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ORIGINAL RESEARCH

Correlation of left ventricular ejection fraction with cardiac troponin I and serum ferritin levels in acute ST elevation myocardial infarction patients

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ABSTRACT

Introduction: India has the highest burden of Acute Coronary Syndrome patients globally. The measurement of left ventricular ejection fraction (LVEF) after myocardial infarction is a class I clinical practice guideline recommendation, with prognostic and therapeutic implications**.** Cardiac troponin I is a sensitive and specific marker for myocardial damage, and serum ferritin, an acute-phase reactant, is considered a risk factor for MI. **Aims and Objectives:** To determine cardiac troponin I and serum ferritin levels in patients with first episode of STEMI, to estimate left ventricular ejection fraction in patients with first episode of STEMI and to correlate cardiac troponin I levels and serum ferritin levels in patients with first episode of STEMI with left ventricular ejection fraction. **Material and Methods:** This cross-sectional study was conducted in a hospital setting in the Medicine Department at GGSMCH Faridkot. 75 participants were included based on the inclusion and exclusion criteria during an 18-month timeframe. **Results:** The study demonstrated that in STEMI patients, lower LVEF is associated with higher levels of both troponin I and serum ferritin. A significant inverse relationship was found between LVEF and troponin I levels and a moderate negative correlation was observed between LVEF and serum ferritin. **Conclusion:** Assessing LVEF, cardiac troponin I and ferritin levels in STEMI patients provide valuable insights into myocardial damage, cardiac function and inflammatory status. The strong inverse correlation between cardiac troponins and LVEF underscores the importance of early and aggressive reperfusion therapies to minimize myocardial damage and preserve cardiac function.

INTRODUCTION

Over the last decade, cardiovascular diseasehas come forth as the predominant reason of premature death worldwide (1). Asian Indians have a noticeably higher prevalence of premature CAD and corresponding mortality rates compared to other ethnic groups. The age-adjusted mortality rate for CVD in India stands at 272 for every 100,000 individuals, surpassing the worldwide average of 235 for every 100,000 individuals (2).

Acute Coronary Syndrome (ACS) includes a broad spectrum of clinical presentations, ranging from ST-Segment Elevation Myocardial Infarction (STEMI) to non-ST-segment elevation myocardial infarction (NSTEMI) to unstable angina (acute coronary syndrome without the release of enzymes or biomarkers indicative of myocardial necrosis) (3).

Risk determinants of CAD are classified into non-modifiable and modifiable. Non modifiable factors include sex, age and family history and modifiable factors include smoking, dyslipidemia, diabetes mellitus, hypertension and obesity.

Acute myocardial infarction is defined by acute myocardial injury that manifests with clinical signs of acute myocardial ischemia. This condition is marked by an elevation and/or decline in cardiac troponin

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(cTn) levels, where at least one measurement exceeds the 99th percentile upper reference limit.

Ventricular function serves as a crucial predictor of mortality after ACS. STEMI can cause substantial damage to the myocardium, which may impact the LVEF, a significant indicator of cardiac function (4).LVEF provides valuable insights into ventricular performance, myocardial contractility, and the degree of myocardial damage. Thus, determining LVEF in ACS patients aids in both diagnosis and prognosis (5). Several factors play a role in development of LV dysfunction following STEMI. These include the duration of ischemia, the degree of myocardial damage, the collateral circulation, and the effectiveness of reperfusion therapy (6).

Cardiac biomarkersplay a pivotal role in diagnosing and stratifying the patients with ACS. Cardiac troponin I is among the most reliable and commonly used biomarkers for the diagnosis of AMI, including STEMI (7). Specifically, cTnI serves as a highly sensitive and specific indicator of myocardial necrosis, as its expression is exclusive to the heart tissue and is not found in other organs (8).Elevated levels of cardiac troponins, typically used to diagnose acute coronary syndrome (ACS), can also rise in various conditions not related to ACS. These include sepsis with or without shock, acute and chronic heart failure, intense physical exertion, acute pericarditis, myocarditis, pulmonary embolism, cardiotoxic chemotherapy, high-frequency ablation, external electrical cardioversion, and defibrillator shocks. In these cases, myocardial injury or stress causes the release of cardiac troponins into the bloodstream.

Although traditional biomarkers like cardiac troponins are important for diagnosing and managing STEMI, evidence indicates that ferritin levels may provide supplementary prognostic information and insights into the underlying pathophysiological mechanisms (9).Ferritin is a widely distributed intracellular protein essential for storing and regulating iron within the body (10). The primary function of ferritin is to sequester iron by acting as a ferroxidase, converting Fe(II) to Fe(III) as iron is taken up and stored in the mineral core of ferritin. Iron can be toxic within cellular environments because it can generate reactive species which can damage DNA and proteins in the cell. Moreover, ferritin is an acute-phase reactant that gets released into the bloodstream during certain inflammatory conditions, including ACS (11). Elevated ferritin levels in STEMI patients have been linked with larger infarct sizes, greater myocardial damage, and an elevated risk of untoward outcomes, including cardiac failure, arrhythmias, and mortality (12). The observed association is said to be mediated by several mechanisms, such as oxidative stress, inflammatory responses, and cytotoxic effects of ferritin on cardiomyocytes (13).

MATERIALS AND METHODS

This cross-sectional study was conducted in a hospital setting among IPD patients in the Medicine Department at GGS Medical College and Hospital, Faridkot, following an approval from institutional ethics committee. In total, 75 participants were included based on the established inclusion and exclusion criteria during an 18-month timeframe. The study aimed to determine cardiac troponin I and ferritin levels in patients with first episode of STEMI, to estimate LVEF in these patients with STEMI, and also to correlate cardiac troponin I levels and ferritin levels in patients with LVEF.

Inclusion criteria

- Patients of acute ST-elevation MI.
- Age 18-70 years, both males and females.
- Case of acute onset STEMI as diagnosed by typical clinical presentation.
- ECG characteristics specific for STEMI.

Exclusion criteria

- Previous history of myocardial infarction.
- A patient having pre-existing ECG changes s/o old MI or ECG showing Q wave at the time of admission.
- Any congenital or structural heart disease.
- LVH, conduction defects and heart blocks.
- Conditions in which Troponin I increase irrespective of Ischemic heart disease: significant renal impairment, rheumatoid arthritis, pericarditis, sepsis, acute congestive heart failure, acute pulmonary embolism, or prolonged tachyarrhythmias.
- Hemochromatosis, Liver disease, TB, patients on iron supplements.

Keeping in view of availability and feasibility of the subjects, a purposive convenient sampling technique was adopted and 75 eligible participants fulfilling the inclusion as well as exclusion criteria were selected for the study. Data was collected using self-structured proforma which consisted of detailed history, thorough examination, investigations and results.Clinical Assessment was done on admission including detailed history regarding the duration, frequency and severity of chest pain, exercise intolerance,presence of coronary risk factors and history of previous myocardial infarction. A detailed cardiovascular and systemic examination was carried out. A standard 12 lead ECG recording was done and blood samples taken for relevant investigations, including cardiac markers and ferritin was taken at the time of admission to the hospital.Troponin I levels were measured and quantitated by Sandwich ELISA and Radiometry method, with cut off value of 0.010 ng/ml. Serum ferritin values were quantified with chemiluminescence method.Echocardiography was done using Philips Epiq 7 machine and left ventricular ejection fraction was estimated using X5-1 probe

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according to the recommendations of the American Society of Echocardiography.

Statistical Analysis: The data pertaining to socio-demographic and other clinical variable was entered as a data matrix in Microsoft Excel and analysis using SPSS software in the light of suitable statistical tests was done. The p value of <0.05 was considered to be significant.

Ethical Considerations: Written and informed consent was secured from all the participants. The plan of the study was submitted for evaluation and approval from the institutional thesis committee. Following this, it was subjected to clearance by the ethics committee of GGS Medical College and Hospital, Faridkot.

OBSERVATION AND RESULTS

Age-wise distribution

In the study, most of the patients, that is 53.3% (40) were aged 60 and above. 30.7% (23 patients) were in the 51-60 age range and 16.0% (12 patients) were 50 years old or younger. The mean age of the group was 60.17 years, with a standard deviation of 8.29 years.

Table 1: Age group distribution in study subjects

Age group (years)	Frequency	Percentage
≤50	12	16.0%
51-60	23	30.7%
>60	40	53.3%
Total	75	100.0%

Mean Age ± S.D: 60.17 ± 8.29 years

Gender-wise distribution

In the study, there was a male predominance, with 57.3% (43 patients) being male and 42.7% (32 patients) being female.

Distribution of risk factors

Most prevalent risk factor in the study was hypertension, affecting 66.7% of the individuals studied, followed closely by diabetes mellitus at 45.3%. Dyslipidemia, another key risk factor, was present in 30.7% of the cases. Smoking and alcohol consumption were observed in 12.0% and 29.3% of the participants, respectively. Family history of CAD was noted in 20.0% of cases. Additionally, a substantial number of individuals were identified as being at risk due to obesity or pre-obesity, with 9.33% classified as obese and 61.33% as pre-obese.

Table 2: Distribution of risk factors

Risk factors	Frequency	Percentage
Diabetes mellitus	34	45.3%
Hypertension	50	66.7%
Dyslipidemia	23	30.7%
Smoking	9	12.0%
Alcohol consumption	22	29.3%
Family history (CAD)	15	20.0%
Pre-Obesity	46	61.33%
Obesity	7	9.33%

Distribution of symptomsin study population

Most frequent presenting symptom was chest pain, affecting 92% (69 patients) of the group. Dyspnea/orthopnea and diaphoresis were the next most prevalent symptoms, each occurring in 60% (45 patients) of the cases. Nausea and vomiting were experienced by 52% (39 patients) of the group. Palpitations were reported by 34.7% (26 patients), while dizziness affected 22.7% (17 patients). The least common symptom among these was epigastric pain, present in 17.3% (13 patients) of the group. This distribution of symptoms suggested a condition primarily affecting the cardiovascular system, with chest pain being the predominant complaint, followed by breathing difficulties, sweating, and gastrointestinal disturbances.

Table 3: Distribution of symptoms in Study Subjects

Symptoms	Frequency	Percentage
Chest pain	69	92.0%
Dyspnea/ Orthopnea	45	60.0%
Epigastric pain	13	17.3%
Diaphoresis	45	60.0%
Nausea/vomiting	39	52.0%

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Palpitations	26	34.7%
Dizziness	17	22.7%

ECG changes in the study population

ECG analysis to assess myocardial involvement in participants revealed a variety of patterns. Predominantly, inferior ECG changes were observed in 28.0% of cases, followed by antero-septal changes at 20.0%, antero-lateral at 17.3%, and lateral at 16.0%. Septal changes were noted in 13.3% of participants, while anterior changes were less frequent at 5.3%.

Table 4: Distribution of ECG changes (region wise) in study population

ECG changes	Frequency	Percentage
Anterior	4	5.3%
Antero Lateral	13	17.3%
Antero Septal	15	20.0%
Inferior	21	28.0%
Lateral	12	16.0%
Septal	10	13.3%
Right Ventricular	0	0%
Total	75	100.0%

Mean values of troponin I levels, S. Ferritin levels and LVEF in study population.

1. **Troponin I Levels**: The mean troponin I level in the study was 0.59 ng/ml, with the standard deviation is 0.48 ng/ml. Troponin I levels ranged from 0.02 ng/ml to 3.10 ng/ml, suggesting a wide distribution of values within the population.
2. **Serum Ferritin Levels**: The mean serum ferritin level in the study was 231.30 ng/ml, with the standard deviations 78.11 ng/ml, showing the spread of the values around the mean. Ferritin levels ranged from 47.00 ng/ml to 450.00 ng/ml in the participants.
3. **LVEF (%)**: The mean LVEF in the study was 40.56%, which is indicative of mildly reduced LVEF on an average. The standard deviation is 10.32%, showing the variability in the ejection fraction among the sample population. LVEF values ranged from 15% to 60% in the study population.

Table 5: Mean value of Troponin I, S. Ferritin and LVEF

	Troponin I (ng/ml)	S. Ferritin (ng/ml)	LVEF (%)
Mean	0.59	231.30	40.56
Std. Deviation	0.48	78.11	10.32
Minimum	0.02	47.00	15
Maximum	3.10	450.0	60

LVEF and its distribution in study population

Nearly half of the individuals in the study population (49.3%) had reduced EF. A substantial proportion (33.3%) had mid-range EF and a smaller proportion (17.3%) had preserved EF, indicating that fewer individuals had normal cardiac function.

Table 6: LVEF and its distribution

LVEF category	LVEF	Frequency	Percentage
Preserved EF	>50%	13	17.3%
Mid-range EF	41-50%	25	33.3%
Reduced EF	≤ 40%	37	49.3%
Total		75	100%

Mean cardiac Troponin I level among LVEF categories

Patients with preserved EF (>50%) had the lowest recorded mean Troponin I levels of 0.19 ng/ml with a corresponding standard deviation of 0.19 ng/ml.Patients with mid-range EF (41-50%) had a higher recorded mean Troponin I level of 0.41 ng/ml with a corresponding standard deviation of 0.33 ng/ml.Patients with reduced EF (≤40%) had the highest recorded mean Troponin I level of 0.85 ng/ml with a corresponding standard deviation of 0.49 ng/ml.A clear upward trend in Troponin I levels is observed as LVEF decreases, indicating that lower LVEF correlates with higher Troponin I levels.The overall mean recorded Troponin I level was 0.59 ng/ml, with a wide range from 0.02 to 3.10 ng/ml. The p-value of <0.001 indicates that these differences in Troponin I levels among LVEF groups are statistically significant.

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Table 7: Mean Troponin I level among LVEF Subgroups in study population

LVEF	N	Mean Troponin I (ng/ml)	Std. Deviation	Minimum	Maximum
>50%	13	0.19	0.19	0.02	0.59
41-50%	25	0.41	0.33	0.02	0.97
≤ 40%	37	0.85	0.49	0.09	3.10
Total	75	0.59	0.48	0.02	3.10
P value	<0.001				

Analysis of variance (ANOVA), P<0.001

Mean S. Ferritin levels among LVEF subgroups in study population

The data presented reveals notable variations in serum ferritin levels among different categories of LVEF. The data revealed that patients with the lowest LVEF (≤40%) had the highest mean ferritin level (255.62 ng/ml), while the two other groups had similar, lower levels (209.53 and 206.61 ng/ml). The overall range of ferritin levels across all 75 patients was 47-450 ng/ml. The p-value of 0.026 suggests a statistically significant difference in ferritin levels among these LVEF subgroups, indicating a potential relationship between ferritin and LVEF.

Table 8: Mean S. ferritin levels across LVEF subgroups in study population

LVEF	N	Mean S. Ferritin (ng/ml)	Std. Deviation	Minimum	Maximum
>50%	13	209.53	75.37	96	321
41-50%	25	206.61	71.72	96	324
≤ 40%	37	255.62	77.57	47	450
Total	75	231.30	78.11	47	450
P value	0.026				

Analysis of variance (ANOVA), P= 0.026

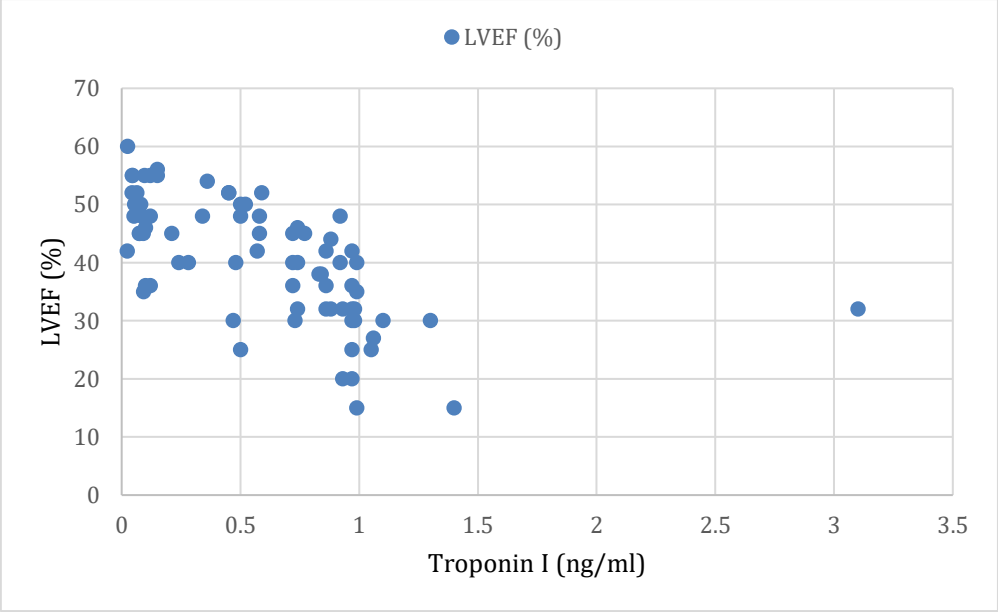
Correlation between Troponin I and LVEF

There's a strong negative correlation between Troponin I and LVEF in this study, with a Pearson correlation coefficient of -0.611. This indicates that elevation in troponin I levels is significantly linked to a reduction in LVEF. The p-value <0.001 suggests this correlation is highly statistically significant.

Table 9: Correlation of Troponin I and LVEF

		LVEF (%)
Troponin I (ng/ml)	Pearson Correlation	-0.611
	P value	<0.001

Figure 1: Correlation of Troponin I and LVEF



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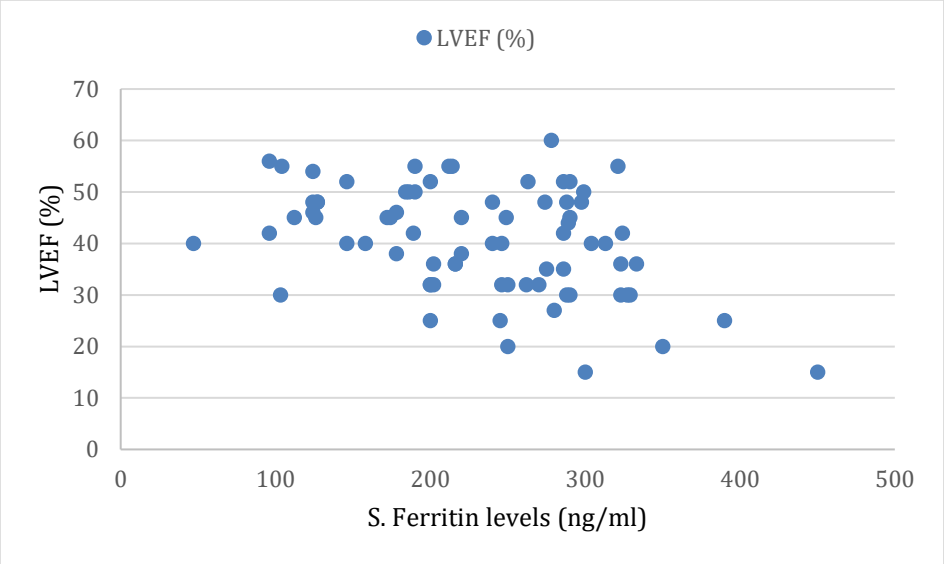
Correlation between LVEF and ferritin levels

In the present study there's a moderate negative correlation between Ferritin and LVEF, with a Pearson correlation coefficient of -0.4104. The results indicate an inverse relationship, where higher ferritin levels are linked with a lower LVEF. The p-value of 0.0002 indicates that this correlation is statistically significant.

Table 10: Correlation analysis of LVEF with S. Ferritin

S. Ferritin (ng/ml)	Pearson Correlation	-0.4104
	P value	0.0002

Figure 2: Correlation Analysis of LVEF with S. Ferritin



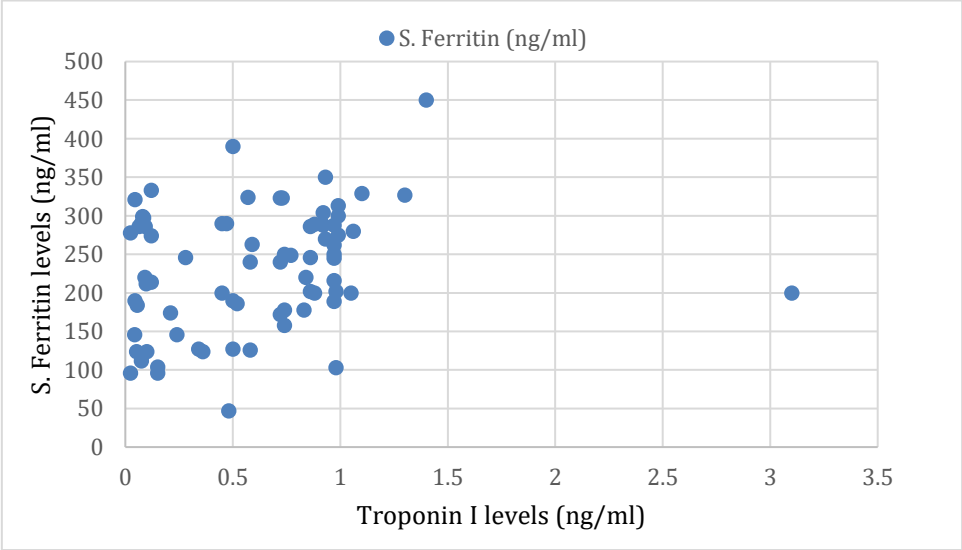
Correlation between Ferritin and Troponin I Levels

The analysis shows a very weak positive correlation between Serum Ferritin and Troponin I level, with a Pearson correlation coefficient of 0.079. Furthermore, the p-value of 0.499 suggests that the observed weak correlation is not statistically significant.

Table 16: Correlation between Ferritin and Troponin I Levels

		S. Ferritin (ng/ml)
TroponinI (ng/ml)	Pearson Correlation	0.079
	P value	0.499

Figure 13: Correlation between Ferritin and Troponin I Levels



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DISCUSSION

Age is a recognized predictor of survival after myocardial infarction (66).In the study, majority of the patients, that is 53.3% (40) were over 60 years of age. 30.7% (23) patients were in the age range 51-60 years and 16.0% (12) patients were 50 years old or younger. The mean age among the study participants was 60.17 years, with astandard deviation of 8.29 years. This distribution highlights the escalating risk of STEMI with advancing age, which is a known risk factor for CAD (14).

The results regarding age distribution in this study match those of a 2018 study by Khilar SM et al., which aimed to investigate the connection between cardiac troponin I and LV dysfunction AMIpatients.(15) The study's results are also in agreement with the HORIZONS-AMI trial, which noted an average age of 59.9 years for STEMI patients (16).

Sex Distribution

In this study there were 57.3%(43) males and 42.7% (32) females. This male predominance is in line with the overall trend in ACS epidemiology, which shows that men typically experience a greater incidence as compared to women (14). Additionally, specific identified risk factors, such as smoking and alcohol use, are commonly associated with the male population(68).

Risk factor distribution

The study highlighted several important established risk factors linked to cardiovascular health among participants. Hypertension was the most prevalent, affecting 66.7% patients, followed by diabetes mellitus at 45.3%. Dyslipidemia was found in 30.7% of cases. Smoking and alcohol consumption were reported in 12.0% and 29.3% of participants, respectively, while family history of CAD was present in 20% of participants. Additionally, a significant number of individuals were classified as being at risk due to obesity or pre-obesity, with 9.33% categorized as obese and 61.33% as pre-obese. The average BMI of the group was 26.34 kg/m^2, with a standard deviation of 2.43.

Hypertension has long been acknowledged as a notable risk factor for CAD and LV systolic dysfunction, primarily because of the oxidative and mechanical stress it exerts on the arterial walls (17,18). Diabetes mellitus in patients after acute myocardial infarctionis considered as a strong predictor of short and long-term mortality. The results of this study are in unison with earlier research by Khilar SM et al. in 2018 and Chen W et al. in 2022 (15,19). The GRACE registry reported that hypertension was prevalent in 65.8% of STEMI patients, while diabetes was reported in 25.1% of cases (20).

Symptom Distribution and presentation in hospital

In our study, chest pain was the most frequently reported symptom, affecting 92% (69) patients. Dyspnea/orthopnea and diaphoresis were the next most prevalent symptoms, each occurring in 60% (45) patients of the cases. Nausea and vomiting were experienced by 52% (39) patientsof the group. Palpitations were reported by 34.7% (26) patients, while 22.7% (17) patients complained of dizziness. The least reported presenting symptom was epigastric pain, present only in 17.3% (13) patients of the group. The high incidence of chest pain (92%) is consistent with its recognition as a hallmark symptom of STEMI.

King Sheir and colleagues in their research on ACS presentations also corroborated that chest pain was the most frequent presenting symptom (89.3%), followed by dysponea(62.4%) (21).A study by Battula S and colleagues on clinical features and outcomesin ACS patients found thatchest pain (95%) was the most frequent symptom followed by diaphoresis (70%), dyspnea(43%). Most patients presented within 9 hrs of experiencing chest pain (22).Thus, the results of the present study were consistent with the other studies.

Troponin I and LVEF correlation

There's a strong negative correlation between Troponin I and LVEF, with a Pearson correlation coefficient of -0.611. Patients with preserved EF (>50%) had the least mean levels of troponin I (0.19 ng/ml) with a standard deviation of 0.19 ng/ml. Patients with mid-range EF (41-50%) had a higher levels of mean troponin I (0.41 ng/ml) with a standard deviation of 0.33 ng/ml. Patients with reduced EF (≤40%) had the highest levels of meantroponin I (0.85 ng/ml) with a standard deviation of 0.49 ng/ml. A clear upward trend in mean troponin I levels is observed as LVEF decreases. The p-value of <0.001 suggests this correlation is highly statistically significant. Cardiac troponin I is a sensitive and a specific biomarker for myocardial injury. High levels of troponin I are a direct indication of necrosis of myocardium and are pivotal for the diagnosis of AMI. Numerous studies have established an inverse relationship between levels of troponin I and LVEF. For instance, the study by Rao AC et al. (1998) noted that higher troponin levels were linked with a substantial reduction in LVEF, indicating extensive myocardial damage (5). Similarly, another study by Ahmed KU et al. in established a strong negative relationship between cardiac troponin I and LVEF following the first AMI (23).In 2022, Mohan N et al. concluded that Troponin I level exhibit a robust negative correlation with LVEF in ACS patients (24).The extent of myocardial injury, as indicated by elevated cTnI levels, directly impacts myocardial function. Greater myocardial cell death results in reduced contractile function, leading to a lower LVEF. Elevated levels of cTnI can act as a clinical predictor of reduced LVEF, assisting clinicians in identifying

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patients at increased likelihood for untoward outcomes and informing the intensity of treatment strategies (25).

LVEF and Ferritin correlation

In this study, there's a moderate negative correlation between ferritin and LVEF, with a Pearson correlation coefficient of -0.4104. The p-value of 0.0002 indicates that this correlation is statistically significant. These results suggest that higherferritin levels are linked with reduced cardiac function, indicating an inverse relationship. Ferritin is a widely distributed intracellular protein essential for storing and regulating iron within the body (10).Ferritin is also an acute-phase reactant that is released into the bloodstream in bodily response to an inflammatory stimulus, such as ACS (11). Elevated ferritin levels in context of STEMI may reflect the inflammatory response and oxidative stress related to myocardial injury. In their 2018 study, Duarte et al. established that disturbances in iron metabolism, particularly reflected in higher serum ferritin levels, were linked with an elevated risk of adverse events. Specifically, elevated ferritin levels independently predicted higher mortality rates over the one-year follow-up period (26). Wen and colleagues in 2020 performed a meta-analysis to find the relationship between increased ferritin levels and AMI. The meta-analysis revealed a pooled standard mean difference of 0.78 (95% CI, 0.68-0.88), indicating that levels of ferritin were significantly higher in individuals with AMI compared to those without (27).The inflammatory response and oxidative stress following AMI contributes to further myocardial damage and dysfunction. Elevated ferritin levels are indicative of this inflammatory state, which can exacerbate myocardial injury and reduce LVEF. Monitoring serum ferritin levels may offer valuable prognostic insights into myocardial function.

Troponin I and Ferritin correlation

The analysis shows a very weak positive correlation between serumferritin and troponin I levels, with a Pearson correlation coefficient of0.079. Furthermore, the p-value of 0.499 suggests that the observedweak correlation is not statistically significant. As established, there canbe elevation of both cTnI and ferritin levels in bodily response to theacute inflammatory stress associated with myocardial infarction,suggesting a potential positive correlation. Past studies havesuggested that increased cTnI and ferritin levels are often observedconcomitantly in STEMI patients. For example, Singh S andcolleagues (2021) noted that high ferritin levels and cTnI levels wereconcomitantly found in ACS patients, reflecting the degree ofmyocardial damage and the inflammatory response (28). Other studiesdone in the past have also established that serum ferritin could serveas a marker of the inflammatory process in ACS. Thisinflammatory response can exacerbate myocardial damage, resultingin higher cTnI levels. The concurrent elevation of cTnI and ferritinlevels suggests a severe inflammatory response and extensivemyocardial injury. This correlation may aid in identifying high-riskpatients requiring intensive monitoring along with tailored therapeutic

CONCLUSION

The study highlights the complex interplay between myocardial damage, cardiac function, and inflammatory response. The strong inverse correlation between cardiac troponins and LVEF underscores the importance of early and aggressive reperfusion therapies to minimize myocardial damage and preserve cardiac function. Preventively, the study reinforces the importance of managing traditional cardiovascular risk factors such as hypertension, diabetes, and obesity, which were prevalent in the study population.Furthermore, assessing LVEF, cardiac troponin I and ferritin levels in STEMI patients provide valuable insights into myocardial damage, cardiac function and inflammatory status. These biomarkers, when combined with clinical findings and other risk factors, assist in risk stratification, outcome prediction, and tailored management strategies. This comprehensive approach aims to improve patient outcomes and minimize adverse events in this high risk group.Ongoing research with a multidisciplinary approach is crucial for refining risk assessment and optimizing therapeutic strategies for STEMI patients.

Strength of the study

The study emphasises on the correlation between troponin I and ferritin with LVEF in STEMI patients, keeping in view the paucity of data on this subject.In addition to troponin I, ferritin and LVEF; assessment of risk factors and demographics was also studied in STEMI patients.The collected data aimed to offer a comprehensive understanding of the patient population and their clinical characterstics.

Limitations of the study

As it was asingle-centerstudy, the results may not be representative of broader populations or different healthcare. Lack of follow-up data limits understanding of long-term outcomes or changes in patients' health status. Laboratory values (e.g., troponin and ferritin) may have variability due to differenttesting methods or pre-analytical factors not controlled in the study.

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