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Performance of the TIMI risk score in predicting in-hospital heart failure after acute coronary syndrome: A hospital based cross-sectional study in Himachal Pradesh

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Abstract

Introduction: Risk assessment and stratification plays a key role in management of acute coronary syndrome (ACS). Thromolysis in myocardial infarction (TIMI) score is one of the most frequently used risk assessment tools. ACS is a well known risk factor for heart failure but recent understanding reveals that ACS can lead to heart failure (HF) even during index hospitalization. We aimed to assess the performance of TIMI score in predicting in-hospital heart failure after index episode of MI.

Methods: We conducted a observational cross sectional study in a tertiary care hospital, analysing data from patients presenting with AMI. Demographic information, comorbidities, symptomatology were collected, TIMI score was calculated and correlated with left ventricular ejection fraction (LVEF) to assess their predictive value for acute HF during index MI presentation.

Results: A total of 283 patients were included in the study, with a mean age of 60.9 ± 12.0 years. Among patients with TIMI score of 4 or less, 61.3% had preserved EF, 22.6% had mildly reduced EF and only 16.1% of patients had reduced EF whereas in patients with TIMI score of more than 4 nearly one-third (32.0%) had reduced EF, more than a fourth (26.8%) had mildly reduced EF and 41.2% had preserved EF. This

difference in EF with change in TIMI score was found to be statistically significant (0.002)

Conclusion: Our study emphasized the importance of comprehensive risk assessment and prognostic scoring using TIMI scoring model in predicting acute HF development. The TIMI score demonstrated a noteworthy correlation with LVEF, with scores more than 4 associated with a increased proportion of patients with reduced EF.

Keywords: Acute myocardial infarction, Comorbidities, Heart failure, Left ventricular ejection fraction, Prognostic scores, TIMI score

Introduction

Acute myocardial infarction (AMI) is a well-known risk factor for Heart failure and similarly heart failure can complicate MI at admission or during hospital stay and severity of heart failure is associated with increased mortality [1-4]. Heart failure (HF) after myocardial infarction is the major cause of late morbidity, mortality and healthcare cost. The timing of heart failure after MI is important clinically, mechanistically and for research [5-6].

Three key time periods have to be defined, HF at the index MI presentation, during the course of the first admission, and post discharge [7].several overlapping mechanisms contribute to HF after MI. HF during the index MI occurs due to a combination of myocardial stunning, myocyte necrosis, and acute mitral regurgitation due to papillary muscle dysfunction. HF during the hospitalisation may also be compounded by fluid or contrast overload, renal dysfunction, or complications such as ventricular septal defect or cardiac tamponade. Late HF reflects the consequences of cardiomyocyte death and scar formation occurring alongside ventricular remodelling [8].

Many risk stratification models are now used including TIMI risk assessment model, GRACE model, Killip score etc. which predict severity of AMI and can be used as a predictor of heart failure, these markers tend to predict acute heart failure in hospital setting [9,10].The 'Thrombolysis in myocardial Infarction (TIMI) risk score' is a risk stratification model which has been shown to accurately predict post-PCI mortality in both genders [11]Medical treatment of heart failure is based on type of heart failure and severity of heart failure. With evolving knowledge of MI and heart failure, early identification and initiation of therapy is important. Very limited studies have been conducted in hilly state of Himachal Pradesh, to study the profile of acute heart failure after acute myocardial infarction. Understanding the interplay between comorbidities, symptoms, and prognostic scores in AMI is crucial for optimizing patient management and improving outcomes, particularly in the context of heart failure (HF) development. The present study was planned to better understand the profile and prognostic indicators of heart failure patients of acute myocardial infarction during hospital stay in a tertiary care centre in Shimla, Himachal Pradesh.

Methodology:

This cross-sectional observational study was conducted at a tertiary care centre in Shimla, Himachal Pradesh over a period of one year, from January 1st, 2022, to December 31st, 2022. The patients admitted to the medicine and cardiology departments of the institute were considered for the study. Inclusion criteria encompassed individuals aged 18 years and above presenting with AMI, defined according to the fourth universal definition [12]. Exclusion criteria comprised patients below 18 years, individuals with prior

myocardial infarctions, known heart failure, chronic kidney disease and individuals unwilling to give consent for the study.

Patients were provided with a comprehensive overview of the study's aims and objectives, and those expressing willingness to participate were requested to provide written informed consent. Subsequently, a pre-designed pre-tested validated questionnaire was employed to gather information from the participants, ensuring that no identifiable details were recorded. The study encompassed comprehensive clinical evaluation, beginning with a detailed history to identify symptoms indicative of acute myocardial infarction, such as chest pain, dyspnea, syncope, and palpitations. A meticulous physical examination, encompassing anthropometric measurements and a systemic assessment with particular emphasis on detecting signs of cardiac failure. Biochemical investigations included high sensitivity Troponin I, complete hemogram, renal and liver function tests, HbA1c, BNP, lipid profile, thyroid profile, and other necessary tests as warranted. Electrocardiograms were conducted using a Heidelco Medicore HE 300 machine, assessing parameters like rate, rhythm, conduction disturbances, ST-T changes, and evidence of chamber enlargement. Echocardiographic examinations were performed using a Philips iE53 machine, with patients positioned supine or in a left decubitus position for optimal assessment. Monitoring of patients in wards involved close observation for symptoms and signs of acute heart failure, such as dyspnea, bibasalcrepts, increasing jugular venous pulse, and gallop heart sounds, with repeated investigations conducted as deemed necessary. Anonymity of the patients and confidentiality of their responses was strictly maintained.

The collected data was entered into an MS Excel master sheet and subsequently tabulated and analyzed using statistical software, including OpenEpi version 3.01 and Statistical Package for Social Sciences (SPSS) version 22. Categorical data are represented as numbers and percentages (%), while quantitative data are expressed as mean and standard deviation. Analysis of categorical variables was done using Pearson's chi-square test and Fisher exact. A p value of <0.05 has been considered as statistically significant.

Results:

A total of 283 patients were included in the study, with a mean age of 60.9 ± 12.0 years. The majority of participants fell within the age bracket of 55 to 64 years (102 patients, 36%), followed by 79 patients (27.9%) aged between 65 to 74 years, and 48 patients (17%) aged 45 to 54 years. Male patients constituted the majority, accounting for 74.9% of the total. The most prevalent co-morbidity among the study cohort was hypertension, observed in 93 patients (32.9%), and closely followed by diabetes affecting a similar proportion of participants (88 patients, 31.1%). Smoking emerged as the most common modifiable risk factor, with over half of the participants being smokers (163 subjects, 57.6%), while peripheral artery disease was present in 47 patients (16.6%).

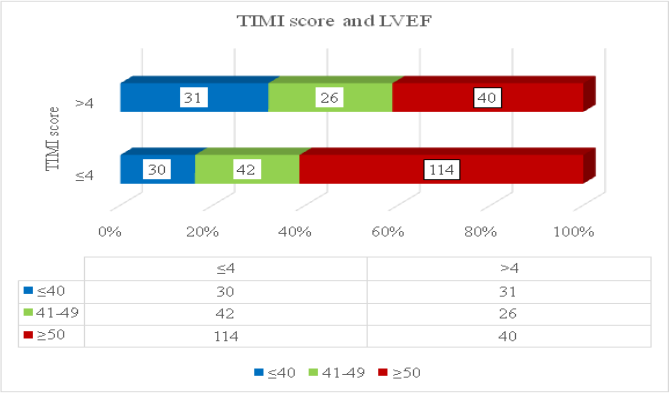

Figure 1: Comparison of TIMI score with LVEF among study participants

Among patients with TIMI score of 4 or less, 61.3% had preserved EF, 22.6% had mildly reduced EF and only 16.1% of patients had reduced EF whereas in patients with TIMI score of more than 4 nearly one-third (32.0%) had reduced EF, more than a fourth (26.8%) had mildly reduced EF and 41.2% had preserved EF. This difference in EF with change in TIMI score was found to be statistically significant (0.002) (figure1).

Discussion:

Over the past few decades, with advances in the management of acute MI, there has been a decline of over 40% in all-cause mortality during the acute phase of MI. AMI is the most common cause of HF which can present as early as in index hospitalization. Keeping this in mind, the present study was undertaken in the department of medicine/ cardiology in a tertiary care hospital of Shimla, Himachal Pradesh.

The initial assessment of left ventricular ejection fraction (LVEF) among acute myocardial infarction (AMI) cases holds paramount importance in guiding patient management and prognostication. Our study, along with previous research, emphasizes the variability in LVEF distribution among different types and locations of MI. Understanding LVEF at presentation enables risk stratification and tailored therapeutic interventions.

In the present study, patients with higher TIMI scores (>4) exhibited a higher prevalence of reduced EF, indicating a correlation between the severity of myocardial infarction and cardiac dysfunction. This aligns with findings by Conway Moris et al [13], who reported a 57% event rate in patients with TIMI scores of ≥5.

The findings of this study highlighted the association between left ventricular ejection fraction (LVEF) and TIMI risk score, emphasizing on utility in risk stratification and guiding therapeutic decisions. Hence, there is a need for early risk assessment, prompt diagnosis, and tailored management strategies in improving outcomes for patients with AMI and acute HF.

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