

Significance of C-Reactive Protein in Patients with ST-Elevation Myocardial Infarction Over Non-ST-Elevation Myocardial Infarction

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ABSTRACT

Objective: To assess the use of C-reactive protein in patients with STEMI and NSTEMI to differentiate between the type of myocardial infarction at our hospital.

Study Design: Comparative cross-sectional study.

Place and Duration of Study: Department of Medicine, Pak Emirates Military Hospital, Rawalpindi and Armed Force Institute of Cardiology & National Institute of Heart Disease, from Mar 2020 to Feb 2022.

Methodology: Patients diagnosed with MI by a consultant cardiologist were included in the study. They underwent all baseline investigations, including C reactive protein, at the time of presentation to a cardiac emergency. The treating consultant diagnosed MI (ST elevation or non-ST elevation) based on electrocardiogram findings. Values of C reactive protein and other socio-demographic variables were compared in both groups (patients with and without ST elevation MI).

Results: A total of 3500 patients with myocardial infarction were included in the final analysis. 2219(63.4%) had NSTEMI, while 1281(36.6%) had STEMI. Statistical analysis showed that C-reactive protein levels were not statistically different in both groups (p -value=0.375), but gender and Creatinine kinase myocardial bound levels were different in patients with non-ST elevation myocardial infarction and ST-elevation myocardial infarction (p -value<0.001).

Conclusion: Raised levels of C reactive protein were not statistically significantly different in ST-elevation myocardial infarction and non-ST elevation myocardial infarction patients. CKMB may give a better clue for differentiation between these two types of myocardial infarctions.

Keywords: C-reactive protein, Non-ST-elevation myocardial infarction, ST-elevation myocardial infarction.

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INTRODUCTION

Acute MI is one of the common clinical emergencies encountered at emergency reception of cardiac and general hospitals.¹ Usually, these patients require in-hospital treatment for a couple of days if complications do not make the clinical picture worse.² Electrocardiogram is the mainstay of diagnosis along with clinical and laboratory findings and based on this tracing, usually event of myocardial infarction is divided into MI with the elevation of ST segment and MI without elevation of ST segment.³

Various inflammatory markers have been used to diagnose or assess the severity of MI in addition to cardiac enzymes. Still, there is ongoing research on this important aspect of diagnosing this prevalent medical condition.⁴ C-reactive protein always has interested researchers and clinicians due to its role in diagnosing illness, mapping the course of the illness or predicting prognosis.⁵ Myocardial infarction is usually diagnosed clinically or by studying the electrical activity of the heart, but still, the role of biochemical

markers is established and used in clinical practice.⁶

Habib *et al.* 2011 conducted a study to compare different bio-chemical markers in STEMI and NSTEMI. They revealed that levels of CRP were found more raised in patients with MI with ST-segment elevation than those who did not show ST-segment elevation at electrocardiogram.⁷ Polyakova *et al.* conducted a study from Russia in 2020 regarding the prognostic value of CRP in patients suffering from MI. They concluded that all the cardiovascular events, including MI, stroke and vascular diseases, occurred more in patients with high CRP values at the time of the cardiac event.⁸

Cardiac centres are growing in our country, and now even rural areas are linked with nearby well-equipped cardiac units. With advancements in laboratory methods and other relevant investigations, the role of basic inflammatory markers cannot be undermined in routine clinical practice.⁹ Journal of the college of physicians and surgeons Pakistan published local data which concluded that C-reactive protein was high in many patients with MI. It was related to underlying inflammation.¹⁰ Limited local data has been published regarding differentiating the type of MI

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(STEMI or NSTEMI) based on inflammatory markers. Therefore, we conducted this study to assess the prognostic significance of C-reactive protein in patients with STEMI over NSTEMI.

METHODOLOGY

This study was conducted at the Medicine Department, Pak Emirates Military Hospital Rawalpindi and AFIC & NIHD from September 2020 and November 2021. Ethical approval was taken from the Ethical Committee of the Hospital (Letter No. 250/2/22). The sample size was calculated using the WHO sample size calculator by using the population proportion of raised CRP levels in MI patients as 23.6%.¹¹ Non-probability consecutive sampling was used to gather the sample.

Inclusion Criteria: All the patients of either gender, aged 18 to 65 years, diagnosed with myocardial infarction by a consultant cardiologist were included in the study.

Exclusion Criteria: Patients with any autoimmune or infective condition (acute or chronic) were excluded. Pregnant females were also not included in the study. Patients using any anti-inflammatory or cytotoxic medications were excluded from the study. Patients who had complications of myocardial infarction at the time of diagnosis or required cardiac critical care unit admission were also excluded. Patients who had a second cardiac event in less than three months were also not made part of the study.

Patients diagnosed with acute myocardial infarction were included in the study after applying inclusion/exclusion criteria. MI was diagnosed by a consultant cardiologist based on clinical, electrocardiogram and laboratory findings.¹² Patients were brought to the cardiac ER by family members or ambulance, and an electrocardiogram was done in the ER and interpreted by a consultant cardiac physician in ER. The same cardiologist classified the patients into STEMI and NSTEMI based on electrocardiogram findings.¹³ All the patients underwent all baseline blood investigations, including CRP, at the time of presentation in a cardiac emergency. Blood was drawn by venipuncture under aseptic techniques by a phlebotomist or staff nurse in ER and sent to the laboratory of its hospital, where it was processed in the chemical pathology department headed by a consultant pathologist. C reactive protein levels were considered raised if they were more than 10.0mg/dL.¹⁴

Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. The qualitative and quantitative variables were described by descriptive statistics. The Chi-square test was used to compare age, gender, levels of CRP and creatinine kinase myocardial bound (CKMB) in patients suffering from STEMI and NSTEMI. The *p*-value less than or equal to 0.05 was considered significant to establish the difference between the two groups.

RESULTS

Three thousand and five hundred myocardial infarction patients received in the emergency reception of AFIC and managed in the institute were recruited for this comparative cross-sectional study. The mean age of the myocardial infarction patients included in the study was 57.89±9.495 years. Table-I described the general characteristics of study participants. 2347(67.1%) patients were male, while 1153 (32.9%) were female. Of 3500 patients, 2219 (63.4%) had NSTEMI while 1281 (36.6%) had STEMI. Out of the total patients recruited for the analysis, 2306 (65.8%) had CRP within range while 1194(34.2%) had CRP above the normal range.

Table-II: Relationship of Raised C Reactive Protein and Other Variables with Type of Myocardial Infarction (n=3500)

Factors Studied	Non-ST Elevation Myocardial Infarction (n=2219)	ST Elevation Myocardial Infarction (n=1281)	<i>p</i> -value
Age			
18-50 years	1264(56.9%)	697(54.4%)	0.143
>50 years	955(43.1%)	584(45.6%)	
C Reactive Protein			
Within range	1474(66.4%)	832(64.9%)	0.375
Raised	745(33.6%)	449(35.1%)	
Gender			
Male	1423(64.1%)	924(72.1%)	<0.001
Female	796(35.9%)	357 (27.9%)	
Raised Creatinine Kinase Myocardial Bound			
No	1191(53.6%)	773 (60.3%)	<0.001
Yes	1028(46.4%)	508 (39.7%)	

Age (*p*-value-0.143) and C-reactive protein levels were not statistically different in both groups (*p*-value-0.375). However, the gender of the patients included in the study (*p*-value<0.001) and Creatinine kinase myocardial bound levels (*p*-value <0.001) were different in patients with non-ST-elevation myocardial infarction and ST-elevation myocardial infarction (Table-II).

DISCUSSION

Our results showed that CRP levels did not differ significantly in STEMI and NSTEMI patients. However, CKMG levels were raised more in STEMI than in NSTEMI patients. Acute myocardial infarction is the commonest cardiac emergency, and the key lies in early diagnosis and management. The study of cardiac biomarkers is a complete branch of chemical pathology and helps the clinician in several ways. Cardiac tissue injury and accompanied by tissue inflammation and damage, and inflammatory markers are usually raised in addition to routine cardiac enzymes. Due to a lack of literature about this very handy parameter, we conducted this study to see whether CRP levels are raised in different patterns in STEMI and NSTEMI.

Raposeiras Roubín *et al.* studied the association of CRP with various factors and parameters in patients presenting with acute MI. They came up with the findings that CRP levels were raised in both STEMI and NSTEMI. However, patients of MI who did not have elevated ST segment of ECG had more chances of raising CRP in their study.¹⁵ They also proposed that CRP could be used in predicting the prognosis of these patients. Unfortunately, we did not study the prognostic value but designed this study to look for any significant difference in CRP levels in patients with STEMI and NSTEMI.

Brunetti *et al.* studied the Italian population regarding the correlation of C-reactive protein with diagnosis (STEMI or NSTEMI), myocardial damage, ejection fraction and angiographic findings in patients diagnosed with acute myocardial infarction.¹⁶ They revealed that CRP levels showed a different pattern in patients with STEMI and NSTEMI. They stated that the difference might be due to more myocardial damage in one type of MI than the other. Our study results concluded that raised C reactive protein levels were not statistically significantly different in STEMI and NSTEMI patients. Therefore, CKMB may give a better clue for differentiation between these two types of myocardial infarction. Patients with myocardial infarction were studied by Panduranga *et al.* in Omani patients for correlation of CRP levels with different clinical parameters. They came up with the findings that patients with recurrent angina, NSTEMI, and those who died had significantly raised CRP levels as compared to those with a first cardiac event, STEMI, and those who survived the event.¹⁷

Stefano *et al.* in 2009, studied the difference between various inflammatory biochemical markers and

heart function in STEMI and NSTEMI patients. They concluded that patients who suffered from STEMI, compared to those who suffered from NSTEMI, were more at risk of having deranged white blood cell count and c-reactive protein levels.¹⁸ Our results did not support the results generated by Stefano *et al.* as we could not conclude from our results that there is any statistically significant difference in CRP levels of patients with STEMI and NSTEMI.

Our results suggest that C-reactive protein levels may give important information about the inflammatory aspect of myocardial infarction but have limited or no role in predicting the type of myocardial infarction. Therefore, an electrocardiogram remains the best and most feasible choice. More studies can be planned in light of international evidence regarding the role of other biochemical and inflammatory markers in predicting the type and prognosis of myocardial infarction and supporting the diagnosis made by clinicians on clinical findings and ECG tracing.

STUDY LIMITATIONS

There were a few limitations in our study. C-reactive protein was assessed at the time of presentation, which may vary from patient to patient as ours is a tertiary care centre receiving patients from far-flung areas. Confounding factors affecting C-reactive protein levels may be controlled better for both groups to find out the true association of these levels with the type of myocardial infarction.

CONCLUSION

Raised C reactive protein levels were not statistically significantly different in ST-elevation myocardial infarction and non-ST elevation myocardial infarction patients. CKMB may give a better clue for differentiation between these two types of myocardial infarction.

Conflict of Interest: None.

Author's Contribution

Following authors have made substantial contributions to the manuscript as under:

SA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

JAK: Conception, data acquisition, data analysis, drafting the manuscript, approval of the final version to be published.

FAS & FA: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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