

## Original Research Article

# Study of C-reactive protein in patients with acute myocardial infarction attending tertiary care teaching hospital in Saurashtra region of Gujarat, India

Shripad R. Kausadikar<sup>1\*</sup>, Hina A. Mehra<sup>2</sup>, Krishnakant P. Pathak<sup>3</sup>

<sup>1</sup>Department of General Medicine, IIMSR Medical College, Badnapur, Jalna, Maharashtra, India

<sup>2</sup>Department of General Medicine, Medical College Baroda, Vadodara, Gujarat, India

<sup>3</sup>Department of General Medicine, Shri M. P. Shah Medical College, Jamnagar, Gujarat, India

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### \*Correspondence:

Dr. Shripad R. Kausadikar,

E-mail: [drsrk001@gmail.com](mailto:drsrk001@gmail.com)

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## ABSTRACT

**Background:** Acute Myocardial Infarction is a major contributor to morbidity and mortality globally. A growing body of evidence supports the concept of local and systemic inflammation playing a critical pathophysiologic role in progression of atherothrombosis and occurrence of infarction. Objectives of the study were to assess the role of serum C-reactive protein (CRP) levels in patients with first acute myocardial infarction attending tertiary care teaching hospital.

**Methods:** A cross sectional study was carried out from October 2009 to September 2010 in tertiary care teaching institute in Saurashtra region, Gujarat, India. A total of 50 patients admitted to intensive cardiac care unit with a diagnosis of acute myocardial infarction were enrolled. Serum CRP levels were sent at 6 hrs to 36 hrs of chest pain. Patients were assessed for early complications as well as left ventricular function on Echocardiography. Results were analysed using appropriate statistical methods.

**Results:** In this study, the mean age of presentation of acute myocardial infarction was 52.7 years which is a decade younger than in previous studies. CRP levels were found to be elevated in 79.4% of patients with anterior wall myocardial infarction. Raised CRP levels were associated with greater incidence of (50%) early complications after acute myocardial infarction. Raised CRP levels were also associated with a LVEF<40% in 32.5% cases implying a poorer prognosis.

**Conclusions:** Present study concluded that raised CRP levels correlated with poorer prognosis in acute myocardial infarction. And can be used as a simple tool for prognostic stratification in acute myocardial infarction.

**Keywords:** Acute myocardial infarction, CRP, Tertiary care teaching hospital

## INTRODUCTION

Cardiovascular disease is the commonest cause of death globally. Coronary artery disease (CAD) prevalence has been increasing in rural India as well as in urban India. Acute myocardial infarction (AMI) is overwhelmingly the most important form of ischemic heart disease which

continues to be the leading cause of death in the industrialized as well as developing countries like India, despite there being spectacular progress in their prevention, detection and treatment over last three decades. AMI has rapidly emerged as the major contributor towards the increasing morbidity and mortality.<sup>1</sup> About one-third of the patients with evolving

myocardial infarction die before they reach the hospital to receive any effective treatment. Thus, myocardial infarction remains an important health problem and merits continued attention from basic and clinical researchers, epidemiologists and practising physicians.<sup>2</sup>

C-reactive protein is a classical acute phase reactant, derived from liver, the serum level of which has long been known to increase after myocardial infarction.<sup>3</sup> C-reactive protein levels partially reflect the extent of myocardial necrosis and can be used to predict in-hospital and long term outcomes in patients with AMI. Elevated plasma C-reactive protein levels in patients with acute coronary syndromes on admission may indicate a state of persistent inflammation with poor short term prognosis.<sup>4</sup>

Elevated C-reactive protein levels after AMI are associated with adverse clinical outcomes including cardiac rupture, left ventricular remodelling and sudden cardiac death. Experimental studies have indicated that C-reactive protein per se has various biological actions including proinflammatory and proapoptotic effects suggesting a pathogenetic role of C-reactive protein in the post-MI remodelling process. C-reactive protein has a higher specificity, positive predictive value and overall relative risk for prediction of an outcome than ST segment depression, although is less sensitive.<sup>5,6</sup>

Due to the irreversibility of most acute cardiac events there is always an interest in searching for simple tools to single out patients with poor prognosis, so that timely revascularization is planned or they are put on intensive conservative regimes. Hence the present study was designed to evaluate the serum concentration of C-reactive protein in AMI.

## METHODS

A cross sectional study was carried out on a group of 50 patients admitted in the intensive coronary care unit (ICCU) of the medicine department of the Guru Gobind Singh hospital, Jamnagar, Saurashtra region, Gujarat, India during the period from October 2009 to September 2010. A detailed history, physical examination and routine investigations including CRP levels between 6 to 36 hours of onset of chest pain were done as per the proforma.

### *Inclusion criteria*

- Adult patients of either sex were included in the study
- Patients with typical chest pain, i.e. retrosternal pain or precordial discomfort described by the patient as aching, burning, squeezing or a feeling of heaviness with or without radiation anteriorly or to the left arm lasting more than 30 minutes
- Patients having acute anterior, inferior, posterior or right ventricular wall myocardial infarction diagnosed based on the following criteria:

- a. ECG showing significant ST elevation which implies more than 2 mm in chest leads or more than 1mm in limb leads
- b. ECG showing ST segment depression with or without T wave inversion with raised cardiac enzymes.

### *Exclusion criteria*

- Patients with fully evolved or Q wave myocardial infarction, previous MI
- History of any recent infection, for example, URI, UTI, sepsis etc
- Known or suspected neoplastic disease
- Recent (less than 3 months) major trauma
- Recent surgery
- Burns
- Immunologic disorders
- Inflammatory disorders eg. Rheumatoid arthritis, osteoarthritis.

Samples of venous blood (2cc) were drawn from the antecubital vein of the above selected patients in plain vacuettes and CRP levels estimated quantitatively using latex turbidimetry (CRP-Turbilatex).

### *Reference values*

Normal values are upto 6 mg/L; Values greater than 6 mg/L are considered elevated.

The samples for measuring CRP levels were drawn from 6 to 36 hours from the onset of chest pain in the patient. This was done keeping in mind that CRP levels start rising after 6 hours of an acute myocardial infarction and peak at 48 hours. The cut-off value was upto 6 mg/L. The CRP levels thus obtained were then correlated with the presenting features and type of the acute myocardial infarction. The patients were in the meantime treated for the same and observed for the development of any complications which included - cardiac failure; cardiogenic shock; arrhythmias; post infarct angina; 2D echocardiography was performed before discharge stating wall motion abnormalities, LVEF.

## RESULTS

The Table 1 shows that the maximum incidence of myocardial infarction was in the age group of 51-60 years which was 36% followed by the age group 61-70 years, i.e., 24%. The lowest incidence was observed in the age group of 18-30 years i.e. of 4%.

There was a predominance of males with myocardial infarction. The incidence of males was 80% whereas that of females was 20%. The Table 2 shows that the maximum number, i.e., 29.4% of the patients with elevated CRP levels fall in the age group of 51-60 yrs. However, the difference in age groups is not marked but

fairly evenly distributed. There are 72.5% of male patients with myocardial infarction had raised CRP levels. In females the incidence of raised CRP levels was 50%.

**Table 1: Age and gender wise distribution of MI patients.**

Particulars	No. of patients (n = 50)	Percentage
<b>Age (in years)</b>		
18-30	02	04
31-40	08	16
41-50	10	20
51-60	18	36
61-70	12	24
<b>Gender</b>		
Male	40	80
Female	10	20

The Table 3 shows that correlates the duration of chest pain, i.e., the time interval during which chest pain (cardinal symptom) lasted in the patients having acute myocardial infarction. It is evident from above that the

maximum rise of CRP levels took place when the chest pain lasted for more than 6 hours, being 90% of the times raised between 6-12 hours and 100% of the times when the pain lasted for more than 12 hours. The p value was found to be <0.05 which is statistically significant.

**Table 2: Age and gender wise distribution of CRP levels in AMI patients.**

Particulars	C-reactive protein		Percentage
	Positive	Negative	
<b>Age (in years)</b>			
18-30	01	01	2.9
31-40	07	00	20.5
41-50	08	03	23.5
51-60	10	07	29.4
61-70	08	05	23.5
<b>Total</b>	<b>34</b>	<b>16</b>	<b>100</b>
<b>Gender</b>			
Male	29	11	72.5
Female	05	05	50.0
<b>Total</b>	<b>34</b>	<b>16</b>	

**Table 3: Correlation of duration of chest pain with CRP levels.**

Duration	CRP Levels		Percentage	p-value
	Positive	Negative		
<3 hours	10	12	45.5	P<0.05
3-6 hours	12	03	80	
6-12 hours	10	01	90.1	
>12 hours	02	00	100	
<b>Total</b>	<b>34</b>	<b>16</b>	<b>50</b>	

**Table 4: Correlation of CRP levels with the type of wall involvement in AMI.**

Wall involvement	C-reactive protein		Percentage	p-value
	Positive	Negative		
Anterior wall	27	05	79.4	P<0.05
Non-anterior wall	07	11	31.3	
<b>Total</b>	<b>34</b>	<b>16</b>		

**Table 5: Correlation of CRP levels with complications of AMI.**

Complications	C- reactive protein		Percentage	p-value
	Positive	Negative		
Present	17	03	50	P<0.05
Absent	17	13	18.75	
<b>Total</b>	<b>34</b>	<b>16</b>		

The Table 4 shows the correlation of CRP levels with the type of wall involvement in patients with acute myocardial infarction. Out of 34 patients with raised CRP levels, 27 of them had suffered from anterior wall infarction (79.4%) whereas only 5 patients out of the 16

patients with negative CRP levels (31.3%) had an anterior wall infarction. The p value was found to be <0.05 which is statistically significant. This shows that patients with an anterior wall MI are more likely to have raised CRP levels and vice versa. The Table 5 shows that

the incidence of complications of acute myocardial infarction is more in patients with elevated levels of CRP, i.e. i. e. out of 34 (not 17) patients with raised CRP 17 suffered from complications. Out of 16 patients with negative CRP levels only 3 suffered from complications (18.75%). The p value was found to be <0.05 which is statistically significant. This shows that a higher chance of complications were present when CRP levels are elevated on admission. The Table 6 shows that a higher

number, 11 out of 34 (32.35%), of patients with elevated CRP levels have an ejection fraction of <40% on echocardiography. This is opposed to only 1 out of the 15 patients with negative CRP values (6.25%) that have an ejection fraction of <40% on echocardiography. The p value was found to be <0.05 which is significant. As an ejection fraction of <40% positively correlates with a poor left ventricular function, it shows that a higher CRP value carries a poor prognosis.

**Table 6: Correlation of CRP levels with LV ejection fraction on echocardiography.**

Ejection fraction	C-reactive protein		Percentage	p-value
	Positive	Negative		
EF <40%	11	1	32.35	P<0.05
EF >40%	23	15	6.25	
<b>Total</b>	<b>34</b>	<b>16</b>		

## DISCUSSION

In present study, 36% patients were in the age group 51-60 age groups, similarly studies done by Enas A et al and Vyas C et al also found that 52% and 31% patients were in 51-60 years age group.<sup>7,8</sup> Another study done by Anazai T et al revealed that 41% patients in the 61-70 years age group.<sup>9</sup> The incidence of AMI was found to be about a decade younger than in previous studies. This implies the impact of changing lifestyle on the incidence of myocardial infarction. It could also be due to a small sample size.

In our study, 80% patients were male whereas in studies done by Enas A et al, Vyas C et al and Kumar A et al found that 67%, 82% and 71% patients were males respectively.<sup>7,8,10</sup> Myocardial infarction shows a male preponderance as compared to females. This could be due to a stressful lifestyle and a greater dependence on harmful substances, for example, smoking, tobacco chewing etc. in males. Also, there is a protective influence of the hormone estrogen in the premenopausal females which serves as a cholesterol clearing factor.

In our study, 90% of the patients having chest pain for 6 to 12 hours had raised CRP levels, whereas in Mohan V et al study revealed that 84% of patients with similar duration of chest pain had raised CRP levels.<sup>11</sup> The C-reactive protein levels correlate directly with the duration of chest pain with it being elevated in cases with duration being 6-12 hours and in 100% with more than 12 hours of duration. In present study, 79% patients had anterior wall MI, whereas in studies done by Kumar A et al and Neelakantan N et al found that the percentage of anterior wall MI was 63% and 86% respectively.<sup>10,12</sup> In the present study, 50% patients developed early complications of acute myocardial infarction. Similarly studies done by Kumar A et al and Mohan V et al

revealed that complication rates for these studies were 29% and 84% respectively.<sup>10,11</sup> Reasons for different complication rates could be due to sample size.

In the present study, reduced left ventricular ejection fraction (<40%) in patients with raised CRP was found to be 32%, which was comparable to studies by Berton G et al and Pietila K et al who found that reduced left ventricular ejection fraction (<40%) in patients with raised CRP was 22% and 23% respectively.<sup>13,14</sup>

## CONCLUSION

From present study, we come to the conclusion that the mean age of AMI was 52.7 years with the maximum incidence in the age group of 51-60 years with male preponderance. The C-reactive protein levels correlate directly with the duration of chest pain. C-reactive protein levels are elevated in patients who present with an anterior wall myocardial infarction reflecting the greater amount of myocardial damage being associated with raised C-reactive protein levels.

Raised C-reactive protein levels are associated with greater number of complications after an AMI and decreased LV ejection fraction of <40%, implying a poorer prognosis. Some differences, however, might be present due to differences in patient selection, the number of patients taken for the study and also the differences in the time at which the sample is taken from the onset of chest pain in different patients.

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