

STUDY OF C - REACTIVE PROTEIN (CRP) LEVELS AND ITS PROGNOSTIC SIGNIFICANCE IN ACUTE MYOCARDIAL INFARCTION (MI)

Pothula Rama Rao¹, B. Pavan Kumar²

¹Associate Professor, Department of General Medicine, GMC, Kadapa.

²Assistant Professor, Department of General Medicine, GMC, Kadapa.

Received: 06-04-2022 / Revised: 28-04-2022 / Accepted: 11-05-2022

Corresponding author: Dr. B. Pavan Kumar

Conflict of interest: Nil

Abstract

Background: Acute myocardial infarction (AMI) remains a leading cause of morbidity and mortality worldwide. Increasing evidence suggests that inflammation plays a crucial role in the pathogenesis and progression of atherosclerosis and its complications. C-reactive protein (CRP), an acute-phase reactant synthesized by the liver, rises following myocardial injury and may serve as a prognostic marker in AMI.

Aim: To evaluate the prognostic significance of CRP levels in patients with acute myocardial infarction and to assess its association with in-hospital complications and mortality.

Materials and Methods: This prospective study was conducted from June 2020 to June 2021 in 50 patients diagnosed with AMI admitted to the Intensive Coronary Care Unit of Government General Hospital, Kadapa. Diagnosis was based on clinical presentation, ECG changes, and elevated CK-MB levels. CRP levels were measured at admission and 48 hours after onset of chest pain using latex agglutination method (normal <6 mg/L). Patients were categorized into Q-wave MI and Non-Q-wave MI. Complications during hospital stay and mortality were recorded.

Results: Among 50 patients, 38 had Q-wave MI and 12 had Non-Q-wave MI. CRP was elevated in 24% at admission and in 76% at 48 hours. Elevated CRP on admission was significantly associated with in-hospital complications ($p=0.008$). In Q-wave MI, all patients with elevated CRP at admission developed complications, including cardiogenic shock, left ventricular failure, and arrhythmias. At 48 hours, 75% of patients with elevated CRP developed complications. Non-Q-wave MI patients showed a lower frequency of CRP elevation and complications. Overall, anterior wall MI (56%) was the most common infarction site. Elevated CRP levels were significantly associated with adverse outcomes and higher morbidity and mortality.

Conclusion: CRP is elevated in the majority (80%) of patients with acute myocardial infarction. Elevated CRP at admission and at 48 hours is strongly associated with increased risk of complications and poor prognosis. CRP estimation is a simple, inexpensive, and valuable tool for risk stratification and prognostic assessment in AMI patients.

Keywords: Acute Myocardial Infarction, C - reactive protein (CRP), Q-wave and Non-Q-wave MI, Prognosis.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

INTRODUCTION

Acute Myocardial Infarction is overwhelmingly the most important form of IHD which continues to be the leading cause of death in the industrialized and developing countries like India, despite spectacular progress in their prevention, detection and treatment over the last three decades. AMI has rapidly emerged as the major contributor towards the increasing morbidity and mortality. [1] A large number of asymptomatic individuals are at serious risk of developing MI because of their genetic predisposition, smoking behavior and sedentary lifestyle. About one third of 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 practicing physicians.

A growing body of evidence supports the concept that local and systemic inflammation play a role in the initiation and progression of atherosclerosis and its complications. [2,3] Inherent to the inflammatory process is the occurrence of an acute phase response. This response is induced by pro-inflammatory cytokines (Interleukin 1 and 6) which are released from the inflamed tissue by inflammatory and / or parenchymal cells. These in turn stimulate the liver to synthesize a number of acute phase proteins. CRP is a hepatically derived classical acute phase reactant, the serum level of which has long been known to increase after myocardial infarction.

Materials & Methods:

This prospective study was conducted from June 2020 to June 2021 in 50 cases of myocardial infarction admitted to intensive coronary care unit of Govt General Hospital, Kadapa.

Prior to admission to the study, evaluation was done by detailed history, meticulous

clinical examination, electrocardiogram and relevant laboratory investigations such as CKMB isoenzyme. Myocardial Infarction was diagnosed using following diagnostic criteria.

Chest pain, ECG by diagnostic criteria with the presence of any one of the following in the setting of chest pain

- a) New or presumably new Q waves (at least 30ms wide and 0.20mv deep) in at least 2 leads from any of the following: i. Leads II, III, aVF, ii. Leads V1 through V 6; or iii. Leads I and aVL.
- b) New or presumably new ST-T segment elevation or depression (> 0.10 mV measured 0.02 s after the J point in two contiguous leads of the previously mentioned lead combination).
- c) A complete left bundle branch block in the appropriate clinical setting.

CK-MB levels double the normal limits.

Based on the findings of the above, patients were categorized into: Q wave acute myocardial infarction (Q-wave AMI), Non- Q wave acute myocardial infarction (Non- Q-AMI).

Inclusion Criteria: Acute myocardial infarction as diagnosed by above criteria, presenting within six hours of onset of chest pain. **Exclusion criteria:** Recent infections, Immunologic disorder, Known or suspected neoplastic disease, Recent (less than 3 months) major trauma, Surgery, Burns, Osteoarthritis, Rheumatoid arthritis (Ostochondritis and all other inflammatory disease), Re-infarction patient, Valvular heart disease, and infarction with pericarditis.

In patients suffering from myocardial infarction, venous blood was collected on admission and at 48 hours after the onset of chest pain. From these blood samples, concentration of C- reactive protein was estimated by latex agglutination slide test.

The detection limit of this test is 6 mg/l. Therefore, value of < 6mg/l was taken as normal concentration of CRP. Values of more than 6mg/l were taken as elevated CRP. During the hospital stay, patients

were observed for complications like cardiogenic shock, arrhythmias, post infarction angina and left ventricular failure. Primary end point was death.

Results:

Table 1: Association between CRP concentration on admission and complications during hospital stay in patients with Q -Wave MI

CRP on admission	No of patients	%	Without Complications		With Complications	
			Number	%	Number	%
Normal	27	71.05	12	44.44	15	55.55
Elevated	11	28.94	-	-	11	100
Total Qwave MI	38	100	12	31.58	26	68.42

Among the total number of 38 patients in Q- wave MI, 27 patients (71.05%) had normal CRP and 11 (28.94%) had elevated CRP on admission. Among the 11 patients who had elevated CRP, all the 11 (100%)

developed complication during hospital stay. By applying chi square test the association between elevated CRP on admission and complication were statistically significant.

Table 2: Association between CRP concentration on admission and complications during hospital stay in patients with Non-Q wave MI.

CRP on admission	No of patients	%	Without Complications		With Complications	
			Number	%	Number	%
Normal	11	91.67	10	90	1	9.09
Elevated	1	8.33	-	-	1	100
Total Qwave MI	12	100	10	90.9	2	16.66

Association between CRP concentration on admission and complications during hospital stay in patients with Non- Qwave MI: Among the total number of 12 patients, with NQWMI, 11 patients (91.67%) had normal CRP and 1 patient (8.33%) had elevated CRP on admission.

Among the 11 patients who had normal CRP, 10 patients (90.90%) did not develop any complication, and only one patient (9.09%) developed complication during the hospital stay, among the 1 patient who had elevated CRP, that 1 patient (100%) developed complication. By applying chi square test the association between elevated CRP concentration and complication is statistically significant.

Discussion:

Acute tissue injury such as myocardial infarction rapidly leads to acceleration in the synthesis of C - reactive protein. The duration of synthesis is related to the extent of tissue injury. In our study, 50 cases of acute myocardial infarction were included. Occurrence of acute myocardial infarction was high in males (84%) compared to females (16%), this is attributed to increased amount of stress and strain. It is also attributed to absence of protective influence of estrogen in premenopausal age which serves as cholesterol clearing factor. In our study maximum numbers of cases were in age group of 51-60 years.

In Anzai.T et al and Bae H et al study, the maximum number of cases were in the age

group of 61-70. In our study, the mean age (54.36 ± 10 years) was a decade younger than the Western population. It is because the Asian Indians have underlying genetic susceptibility associated with a modest abnormality in lipid and lifestyle factors. [4,5] In our study CRP was elevated in 24% of patients at admission. At 48 hours after onset of chest pain, CRP was elevated in 76% patients of acute myocardial infarction. Their appeared to be some difference in this pattern, when Q-Wave MI and Non-Q Wave MI were compared. The CRP level were more often raised in both at admission and 48hours in Q-Wave MI, whereas this CRP changes were less often seen in Non-Q Wave MI. However overall CRP was elevated in majority (80%) of the patients, at 48 hours after the onset of chest pain. Our results were similar to those observed by Lagrand et al, Nader eligharib et al. For plasma CRP to be elevated, some time lag is expected. Cytokines released as a result of tissue damage precede the synthesis and subsequent increase in CRP in plasma after the onset of myocardial damage. [6]

Out of 50 cases, 38 patients had Q-Wave MI and 12 had Non- QWave MI. In 38 patients with QWMI, 11 (28.94%) patients had elevated CRP on admission, 48 hours after the onset of chest pain 4 patients died. Hence only 34 patients were available for study. Out of them 28 patients (82.35%) had elevated CRP. In 12 patients of NQWMI, only one patient had elevated CRP on admission but at 48 hours 7 (58.33%) had elevated CRP In our study, anterior wall (56%) was the most common site of infarction, and inferior wall (26%) was the next common site. This was similar to Anzai et al study where anterior wall was (64%) the most common location of infarction. The next common location was inferior wall MI (34%). [7,8]

CRP level and outcome: Q Wave MI: 27 out of 38 had normal CRP on admission and 11 had elevated CRP levels. During hospital stay, patients with elevated CRP

developed complications, cardiac shock in 6 patients (54.54%), LVF in 5 patients (27.27%) and ventricular fibrillation in 3 patients. At 48 hours after the onset of chest pain, 28 patients had elevated CRP levels from 34 patients under study, out of them 21 patients (75%) developed complications. Among these 21 patients 11(39.3%) had cardiogenic shock, 7 (25.0%) had post MI angina, 7 (25.0%) developed LVF, 7(25%) patients had AV-Block.

Non-Q-Wave MI: Out of 11 patients with normal CRP, only one (8.33%) developed complication and the one patient with elevated CRP had developed ventricular tachycardia during hospital stay. At 48 hours after the onset of chest pain, 5 patients with normal CRP had no complication, whereas out of 7 patients with elevated CRP levels 2 patients developed complications. One had cardiac shock and other had ventricular tachycardia. Overall, elevated CRP at admission was significantly associated with subsequent complications during hospital stay and during 7 days follow up. Early raise of CRP denotes extensive tissue damage and hence higher is the morbidity and mortality.

Conclusion:

CRP is elevated in majority of patient with acute myocardial infarction (80%). Association of elevated CRP levels and extensive anterior wall MI is significant statistically. CRP is a potent predictor of prognosis in patients with acute myocardial infarction. Elevated CRP level at admission and at 48 hours after the onset of chest pain indicates poor prognosis in patients with acute myocardial infarction during hospital study. It is useful to carry out this simple and inexpensive test routinely in all patients with acute myocardial infarction as it helps in prognosis, stratification and management of patients with myocardial infarction.

Reference

1. Sethi KK. Ed "Preface" in Coronary Artery Disease in Indians. A Global Prospective 1998: 9 pp
2. Ross R. Cell biology of atherosclerosis Annu Rev Physiol 1995; 57: 791-804
3. Van der wal AC, Becker AE, Van der Loos CM, Das PK. Site of intimal rupture or erosion of thrombosed coronary atherosclerotic plaques is characterized by an inflammatory process irrespective of the dominant plaque morphology. Circulation 1994; 89: 36-44.
4. Rude RE, Poole WK, Muller JE ET al. Electrocardiographic and clinical criteria for recognition of acute myocardial infarction based on analysis of 2-3,697 patients. Am J cardiol 1983;52:936-942
5. Bae FH, Lim SY, Jeong MH, Park HW, et al. Long term predictive factors of major adverse cardiac events in patients with acute myocardial infarction complicated by cardiogenic shock. Korean J Intern Med 2005; 20:8-14
6. Wim K Lagrand, Hans W M, Nissen, CRP co-localizes with complement in human hearts during acute myocardial infarction. Circulation .1997; 95:97-103.
7. Elgharib N, Chi DS, and Yunis W, et al. C - reactive protein as a novel biomarker: reactant can flag atherosclerosis and help predict cardiac events. Postgrad Med 2003; 114:39-44
8. Lalchandani A, Dig Vijay T, Saxena SK et al. Blood levels of Myeloperoxidase, C-reactive protein and Troponin I as prognostic marker in acute coronary syndrome. Indian Heart J 2005;57:411.