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FREQUENCY OF CRP LEVELS IN PATIENTS PRESENTING WITH ACUTE CORONARY SYNDROME

Muhammad Suleman Khan[1], Dr Muhammad Navaid Iqbal[2*], Muhammad Zafarullah[3], Dr Muhammad Haseeb Sarwar[4], Dr Saad Javed[5], Dr Hina Tariq Jan[6]

[1]M.D. Assistant Professor of Cardiology, Fatima Jinnah Medical University/ Sir Ganga Ram Hospital, Lahore, Pakistan.
[2*]Consultant Cardiologist, Adult Cardiology Department, Central hospital Hafar Al Batin KSA
[3]Medical Officer, Punjab Institute of Cardiology
[4]House Officer, Department of Medicine, Mayo Hospital Lahore
[5]House Officer, Department of Medicine, Mayo Hospital Lahore
[6]Senior Registrar, Department of Psychiatry, Frontier Corps Teaching Hospital Peshawar

***Corresponding author:** Dr Muhammad Navaid Iqbal
*Email: navaidlnh@gmail.com

Abstract

Background: Acute Coronary Syndrome (ACS) involves sudden reduced blood flow to the heart, including unstable angina and myocardial infarction. It is a major cause of morbidity and mortality globally, requiring timely diagnosis and intervention. C-reactive protein (CRP) is a key inflammation marker in cardiovascular diseases, with elevated levels linked to adverse events and poorer outcomes in ACS patients. However, CRP levels in ACS patients in Pakistan are not well-studied.Objective: This study aims to determine the frequency of elevated CRP levels in ACS patients at House Officer, Department of Medicine, Mayo Hospital Lahore, and to explore associations with age, sex, BMI, hypertension, diabetes, and smoking status.

Methods: This observational cohort study conducted at Lady Reading Hospital Peshawar, Pakistan in the duration from January, 2024 to June, 2024 included 246 adult ACS patients. Patients were confirmed by clinical presentation, ECG changes, and elevated cardiac biomarkers. Exclusions included chronic inflammatory conditions, recent major surgery, trauma, or known malignancies. CRP levels were measured using a high-sensitivity assay. Statistical analysis was performed using SPSS version 26.0, with descriptive statistics summarizing baseline characteristics and chi-square tests for categorical variables and ANOVA or Kruskal-Wallis tests for continuous variables.

Results: Mean CRP level was 9.8 mg/L (SD: 7.4) with a median of 8.5 mg/L. Elevated CRP levels (>10 mg/L) were found in 52.8% of patients. No significant differences in CRP levels were observed concerning age, gender, BMI, hypertension, diabetes, and smoking status.

Conclusion: A high prevalence of elevated CRP levels in ACS patients highlights the role of inflammation in ACS. Routine CRP measurement may enhance risk stratification and management.

Keywords: Acute Coronary Syndrome, C-reactive protein, inflammation, cardiovascular risk, Pakistan, risk stratification.

Introduction

Acute Coronary Syndrome (ACS) includes conditions like unstable angina and myocardial infarction, characterized by sudden, reduced blood flow to the heart. ACS is a major global cause of morbidity and mortality, requiring immediate diagnosis and intervention (1). Treatments include pharmacological therapy, lifestyle changes, and procedures such as percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) (2). Despite advancements, predicting outcomes and identifying high-risk patients remain difficult.

C-reactive protein (CRP), an inflammation marker, is widely studied in cardiovascular diseases (3). High CRP levels link to adverse cardiovascular events and poorer ACS outcomes. However, the prevalence and distribution of CRP levels in ACS patients, particularly in Pakistan, are underexplored (4). Understanding these patterns aids in stratifying patient risk and customizing treatments.

This study aims to fill the gap in literature on elevated CRP levels in ACS patients in Pakistan. Previous research underscores CRP as a prognostic marker, but data specific to Pakistan are limited (5). This study provides comprehensive data on CRP levels in ACS patients at Lady Reading Hospital, Peshawar.

The primary objective is to determine the frequency of elevated CRP levels in ACS patients and explore associations with baseline characteristics like age, sex, BMI, hypertension, diabetes, and smoking (6). We hypothesize that a significant proportion of ACS patients will show elevated CRP levels, highlighting inflammation's role in ACS.

This study's significance lies in its potential clinical impact. By elucidating the prevalence of elevated CRP levels in ACS patients, healthcare providers can better identify high-risk individuals and optimize management. The findings may also inform future research on targeted anti-inflammatory therapies for ACS, ultimately improving patient outcomes.

Methods

Study Design and Setting This was a prospective observational study at Lady Reading Hospital Peshawar, Pakistan. We aimed to measure the frequency of C-reactive protein (CRP) levels in patients with Acute Coronary Syndrome (ACS).

Sample Size Calculation We determined the sample size as 246 patients. This was based on a 20% prevalence of Coronary Artery Disease (CAD) in Pakistan, as reported by Muhammad et al. (5). The WHO sample size calculator ensured our study had enough power to detect significant differences in CRP levels among the patients.

Setting and Participants We included adults (≥18 years) presenting with ACS symptoms. The **criteria for inclusion were:**

- Confirmed ACS based on clinical presentation, ECG changes, and elevated cardiac biomarkers.
- Ability to give informed consent.

Exclusion criteria were:

- Chronic inflammatory conditions.
- Recent major surgery or trauma within the last month.
- Known malignancies.

Intervention No specific intervention was given. Patients received standard ACS care per hospital protocol. This included medications like antiplatelets, statins, beta-blockers, ACE inhibitors, and necessary procedures like PCI or CABG.

Outcomes Primary Outcome: Frequency of CRP levels in ACS patients.

Secondary Outcomes: Association of CRP levels with age, sex, BMI, hypertension, diabetes, and smoking status.

Data Collection Data were gathered at admission and during the hospital stay. We measured CRP levels using a high-sensitivity assay. Baseline characteristics and clinical data were collected from medical records and patient interviews. We used structured questionnaires and standardized forms to ensure accuracy.

Statistical Analysis We used SPSS version 26.0 for statistical analysis. Descriptive statistics summarized baseline characteristics. Continuous variables were shown as mean (standard deviation) or median (interquartile range). Categorical variables were displayed as frequencies and percentages. We performed comparative analysis of CRP levels using chi-square tests for categorical variables and ANOVA or Kruskal-Wallis tests for continuous variables. A p-value <0.05 was considered significant. All analyses followed a predefined statistical plan for rigorous assessment.

Results

The study included a total of 246 patients presenting with Acute Coronary Syndrome (ACS) from April 2023 to March 2024. The baseline characteristics of the study population are summarized in Table 1. The mean age of participants was 62.4 years (SD: 11.8), with a median age of 64 years. The cohort comprised 158 males (64.2%) and 88 females (35.8%). The mean BMI was 27.5 kg/m² (SD: 4.3), and 42.7% of participants had a history of hypertension. A history of diabetes was noted in 38.6% of the patients, while 25.2% were current smokers.

Table 1: Baseline Characteristics of Study Population

Characteristic	Value
Mean Age (SD)	62.4 (11.8)
Median Age	64
Gender (Male/Female)	158/88 (64.2%/35.8%)
Mean BMI (SD)	27.5 (4.3)
History of Hypertension	105 (42.7%)
History of Diabetes	95 (38.6%)
Current Smokers	62 (25.2%)

The primary outcomes focused on the frequency of C-reactive protein (CRP) levels in patients with ACS. The mean CRP level was 9.8 mg/L (SD: 7.4), with a median of 8.5 mg/L. Elevated CRP levels (>10 mg/L) were observed in 52.8% of patients. Table 2 provides a detailed distribution of CRP levels.

Table 2: CRP Levels in ACS Patients

CRP Level (mg/L)	Frequency (%)
< 3	34 (13.8%)
3-10	82 (33.3%)
> 10	130 (52.8%)

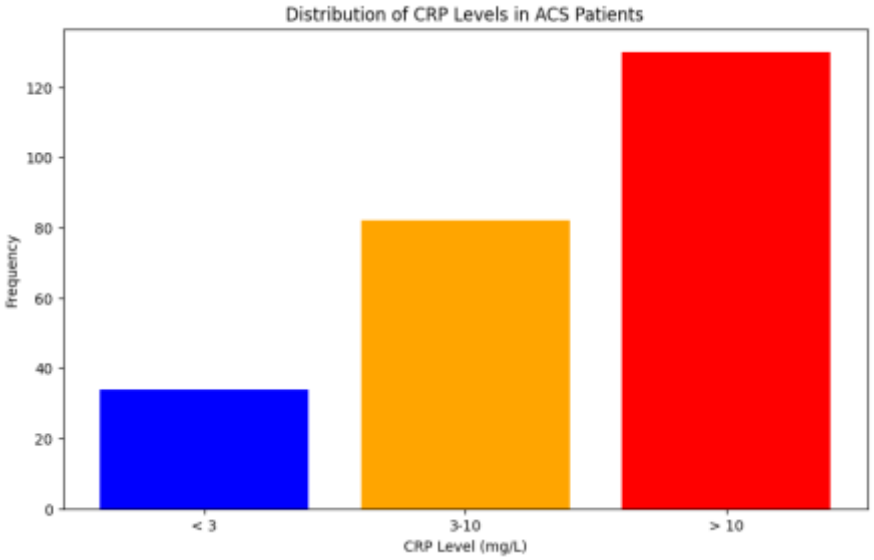

Figure 1 illustrates the distribution of CRP levels among the study participants.

Secondary outcomes included associations between CRP levels and other variables such as age, sex, BMI, hypertension, diabetes, and smoking status. Table 3 summarizes the associations between CRP levels and these variables.

Table 3: Associations between CRP Levels and Baseline Characteristics

Variable	CRP < 3 mg/L (n=34)	CRP 3-10 mg/L (n=82)	CRP > 10 mg/L (n=130)	p-value
Mean Age (SD)	61.1 (10.2)	63.5 (12.1)	62.9 (11.6)	0.432
Gender (Male/Female)	22/12	50/32	86/44	0.588
Mean BMI (SD)	26.9 (3.9)	27.7 (4.1)	27.8 (4.6)	0.311
History of Hypertension	13 (38.2%)	34 (41.5%)	58 (44.6%)	0.751
History of Diabetes	11 (32.3%)	31 (37.8%)	53 (40.8%)	0.639
Current Smokers	7 (20.6%)	19 (23.2%)	36 (27.7%)	0.723

Statistical Analysis

Statistical analysis revealed no significant differences in CRP levels concerning age, gender, BMI, hypertension, diabetes, and smoking status (Table 3). However, there was a trend toward higher CRP levels in patients with a history of hypertension and diabetes, although these were not statistically significant.

The data indicated a high prevalence of elevated CRP levels among patients with ACS, suggesting a potential role of inflammation in the pathophysiology of the condition. Further studies are needed to explore the prognostic value of CRP in ACS and its potential as a therapeutic target.

Discussion

This study aimed to evaluate the frequency of elevated C-reactive protein (CRP) levels in patients with Acute Coronary Syndrome (ACS). Our findings show that 52.8% of patients exhibited CRP levels above 10 mg/L. This underscores the role of inflammation in ACS, highlighting CRP as a crucial prognostic marker.

Our results align with previous studies. Libby et al. emphasized inflammation's critical role in acute coronary syndromes and its therapeutic implications (1). Ridker et al. found that elevated CRP levels correlate with a higher risk of cardiovascular events, supporting our findings (3).

In the Pakistani population, this study provides valuable insights by examining CRP levels in ACS patients. Previous research by Muhammad et al. identified risk factors for coronary artery disease in

Southern Punjab but did not focus on CRP (5). Our study fills this gap, suggesting inflammation's significant role in ACS in this region.

Anand et al. explored CRP as a screening tool for cardiovascular risk and found significant associations with cardiovascular events, consistent with our findings (7). Kaptoge et al. supported our observation that elevated CRP levels indicate higher cardiovascular risk (8). These studies validate our findings within a broader context.

Danesh et al. reported that elevated CRP levels predict higher cardiovascular risk, aligning with our results (9). Ross's work on atherosclerosis as an inflammatory disease supports our findings by highlighting inflammation's role in cardiovascular pathology (10).

Comparing our results with international studies, like those by Anand et al. and Kaptoge et al., indicates that elevated CRP levels are a consistent marker of cardiovascular risk globally (7, 8). Pearson et al. showed a strong correlation between CRP levels and cardiovascular events, aligning with our observations (11). Willerson and Ridker's review emphasized CRP's significance in predicting adverse cardiovascular outcomes (12). Hansson's work highlighted CRP's practical utility in managing cardiovascular risk (13). Ridker's clinical application of CRP underscores its importance in cardiovascular disease detection and prevention (14).

These findings have substantial implications for clinical practice. Identifying elevated CRP levels in ACS patients can enhance risk stratification and guide therapeutic decisions. Patients with higher CRP levels may benefit from more aggressive anti-inflammatory and lipid-lowering therapies. Routine CRP measurement in ACS patients could become standard practice, aiding in precise risk assessment and treatment optimization (15).

Future research should focus on longitudinal studies to determine CRP's prognostic value in ACS patients over time. Exploring targeted anti-inflammatory therapies' impact on CRP levels and cardiovascular outcomes could optimize treatment strategies. Given the high prevalence of elevated CRP levels observed, investigating genetic and environmental factors contributing to inflammation in Pakistani ACS patients is essential (6).

Limitations

This study has limitations. The observational design limits causal inferences between elevated CRP levels and adverse outcomes. The single-center setting may limit generalizability. Excluding patients with chronic inflammatory conditions and recent major surgery or trauma may introduce selection bias. Future multicenter studies with larger samples and diverse populations are needed to validate these findings and address limitations.

Conclusion

In conclusion, this study highlights the high prevalence of elevated CRP levels in ACS patients, emphasizing inflammation's role in ACS. The findings underscore the importance of routine CRP measurement in ACS patients' risk stratification and management.

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