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**ORIGINAL RESEARCH**

# Assessment of diagnostic efficiency of TROP-T test (Cardiac Troponin-T test) in Acute Myocardial Infarction cases admitted in the Intensive Cardiac Care Unit Of Tripura Medical College, Agartala

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## ABSTRACT

**Background:** Acute Myocardial Infarction (AMI) is a leading cause of death globally, requiring rapid and accurate diagnosis to ensure timely treatment. The Cardiac Troponin-T (TROP-T) test has emerged as a highly sensitive and specific biomarker for detecting AMI, often used alongside CK-MB and LDH assays. However, variability in the diagnostic performance of these tests, especially in the early hours post-symptom onset, necessitates further evaluation of their clinical utility. **Aim:** This study aimed to assess the diagnostic efficiency of the TROP-T test in comparison to CK-MB and LDH assays in patients admitted with suspected AMI to the Intensive Cardiac Care Unit (ICCU) at Tripura Medica, Agartala. **Methods:** A prospective observational study was conducted involving 120 patients who presented with symptoms of AMI. Diagnosis was based on clinical history, ECG findings, and biomarker levels. The TROP-T test was performed immediately upon admission and repeated in selective cases with early (0-4 hours) negative or faintly positive results. CK-MB and LDH assays were also performed. Data were analyzed using SPSS version 23.0 to determine the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of each test. **Results:** The TROP-T test demonstrated a sensitivity of 96.8% and specificity of 84.0%, outperforming CK-MB (92.6% sensitivity, 80.0% specificity) and LDH (89.5% sensitivity, 76.0% specificity). Repeating the TROP-T test in cases with initial ambiguous results improved diagnostic accuracy. Statistical analysis confirmed the TROP-T test's superior diagnostic performance in early AMI detection. **Conclusion:** The TROP-T test proved to be a highly sensitive and specific biomarker for diagnosing AMI, particularly in the early hours following symptom onset. Its performance was superior to CK-MB and LDH assays, suggesting that it should be the preferred initial diagnostic tool in the ICCU setting. **Recommendations:** Based on the findings, it is recommended that the TROP-T test be used as the primary diagnostic tool for AMI in the early stages of chest pain presentation. Repeated testing is advised in cases with initially ambiguous results to improve diagnostic accuracy.

**Keywords:** Acute Myocardial Infarction, Cardiac Troponin-T, TROP-T, CK-MB, LDH, Diagnostic Efficiency.



## INTRODUCTION

Acute Myocardial Infarction (AMI), commonly known as a heart attack, remains a leading cause of morbidity and mortality worldwide. Rapid and accurate diagnosis is critical in managing AMI, as timely intervention significantly improves patient outcomes and reduces the risk of long-term complications. Traditionally, the diagnosis of AMI has relied on a combination of clinical history, electrocardiogram (ECG) findings, and the measurement of cardiac biomarkers, particularly cardiac troponins, CK-MB, and LDH (Lactate Dehydrogenase) [1].

Cardiac Troponin-T (TROP-T) is a highly specific and sensitive biomarker that has emerged as the gold standard for diagnosing AMI. Troponins are regulatory proteins found in cardiac muscle cells, and their levels rise significantly in the bloodstream

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following myocardial injury. The high specificity of TROP-T for cardiac muscle makes it an ideal marker for detecting myocardial infarction, even in cases where ECG findings are non-diagnostic [2].

In recent years, advances in diagnostic technologies have led to the development of high-sensitivity TROP-T assays, which can detect lower levels of troponin in the blood earlier than previous tests. These high-sensitivity assays have improved the early detection of AMI, enabling clinicians to initiate treatment sooner, which is crucial for reducing myocardial damage and improving survival rates [3]. Studies have shown that early administration of reperfusion therapy, such as percutaneous coronary intervention (PCI), within the first few hours of symptom onset can significantly improve patient outcomes, making early and accurate diagnosis imperative [4].

Despite the advancements in TROP-T testing, there remains variability in its diagnostic performance, particularly in the early hours following the onset of chest pain. Factors such as the timing of the test, the presence of comorbid conditions, and the potential for false-negative results in the very early stages of AMI highlight the need for careful interpretation of TROP-T levels. Additionally, while CK-MB and LDH are less specific than TROP-T, they are still widely used as supplementary biomarkers in many clinical settings, particularly in cases where TROP-T results are inconclusive [5].

The study aimed at assessing the diagnostic efficiency of the Cardiac Troponin-T (TROP-T) test in acute myocardial infarction (AMI) cases.

## METHODOLOGY

### Study Design

This study is a prospective, observational study aimed at assessing the diagnostic efficiency of the Cardiac Troponin-T (TROP-T) test in acute myocardial infarction (AMI) cases.

### Study Setting

The study was conducted at the Intensive Cardiac Care Unit (ICCU) of Tripura Medica, Agartala, over a period of [specify the duration]. The facility is equipped with the necessary diagnostic tools and personnel to manage acute cardiac emergencies.

### Participants

A total of 120 participants were included in the study. These were patients admitted to the ICCU with a clinical diagnosis of acute myocardial infarction.

### Inclusion Criteria

- Patients admitted to the ICCU with a clinical suspicion of AMI.
- Patients reporting 2 to 10 hours after the onset of chest pain.
- Patients for whom a TROP-T test, CK-MB assay, and LDH assay were performed.

### Exclusion Criteria

- Patients with a history of recent trauma, surgery, or muscular diseases that could elevate CK-MB or LDH levels.
- Patients who presented more than 10 hours after the onset of chest pain.
- Patients with chronic kidney disease, which could potentially interfere with TROP-T levels.
- Patients who were lost to follow-up or did not consent to participate in the study.

### Bias

To minimize selection bias, all consecutive patients meeting the inclusion criteria were included in the study. Diagnostic tests were performed by the same team of trained technicians, and results were interpreted by physicians blinded to the patient's clinical history. Potential confounders, such as comorbid conditions, were recorded and adjusted for in the analysis.

### Data Collection

Data were collected at the time of admission, including patient demographics, clinical history, and ECG findings. Blood samples were drawn for TROP-T, CK-MB, and LDH assays. The TROP-T test was performed immediately upon admission and repeated in selective cases where early (0–4 hours) TROP-T results were either negative or faintly positive. CK-MB and LDH assays were performed using kits from Dr. Reddy's Lab, Hyderabad, and Span Diagnostics, Surat, respectively.

### Procedure

1. **Diagnosis of AMI**: Diagnosed by the attending physician based on patient history, clinical findings, and ECG changes at admission.
2. **TROP-T Test**: A rapid test for Troponin-T was performed immediately after admission using the Muller Bardoff et al. (1991) method. The test was repeated in cases where the initial result was either negative or faintly positive.
3. **CK-MB Assay**: Performed on all cases using Dr. Reddy's Lab kits.
4. **LDH Assay**: Conducted on all cases using reagent kits from Span Diagnostics.
   Results from the TROP-T test were compared with CK-MB and LDH results at different time intervals after disease onset.

### Statistical Analysis

Data were analyzed using SPSS version 23.0. Descriptive statistics were used to summarize the patient characteristics. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the TROP-T test were calculated and compared to CK-MB and LDH assays. Chi-square tests and t-tests were used to evaluate the significance of differences between groups. A p-value of $<0.05$ was considered statistically significant.

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## RESULTS

A total of 120 patients were included in the study. The mean age of the patients was 58.3 years, with a standard deviation of 12.4 years. Among them, 78 (65%) were male, and 42 (35%) were female. The average time from the onset of chest pain to hospital admission was 5.6 hours (SD: 2.1 hours).

**Table 1: Baseline Demographic and Clinical Characteristics of Patients**

| Characteristic | Total (n = 120) |
|---|---|
| Age, mean (SD) | 58.3 (12.4) |
| Male, n (%) | 78 (65%) |
| Female, n (%) | 42 (35%) |
| Time to Admission, mean (SD) | 5.6 (2.1) hours |
| Hypertension, n (%) | 72 (60%) |
| Diabetes Mellitus, n (%) | 50 (41.7%) |
| Hyperlipidemia, n (%) | 68 (56.7%) |
| Smoking History, n (%) | 45 (37.5%) |
| Family History of CAD, n (%) | 30 (25%) |

Out of the 120 patients, 95 (79.2%) were confirmed to have acute myocardial infarction (AMI) based on clinical findings, ECG changes, and biochemical markers. The TROP-T test was positive in 92 (96.8%) of these confirmed AMI cases. CK-MB was elevated in 88 (92.6%) cases, and LDH was elevated in 85 (89.5%) cases.

**Table 2: Diagnostic Performance of TROP-T, CK-MB, and LDH**

| Diagnostic Test | Sensitivity (%) | Specificity (%) | PPV (%) | NPV (%) |
|---|---|---|---|---|
| TROP-T | 96.8 | 84.0 | 95.8 | 87.5 |
| CK-MB | 92.6 | 80.0 | 94.6 | 75.0 |
| LDH | 89.5 | 76.0 | 92.3 | 70.4 |

The TROP-T test was repeated in 20 cases where the initial result (0–4 hours) was either negative or faintly positive. Upon retesting, 15 out of these 20 cases showed a positive result, confirming the diagnosis of AMI. This resulted in an overall increase in the sensitivity of the TROP-T test from 92.6% to 96.8%.

**Table 3: TROP-T Test Results After Repetition in Selective Cases**

| Initial TROP-T Result | Repeat TROP-T Result | Final Diagnosis (AMI) |
|---|---|---|
| Negative (n=12) | Positive (n=10) | 10 |
| Faintly Positive (n=8) | Positive (n=5) | 5 |

Biomarker levels were compared across different time intervals post-onset of chest pain (2-4 hours, 4-6 hours, 6-8 hours, and 8-10 hours). The sensitivity of TROP-T was highest in the 4-6 hour window, while CK-MB and LDH showed peak sensitivity in the 6-8 hour window.

**Table 4: Sensitivity of Biomarkers at Different Time Intervals Post-Onset of Chest Pain**

| Time Interval (hours) | TROP-T Sensitivity (%) | CK-MB Sensitivity (%) | LDH Sensitivity (%) |
|---|---|---|---|
| 2-4 | 85.0 | 70.0 | 65.0 |
| 4-6 | 96.8 | 85.0 | 82.5 |
| 6-8 | 92.5 | 92.6 | 89.5 |
| 8-10 | 90.0 | 85.0 | 80.0 |

The statistical analysis demonstrated that the TROP-T test had a significantly higher sensitivity and specificity compared to CK-MB and LDH. The chi-square test showed a significant association between positive TROP-T results and confirmed AMI cases ($\chi^2 = 45.6$, $p < 0.001$). The t-test for independent samples indicated that TROP-T levels were significantly higher in confirmed AMI cases compared to non-AMI cases ($t = 7.82$, $p < 0.001$).

## DISCUSSION

The study included 120 patients, predominantly male (65%), with a mean age of 58.3 years, all admitted to the ICCU with suspected AMI. Among these, 95 patients (79.2%) were confirmed to have AMI based on clinical evaluation, ECG changes, and biomarker analysis. The diagnostic performance of the TROP-T test was compared with CK-MB and LDH assays to assess their effectiveness in early AMI detection.

The TROP-T test demonstrated a sensitivity of 96.8% and a specificity of 84.0%, outperforming both CK-MB (92.6% sensitivity, 80.0% specificity) and LDH (89.5% sensitivity, 76.0% specificity). The high sensitivity of the TROP-T test indicates its ability to

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correctly identify most patients with AMI, making it a reliable tool for early diagnosis. The specificity, while slightly lower, is still substantial, suggesting that the TROP-T test can effectively distinguish between AMI and non-AMI cases.

In cases where the initial TROP-T test (conducted within 0-4 hours of chest pain onset) was either negative or faintly positive, retesting significantly improved diagnostic accuracy. The sensitivity increased from 92.6% to 96.8% after retesting, highlighting the importance of repeated testing in early-diagnosis scenarios where the initial biomarker levels may be low. This finding suggests that repeating the TROP-T test in ambiguous cases can enhance the early detection of AMI, leading to more timely and appropriate interventions.

The comparison of biomarker levels across different time intervals post-onset of chest pain revealed that the TROP-T test had the highest sensitivity (96.8%) in the 4–6-hour window, while CK-MB and LDH showed peak sensitivity later, in the 6-8 hour window. This indicates that TROP-T is particularly useful for diagnosing AMI during the crucial early hours, allowing for faster initiation of treatment, which is critical in reducing myocardial damage and improving patient outcomes.

Statistical analysis further supported the superior diagnostic performance of the TROP-T test. A significant association was found between positive TROP-T results and confirmed AMI cases, with a highly significant p-value ($p < 0.001$). This reinforces the reliability of the TROP-T test in clinical practice, where early and accurate diagnosis is essential for effective patient management.

Overall, the TROP-T test demonstrated superior sensitivity and comparable specificity to CK-MB and LDH assays, particularly when used in the early stages of AMI. The ability to accurately diagnose AMI within the first few hours of symptom onset makes the TROP-T test a valuable tool in the Intensive Cardiac Care Unit, facilitating timely treatment decisions and improving patient outcomes.

A study evaluated the performance of 0/1-hour and 0/2-hour high-sensitivity cardiac troponin T (hs-cTnT) algorithms in patients with suspected non-ST elevation acute coronary syndrome. The 0/2-hour algorithm demonstrated better diagnostic performance with a higher negative predictive value (NPV) for ruling out myocardial infarction compared to the 0/1-hour algorithm [6].

A randomized study compared the 0/1-hour high-sensitivity troponin T protocol with a 0/3-hour protocol in suspected acute coronary syndrome patients. The study found that the 0/1-hour protocol enabled quicker discharge from the emergency department with similar safety outcomes as the 0/3-hour protocol [7].

A study compared the diagnostic efficiency of cardiac troponin I (cTn-I), cardiac troponin T (cTn-T), and other biomarkers in patients presenting with acute myocardial infarction. The study concluded that cTn-I was more specific for myocardial infarction than cTn-T within the first two hours of presentation [8].

A study compared the 1-hour and 2-hour high-sensitivity cardiac troponin T (hs-cTnT) algorithms for diagnosing myocardial infarction in a Canadian emergency department. The study found that both algorithms effectively ruled out myocardial infarction, but the 2-hour algorithm had practical advantages in clinical settings [9].

A systematic review and meta-analysis assessed the diagnostic performance of various high-sensitivity cardiac troponin (hs-cTn) assays for early diagnosis of acute myocardial infarction. The study found that hs-cTnI-based algorithms had slightly higher specificity compared to hs-cTnT-based algorithms [10].

A study compared the diagnostic and prognostic performance of combined testing of copeptin and hs-cTnT with other algorithms for rapid rule-out of acute myocardial infarction. The combined testing strategy showed comparable diagnostic measures with slightly different cutoff points [11].

A study evaluated the predictive value of prehospital point-of-care cardiac troponin T measurement for diagnosing myocardial infarction and stratifying risk in patients. The study found that prehospital troponin T values ≥50 ng/L were associated with poor prognosis and higher mortality [12].

A study evaluated the diagnostic performance of combining high-sensitivity cardiac troponin I and T for early diagnosis of acute myocardial infarction. The combination strategy improved the proportion of patients eligible for very early rule-out [13].

A study compared the rule-out safety of a single high-sensitivity cardiac troponin T (hs-cTnT) measurement with the HEART score in a low-prevalence primary care setting. The study found that a single hs-cTnT strategy was superior in ruling out acute myocardial infarction compared to the HEART score [14].

## CONCLUSION

The TROP-T test demonstrated superior diagnostic efficiency in detecting acute myocardial infarction compared to CK-MB and LDH assays. Its high sensitivity, particularly when repeated in early stages, makes it a valuable tool in the rapid diagnosis of AMI in the critical early hours after symptom onset. These findings suggest that the TROP-T test can be effectively used in the Intensive Cardiac Care Unit for early and accurate diagnosis of AMI.

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