



A COMPARITIVE ANALYSIS AND STUDY OF HEART AND TIMI SCORING WITH USE OF HIGH SENSITIVITY TROPONIN I IN PATIENTS WITH ACUTE CHEST PAIN

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ABSTRACT

Introduction

Chest pain is the most common initial symptom in patients diagnosed with coronary artery disease. Therefore, distinguishing Acute coronary syndrome from other cardiac and non-cardiac disease is crucial to identify patients who are at high and low risk of developing major adverse cardiac events (MACE) in order to optimally allocate Emergency department (ED) and hospital resources and to promote efficient and effective care. The study was planned to compare the performances of risk scores HEART and TIMI for the prediction of major adverse cardiac events (MACE) in acute chest pain patients presenting to Emergency department.

Aims

- 1.To study comparative accuracy of HEART, TIMI for the prediction of major adverse cardiac events (MACE)in acute chest pain patients presenting to emergency department.
- 2.To study the role of high sensitivity cardiac troponins as marker in HEART scoring system in emergency department

Setting And Design: A prospective observational study in patients presented with chest pain of acute onset at the emergency department of our hospital

Material And Method: The study was carried out at MGM medical college, Kamothe, Navi Mumbai which included 100 patients presented to ED with acute chest pain. The patients were evaluated by data on age, gender, presenting history, physical examination, electrocardiography, laboratory results and risk factors. The end point in our study was major adverse cardiac events (MACE) within 6 weeks after the initial ED presentation

Results And Conclusion

Mean age of the study cases was 63.32 years and 68% cases being over 60 years of age and Male predominance was seen in the study cases with 69% males to 31% females.

Major risk factors seen in the study cases was hypertension (61%), dyslipidemia (33%), diabetes (31%), history of smoking (29%) and obesity (21%). Family history of CAD was given by 13% and history of IHD was given by 11% cases.

The study shows incidence of MACE (UA, NSTEMI, STEMI, PCI, CABG, stenosis) managed conservatively, cardiovascular death with unknown cause among cases with acute chest pain was 21% and incidence of mortality was 7% in acute chest pain cases.

Sensitivity and specificity of TIMI score (>0) for prediction of MACE was 90.5% and 68.4% with overall accuracy as 73%. Sensitivity and specificity of HEART score (>3) for prediction of MACE was 95.2% and 72.2% with overall accuracy as 77%. Sensitivity and specificity of high Hs troponin I for prediction of MACE event was 76.2% and 70.9% with overall accuracy as 72%.

Keywords: Chest pain, Major Adverse Cardiac Events (MACE), Heart stands for {History, Electrocardiogram, Age, Risk factors, Initial troponin}, TIMI {Thrombolysis in Myocardial infarction}, GRACE {Global registry of acute coronary events}.

INTRODUCTION

Chest pain is common presenting complaint in the emergency department that requires efficient risk stratification, timely initiation of treatment in high-risk patients and safe determination of patient disposition.^[1-5]

Diagnostic evaluation of patients with acute chest pain remains challenging due to the heterogeneous spectrum of underlying etiologies that can be of cardiovascular or non-cardiovascular. Almost most of the patients have non-life-threatening disorders, approximately 15% are diagnosed as having acute myocardial infarction and in rare cases with acute aortic dissection or pulmonary embolism. Even after thorough evaluation a firm diagnosis remains uncertain particularly in those with atypical chest, the pain can be musculoskeletal, gastrointestinal, or respiratory in origin but we can never predict the outcome and ignore an acute chest pain patient in emergency department.^{6,7,8,9} Despite this

fact, only a minority of these patients are ultimately found to have either a STEMI or ACS¹⁰. Given that Asian Indians have a mean onset of coronary artery disease (CAD) 5–10 years earlier than the western world, the burden of chest pain visits to EDs in India is likely much higher¹¹. Approximately 10% of patients presenting to the ED with chest pain are ultimately diagnosed with ACS^[12].

For decades, biomarkers testing has been playing an important role in the evaluation of patients with acute chest pain. Likewise, there are various scoring system which helps us to evaluate patients who come with acute chest pain like HEART score, TIMI score, GRACE score.

A multimarker approach incorporating biomarkers and clinical scores will increase the prognostic accuracy. However, it is important to note that only troponin has been used to direct therapeutic intervention and none of the new prognostic biomarkers have been tested and proven to alter outcome of therapeutic intervention. Novel biomarkers have improved prediction of outcome in acute myocardial infarction, but none have been demonstrated to alter the outcome of a particular therapy or management strategy.

Good biomarker is that which is easily available, easily measured and can be used to surrogate as a marker for disease and to know about the diagnostic/prognostic part of the disease.

There are other new biomarkers like H-FABP (HEART-Type binding protein) which can detect pre-necrosis and ST2 is IL1 receptor like protein which can be found elevated in serum of under mechanical stress.

So, this study is an observational study comparing the performance of risk scores in the same population presenting to emergency department with acute chest pain.

MATERIALS AND METHODOLOGY

The single centered prospective study was undertaken in Emergency Medicine Department, MGM Hospital, Navi Mumbai over a two-year period from December 2018 to November 2020. In this study all patients above twenty-one years old, who presented within 6 hours of CHEST PAIN were included, the patients were primarily seen by Emergency Medicine resident. Data on age, gender, history, physical examination, electrocardiography, Laboratory results, risk factors, was collected.

The well-known risk scores are Grace (global registry of acute coronary events), TIMI (thrombolysis in myocardial infarction) & heart scores weigh various predictors to calculate the risk of acute coronary.

STATISTICAL METHODS:

The quantitative data was represented as their mean \pm SD. Categorical and nominal data was expressed in percentage. T-test was used for analyzing quantitative data, or else non parametric data was analysed by Mann Whitney test and categorical data was analysed by using chi-square test. We compared the discrimination of the two scores by

examining their ROC curves and calculating the areas under the ROC curve (AUCs). The significance of p-value was set at <0.05. All analysis was carried out by using SPSS software version 21.

RESULTS AND DISCUSSION

Present hospital-based screening-based study aimed to compare the accuracy of HEART and TIMI scores for the prediction of major adverse cardiac events (MACE) in acute chest pain patients presenting to emergency department (ED) of a tertiary care centre. We also aimed to study the role of high-sensitivity cardiac troponin as marker in HEART scoring system in emergency department. Study included 100 consecutive cases of acute chest pain that presented in emergency department of our hospital.

1. Analysis according to Mean age and Gender distribution of study case

The present study shows Mean age of 63.32 years with 68% cases being over 60 years of age. Male predominance was seen in the study cases with 69% males to 31% females. Goodacre SW et al. ^[13] in their study observed mean age of cases as 54.5 years with 58% males to 42% females. Akula PS et al. ^[14] in their study observed the mean age as 56.3 years with 70% male population.

2. Analysis according to Distribution of study cases as per risk factors

Table 1. Distribution of study cases as per risk factors

Risk Factors	N	%
Hypertension	61	61.0%
Diabetes	31	31.0%
Dyslipidemia	33	33.0%
Family history of CAD	13	13.0%
Smoking	29	29.0%
Obesity	21	21.0%
History of IHD	11	11.0%

Major risk factors seen in the study cases was hypertension (61%), dyslipidemia (33%), diabetes (31%), history of smoking (29%) and obesity (21%). Family history of CAD was given by 13% and history of IHD was given by 11%

cases. Madani heart hospital trial ^[15] of 170 patients had hypertension as the most common risk factor found in 43 % patients followed by diabetes (33%).

3. Analysis of distribution of study cases as per incidence of 30-day major adverse cardiac events

Incidence of MACE (UA, NSTEMI, STEMI, PCI, CABG, stenosis managed conservatively, cardiovascular death, non-cardiovascular death, and death with unknown cause) among cases with acute chest pain was 21%. Burkett E et al. ^[16] studied 281 cases with non-traumatic chest pain, the rate of MACE was 14.1%.

4. Analysis of distribution of study cases as per incidence of mortality for 30-days major adverse cardiac events

In present study, incidence of mortality shows 7% in acute chest pain cases which shows same similarity in a study conducted by Streitz MJ et al. ^[17] in their study on 417 patients, observed 31 (7.4%) of these patients experienced 6-week MACE.

5. Analysis of Mean HEART and TIMI scores in cases with and without MACE

Mean TIMI score (1.29 vs 3.23; $p < 0.01$) and HEART score (4.81 vs 6.73; $p < 0.01$) was significantly lower in cases with MACE. Streitz MJ et al. ^[17] also reported that patients with a HEART score ≤ 3 are at low risk for 6-week MACE. The area under the receiver operator curve (AUROC) is 0.885 (95% confidence interval 0.838-0.931).

6. Analysis of Diagnostic accuracy of HEART for prediction of MACE

Sensitivity and specificity of HEART score (>3) for prediction of MACE event was 95.2% and 72.2% with overall accuracy as 77% which shows that a study conducted by Mahler SA et al. ^[18] reported that MACE occurred in 0.6% (5/904) of patients with low-risk HEART scores compared with 4.2% (7/166) with a high-risk HEART score. A HEART score of >3 was 58% sensitive and 85% specific for MACE.

7. Analysis of Diagnostic accuracy of TIMI for prediction of MACE

Sensitivity and specificity of TIMI score (>0) for prediction of MACE event was 90.5% and 68.4% with overall accuracy as 73%. Jain T et al. ^[19] observed the AUC for the HEART score as 0.82 and 0.68 for the TIMI score for predicting 30-day MACE ($P < 0.05$). Patients with HEART score ≤ 3 had lower 5-year mortality rate compared with those with TIMI score of 0.

8. Analysis of Diagnostic accuracy of Hs-Troponin for prediction of MACE

Sensitivity and specificity of High Hs troponin I for prediction of MACE event was 76.2% and 70.9% with overall accuracy as 72% is compared with a study conducted by a Mahler SA et al. ^[18] observed that combination of serial troponin >0.065 ng/mL or HEART score >3 resulted in sensitivity of 100% and specificity of 83%.

9. Analysis of ROC curve of HEART, TIMI and Hs Troponin**Table 2. ROC curve analysis of HEART, TIMI and Hs Troponin**

Area Under the Curve					
Test Result Variable(s)	Area	SE	p- value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
HEART	0.812	0.057	<0.01	0.70	0.92
TIMI	0.739	0.113	<0.01	0.57	0.92
Hs Troponin I	0.686	0.056	<0.01	0.56	0.80

On ROC analysis, all the three parameters i.e. HEART score (AUC – 0.812; 95% CI: 0.70-0.92), TIMI score (AUC – 0.739; 95% CI: 0.57-0.92) and Hs Troponin I (AUC – 0.686; 95% CI: 0.56-0.80) were observed to be statistically significant for prediction of MACE events in acute chest pain cases. Highest AUC was observed for HEART score followed by TIMI and Hs Troponin I.

Six AJ et al. ^[20] compared TIMI and HEART scores for the prediction of MACE events, similar to present study. The AUC were 0.83 (0.81-0.85) for HEART and 0.75 (0.72-0.77) for TIMI ($P < 0.01$).

Goodacre SW et al. ^[13] in their study observed that AUC for 30-day MACE was 0.682 (95% CI, 0.662-0.701) for TIMI. The corresponding 90-day statistics was 0.693 (95% CI, 0.674-0.712). Burkett E et al. ^[16] reported the AUC of the TIMI for the endpoint of MACE as 0.71 (95% CI: 0.58-0.88). Chen XH et al. ^[21] observed that HEART score had the largest (compared to TIMI and GRACE scores) area under the receiver operating characteristic (ROC) curve for predicting MACE at 7-day, 30-day, and 6-month follow-up.

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