Study Of C-Reactive Protein (Crp) As An Indicator Of Prognosis After Acute Myocardial Infarction In Tertiary Care Centre In South Gujarat

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ABSTRACT
INTRODUCTION : Acute myocardial infarction is associated with rise in serum levels of markers of acute inflammation like C – reactive protein. CRP is an indicator of underlying coronary inflammation as well as of the extent of myocardial necrosis. We aim to study the serum concentration of C-reactive protein in patients of acute myocardial infarction in hospitalprognosis.

METHODS : The present study was done in 57 cases of acute myocardial infarction admitted to tertiary care centre in south Gujarat from January 2019 to March 2020. The patients underwent detailed history and clinical examination. Serum CRP concentration at admission were measured by immunoturbidimetry method and all the cases were followed for any complications like heart failure, arrhythmias etc.

RESULTS : Diabetes (38%) and hyper tension (54%) were found more frequently in high CRP group than in low CRP group. Complications like heart failure (44%), low ejection fraction ≤40% (49%), mortality (44%) was found more frequently in high CRP group.

CONCLUSION : The serum CRP concentration on admission in patients of acute myocardial infarction is significant prognostic indicator in hospital stay.

KEY WORDS: C-reactive protein,acute myocardial infarction

I.   INTRODUCTION
Acute myocardial infarction continues to be a major public health problem in the industrialized and developing countries like India, despite progressive research in diagnosis and management over the last three decades.

During the past decades, major improvements have been achieved in management of patients with acute myocardial infarction. The introduction of coronary care units in the 1960s, pharmacological reperfusion therapy in 1980s and widespread application of catheter based interventions in the 1990s have contributed to striking fall in hospital mortality rates. Additionally, chronic treatment with aspirin, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, and statins has contributed to improve long term prognosis in survivors of the acute phase of this disorder. Despite these developments, myocardial infarction remains a major event from a clinical, psychological and social point of view.[1] First, a large number of asymptomatic individuals are at serious risk of developing a first heart attack because of their genetic predisposition, smoking behavior, unhealthy dietary habits or physicalinactivity.

Second, evidence is emerging that medical practice does not adequately implement preventive actions in asymptomatic high risk individuals and patients with established coronary disease and thus they remain at substantial risk of disease and death.

Third, about a third of patients with evolving myocardial infarction die before they reach hospital to receive any effective treatment. Finally, the improved survival of acute coronary syndromes has resulted in a growing population of patients with chronic conditions, which is amplified by the ageing of the generalpopulation.Thus, myocardial infarction remains an important health problem and merits continued attention from basic and clinical researchers, epidemiologists and practicing physicians.It is becoming increasingly clear that inflammation is an important factor in acute myocardial infarction inherent to the inflammatory process is the occurrence of an acute

phase response. This response is induced by pro-inflammatory cytokines which are released from the inflamed tissue by inflammatory and / or parenchymal cells and stimulate the liver to synthesize a number of acute phase proteins.[2] C-reactive protein (CRP) is the classical acute phase reactant, the serum level of which has long been known to increase after myocardial infarction. In clinical studies, circulating levels of CRP were found to correlate with total infarct size in Acute Myocardial Infarction (AMI) and with prognosis.

Thus CRP is an indicator of underlying coronary inflammation as well as the extent of myocardial necrosis. We aimed to study the serum concentration of C- reactive protein in patients of AMI and their subsequent in hospital morbidly andmortality.

AIMS AND OBJECTIVES
To find out the prognostic importance of C - reactive protein at admission in acute myocardial infarction during hospital course.

II.   MATERIALS AND METHODS
Patients presenting with acute coronary syndrome and meeting all inclusion criteria's admitted to tertiary care centre in South Gujarat from January 2019 to March 2020 were studied and cross-sectional analytical study was done. The study was carried out on patients of acute myocardial infarction presenting within 48 hours in the emergency wards of Medicine Department,SMIMER,Surat. Patients satisfying the inclusion criteria were invited to participate in the study by explaining to them the details and purpose of our study. Patients were provided with PIS (Patient Information Sheet) which contained all the relevant details regarding thestudy. All the patients

who gave written consent after reading the PIS were enrolled as study participants. Detailed history was taken regarding their chief complaints, present illness, past illness, family history and personal history. General Physical Examination and Systemic Examination was carried out in details. Estimation of C-reactive in serum was done by turbidimetric immunoassay.

➢   **INCLUSIONCRITERIA**
All acute myocardial infarction patients having
a) Chest pain lasting more than 20minutes
b) Diagnostic ECG changes with characteristic ECG alterations consisting of new pathological Q waves or ST segment and T wave changes.
c) Elevated creatine kinase MBlevels

➢ **EXCLUSIONCRITERIA**
1. All patients with acute myocardial infarction presenting after 48hrs.
2. All patients with previous myocardialinfarction
3. All patients associated with any infective or inflammatory and neoplasticcondition.

All statistical analyses were conducted using MS Excel version 2016 and SPSS software version 22 for Windows. The level of significance was defined as $p<0.05$ (two-tail)

III.   RESULTS
The is cross sectional study of 57 indoor patients diagnosed as acute myocardial infarction admitted to medicine ward in tertiary care hospital at south gujarat. Serum C Reactive Protein was measured in all patients.

TABLE 1: GENDER DISTRIBUTION IN VARIOUS AGE GROUPS

AGE	MALE	FEMALE
25-34	3	1
35-44	6	0
45-54	9	3
55-64	10	6
65-74	7	5
75-84	4	2
85-94	0	1
Total	39	18

Thus in Male, mean age ± standard deviation is 57.08 ± 13.9 while in Female, mean age ± standard deviation is 57.75 ± 13.36.So there is no statistically significant association observed in gender distribution in various age groups. (P value >0.05)

TABLE 2: DISTRIBUTION OF CASES IN TWO CRP GROUPS

CRP Groups	Total Cases
Group A(<3mg/dl)	18
Group B(>3mg/dl)	39
Total	**57**

We classified patients into two groups based on the level of CRP.Group A consist of patients with CRP ≤3 mg/dl, which includes 18 patients (32%).Group B consist of patients with CRP level >3 mg/dl, which includes 39 patients (68%).

TABLE 3: DISTRIBUTION OF RISK FACTORS

RISK FACTORS	NUMBER OF CASES
Hypertension	25
Diabetes Mellitus	17
Smoking	23

In our study, out of 57 patients, 23 (40%) patients were smoker, and 34 (60%) patients were nonsmoker. In group A, out of 18 patients, 12(67%) were nonsmoker and 6(33%) were smoker. In group B, out of 39 patients, 22(56%) were nonsmoker and 17(44%) were smoker.No statistically significant association observed in between Smoking and CRP level. (P value >0.05) In this study, out of 57 patients, 25 (44%) patients were hypertensive, and 32(56%) patients were normotensive. In group A, out of 18 patients, 04(22%) were hypertensive and 14(78%) were normotensive. In group B, out of 39 patients, 21(54%) hypertensive and 18(46%) were normotensive.Thus in group A, total 22% patients were hypertensive while in group B, total 54% patients were hypertensive.Statistically Significant association observed in between Hypertension and high CRP level. (P value <0.05) In present study, out of 57 patients, 17 (30%) patients were diabetic, and 40 (70%) patients were nondiabetic. In group A, out of 18 patients, 02(11%) were diabetic and 16(89%) were nondiabetic. In group B, out of 39 patients, 15(38%) were diabetic and 24(62%) were nondiabetic.So in group A, total 11% patients were diabetic while in group B, total 38% patients were diabetic. Statistically Significant association observed in between Diabetes and high CRP level. (P value<0.05)

TABLE 4: STEMI IN STUDYGROUPS

STEMI	CRP Groups		Total	P value
	Group A	Group B		
NO	8	10	18	0.156
YES	10	29	39	

Total	18	39	57	

In present study, out of 57 patients, 39 (68%) patients were having STEMI, and 18 (32%) patients were not having STEMI. In group A, out of 18 patients, 10(56%) were having STEMI and 8(44%) were not having STEMI. In group B, out of 39 patients, 29(74%) were having STEMI and 10(26%) were not having STEMI.No statistically significant association observed in between STEMI and high CRP level. (P value >0.05)

TABLE 5: NSTEMI IN STUDY GROUPS

NSTEMI	CRP Groups		Total	P value
	Group A	Group B		
NO	10	29	39	0.156
YES	8	10	18	
Total	18	39	57	

In present study, out of 57 patients, 18 (32%) patients were having NSTEMI, and 39 (68%) patients were not having NSTEMI. In group A, out of 18 patients, 8(44%) were having NSTEMI and 10(56%) were not having NSTEMI. In group B, out of 39 patients, 10(26%) were having NSTEMI and 29(74%) were not having NSTEMI.No statistically significant association observed in between NSTEMI and high CRP level. (P value >0.05)

TABLE 6: MORTALITY IN STUDYGROUPS

Mortality	CRP Groups		Total	P value
	Group A	Group B		
NO	16	22	38	0.016
YES	2	17	19	
Total	18	39	57	

In present study, out of 57 patients, 19 (33%) patients were died, and 38 (67%) patients were survived. In group A, out of 18 patients, 2(11%) were died and 16(89%) were survived. In group B, out of 39 patients, 17(44%) were died and 22(56%) were survived.So mortality in group A was 11% while in group B was 44%.Statistically Significant association observed in between Mortality and high CRP level. (P value <0.05)

TABLE 7: LOW EF IN STUDYGROUPS

Low EF	CRP Groups		Total	P value
	Group A	Group B		
NO	17	20	37	0.002
YES	1	19	20	
Total	18	39	57	

In present study, out of 57 patients, 20 (35%) patients were having low EF, and 37(65%) patients were not having low EF. In group A, out of 18 patients, 1(6%) were having low EF and 17(94%) were not having low EF. In group B, out of 39 patients, 19(49%) were having low EF and 20(51%) were not having lowEF.Thus in group A, 6% patients were having low EF while in group B, 49% patients were having lowEF.Statistically Significant association observed in between Low EF and high CRP level. (P value<0.05)

TABLE 8: RHYTHM DISTURBANCES IN STUDY GROUPS

Rhythm Disturbances	CRP Groups		Total	P value
	Group A	Group B		
NO	11	21	32	0.607
YES	7	18	25	
Total	18	39	57	

In present study, out of 57 patients, 25 (44%) patients were having rhythm disturbances, and 32 (56%) patients were not having rhythm disturbances. In group A, out of 18 patients, 07(39%) were having rhythm disturbances and 11(61%) were not having rhythm disturbances. In group B, out of 39 patients, 18(46%) were having rhythm disturbances and 21(54%) were not having rhythmdisturbances.No statistically Significant association observed in between rhythm disturbances in ECG and high CRP level. (P value>0.05)

TABLE 9: KILLIP ≥ 2 IN STUDY GROUPS

KILLIP ≥2	CRP Groups		Total	P value
	Group A	Group B		
NO	16	22	38	0.034
YES	2	17	19	
Total	18	39	57	

In present study, out of 57 patients, 19 (33%) patients were having KILLIP≥2 score, and 38 (67%) patients were not having KILLIP≥2 score. In group A, out of 18 patients, 02(11%) were having KILLIP≥2 score and 16(89%) were not having KILLIP≥2 score. In group B, out of 39 patients, 17(44%) were having KILLIP≥2 score and 22(56%) were not having KILLIP≥2score.Statistically Significant association observed in between having KILLIP≥2 score and high CRP level. (P value <0.05)

IV.   DISCUSSION :

Total 57 patients were enrolled in our study. 39 patients (68.42%) had increased CRP > 3 mg/dl at admission and 18 patients (31.58%) had low CRP ≤ 3mg/dl. In a similar study conducted by P. Mishra et al[3] 62% had high CRP.

The age range was from 25 years to 90 years. The maximum numbers of patients were in the age group 55-64 years which was 28% and next highest numbers of patients were in age group 45-54 & 65-74 years which was 21%. Mean age of study population was 57.22 years. (SD – 13.81).

In our study the mean age of occurrence of acute MI in low CRP group is 51±16 while in high CRP group 60±11. In similar study done by Suleiman M et al[4] mean age of occurrence in low CRP group is 59±12 while in high CRP group is 65±12. In Indian subcontinent the coronary artery disease is said to be peak between 50-60 years. As mentioned by Park et al this is about a decade earlier compared to developedcountries.In this study male: female ratio is 2.16:1.Among 57 patients studied, 68% were males and 32% were females. In low CRP group i.e. group A, male patients were 12(67%) and female patients were 6(33%).In high CRP group i.e. group B, male patients were 27(69%) and female patients were12(31%).

Out of 57 patients, 25 (44%) patients were hypertensive, and 32 (56%) patients were

normotensive. In group A, out of 18 patients, 04(22%) were hypertensive and 14(78%) were normotensive. In group B, out of 39 patients, 21(54%) were hypertensive and 18(46%) were normotensive.Out of 57 patients, 17 (30%) patients were diabetic, and 40 (70%) patients were nondiabetic. In group A, out of 18 patients, 02 (11%) were diabetic and 16 (89%) were non diabetic. In group B, ou of 39 patients 15(38%) were diabetic and 24(64%) were non diabetic. Thus, in current study; Hypertension and Diabetes mellitus shows significant association with high CRP level in acute MI patient (P Value < 0.05) while smoking is not significantly associated with high CRP level in acute MI patient (P Value > 0.05). This is similar with Arruda-Olson et al[5] study and Suleiman M et al[4] study except Hypertension in Suleiman M et al study which didn't show significant association with high CRP level in acute MIpatients.

In present study, out of 57 patients, 20 (35%) patients were having low EF, and 37 (65%) patients were not having low EF. In group A, out of 18 patients, 1(6%) were having low EF and 17(94%) were not having low EF. In group B, out of 39 patients, 19(49%) were having low EF and 20(51%) were not having lowEF.In present study, out of 57 patients, 25 (44%) patients were having rhythm disturbances, and 32 (56%) patients were not having rhythm disturbances. In group A, out of 18 patients, 07(39%) were having rhythm disturbances and 11(61%) were not having rhythm disturbances. In group B, out of 39 patients, 18(46%) were having rhythm disturbances and 21(54%) were not having rhythmdisturbances. In present study, out of 57 patients, 19 (33%) patients were having KILLIP≥2 score, and 38 (67%) patients were not having KILLIP≥2 score. In group A, out of 18 patients, 02(11%) were having KILLIP≥2 score and 16(89%) were not having KILLIP≥2 score. In group B, out of 39 patients, 17(44%) were having KILLIP≥2 score and 22(56%) were not having KILLIP≥2score. In our study, patients with acute myocardial infarction with increased CRP, 44% of patients shown clinical sign of heart failure (Killip class ≥2) This is in accordance with Giuseppe Berton et al[6] (heart failure in patients with increased CRP is 39%).Thus there is statistically significant association observed in our study between high CRP level and complications of acute MI like Low EF, Killip ≥ 2. This is in accordance to the Williams et al[7] study and Suleiman M et al[4] study.In this study average ejection fraction in high CRP group is 38±12% whereas similar study done by S. Pandian et al[8], average ejection fraction in high CRP group is 46.7±11.9%

These data suggest that CRP may predict the risk of heart failure or may play a direct role in augmenting micro vascular inflammatory response after ischemic insult. In other words, the marked CRP rise in patients with acute myocardial infarction with heart failure may not only be an epiphenomenon but may represent a pathogenic process that leads to myocardial damage and left ventriculardysfunction.In present study, out of 57 patients, 39 (68%) patients were having STEMI, and 18 (32%) patients were having NSTEMI. In group A, out of 18 patients, 10(56%) were having STEMI and 8(44%) were having NSTEMI. In group B, out of 39 patients, 29(74%) were having STEMI and 10(26%) were having NSTEMI.No statistically significant association observed in between high CRP level and types of MI in our study.

In present study, out of 57 patients, 19 (33%) patients were died, and 38 (67%) patients were survived. In group A, out of 18 patients, 2(11%) were died and 16(89%) were survived. In group B, out of 39 patients, 17(44%) were died and 22(56%) were survived.In our study, the patients presented with acute myocardial infarction and high CRP>3mg/dl had 44% of mortality. A similar study done by Tomoda et al[9] shown mortality of 28% in patients with acute myocardial infarction with high CRP. This may be due to late presentation of acute MI patients as well as lack of availability of PCI facility in our institute.Thus, statically significant association found between high CRP level and mortality in our study. This is in accordance to Tomoda et al[9] study and Suleiman et al[4] study.The mean CRP was 77.52 ± 27.34 in those who died, while mean CRP was 4.84 ± 3.58 in those who survived.The present analysis shows the significance of association between elevated CRP and mortality after acute myocardialinfarction.

So in our study the mean age of occurrence of acute MI in male was 57.08 years while in female it was 57.75 years. In similar study done by Bajaj S et al[10] mean age of occurrence in male was 56.5 years while in female it was 62years. Thus there is no statistically significant association observed between gender distributions in various age groups in our study (P value - 0.095). This is similar to Bajaj S et al[10] study.

V.   CONCLUSION
It is observed that mortality appears to be increased in patients with high CRP level after acute myocardial infarction in our study.So, Patients with high CRP should be looked after for

in hospital complication. CRP level may serve as simple marker to identify patients at risk of mortality.Therefore, more advance studies and clinical trials focused on CRP level in acute myocardial infarction will improve our understanding of these associations with the goal of reducing the mortality in acute myocardial infarction.

REFERENCES:-

[1]. Eric Boersma, Nestor Mercado. Acute myocardial infarction. Lancet 2003; 361: 847- 55.
[2]. Lagrand WK, Niessen JWM. C-reactive protein co localizes with complement in human hearts during acute myocardial infarction. Circulation 1997;95:97-103.
[3]. P Mishra Study of CRP as an indicator of prognosis in acute MI, GSVM medical college, Khanpur. JAPI vol Jan 2002;50:36.
[4]. M. Suleiman. Admission C-Reactive protein levels and 30 day mortality in acute myocardial infarction. amjmed.2003.06.008
[5]. Arruda-Olson, Adelaide M et al. "Left ventricular function and C-reactive protein levels in acute myocardial infarction." The American journal of cardiology vol. 105, 7 (2010): 917-21.doi:10.1016/j.amjcard.2009.11.025
[6]. Guiseppe Berton, Rocco Cordiano, Rosa Palmieri. C-reactive protein in acute myocardial infarction: association with heart failure. American Heart Journal 2003; 73:205 to 210.
[7]. Williams, Eric S et al. "C-reactive protein, diastolic dysfunction, and risk of heart failure in patients with coronary disease: Heart and Soul Study." European journal of heart failure vol. 10, 1 (2008): 63-9.doi:10.1016/j.ejheart.2007.11.003
[8]. S. Pandian, V Amuthan, P Sukumar. Plasma CRP level predicts left ventricular function and exercise capacity in patient with acute myocardial infarction. Indian heart journal 2005;57:54-57.
[9]. Tomoda H, Aoki N. Prognostic value of C-reactive protein levels within 6 hours after the onset acute myocardial infarction. American Heart Journal 2000;140:324-328.
[10]. Bajaj, Supriya et al. "Gender Based Differences in Risk Factor Profile and Coronary Angiography of Patients Presenting with Acute Myocardial Infarction in North Indian Population." Journal of clinical and diagnostic research: JCDR vol. 10, 5 (2016): OC05-7.doi:10.7860/JCDR/2016/16512.7725