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TO EVALUATE CARDIAC BIOMARKER (TROP I, CRP) AND HEMATOLOGICAL PARAMETER IN PATIENTS WITH ACUTE MYOCARDIAL INFARCTION INTERTIARY CARE HOSPITAL LRH PESHAWAR

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Myocardial infarction, Troponin I, Hematological parameters, WBC, Neutrophils, Platelets, acute phase, healthy control, cardiac biomarkers, prognosis, cardiology.

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Abstract

Aim: *The aim of this study to compare the level of (Trop I, CRP) and hematological parameters between patients with acute myocardial infarction and healthy control in Tertiary care hospital LRH Peshawar.*

Methodology: *This case control study was conducted in Al Raze institute of medical sciences, Peshawar, within the Khyber Pakhtunkhwa province of Pakistan. Data were collected from 120 myocardial infarction patients, including both male and female participants, who were either experiencing an acute myocardial infarction and minor illness (healthy control group) from the cardiology wards of Lady reading hospital Peshawar. Data collection involved administering questionnaires that included demographic information and questions related to Hematological parameters and cardiac biomarkers. The data was analyzed using IBM SPSS version 24, with paired sample t-tests conducted to compare means, and p-values.*

Results*: The study revealed a significant reduction in Troponin I levels from a mean of 9.8241ng/ml in the acute phase to 0.9325 ng/ml in the healthy control ($p < 0.01$).Comparison of level of various parameters between acute and in healthy control group was done by calculating p-value. In Results the White blood cells, Neutrophils, platelets and CRP level are significant high in AMI patients are 15.152, cells/µl 85.79 %, 420.0821 and 15.8412mg/L as compared during the healthy control group are 7.831cells/ µl ,63.17% ,352.981 and 2.5942 mg/L. But, the levels of Red blood cells and hemoglobin didn't show any significant difference between acute and healthy control groups.*

Conclusion*: Troponin I is the ideal marker for the diagnosis of AMI. Leukocytosis, Neutrophilia, Thrombocytosis and High CRP are indicators of acute myocardial infarction. Therefore, we conclude that in Hematological parameters White blood cells, platelets and Neutrophils and High Trop I and CRP are ideal biomarkers for diagnosing AMI. Estimation of White blood cells, platelets, Neutrophils and High Trop I and CRP level in acute MI patients can help assess their prognosis.*

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INTRODUCTION

Acute myocardial infarction (AMI) is a major cardiovascular emergency resulting from acute myocardial injury and ischemia, most commonly due to disruption of an atherosclerotic coronary plaque followed by thrombus formation and impaired coronary blood flow. Prolonged ischemia leads to myocardial necrosis and may result in serious complications, including arrhythmias, heart failure and death. The diagnosis of AMI is based on evidence of acute myocardial injury, demonstrated by a rise and/or fall in cardiac troponin with at least one value above the 99th percentile, together with clinical evidence of myocardial ischemia.[1] AMI is classified into different types according to its underlying mechanism. Type 1 MI is generally associated with atherosclerotic plaque rupture or erosion and subsequent coronary thrombosis, whereas type 2 MI results from an imbalance between myocardial oxygen supply and demand in the absence of acute atherothrombosis. Other categories include MI associated with sudden cardiac death and coronary revascularization procedures.[2] Atherosclerosis and its associated inflammatory and thrombotic processes play central roles in the development and progression of myocardial infarction.[3] Inflammatory responses following myocardial injury may further contribute to myocardial dysfunction and adverse clinical outcomes.[4] Cardiac biomarkers are fundamental to the diagnosis and assessment of AMI. Cardiac troponin I (cTnI) is a highly specific marker of myocardial injury and, together with cardiac troponin T, is considered a preferred biomarker for detecting myocardial injury.[1,5] Troponin concentrations increase following myocardial cell injury and provide important diagnostic information when interpreted alongside clinical findings and electrocardiographic changes. In addition to markers of myocardial injury, inflammatory biomarkers may provide complementary information. C-reactive protein (CRP) is an acute-phase protein produced primarily by the liver in response to inflammation and is frequently elevated in patients with AMI. Increased CRP has been associated with inflammatory activity and adverse cardiovascular outcomes, making it a potentially useful prognostic marker, although it lacks the specificity required for diagnosis of AMI on its own.[6]

Hematological parameters may also reflect the inflammatory and thrombotic processes associated with AMI. The complete blood count (CBC) provides information about leukocytes, erythrocytes, hemoglobin and platelets and is routinely available in clinical practice. Leukocytosis may occur as part of the inflammatory response to myocardial injury, while platelet count and platelet-related indices may reflect platelet activation and thrombo-inflammatory activity.[7] These readily available parameters may therefore provide supportive information regarding the biological response to AMI and may have potential clinical and prognostic relevance. Although cardiac biomarkers and hematological alterations in AMI have been investigated extensively worldwide, evidence from Peshawar remains limited. The present study therefore aims to compare Troponin-I, CRP and selected hematological parameters between patients with acute myocardial infarction and healthy controls at Lady Reading Hospital, Peshawar. Evaluation of these parameters may improve understanding of their patterns in the local population and provide useful laboratory information for the assessment and management of patients with AMI. The study objectives are to evaluate differences in hematological parameters, assess Troponin-I levels, and compare CRP concentrations between AMI patients and healthy controls.

Objective

To compare the levels of Troponin-I, C-reactive protein (CRP), and hematological parameters between patients with acute myocardial infarction (AMI) and healthy controls at Lady Reading Hospital, Peshawar.

MATERIAL AND METHODS

A case-control study was conducted among patients with acute myocardial infarction (AMI) and control participants at the Cardiology Department of Lady Reading Hospital (LRH), Peshawar, Khyber Pakhtunkhwa, Pakistan. Ethical

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approval was obtained from the Ethical Review Committee of Al Razi Institute of Medical Sciences, Peshawar, and approval for data collection was submitted to the ethical committee of LRH. Written informed consent was obtained from all participants or, when a patient was unable to provide consent because of their clinical condition, from an appropriate relative. Participant confidentiality and anonymity were maintained throughout the study. A total of 120 participants were included using a convenient sampling technique, comprising 60 patients with acute myocardial infarction and 60 control participants. Both male and female participants were included. The AMI group consisted of hospitalized patients experiencing an acute myocardial infarction, while the control group consisted of participants without myocardial infarction or systemic illnesses expected to affect Troponin-I or CRP levels. Patients with chronic kidney disease, chronic inflammatory diseases, acute liver failure, or chronic liver failure were excluded. Demographic information, including age and gender, was obtained from participants and their medical records. Relevant clinical and laboratory information was retrieved from hospital records and the cardiology ward computer system using patients' inpatient numbers. The laboratory parameters evaluated included Troponin-I (Trop-I), C-reactive protein (CRP), and selected hematological parameters. Data were analyzed using IBM SPSS Statistics version 24. Descriptive statistics were used to summarize demographic characteristics, while comparative statistical analyses were performed to assess differences in Troponin-I, CRP, and hematological parameters between the AMI and control groups. A p-value <0.05 was considered statistically significant.

RESULT

Paired sample t – test

This chapter contains the statistical analysis of Hematological parameters Troponin I and CRP level in acute myocardial infarction and during a healthy control group. The data was analyzed using IBM SPSS version 24, with paired sample t-tests conducted to compare means, and p-values.

Table 1: shows comparison of Hematological parameters in Acute MI and healthy control group

Parameters	Category	Number	Mean	P-Value
RBC	Acute MI(Case)	60	4.318	0.234
	Control group	60	4.432	
WBCs	Acute MI(Case)	60	15.152	<0.001
	Control group	60	7.831	
Platelets	Acute MI(Case)	60	420.821	<0.001
	Control group	60	352.981	
Hemoglobin	Acute MI (Case)	60	14.972	0.067
	Control group	60	15.092	
Neutrophils	Acute MI(Case)	60	85.79	<0.001
	Control group	60	63.17	

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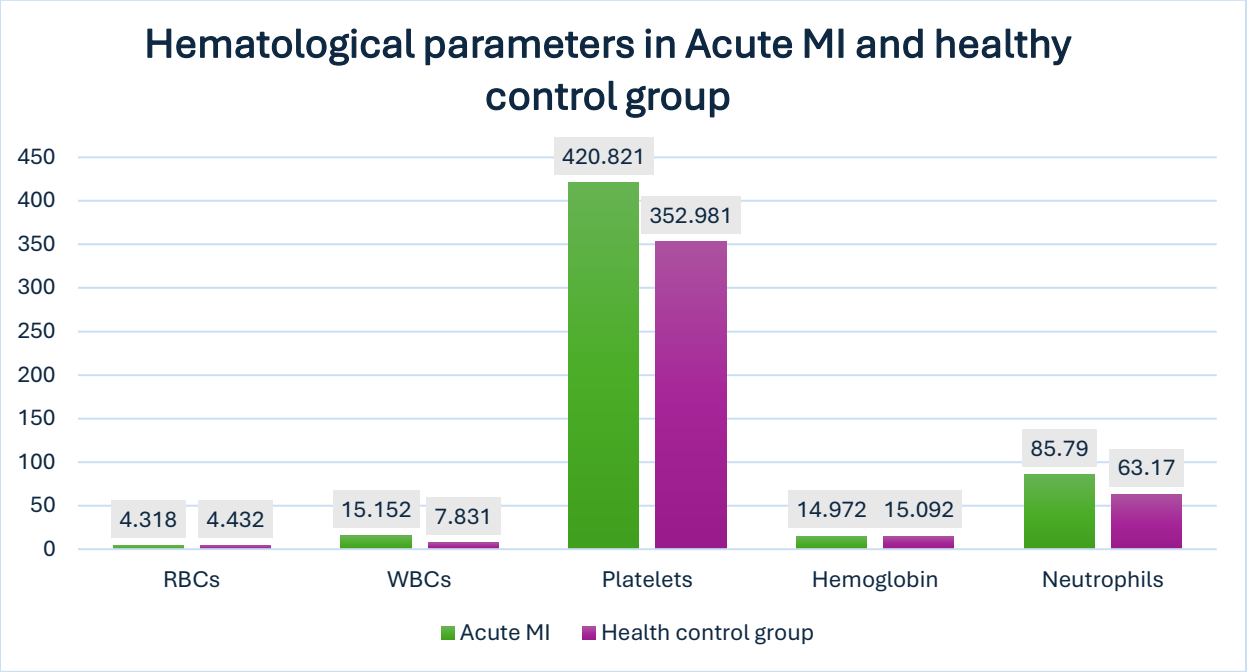


Figure 1: describe Hematological parameters of their mean and p value in acute MI and healthy control group.

Statistical analysis of Hematological parameters in acute MI and during healthy control

For analysis and comparison of changes of cardiac biomarker hematological parameters in acute MI and healthy control. The data was analyzed by using the paired sample t-test. The means and P-value of the sample is observed. The hematological parameters such as white blood cells, platelet, neutrophils and c reactive protein shows significant difference between acute MI and healthy control group .Elevation of white blood cells, neutrophils and platelets level in acute myocardial infarction shows leukocytosis, neutrophilia and thrombocytosis are indicators of acute myocardial infarction. White blood cells, neutrophils and platelets and CRP levels are prognostic indicators. But the Hematological parameters e such as Red blood cells and hemoglobin shows non-significant difference between AMI and the healthy control group. RBS and hemoglobin levels remained stable and within normal ranges throughout both phases, with no significant statistical change.

Table 2shows comparison of Trop I Level in acute MI and healthy control group

Tests	Category	Number	Mean	P- Value
Troponin I level	Acute MI(Case)	60	9.8241	<0.01
	Control group	60	0.9325	

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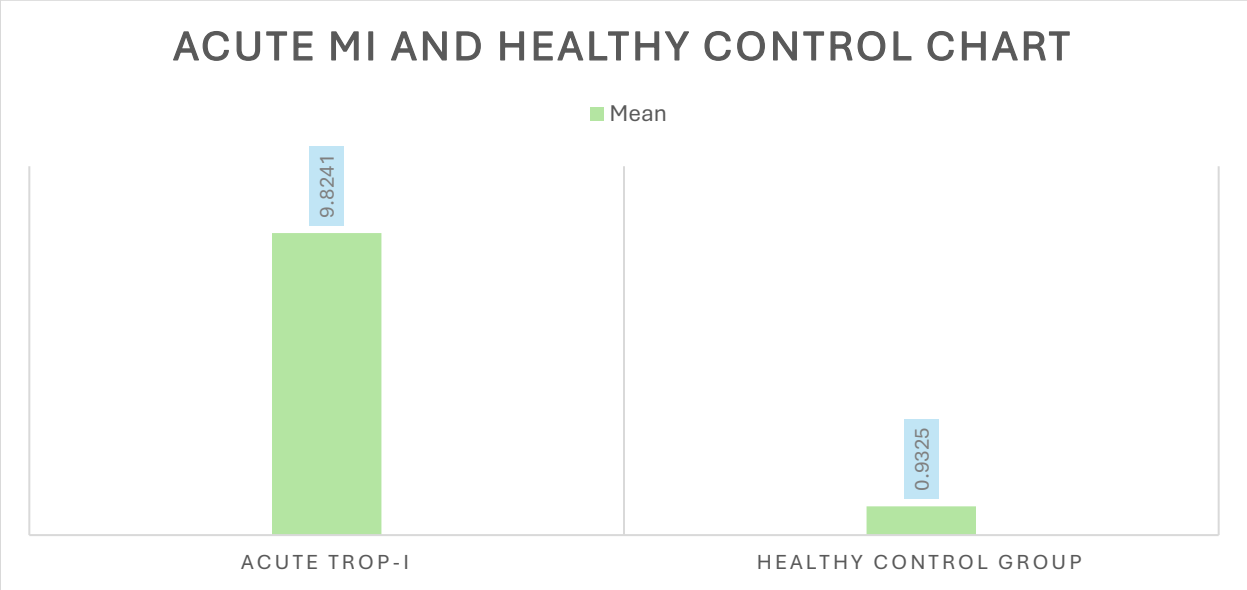


Figure 2 describe the trop I level their mean and p value in acute MI and healthy control group.

Statistical analysis of Troponin I level in acute and during healthy control

For analysis and comparison of changes of cardiac biomarker (Trop I) in acute and healthy control. The data was analyzed by using the paired sample t-test. The means and P- value of the sample is observed. The mean level of Troponin I in acute phase 9.8241ng/ml that is also very high in compared to 0.9325 ng/ml in healthy control group and then difference found among them is found to be highly significant. ($p<0.001$). The results indicate significant differences in cardiac troponin I levels between acute and healthy control group.

Table 3 shows comparison of CRP level in Acute MI and healthy control group

Tests	Category	N	Mean	P- Value
CRP (C reactive protein)	Acute MI(Case)	60	15.8412	<0.001
	Control group	60	2.5942	

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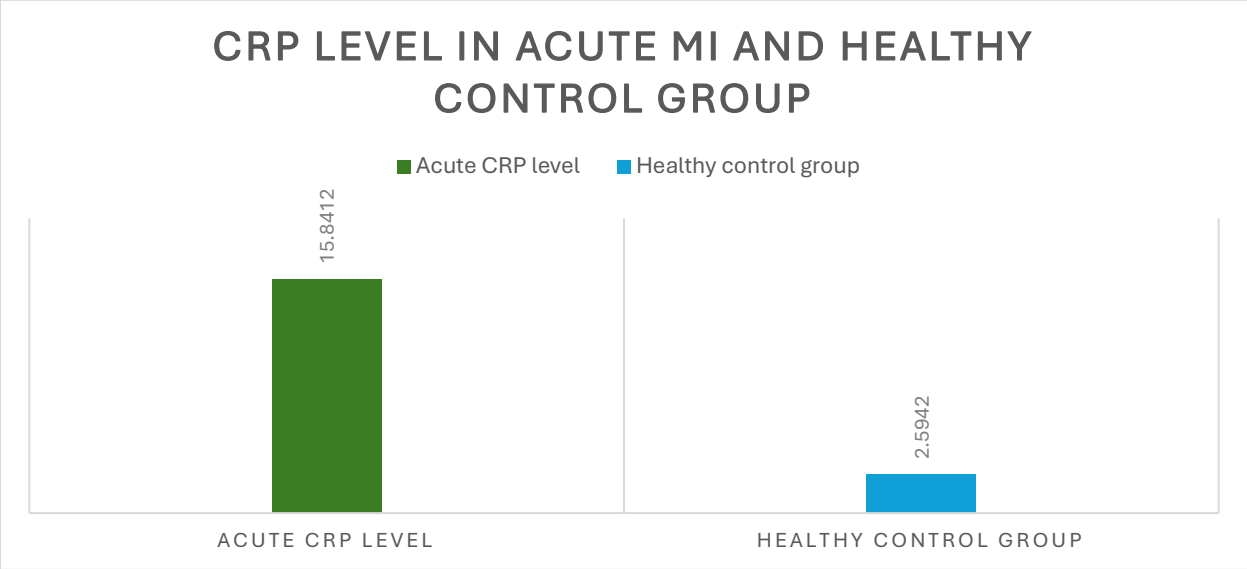


Figure 3: describe the CRP level their mean and p value in acute MI and healthy control group.

Statistical analysis of CRP level in acute MI and during healthy control

For analysis and comparison of changes of cardiac biomarker (Trop I) in acute and healthy control. The data was analyzed by using the paired sample t-test. The means and P- value of the sample is observed. The CRP level are significantly high in AMI patients is 15.8412mg/L compared to healthy control group which is 2.5942 mg/L (p value <0.001). Elevation of c reactive protein are indicators of acute myocardial infarction

Table 4: shows comparison of hematological parameters, Trop I and CRP in acute MI and healthy control group

Parameters	Category	Number	Mean	P-Value
RBC	Acute MI(Case)	60	4.318	0.234
	Control group	60	4.432	
WBCs	Acute MI(Case)	60	15.152	<0.001
	Control group	60	7.831	
Platelets	Acute MI(Case)	60	420.821	<0.001
	Control group	60	352.981	
Hemoglobin	Acute MI (Case)	60	14.972	0.067
	Control group	60	15.092	
Neutrophils	Acute MI(Case)	60	85.79	<0.001
	Control group	60	63.17	
Troponin I	Acute MI(Case)	60	9.8241	<0.001
	Control group	60	0.9325	
C reactive protein	Acute MI(Case)	60	15.8412	<0.001
	Control group	60	2.5942	

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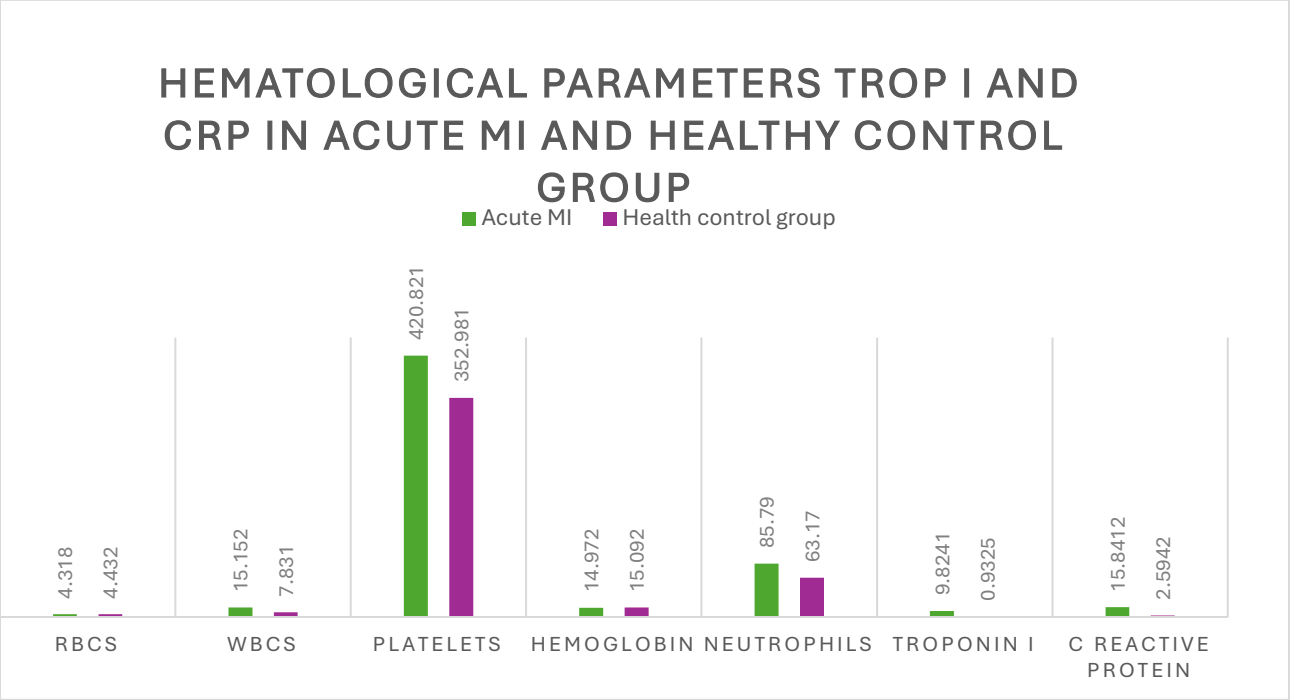


Figure 4 describe the hematological parameters Trop I and CRP level there mean p value in acute MI and healthy control group

Statistical analysis hematological parameters of Troponin I and CRP level in acute and during healthy control

For analysis and comparison of changes of cardiac biomarker (Trop I) in acute and healthy control. The data was analyzed by using the paired sample t-test. The means and P- value of the sample is observed. The mean level of Troponin I in acute phase 9.8241ng/ml that is also very high in compared to 0.9325 ng/ml in healthy control group and then difference found among them is found to be highly significant. ($p<0.001$). The results indicate significant differences in cardiac troponin I levels between acute and healthy control groups. The hematological parameters such as white blood cells, platelet, neutrophils and c reactive protein show significant difference between acute MI and healthy control group .Elevation of white blood cells, neutrophils and platelets level in acute myocardial infarction shows leukocytosis, neutrophilia and thrombocytosis are indicators of acute myocardial infarction. White blood cells, neutrophils and platelets and CRP levels are prognostic indicators. But the Hematological parameters such as Red blood cells and hemoglobin shows non-significant difference between AMI and the healthy control group. RBS and hemoglobin levels remained stable and within normal ranges throughout both phases, with no significant statistical change. The means and P-value of the sample is observed. The CRP level is significantly high in AMI patients is 15.8412mg/L compared to healthy control group which is 2.5942 mg/L (p value <0.001). Elevation of c reactive protein is indicators of acute myocardial infarction.

DISCUSSION

Myocardial infarction, a heart disease, emerges due to disarrangement in coronary circulation, such as issues with arteries, thrombosis, or spasms affecting the heart muscle. Factors like hypertension, diabetes, obesity, sedentary lifestyle, and both physical and mental stress Participate to the occurrence of myocardial infarction. A primary indicator of this condition involves

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prolonged and intense chest pain in a specific region of the heart muscle, stemming from a decrease in oxygen and nutrient supply. Troponin I (cTnI) are distinct forms present in cardiac muscle. The Initiation of cardiac troponins (cTn) as biomarkers for myocardial injury has significantly transformed the landscape of AMI diagnosis. Currently, cTn stands as the most widely.

An increase in C-reactive protein (CRP), due to increased hepatic synthesis of acute phase proteins, and an increase in ESR follow the inflammatory process and hence these parameters are used in the diagnosis and follow-up of patients. The complete blood count (CBC) is instrumental in diagnosing acute myocardial infarction (AMI) by providing essential information on baseline hematologic status, which helps guide treatment decisions and monitor for potential complications.

In the present study, we found that the mean level of Troponin I in the acute phase is 9.8241ng/mL, significantly higher compared to 0.9325 ng/mL in the c ($p < 0.01$). This indicates a significant difference in cardiac troponin I levels between the acute and during healthy control group. In our study, we investigated the dynamics of Troponin I levels in patients recovering from acute myocardial infarction (AMI). We observed that during the acute phase, patients exhibited a mean Troponin I level of 9.8241 ng/mL, which was significantly higher than the mean level of 0.9325 ng/mL observed during healthy control group ($p < 0.001$).This substantial difference underscores Troponin I's sensitivity as a biomarker for myocardial injury. In the past study observed that the mean level of Troponin I in patients with acute myocardial infarction (AMI) was 10.36 ± 9.3 ng/mL, which was markedly higher than the mean level of 0.512 ± 0.4 ng/mL found in the control group (healthy individuals). This difference between the two groups was found to be highly significant ($p < 0.01$). Troponin I is a sensitive biomarker of myocardial injury, and these findings underscore its diagnostic utility in distinguishing AMI patients from healthy individuals.

In the present study we found that level of White blood cells, Neutrophils, platelets and CRP level in acute myocardial infarction and healthy control group. We found that during acute phase the mean level of white blood cells, platelets, neutrophils and CRP were significantly high are 15.152, cells/ microliters 85.79 %, 420.0821 and 15.8412mg/L as compared are 7.831cells/ microliters, 63.17%, 352.981 and 2.5942 during the healthy control group ($p < 0.001$). This indicates a state of leukocytosis, neutrophil and thrombocytosis and high CRP level during the acute phase, reflecting the physiological response to myocardial injury and metabolic changes .In contrast, RBC and hemoglobin levels did not show a significant difference between the acute (mean = 4.318 and 14.972) and healthy control group (mean =4.432 and 15.092; $p > 0.001$), remaining within normal ranges throughout both phases.

In the past study observed that the hematological parameters such as , the mean level of the hemoglobin (Hb) 13.331 g/l (Std. Dev. ± 15.29), the mean level of the leukocytes (WBC) 8.76 /µl (Std. Dev. ± 2.77), the mean level of the red blood cells (RBC) 4.55 /µl (Std. Dev. ± 0.52), the mean level of the relative value of the lymphocytes 24.46 % (Std. Dev. ± 9.015), and the mean level of the thrombocytes 207.87 /µl (Std. Dev. ± 64.035). The mean erythrocytes segmentation rate (ESR) is 18.99 mm/hr (Std. Dev. ± 12.16).

CONCLUSION

The study demonstrated a significant difference in Troponin-I, CRP, white blood cells, neutrophils, and platelets between AMI patients and the control group. Troponin-I showed a marked elevation in AMI patients, supporting its importance as a cardiac biomarker for AMI detection. Increased WBCs, neutrophils, platelets, and CRP may reflect the inflammatory response associated with AMI and have potential prognostic significance. In contrast, RBC and hemoglobin levels showed no statistically significant difference between the groups. Overall, the findings highlight the potential value of cardiac biomarkers and selected hematological parameters in the assessment and management of AMI.

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LIMITATIONS

The study had a relatively small sample size, which may limit the generalizability of the findings to the wider population. The study was also conducted over a limited period, which restricted the time available for sample collection and follow-up.

RECOMMENDATIONS

Future studies should include a larger sample size and be conducted over a longer period to obtain more reliable and generalizable findings. Further research should also evaluate these biomarkers and hematological parameters in larger and more diverse patient populations to better establish their diagnostic and prognostic significance.

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