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Original Article

Evaluation of Cardiac Enzymes in Newly Diagnosed Patients with Myocardial Infarction: A Cross-Sectional Study

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ABSTRACT

Background: Myocardial Infarction (MI) is a leading cause of mortality worldwide. While cardiac troponins and CK-MB are specific biomarkers for myocardial injury, their elevation typically takes hours. This study evaluates the prognostic value of cardiac enzymes in newly diagnosed MI patients.
Methods: A cross-sectional study was conducted on 150 newly diagnosed MI patients admitted to the Cardiac ICU of Geetanjali Medical College and Hospital from July 2023 to February 2024. Cardiac biomarkers (Troponin-I, Troponin-T, CK-MB, and BNP) were measured at admission. Patients were followed for in-hospital outcomes (discharge vs. death). Statistical analysis was performed using SPSS version 21, with a p-value <0.05 considered significant.
Results: Of 150 patients, 88.67% were male and 50.67% were aged <40 years. In-hospital mortality was 7.33% (n=11). Non-survivors had significantly elevated levels of Troponin-I (4.17 ± 3.40 vs. 0.59 ± 1.24, p=0.001) and CK-MB (24.17 ± 24.77 vs. 8.74 ± 15.01, p=0.043) compared to survivors. Troponin-T and BNP showed no significant difference. Elevated Troponin-I and CK-MB were strong predictors of mortality.
Conclusion: Cardiac enzymes, particularly Troponin-I and CK-MB, are significant prognostic markers for in-hospital mortality in acute MI patients. Their elevation reflects the extent of myocardial damage and should guide aggressive early management.

Keywords: *Myocardial Infarction, Troponin-I, CK-MB, Cardiac Enzymes, Prognosis, Mortality.*

INTRODUCTION

Myocardial Infarction (MI) remains one of the foremost causes of mortality and long-term disability across the globe, resulting from reduced blood flow to the heart muscle due to plaque buildup in the coronary arteries [1]. The World Health Organization reports that India contributes to one-fifth of these global deaths, with a particularly high incidence among younger populations [2].

In patients with MI, cardiac markers such as CK-MB, Troponin-I, and Troponin-T are recognized as specific biomarkers for myocardial injury. However, these markers typically take 4–6 hours to become detectable in the blood following chest pain [3]. Despite this limitation, they remain the gold standard for diagnosis and risk stratification. This study was designed to evaluate the role of cardiac enzymes as prognostic indicators in patients with acute myocardial infarction.

MATERIALS AND METHODS

Study Design and Setting

This was a hospital-based cross-sectional study conducted at Geetanjali Medical College and Hospital (GMCH), Udaipur, after obtaining approval from the Institutional Research Ethics Board.

Study Period and Population
The study was conducted from July 2023 to February 2024. A total of 150 newly diagnosed patients with acute myocardial infarction admitted to the Cardiac ICU were included.
Inclusion Criteria: All newly diagnosed patients of Myocardial Infarction.

Exclusion Criteria:
- Known case of myocardial infarction
- Patients with hematological disorders, malignancy, autoimmune disorders, or active infections
- Patients whose outcome data was not available or left against medical advice (LAMA)

Sample Collection and Cardiac Enzyme Analysis
Blood samples were collected from the venipuncture site under complete aseptic precautions within 24 hours of admission. Samples were immediately transported to the central laboratory for analysis.
The following cardiac enzymes and biomarkers were measured:
- Troponin-I (TROP-I)
- Troponin-T (TROP-T)
- Creatine Kinase-MB (CK-MB)
- Brain Natriuretic Peptide (BNP)

All samples were processed using standard automated analyzers per manufacturer protocols.

Data Collection and Outcome
Demographic data, clinical history, and biochemical investigation reports were collected using a predesigned proforma. Patients were followed throughout their hospital stay. The primary outcome was in-hospital mortality.

Statistical Analysis
Data were entered and cleaned using Microsoft Excel and analyzed using SPSS version 21 (IBM Corporation). Descriptive statistics were presented as mean and standard deviation for continuous variables and as frequencies and percentages for categorical variables. Inferential statistics included the Chi-square test and independent t-test. A p-value of <0.05 was considered statistically significant.

RESULTS
Baseline Demographics (n=150)
- **Age Distribution:** 76 patients (50.67%) were aged <40 years, and 74 (49.33%) were aged ≥40 years. The youngest patient was 21 years old.
- **Sex Distribution:** 133 patients (88.67%) were male, and 17 (11.33%) were female (male: female ratio ~9:1).
- **In-hospital Mortality:** 11 patients (7.33%) died during hospitalization, while 139 (92.67%) were discharged.

Age-wise Distribution of Outcomes (Table 1)
The highest mortality was observed in patients aged >60 years (4 out of 16, 25.0%), despite this group having the smallest number of total cases. The 30-40 years age group had the highest number of MI cases but very low mortality (2 out of 64, 3.1%).

Table 1: Age-wise Distribution of MI Patients with Outcome (n=150)

Age Group	Deceased (n=11)	Discharge (n=139)	Total (n=150)	Mortality Rate (%)
<30 yrs	1	19	20	5.0%
30-40 yrs	2	62	64	3.1%
41-50 yrs	2	24	26	7.7%
51-60 yrs	2	22	24	8.3%
>60 yrs	4	12	16	25.0%

Cardiac Enzymes and Outcome (Table 2)
Non-survivors (deceased) had significantly higher levels of Troponin-I and CK-MB compared to survivors. Troponin-T and BNP showed no significant association with mortality.

Table 2: Correlation of Cardiac Enzymes with Outcome (n=150)

Parameter	Deceased (n=11) Mean ± SD	Alive (n=139) Mean ± SD	P value	Interpretation
Troponin-I (ng/mL)	4.17 ± 3.40	0.59 ± 1.24	0.001	Significant
Troponin-T (ng/mL)	0.63 ± 0.38	0.67 ± 0.36	0.736	Not Significant
BNP (pg/mL)	608.15 ± 783.89	515.02 ± 777.69	0.705	Not Significant
CK-MB (U/L)	24.17 ± 24.77	8.74 ± 15.01	0.043	Significant

DISCUSSION

This study evaluated the prognostic value of cardiac enzymes in 150 newly diagnosed MI patients. The key finding is that elevated Troponin-I and CK-MB at admission are strong predictors of in-hospital mortality.

Age and Gender Distribution

Over half (50.67%) of our MI patients were aged below 40 years, highlighting a concerning trend toward younger onset in developing regions, consistent with findings by Lu et al. (2015) and Kumar et al. (2020) [1,2]. The male predominance (88.67%) is congruent with Singh et al. (2022) and reflects higher rates of traditional risk factors in men, along with the cardioprotective effects of estrogen in premenopausal women.

Mortality and Age

The mortality rate in patients >60 years was 25%, reinforcing the established vulnerability of elderly patients to ischemic insults. In contrast, younger patients (<40 years) had significantly better survival, supporting findings by Tang et al. (2013) regarding favorable outcomes in this subgroup [4].

Cardiac Enzymes as Prognostic Markers

Our findings demonstrate that Troponin-I and CK-MB are significantly elevated in non-survivors, affirming their diagnostic and prognostic relevance.

Troponin-I: Deceased patients had a mean Troponin-I level of 4.17 ng/mL compared to 0.59 ng/mL in survivors ($p=0.001$). This aligns with Jendoubi et al. (2019), who demonstrated that peak troponin levels were significantly higher in patients who succumbed to MI during hospitalization [5]. Troponin I serves not only as a diagnostic marker but also as an important risk stratification tool.

CK-MB: The significant elevation of CK-MB in non-survivors (24.17 vs. 8.74 U/L, $p=0.043$) emphasizes myocardial cell damage. Dohi T et al. (2015) reported that patients with higher CK-MB values on admission were more likely to experience adverse cardiac events, including death [6]. Though less specific than troponins, CK-MB remains valuable in monitoring reinfarction and reflecting broader myocardial stress.

Non-significant markers: Troponin-T and BNP did not show significant associations with mortality. The lack of significance for BNP, despite its known role in heart failure, may be due to the timing of sample collection or the predominance of ischemic injury without acute decompensated heart failure in this cohort.

Clinical Implications

The concurrent evaluation of Troponin-I and CK-MB provides a dual assessment of myocardial necrosis. Patients presenting with markedly elevated levels of both markers should be identified as high-risk and prioritized for aggressive reperfusion strategies and intensive monitoring.

Study Limitations

1. **Single-Centre Study:** Findings may limit generalizability to broader populations.
2. **Sample Size:** The relatively small deceased subgroup (n=11) reduces statistical power.
3. **Timing of Sampling:** Single measurements at admission may miss peak enzyme levels in some patients. Serial measurements were not uniformly analyzed.
4. **Short-Term Follow-Up:** The study focused solely on in-hospital outcomes; long-term prognostic implications were not assessed.

CONCLUSION

Cardiac enzymes, particularly Troponin-I and CK-MB, are powerful prognostic markers for in-hospital mortality in patients with acute myocardial infarction. Their elevation at admission reflects the extent of myocardial damage and should guide early risk stratification and aggressive management. Troponin-T and BNP showed limited utility in predicting short-term mortality in this cohort. Integrating cardiac enzyme levels with clinical assessment offers a comprehensive approach to improving outcomes in MI patients.

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