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Original Research Article

Role of High-Sensitivity Troponins in Early Diagnosis of Acute Coronary Syndrome

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Abstract:

Background: Early diagnosis is critical for effective therapy of Acute Coronary Syndrome (ACS), a cause of significant morbidity and mortality worldwide. The sensitivity of conventional cardiac biomarkers to detect early myocardial damage is often low. In a bid to identify early mild myocardial necrosis, high-sensitivity cardiac troponins (hs-cTn) are now reliable markers for the early diagnosis of ACS.

Objectives: For patients presenting with acute chest pain, the present study aimed to establish the diagnostic utility of high-sensitivity troponins compared to conventional diagnostic methods and their role in the early diagnosis of ACS.

Materials and Methods: This prospective observational study was conducted over a period of one year in the cardiology department of a tertiary care center. 205 patients with acute chest pain suspected to be due to ACS were enrolled. High-sensitivity cardiac troponin (hs-cTn) was serially tested on admission and three to six hours afterwards, and every patient had a comprehensive clinical assessment and electrocardiogram (ECG). Cardiologists relied on clinical, biochemical, and imaging evidence to make the final diagnosis, which was based on the patient's clinical presentation. Predictive values, sensitivity, and specificity of hs-cTn's diagnostic accuracy were assessed.

Results: 128 (62.4%) of the 205 patients had a diagnosis of ACS. 116 of the ACS patients had elevated levels of hs-cTn upon admission, and the sensitivity was 90.6% and specificity was 85.2%. Early detection of hs-cTn compared to the use of conventional ECG signs alone significantly increased diagnosis, particularly in non-ST elevation ACS individuals. The substantial negative predictive value confirmed its role in excluding ACS in low-risk patients.

Conclusion: Compared with conventional modalities, high-sensitivity troponins performed better in the early diagnosis of ACS. Their use in the initial evaluation of patients with acute chest pain in tertiary care settings makes rapid diagnosis, timely intervention, and enhanced clinical outcomes possible. The management of ACS can be significantly improved by incorporating hs-cTn assays as a part of routine diagnostic testing.

Keywords: High-sensitivity troponin, Acute Coronary Syndrome, Early diagnosis, Cardiac biomarkers, Tertiary care hospital, Chest pain, Diagnostic accuracy.

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Introduction

Acute Coronary Syndrome (ACS) is a continuum of clinical syndromes from unstable angina to non–ST–elevation myocardial infarction (NSTEMI) and ST-elevation myocardial infarction (STEMI). It continues to be one of the significant causes of mortality and morbidity worldwide, and rising incidence has been noted even in developing nations [1]. Early detection and urgent management of ACS are paramount for enhancing patient outcomes, limiting complications, and preventing premature cardiac death. Nonetheless, an early diagnosis remains a significant hindrance in the context of emergency and tertiary care populations because of heterogeneity of presentation and superimposable symptoms with other non-cardiac illnesses [2].

Historically, electrocardiography (ECG) and conventional cardiac biomarkers such as creatine kinase-MB (CK-MB) have been employed for the diagnosis of ACS. ECG provides valuable information, but in NSTEMI or atypical presentation patients, its sensitivity is not adequate [3]. Although conventional troponin assays provided enhanced diagnostic accuracy, they often missed early mild myocardial necrosis. Reperfusion or alternative resuscitative measures can be delayed due to this

biomarker rise delay, which can result in a missed or delayed diagnosis [4].

Early detection of myocardial damage has been revolutionized by high-sensitivity cardiac troponins (hs-cTn). Physicians can detect myocardial damage within a few hours of symptom onset due to the high precision of these assays in measuring circulating troponin at very low levels [5]. Various international studies have demonstrated the critical role they play in differentiating between ACS and non-cardiac chest pain. In addition, due to the high negative predictive value of hs-cTn testing, doctors can safely exclude ACS in low-risk patients, reducing unnecessary hospitalisations and optimising healthcare resources [6].

A rapid, precise, and responsive diagnostic aid is essential in India, where cardiovascular disease prevalence is increasing and tertiary care hospitals treat a high volume of emergency patients. Thus, the objective of the present study was to assess the diagnostic usefulness of hs-cTn in patients who arrived at a tertiary care center with acute chest pain suspected to be due to ACS [7]. This study aims to compare the sensitivity, specificity, and predictive value of high-sensitivity troponins with conventional diagnostic methods in a tertiary setting to evaluate their diagnostic utility for early detection of Acute Coronary Syndrome.

Methodology

Study Design: The role of high-sensitivity troponins in the early recognition of Acute Coronary Syndrome (ACS) was evaluated in a prospective observational study.

Study Setting: The research was conducted in the cardiology department of a tertiary care hospital, which is a referral center for adjacent regions and caters to a significant urban and semi-urban population.

Study Population: Those who came to the emergency room with sudden chest pain believed to be of cardiac origin were the participants in the study.

Study Duration: The research was done over a period of one year.

Sample Size: According to the selection criteria, a total of 205 patients were recruited into the trial.

Inclusion Criteria:

- Adults aged ≥18 years presenting with acute chest pain suggestive of ACS.
- Patients with symptom onset within the previous 12 hours.
- Patients who provided informed consent.

Exclusion Criteria:

- Patients with known chronic renal failure or severe hepatic dysfunction.
- Patients with recent trauma, surgery, or myopathy may have elevated troponin levels.
- Patients with incomplete clinical data or those unwilling to participate.

Sampling Technique: Consecutive sampling was used, and all eligible patients during the study period were included.

Data Collection: The study involved documentation of clinical history, risk factors, demographic details, and physical examination findings. Routine laboratory investigations and first electrocardiograms (ECGs) were performed. Admission levels (0 hours) and subsequent levels 3–6 hours after admission of high-sensitivity troponin (hs-cTn) were measured.

Study Procedure: The last clinical diagnosis of the cardiology team, considering the outcome of the ECG, hs-cTn, echocardiography, and other relevant tests, was employed to classify the patients. To assess their diagnostic accuracy for detecting ACS, levels of hs-cTn were correlated with the last diagnosis.

Statistical Analysis: Statistical analysis was performed using SPSS. The hs-cTn's sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. For dichotomous variables, the chi-square test was applied, and a p-value of less than 0.05 was considered statistically significant.

Results

Table 1 showed that the population under study consisted of 205 patients, with a predominance of males (62.4%) and a mean age of 56.4 years, as is usually the case in ACS patients. The most common comorbid conditions were hypertension (46.8%) and diabetes mellitus (36.1%). Cigarette smoking was noted in almost one-third of the population, indicating an essential modifiable ACS risk factor.

Table 1: Baseline Characteristics of Study Population (N = 205)

Variable	Value
Total patients	205
Male	128
Female	77
Mean age (Years)	56.4
Hypertension	96
Diabetes mellitus	74
Smokers	65

Table 2 showed that its essential diagnostic value in acute myocardial infarction was established by the fact that maximum positivity for hs-troponin occurred in STEMI (97.2%). Troponin was positive in 82.1% of NSTEMI patients, demonstrating its role in identifying non-ST elevation episodes. Only 60% of unstable angina patients were positive, consistent with the minimal myocardial injury present in these cases. Troponin was abnormal in most with non-cardiac chest pain, emphasizing the utility of the test in excluding ACS.

Table 2: Comparison of hs-Troponin Positivity with Final Diagnosis

Final Diagnosis	Total Patients	hs-Troponin Positive	hs-Troponin Negative
STEMI	72	70	2
NSTEMI	56	46	10
Unstable Angina	45	27	18
Non-cardiac chest pain	32	5	27

Figure 1 shows that hs-Troponin has good sensitivity (90.6%) and specificity (85.2%) in ACS, with high diagnostic accuracy. Positive and negative predictive values (88.3% and 87.1%) indicate consistent accuracy in identifying and excluding ACS. Considering everything, hs-Troponin is a trustworthy biomarker for an early and accurate diagnosis of ACS.

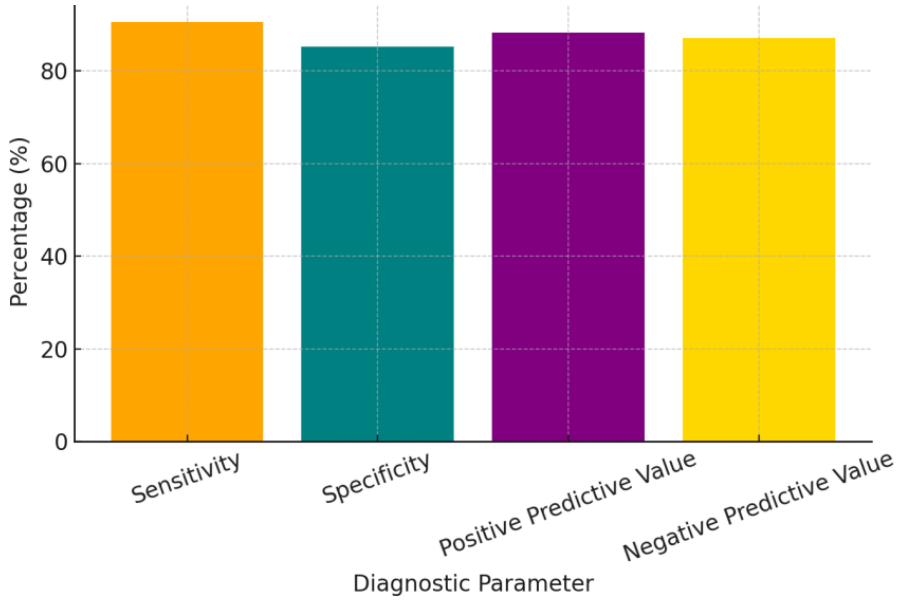

Figure 1: Diagnostic Performance of hs-Troponin in ACS

Figure 2 illustrates that STEMI was the most frequent diagnosis (35.1%), followed by NSTEMI (27.3%) and unstable angina (22.0%), based on distribution. In emergency presentations, it can be hard to differentiate cardiac from non-cardiac causes of chest pain, as indicated by the 15.6% of non-cardiac cases. Overall, most patients presenting with chest pain were found to have ACS.

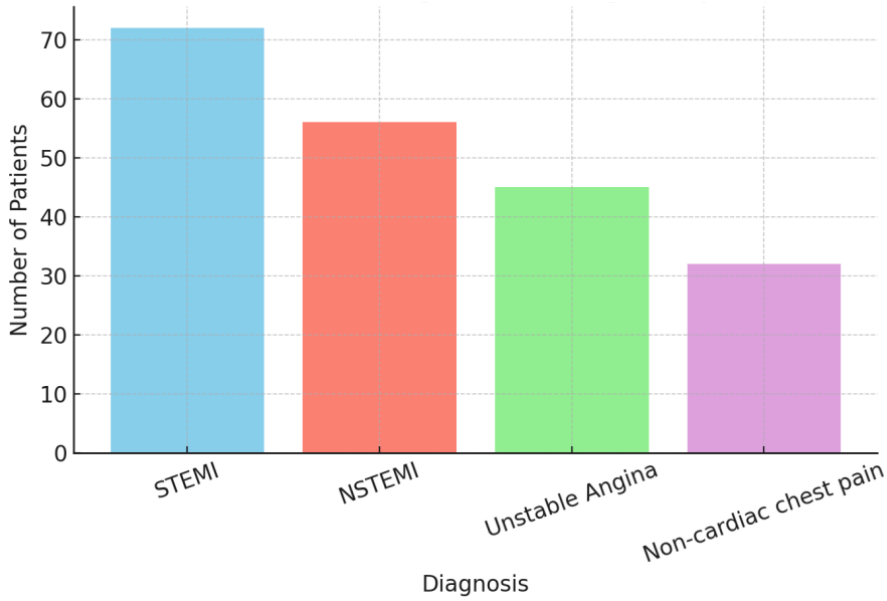

Figure 2: Distribution of Final Diagnosis among Study Population

Table 3 shows that, when contrasted with standard troponin (6.2 hours) and ECG in isolation (3.8 hours), high-sensitivity troponin significantly reduced the mean time to diagnosis (2.1 hours). This demonstrates how well it allows for faster clinical decision-making. Early hs-troponin diagnosis can lead to early therapies and improved patient outcomes in ACS.

Table 3: Time to Diagnosis Using hs-Troponin vs Conventional Methods

Diagnostic Method	Mean Time to Diagnosis (hours)
ECG alone	3.8 ± 1.2
Conventional Troponin	6.2 ± 1.5
High-Sensitivity Troponin	2.1 ± 0.9

Discussion

The present study evaluated the role of high-sensitivity troponin (hs-Troponin) in the early diagnosis of acute coronary syndrome (ACS) among 205 patients presenting with chest pain in a tertiary care hospital. Our findings demonstrated high sensitivity (90.6%) and specificity (85.2%) of hs-Troponin, along with strong predictive values, which are in line with existing literature. The mean time to diagnosis using hs-Troponin was significantly shorter (2.1 hours) compared to conventional troponin (6.2 hours), underscoring its utility as a rapid diagnostic biomarker.

Previous studies have consistently reported similar advantages of hs-Troponin over conventional assays. The study showed that hs-Troponin assays allow for earlier detection of myocardial necrosis, with sensitivities exceeding 90% within 2–3 hours of symptom onset [8]. Likewise, one study demonstrated that hs-Troponin improved the diagnostic accuracy of ACS and reduced the need for prolonged observation. Our results corroborate these findings, showing that a majority of STEMI (97.2%) and NSTEMI (82.1%) cases were troponin-positive on initial testing [9].

The present study also highlighted that unstable angina had lower hs-Troponin positivity (60%), consistent with earlier reports, which noted that unstable angina often presents without measurable myocardial necrosis [10,11]. Additionally, the low positivity in non-cardiac chest pain further strengthens the specificity of hs-Troponin in ruling out ACS, as reported by the study [12].

Importantly, our demographic data revealed a male predominance and a mean age of 56.4 years, which aligns with epidemiological patterns observed in South Asian populations [13]. The prevalence of risk factors such as hypertension, diabetes, and smoking in our cohort further reflects the established association of these comorbidities with ACS [14]. Overall, the present study confirms the diagnostic superiority of hs-Troponin in ACS, supporting its integration into emergency protocols for earlier detection, risk stratification, and timely management.

Conclusion

The study concludes by showing that high-sensitivity troponin is a very trustworthy biomarker for early diagnosis of acute coronary syndrome. With hs-troponin, ACS can be quickly distinguished

from non-cardiac chest pain with better sensitivity, specificity, and a shorter time to diagnosis than traditional techniques. Its diagnostic accuracy is demonstrated by its poor detection in unstable angina and high positivity rates in STEMI and NSTEMI. Early detection by hs-troponin can lower morbidity and mortality, improve patient outcomes, and enable prompt therapies. Therefore, for efficient ACS care, it is highly advised to include hs-troponin in standard emergency evaluation procedures.

Limitations

The study may not be as generalisable to other demographics because it was only carried out at one tertiary care facility. Although sufficient, the sample size of 205 may not capture all uncommon ACS presentations. Furthermore, prognostic evaluation was limited due to the exclusion of follow-up data on long-term outcomes.

Recommendations

It is advised that future research use bigger, multicentric cohorts to confirm results across a range of demographics. In borderline circumstances, adding serial hs-troponin readings may increase the accuracy of the diagnosis. The combination of hs-troponin with imaging and clinical risk factors may improve patient treatment and early ACS identification.

References

1. Boeddinghaus, Jasper, et al. "Early diagnosis of myocardial infarction with point-of-care high-sensitivity cardiac troponin I." Journal of the American College of Cardiology, 75 (10), 1111-1124 (2020).
2. Boeddinghaus, Jasper, et al. "High-sensitivity cardiac troponin I assay for early diagnosis of acute myocardial infarction." Clinical chemistry 65.7 (2019): 893-904.
3. Hof, Danielle, and Arnold von Eckardstein. "High-sensitivity troponin assays in clinical diagnostics of acute coronary syndrome." Calcium-Binding Proteins of the EF-Hand Superfamily: From Basics to Medical Applications (2019): 645-662.
4. Bularga, Anda, et al. "High-sensitivity troponin and the application of risk stratification thresholds in patients with suspected acute coronary syndrome." Circulation 140(19): 1557-1568.
5. Muzyk, Piotr, et al. "Use of cardiac troponin in the early diagnosis of acute myocardial infarction." Polish Heart Journal (Kardiologia Polska) 78.11 (2020): 1099-1106.
6. Chew, Derek P., et al. "A randomized trial of a 1-hour troponin T protocol in suspected acute coronary syndromes: the rapid assessment of possible acute coronary syndrome in the emergency department with high-sensitivity troponin T study (RAPID-TnT)." Circulation 140, no. 19 (2019): 1543-1556.
7. Geyer, Martin, et al. "State of the Art—High-Sensitivity Troponins in Acute Coronary Syndromes." Cardiology Clinics 38.4 (2020): 471-479.
8. Golino, Michele, et al. "High-sensitivity cardiac troponin T and the diagnosis of cardiovascular disease in the emergency room: the importance of combining cardiovascular biomarkers with clinical data." Journal of Clinical Medicine 11.13 (2022): 3798.
9. Mueller, Christian, Raphael Twerenbold, and Tobias Reichlin. "Early diagnosis of myocardial infarction with sensitive cardiac troponin assays." Clinical chemistry 65.3 (2019): 490-491.
10. Chapman, Andrew R., and Nicholas L. Mills. "High-sensitivity cardiac troponin and the early rule out of myocardial infarction: time for action." Heart 106.13 (2020): 955-957.
11. Chew, Pei Gee, et al. "A direct comparison of decision rules for early discharge of suspected acute coronary syndromes in the era of high sensitivity troponin." European Heart Journal: Acute Cardiovascular Care 8.5 (2019): 421-431.
12. Rocco, Erica, et al. "High-sensitivity cardiac troponin assays and acute coronary syndrome: a matter of sex?" Journal of Cardiovascular Medicine 20.8 (2019): 504-509.
13. Barnes, Cara, et al. "Single high-sensitivity troponin levels to assess patients with potential acute coronary syndromes." Heart 107.9 (2021): 721-727.
14. Lee, Chien-Chang, et al. "High-sensitivity-cardiac troponin for accelerated diagnosis of acute myocardial infarction: a systematic review and meta-analysis." The American Journal of Emergency Medicine, 38 (7), 2020, pp. 1402-1407.