Section: Emergency Medicine

Original Research Article

COMPARISON OF TIMI AND HEART SCORE TO ASSESS THE RISK OF MAJOR ADVERSE CARDIAC EVENTS IN CHEST PAIN PATIENTS PRESENTING TO THE EMERGENCY DEPARTMENT

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ABSTRACT

Background: Chest pain is a frequent reason for Emergency Department (ED) visits and hospital admissions for suspected myocardial infarction. Differentiating acute coronary syndrome (ACS) from non-cardiac causes is essential to optimize care and resource use. Major Adverse Cardiac Events (MACE) include myocardial infarction (STEMI, NSTEMI), stroke, revascularization (PCI, CABG), heart failure hospitalization, and cardiovascular death within 30 days. This study compared the HEART (History, ECG, Age, Risk factors, Troponin) and TIMI (Thrombolysis in Myocardial Infarction) scores in predicting 30-day MACE among ED chest pain patients.

Materials and Methods: A prospective observational study was conducted at the SVIMS ED, Tirupati, from April 2020 to June 2021. Adults presenting with chest pain were included, excluding those <18 years, pregnant, or unwilling to participate. A total of 450 patients were screened. HEART and TIMI scores were calculated at presentation, and patients were followed for 30 days for MACE. Statistical analyses included Chi-square, Student's t-test, Mann–Whitney U test, and ROC curve comparison ($P < 0.05$).

Results: Of 450 patients, 200 (44.4%) had cardiac chest pain (120 STEMI, 80 NSTEMI/UA). Thirty patients (6.6%) developed MACE; mortality was 3.3%. MACE incidence rose with higher HEART scores: low (1.23%), moderate (7.29%), high (24.28%). The mean HEART score among MACE-positive patients was 4.9. The HEART score showed superior predictive accuracy (AUC 0.865) compared to TIMI (AUC 0.633; $P = 0.000$). A HEART score ≤3 had 98.9% sensitivity and 97.9% NPV.

Conclusion: The HEART score outperformed the TIMI score in predicting 30-day MACE and should be preferred for chest pain risk stratification in the ED.

Keywords: Acute coronary syndrome; Chest pain; Clinical prediction rule; HEART score; TIMI score.

INTRODUCTION

Chest pain is the most frequent presenting symptom in the Emergency Department (ED) and a major diagnostic challenge. Although many patients are admitted for suspected myocardial infarction, only 15–25% actually have Acute Coronary Syndrome (ACS). Efficient use of hospital resources requires accurate identification of patients at high or low risk for Major Adverse Cardiac Events (MACE)1. In this study, MACE included myocardial infarction (STEMI, NSTEMI), stroke, revascularization (PCI, CABG), hospitalization for heart failure (e.g., cardiogenic shock, arrhythmias, pulmonary edema, symptomatic bradycardia), and cardiovascular death within 30 days.[1-3]

ACS comprises unstable angina (UA), NSTEMI, and STEMI, all resulting from reduced coronary blood flow. It remains a major cause of mortality, with an estimated 30-day mortality of 5.6% in India. To improve outcomes for high-risk patients and reduce unnecessary admissions for low-risk cases, validated risk stratification tools are essential.[4-6]

The HEART score was developed specifically for undifferentiated chest pain in the ED. It ranges from 0–10 points, based on History, ECG, Age, Risk factors, and Troponin, and categorizes patients as low (0–3), moderate (4–6), or high risk (7–10). Reported MACE rates are 1.9%, 13%, and 50%, respectively 7-10. The TIMI score, designed in 2000 for NSTEMI, assigns 0–7 points using seven clinical variables. It classifies patients as low (0–2), intermediate (3–4), or high risk (5–7), with 30-day MACE ranging from 2.1% to 100%. This study aimed to compare the accuracy of the HEART and TIMI scores in predicting 30-day MACE in ED chest-pain patients and to determine the preferred scoring tool.[7-10]

MATERIALS AND METHODS

This prospective observational study was conducted in the Emergency Department of Sri Venkateswara Institute of Medical Sciences (SVIMS), Tirupati, over 16 months from April 2020 to June 2021. All patients presenting with chest pain were included, except those under 18 years, pregnant women, and those unwilling to participate. Ethical approval was obtained from the institutional committee.

Written informed consent was obtained from each patient or their attendant. Patients were stabilized according to standard ED protocols. Demographic and clinical data, including age, socioeconomic status, duration and nature of chest pain, and associated symptoms such as vomiting, sweating, syncope, and palpitations, were recorded. Investigations included ECG, troponin, and relevant blood tests. Patients were then transferred to appropriate care units based on clinical condition. HEART and TIMI scores were calculated at presentation. The HEART score (0–10) included History, ECG, Age, Risk factors, and Troponin. The TIMI score (0–7) was used for NSTEMI/UA, and the TIMI risk index (0–14) for STEMI. Patients were followed up for 30 days through phone or hospital records for readmission or MACE. Data were analyzed using SPSS v23, Systat 12, and MedCalc v11.3. Statistical significance was set at $P < 0.05$.

RESULTS

A total of 450 patients presenting with chest pain were enrolled in the study. Among them, 200 (44%) had cardiac chest pain, while 250 (55.5%) had non-cardiac causes. Of the cardiac cases, 120 (26.6%) were diagnosed with STEMI and 80 (17.7%) with NSTEMI or unstable angina (UA). The majority of patients were aged 50–59 years, and males accounted for 69.6% of the total cohort. High-acuity chest pain and increased 30-day MACE rates were more frequent in the 70–90 years age group.

Overall, 30 patients (6.6%) experienced MACE within 30 days, and 15 (3.3%) died. MACE occurred more often in males (21 vs. 9 females). Significant associations were found between MACE and age ($P = 0.001$) as well as prior PCI history (14.5% MACE positive, $P = 0.001$).

Table 1: HEART Score Performance

Risk Group	N	MACE (%)	Mortality (%)
Low (0-3)	243	1.23	0.41
Moderate (4-6)	137	7.29	3.64
High (7-10)	70	24.28	12.85

The mean HEART score for the entire population was 5.3 (SD 2.31). MACE incidence rose significantly with increasing score categories ($P < 0.001$).

Table 2: TIMI Score (NSTEMI/UA, n = 80)

Risk Group	N	MACE (%)	Mortality (%)
Low (0-2)	24	4.1	0
Moderate (3-5)	42	9.52	4.76
High (6-7)	14	50	21.42

Table 3: TIMI Risk Index (STEMI, n = 120)

Risk Group	N	MACE (%)	Mortality (%)	Score Range
Mild (0-2)	22	4.5	4.5	0–2
Moderate (3-5)	72	9.72	4.16	3–5
Severe (>7)	26	38.46	23.07	>7

Table 4: Predictive Accuracy and Comparison

Score	AUC	95% CI	P value
HEART	0.865	0.826–0.904	0.000
TIMI	0.633	0.556–0.709	0.015

The HEART score demonstrated significantly better discriminative ability than the TIMI score in predicting 30-day MACE.

Table 5: Diagnostic Metrics

Metric	HEART ≤3	TIMI ≤1
Sensitivity	98.9%	92.6%
Specificity	25.6%	53.2%
Negative Predictive Value (NPV)	97.9%	73.2%

A HEART score ≤3 effectively identified low-risk patients with high sensitivity and NPV, confirming its superiority over the TIMI score in early risk stratification of chest pain patients.

DISCUSSION

This prospective study compared the predictive performance of the HEART and TIMI scores in assessing 30-day Major Adverse Cardiac Events (MACE) among patients presenting with chest pain to the Emergency Department. The findings demonstrated that the HEART score had superior diagnostic accuracy (AUC = 0.865) compared to the TIMI score (AUC = 0.633), confirming its greater usefulness for early risk stratification in the ED.

The strong correlation between increasing HEART score categories and higher MACE incidence aligns with previous studies. Backus et al,[11] (2013) reported that the HEART score provided better discrimination for short-term MACE than TIMI or GRACE scores, with an AUC of 0.83. Similarly, Six et al,[12] (2008) originally developed and validated the HEART score, showing that a low HEART score (0–3) was associated with minimal risk of MACE and could safely identify patients suitable for early discharge. In the present study, patients with HEART ≤3 had a 1.23% MACE rate and 97.9% NPV, reinforcing its safety in excluding high-risk disease.

The TIMI score, though widely validated in ACS, was designed primarily for NSTEMI and UA populations by Antman et al.[13] Its lower AUC in this study may reflect reduced applicability in undifferentiated ED chest pain, where clinical presentations are more variable. Similar observations were made by Mahler et al,[14] who found the HEART Pathway superior to TIMI in identifying low-risk patients, reducing unnecessary admissions.

Age and previous PCI history were significant predictors of MACE, consistent with findings from Poldervaart et al,[15] who emphasized incorporating patient history and troponin trends into risk models to improve prognostic accuracy.

Overall, the HEART score demonstrated higher sensitivity and negative predictive value, making it a more reliable and practical tool for frontline clinicians. Its simplicity, rapid calculation, and reproducibility support its integration into ED protocols for chest pain assessment.

In summary, this study supports the growing body of evidence that the HEART score outperforms TIMI in predicting 30-day MACE and effectively distinguishes low-risk patients who can be safely managed without hospital admission.

CONCLUSION

In summary, the HEART score demonstrated superiority over the TIMI score in predicting 30-day Major Adverse Cardiac Events (MACE) in a high acuity chest pain patient population presenting to a tertiary Emergency Room. We suggest that the HEART score should be preferred and is widely validated as a clinical tool for risk stratifying chest pain patients in the ED.

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