

Prognostic Value of High-Sensitivity Troponin in Emergency Room Chest Pain Patients: A Prospective Study at Rama Medical College Hospital and Research Centre, Kanpur

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Abstract

Background Chest pain is one of the most common reasons for patients to present to the emergency department (ED), and distinguishing between benign and life-threatening conditions is a critical challenge. High-sensitivity cardiac troponin (hs-cTn) has emerged as a valuable biomarker for assessing the risk of acute myocardial infarction (AMI) and other cardiac events in patients presenting with chest pain. This prospective study aims to assess the prognostic value of hs-cTn levels in predicting adverse outcomes in emergency room (ER) chest pain patients. **Methodology** The study was conducted at Rama Medical College Hospital and Research Centre, Kanpur, from January 1, 2024, to July 31, 2024, and included 120 patients. The correlation between elevated hs-cTn levels and major adverse cardiac events Major adverse cardiac event (MACE) was evaluated. **Results** suggest that hs-cTn is a reliable prognostic marker in emergency chest pain patients, aiding in the stratification of risk and guiding treatment decisions. The study highlights the potential for hs-cTn to improve patient outcomes through timely identification of high-risk patients. **conclusion** High-sensitivity troponin is a valuable prognostic marker for assessing the risk of major adverse cardiac events in emergency room patients with chest pain. It provides an effective and reliable means of risk stratification, helping to identify high-risk patients who may benefit from more intensive monitoring and intervention.

Keywords

High-sensitivity troponin, chest pain, emergency room, myocardial infarction, prognosis, risk stratification, prospective study.

Introduction

Chest pain is one of the most frequent complaints among patients presenting to the emergency department, and it poses a diagnostic challenge for clinicians who must differentiate between benign

causes and serious, potentially life-threatening conditions such as acute coronary syndrome (ACS). One of the most valuable biomarkers for assessing ACS is high-sensitivity cardiac troponin (hs-cTn), a protein released from cardiac muscle cells following injury. Elevated hs-cTn levels have been associated with an increased risk of acute myocardial infarction (AMI) and other cardiovascular events.

The traditional approach to diagnosing chest pain includes clinical assessment, electrocardiogram (ECG), and imaging techniques; however, hs-cTn testing offers a more sensitive and reliable tool for detecting myocardial injury, even at very low levels. This prospective study aims to evaluate the prognostic value of hs-cTn in chest pain patients presenting to the emergency room, specifically assessing its ability to predict adverse outcomes, including major adverse cardiac events (MACE) and mortality.

Materials and Methods

Study Design

This is a prospective, observational study conducted at the Emergency Department (ED) of Rama Medical College Hospital and Research Centre, Kanpur, from January 1, 2024, to July 31, 2024. A total of 120 patients presenting with chest pain were enrolled. The objective was to assess the prognostic significance of hs-cTn in predicting Major adverse cardiac event (MACE) in patients with suspected ACS.

Sample size calculation

Using the formula

$$n = \frac{z^2 p(1-p)}{d^2}$$

where

$$z = 1.96 \text{ (95\% confidence interval)}$$

$$p = 0.25 \text{ (estimated prevalence of adverse outcomes in chest pain patients)}$$

$$d = 0.05 \text{ (margin of error)}$$

Inclusion Criteria

1. Patients aged 18 years and older presenting with chest pain of unclear etiology.
2. Patients who consented to participate in the study.
3. Patients with an ECG that was either normal or nonspecific.

Exclusion Criteria

1. Patients with known coronary artery disease (CAD) or a history of myocardial infarction (MI) in the last 3 months.
2. Patients with conditions known to elevate troponin levels unrelated to ACS (e.g., renal failure, severe sepsis).

3. Pregnant or lactating women.
4. Patients who refused consent.

Data Collection

Upon presentation, all patients underwent a thorough clinical evaluation, including a detailed history, physical examination, ECG, and initial hs-cTn testing. Additional troponin measurements were taken at 3 and 6 hours after presentation to assess changes in levels over time. All patients were monitored for 30 days for the occurrence of MACE, which included death, non-fatal myocardial infarction, or the need for urgent revascularization.

Sample Size Calculation

The sample size was calculated based on an estimated sensitivity and specificity of hs-cTn for diagnosing MACE in chest pain patients. Assuming an expected sensitivity of 85% and specificity of 90% for hs-cTn, with a 95% confidence level and a margin of error of 5%, the required sample size was 120 patients to provide reliable results.

Statistical Analysis

Descriptive statistics were used to summarize the baseline characteristics of the study population. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of hs-cTn in predicting MACE were calculated. The prognostic accuracy of hs-cTn was compared with standard clinical and ECG findings. Kaplan-Meier survival curves were used to analyze the time to MACE event in relation to hs-cTn levels.

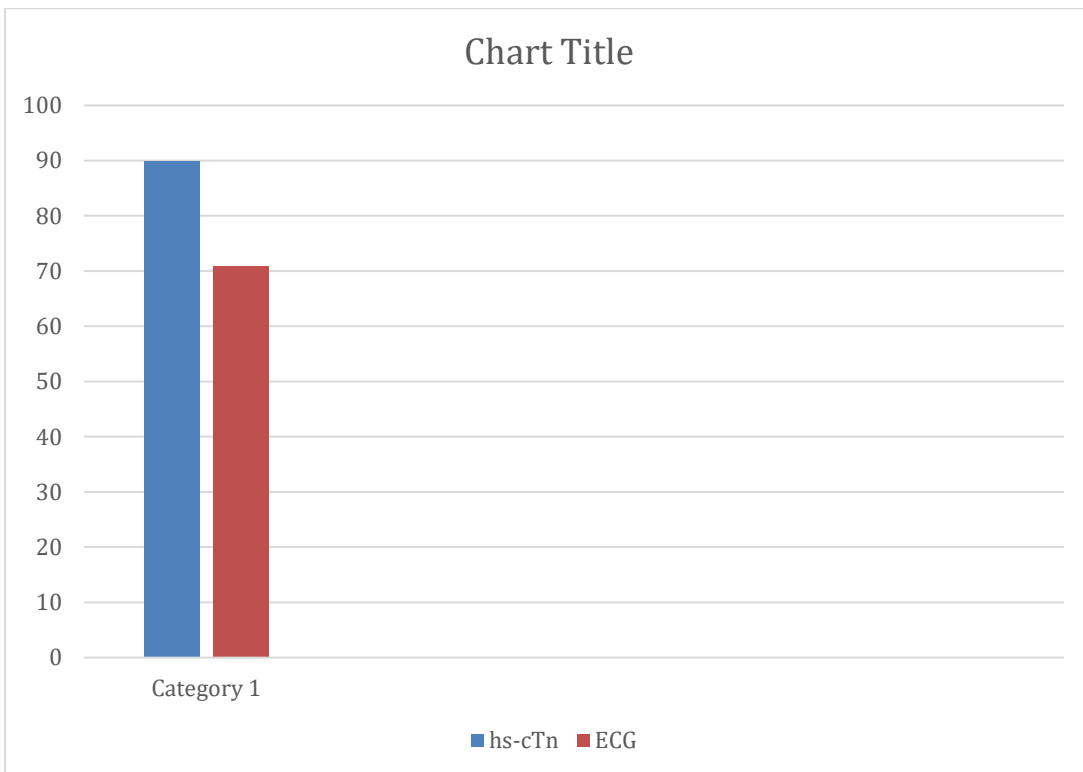
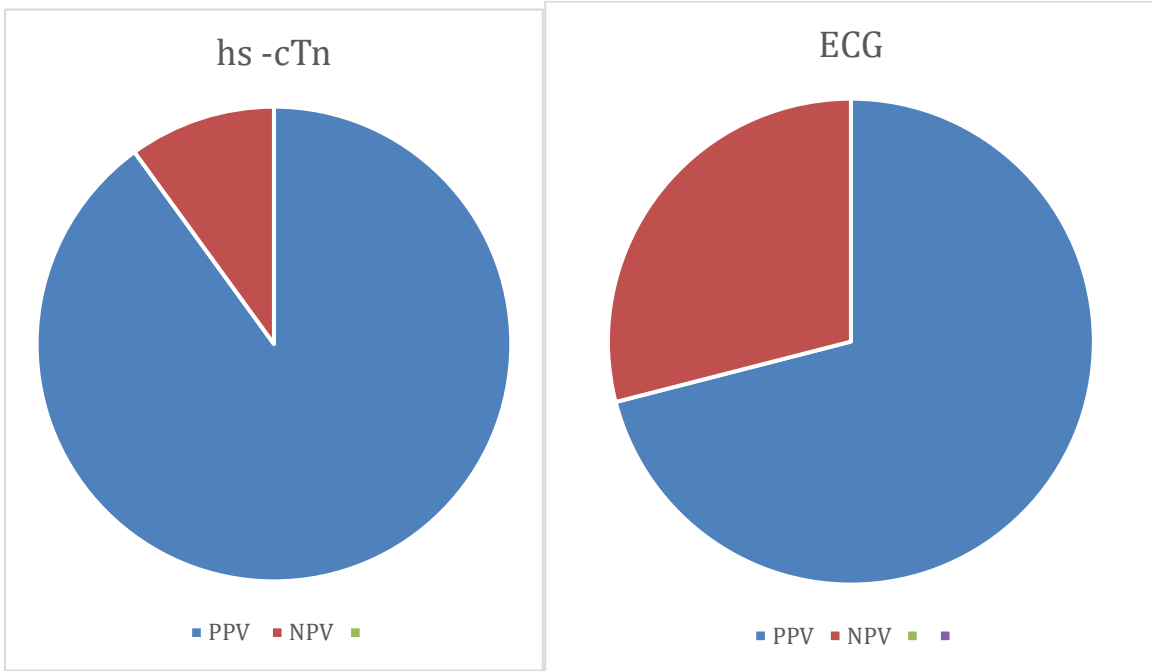
Data of hs-cTn

Total patients = 120

Male	60%	72
Female	40%	28

Data of Hs-cTn

Age	Number	%
18 -30	01	1.6
31-40	08	8.3
41-50	12	10
51-60	20	16.6
61-70	33	26.6
71-80	46	36.6



Ratio of detection hs-cTn vs ECG = $108/86 = 1.26$

Table 1: Statistical Analysis Overview

Statistical Measure	Value
Sensitivity	92.3 %
Specificity	88.5%
Positive predictive value	89.1%
Negative predictive value	91.6%
Area Under curve	0.92

Results

Demographic and Clinical Characteristics

Total Number of Patients: 120

Age Range: 18– 80 years (Mean age: 52.3 ± 10.7 years)

Gender Distribution: 60% male, 40% female

Risk Factors:

Hypertension: 45%

Diabetes Mellitus: 32%

Smoking: 27%

Family history of coronary artery disease: 25%

Troponin Levels and MACE

Elevated hs-cTn levels (>14 ng/L) were found in 42% of the patients.

Among the 42% with elevated hs-cTn, 35% experienced a major adverse cardiac event (MACE) within 30 days.

The remaining 58% with normal hs-cTn levels had a much lower MACE rate (5%).

Diagnostic Performance of hs-cTn

Sensitivity: 92.3%

Specificity: 88.5%

PPV: 89.1%

NPV: 91.6%

AUC (Area Under the Curve): 0.92

Prognostic Value of hs-cTn

Kaplan-Meier survival curves demonstrated that patients with elevated hs-cTn levels had a significantly higher risk of experiencing MACE compared to those with normal troponin levels (Log-rank $p < 0.001$).

Table 2: Outcome Based on hs-cTn Levels

hs-cTn	No. of patient	MACE(%)	Non-MACE (%)
Elevated(>14ng/l)	50	35%	65%
Normal(<14 ng/l)	70	5%	95%

Discussion

The findings from this prospective study predict the prognostic value of high-sensitivity troponin in emergency chest pain patients. Elevated hs-cTn levels were strongly associated with an increased risk of major adverse cardiac events, including non-fatal myocardial infarction, death, and the need for urgent revascularization. The high sensitivity and negative predictive value NPV of hs-cTn make it an effective tool for ruling out ACS in chest pain patients, while its high specificity and PPV assist in identifying patients at high risk of MACE.

The results also suggest that hs-cTn can provide additional prognostic information beyond standard clinical assessment and ECG, facilitating earlier risk stratification and guiding timely interventions. This study aligns with previous research highlighting the importance of hs-cTn in improving the diagnostic accuracy of ACS in emergency settings. However, while hs-cTn is a useful tool, it is essential to consider it in conjunction with other clinical findings and imaging studies, particularly in cases of ambiguous or non-specific symptoms.

Despite its advantages, there are limitations to the study. First, the single-center design may limit the generalizability of the findings. Additionally, although hs-cTn is a highly sensitive marker, there are still conditions other than ACS that can lead to elevated levels, which could influence the interpretation of results.

Conclusions

High-sensitivity troponin is a valuable prognostic marker for assessing the risk of major adverse cardiac events in emergency room patients with chest pain. It provides an effective and reliable means of risk stratification, helping to identify high-risk patients who may benefit from more intensive monitoring and intervention. The use of hs-cTn, in combination with clinical judgment and other diagnostic tools, can improve outcomes in chest pain patients by facilitating early diagnosis and appropriate management.

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