	6	6
51-60	31	31
61-70	41	41
71-80	15	15
>80	2	2
<b>Gender</b>		
Female	32	32%
Male	68	68%
<b>Motor symptoms</b>	<b>Right (n=39)</b>	<b>Left (n=61)</b>
Hemiparesis	31	47
Hemiplegia	8	12
Monoparesis	0	2
<b>Cranial nerve involvement</b>		
Present	10	10

Absent	90	90
<b>Other symptoms</b>		
Headache	16	46%
Vomiting	11	31%
Seizure	8	23%
<b>Hs-CRP level</b>		
<10	22	22
>10	78	78

The Mean Age group of study participants was  $61.74 \pm 11.28$  with 5% in 18-40 years, 6% in 41-50, 31% in 51-60, 41% in 61-70, 15% in 71-80 and 2% were above 80. There were 32% were females and 68% males. In our study 33 patients had right side hemiparesis and 6 patients on right side had hemiplegia, 47 patients had left side hemiparesis, 12 patients had hemiplegia 2 had monoparesis. There were 10% cases had cranial nerve involvement in our study. The most common symptom was headache followed by vomiting and seizures. Seizure was seen in 8 cases out of which 5 were hemorrhagic and 3 were ischemic infarct. The data showed 22% patients had Hs-CRP levels <10 and 78% had CRP levels >10.

Table 2: Distribution Of Hypertensives and diabetes according to Type of Stroke

	<b>Non-hypertensive</b>	<b>Hypertensive</b>
Hemorrhagic	8%	92%
Non-Hemorrhagic (Ischemic )	23%	77%
	<b>Non- Diabetic</b>	<b>Diabetic</b>
Hemorrhagic	15.40%	84.60%
Ischemic	32.50%	67.50%

In Hemorrhagic Pattern of Stroke there were 92% hypertensives and in Non-Hemorrhagic Ischemic type 77%. There are 84.6% of diabetics in hemorrhagic subjects and 67.5% in ischemic subjects.

Table 3: Distribution of Hs-CRP values between hemorrhagic pattern of stroke among the study participants

	COUNT	Hemorrhagic	Non-Hemorrhagic (Ischemic)
Hs-CRP LESS THAN 10	22	2	20
Hs-CRP MORE THAN 10	78	24	54

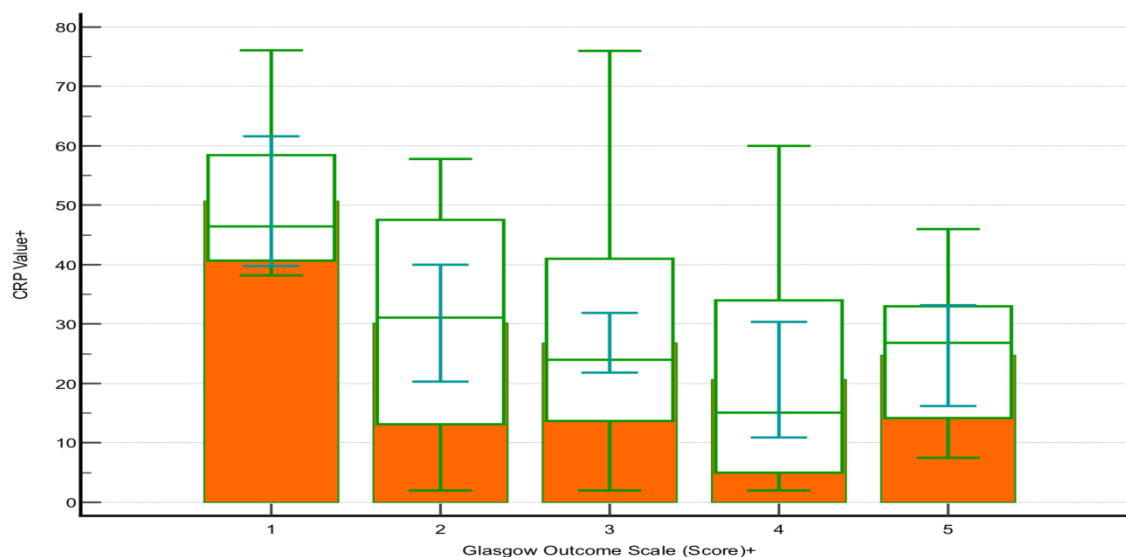
In Hemorrhagic Stroke the data showed only 2 patients had Hs-CRP less than 10 whereas 20 patients had HS-CRP more than 10. In Ischemic patients, 24 patients had HS-CRP of less than 10, and 54 patients had a HS-CRP of more than 10.

Table 4: Distribution of Glasgow coma scale between the hemorrhagic pattern of stroke among the study participants

	Hemorrhagic	Non-Hemorrhagic (Ischemic )
1	12%	7%
2	19%	16%
3	42%	51%
4	15%	16%
5	12%	10%

Among hemorrhagic Glasgow outcome scale of 1 were 12%, 19% with 2, 42% with scale 3, 15% with scale of 4 and 12% with scale of 5. Among Ischemic Infarcts the Glasgow outcome scale of 1 were 7%, 16% with 2 51% with scale 3, 16% with scale of the 4 and 9% with scale of 5.

Graph 1: Summary of hS-HS-CRP with Each Scale on the Glasgow Coma Scale



A one-way ANOVA was performed to study the relationship between Glasgow outcome scale and HS-CRP. A one-way ANOVA revealed that there was a statistically significance between Glasgow Outcome Scale and HS-CRP ( $F(4, 95) = [4.422], p = 0.003$ ).

## DISCUSSION

Stroke is a leading cause of disability and mortality around the world, with devastating emotional and socioeconomic consequences for patients, their families, and the health-care system. High-sensitive C-reactive protein (hsCRP) is a sensitive measure of artery wall inflammation and tissue injury. CRP is a glycoprotein produced by the liver that plays an important role in the development of atherosclerotic disease in the heart and cerebral circulation.

With 68% of cases being men and 32% being women, men predominated in the current study. . A fixed risk factor for stroke is also thought to be male sex. In studies conducted by Sujit Kumar et al, and Davinder Singh Rana included males and similar results were obtained.<sup>18,19</sup>

In the current study, the most prevalent comorbidities were diabetes mellitus (72%), followed by hypertension (81%). This is consistent with other studies carried out by Jayachandra et al.<sup>20</sup> and Jaydip Rai Chaudhuri et al.<sup>21</sup> Our study showed an association with cases who had a higher CRP and significantly lesser HDL level with a p-value being significant of  $p=0.001$ , showing that lower levels of HDL was associated with an elevated risk of the stroke which was in accordance to the studies done by Samantha A Reina MS et al.<sup>22</sup>

Out of the 100 cases enrolled in the study, 78 cases (78%) had CRP values  $> 10.0$  mg/L and 22 cases (22%) had CRP  $< 10.0$  mg/L. The mean hsCRP value in patients with Ischemic stroke was  $26.32 \pm 18.04$  mg/L and in Hemorrhagic Stroke was  $32.30 \pm 16.91$ . The hsCRP levels were higher in patients with hemorrhagic stroke than in patients with non-hemorrhagic stroke. These results parallel those of Jayachandra et al.<sup>20</sup>

The One way ANOVA between hs-CRP and GOS was significant statistically ( $p < 0.003$ ). Consequently, greater hs CRP levels were related to lower GOS scores. Patients with a GOS of 3 or above had a mean hs CRP concentration of  $26.83 \pm 17.54$  mg/L which was significantly lower than patients with GCS  $< 3$  who had mean hs CRP level of  $50.68 \pm 13.08$  mg/L. This shows that elevated hs CRP levels are linked with significant neurological impairment and, therefore, worse outcomes.<sup>23</sup> Studies by Tahir Yoldas et al<sup>24</sup> Levels of high-sensitivity C-reactive protein measured on the second day after an ischemic stroke were highly related with a poor prognosis in the near term.

## CONCLUSION

The aim of the present study was to analyze the role of Hs-CRP in patients with Acute Ischemic and Hemorrhagic Stroke. Our Study showed that HS-CRP are elevated and can be considered as independent risk factors of Stroke.

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