RESEARCH PAPER

CLINICAL UTILITY AND EVALUATION OF TIMI RISK SCORE FOR EARLY RISK STRATIFICATION IN ACS PATIENTS AT A TEACHING MEDICAL HOSPITAL - AN OBSERVATIONAL STUDY

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ABSTRACT

Background: Acute coronary syndrome (ACS) remains an important cause of cardiovascular morbidity and mortality. Early risk stratification may support triage, monitoring, and treatment decisions. This study assessed the clinical utility of the Thrombolysis in Myocardial Infarction (TIMI) risk score for risk stratification and in-hospital prognostication among patients with ACS.

Methods: A prospective observational study was conducted in the coronary intensive care unit of RVMIMS, Siddipet, Telangana. A total of 130 inpatients aged 18–75 years with ACS were included. Demographic and clinical information, ECG findings, laboratory data, and TIMI score variables were collected using a structured case record form. Patients were stratified into low-, intermediate-, and high-risk groups using the appropriate TIMI criteria for STEMI and UA/NSTEMI. In-hospital outcomes included acute heart failure/pulmonary edema, ventricular tachycardia/ventricular fibrillation requiring intervention, cardiogenic shock, and all-cause mortality. Categorical associations were assessed using the chi-square test, with $p<0.05$ considered statistically significant.

Results: The mean age was 58.53±10.70 years and 61.5% of participants were male. Hypertension (60.0%) and diabetes mellitus (40.0%) were common. NSTEMI accounted for 77.69% of cases and STEMI for 22.31%. Overall, 9.2% of patients were classified as low risk, 70.8% as intermediate risk, and 20.0% as high risk. Among STEMI patients, intermediate- and high-risk categories each accounted for 48.3%. Among NSTEMI patients, 40.6% were intermediate risk and 48.5% high risk. Adverse in-hospital events were concentrated in the intermediate- and high-risk categories, while low-risk patients had minimal events. However, reported associations between TIMI categories and individual outcomes did not reach statistical significance ($p>0.05$)due to limited sample size.

Conclusion: TIMI scoring provided clinically interpretable early risk stratification in this observational study of ACS patients. Adverse outcomes tended to occur in higher-risk groups, although statistical significance was not demonstrated. Larger studies with longer follow-up and formal discrimination/calibration analyses are needed before claiming local predictive validation.

Keywords: acute coronary syndrome; TIMI risk score; STEMI; NSTEMI; risk stratification; major adverse cardiac events; prognosis

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INTRODUCTION

Acute coronary syndrome (ACS), comprising ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina, results primarily from an acute reduction in coronary blood flow following atherosclerotic plaque disruption and thrombosis. ACS continues to contribute substantially to cardiovascular morbidity and mortality worldwide [1–5]. Early clinical assessment is therefore essential for identifying patients at greater risk of complications and for guiding the intensity of monitoring and treatment.

Risk scores provide a standardized approach to prognosis in ACS. The Thrombolysis in Myocardial Infarction (TIMI) risk score is a practical bedside tool that integrates routinely available clinical variables to estimate short-term risk [6,7]. Its simplicity makes it attractive in routine and resource-limited settings; however, predictive

performance may vary according to patient characteristics, clinical setting, treatment practices, and outcome definitions [9,11,12]. Local evaluation is consequently important before assuming that published performance estimates apply to every population. The present study evaluated the clinical utility of TIMI risk stratification among ACS patients admitted to a teaching medical hospital and examined the distribution of in-hospital adverse outcomes across TIMI risk categories. The primary research question was whether TIMI risk categories were associated with in-hospital major adverse cardiac events (MACE) in this population.

MATERIALS AND METHODS

- **Study design and setting**
  This prospective observational study was conducted in the coronary intensive care unit (CICU) of RVMIMS, Siddipet District, Telangana, India. The thesis reports a six-month study period. The source document contains an internally inconsistent calendar range for this period; therefore, the exact start and end dates should be verified before journal submission.
- **Participants**
  Inpatients aged 18–75 years who were diagnosed with ACS and consented to participate were eligible. Patients younger than 18 years or older than 75 years, outpatients, pregnant or lactating women, and patients with end -stage cardiovascular disease were excluded. A total of 130 valid participant records were analysed.
- **Sample size**
  The sample size was estimated using the Raosoft online calculator with a population size of 200, 5% margin of error, 95% confidence level, and 50% response distribution, yielding a target of 132. Of 137 forms distributed, 130 valid forms were retrieved and included in the analysis.
- **Data collection and TIMI risk assessment**
  Data were collected using a structured case record form from patient interviews, physical examination, ECG findings, laboratory investigations, and hospital records. For UA/NSTEMI, TIMI variables included age ≥65 years, at least three coronary artery disease risk factors, known coronary stenosis ≥50%, aspirin use in the preceding 7 days, at least two anginal episodes within 24 hours, ST-segment deviation ≥0.5 mm, and elevated cardiac biomarkers. For STEMI, the score incorporated age, history of diabetes/hypertension/angina, systolic blood pressure, heart rate, Killip class, body weight, anterior ST elevation or left bundle- branch block, and treatment delay, as specified in the study protocol [8,9]. Patients were subsequently classified into low-, intermediate-, and high-risk categories.
- **Outcomes**
  The in-hospital outcomes assessed were acute heart failure/pulmonary edema (AHF/PE), ventricular tachycardia or ventricular fibrillation (VT/VF) requiring intervention, cardiogenic shock, and all-cause mortality. These outcomes were used to assess the clinical usefulness of TIMI risk categorisation.
- **Statistical analysis**
  Data were coded in Microsoft Excel and analysed using SPSS Statistics version 31.0.1 (Build 49). Continuous variables were summarised as mean ± standard deviation and categorical variables as frequencies and percentages. Chi-square testing was reported for categorical comparisons. A two-sided p-value <0.05 was considered statistically significant.
- **Ethical considerations**
  Ethical approval was obtained from the Institutional Review Board of Geethanjali College of Pharmacy before study initiation (Ref. No. GCPK/PD25/19; dated 29 August 2025).

RESULTS

Table 1. Baseline and clinical characteristics of the study population (N=130).

A total of 130 participants were analyzed. Mean age was 58.53±10.697 years. Most patients were 56–75 years old (54.6%), and males constituted 61.5% of the cohort. Hypertension was present in 60.0%, diabetes mellitus in 40.0%, smoking in 16.2%, and a family history of coronary artery disease in 6.2%.

Characteristic	n	%
Age 18–35 years	2	1.5
Age 36–55 years	57	43.8
Age 56–75 years	71	54.6
Male	80	61.5
Female	50	38.5
Hypertension	78	60.0
Diabetes mellitus	52	40.0
Smoking	21	16.2
Family history of CAD	8	6.2

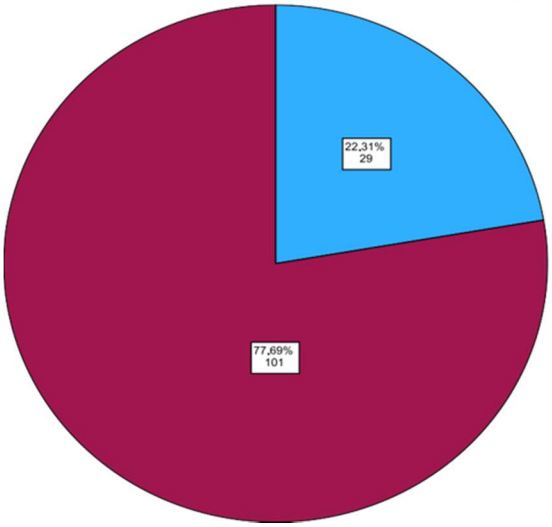

Figure 4.1: Proportion of STEMI and NSTEMI cases

Table 2. Distribution of TIMI risk categories.

NSTEMI was the predominant ACS presentation, accounting for 77.69% (101/130) of cases, whereas STEMI accounted for 22.31% (29/130). Across the total cohort, 12 patients (9.2%) were classified as low risk, 92 (70.8%) as intermediate risk, and 26 (20.0%) as high risk. In the STEMI subgroup, 1 patient (3.4%) was low risk and 14 patients each (48.3%) were intermediate and high risk. In the NSTEMI subgroup, the source table reports 11 low-risk (10.9%), 41 intermediate-risk (40.6%), and 49 high-risk (48.5%) patients.

Group	Low risk	Intermediate risk	High risk
Overall (N=130)	12 (9.2%)	92 (70.8%)	26 (20.0%)
STEMI (n=29)	1 (3.4%)	14 (48.3%)	14 (48.3%)
NSTEMI (n=101)	11 (10.9%)	41 (40.6%)	49 (48.5%)

Table 3. Distribution of TIMI risk categories among STEMI patients

The majority of patients were classified into the intermediate- and high-risk categories, with each group accounting for 48.3% of the study population. In contrast, only 3.4% of patients were categorized as low risk. Thus, the study population was predominantly represented by patients with intermediate to high TIMI risk, indicating a greater burden of baseline risk factors and the need for close clinical monitoring and appropriate management.

	Variables	Frequency	Percent
Category	low	1	3.4
	Intermediate	14	48.3
	high	14	48.3

Table 4. Distribution of TIMI risk categories among NSTEMI patients

The majority of patients were classified as high-risk (48.5%), followed by intermediate-risk (40.6%), while only 10.9% were in the low-risk category. Overall, most patients were in the intermediate- to high-risk groups, indicating a greater burden of adverse risk.

	Variables	Frequency	Percent
Category	low	11	10.9
	Intermediate	41	40.6
	high	49	48.5

Table 5. Reported in-hospital outcomes across TIMI risk categories in the STEMI subgroup.

In the source results, low-risk patients had no reported events, while complications were observed in intermediate- and high-risk categories. For the reported STEMI comparison, AHF/PE occurred in 3 intermediate-risk patients (21.4%); VT/VF requiring intervention occurred in 1 high-risk patient (7.1%); cardiogenic shock occurred in 2 high-risk patients (14.3%); and all-cause mortality occurred in 1 intermediate-risk (7.1%) and 2 high-risk patients (14.3%). None of these comparisons reached statistical significance (all $p>0.05$).

Outcome	Low risk	Intermediate risk	High risk	p value
AHF/PE	0 (0.0%)	3 (21.4%)	0 (0.0%)	0.167
VT/VF requiring intervention	0 (0.0%)	0 (0.0%)	1 (7.1%)	0.574
Cardiogenic shock	0 (0.0%)	0 (0.0%)	2 (14.3%)	0.316
All-cause mortality	0 (0.0%)	1 (7.1%)	2 (14.3%)	0.777

Table 6. Reported in-hospital outcomes across TIMI risk categories in the NSTEMI subgroup.

The table shows that clinical complications were more frequently observed in the intermediate- and high-risk groups. AHF/PE occurred in the intermediate-risk group, while VT/VF, cardiogenic shock, and mortality were observed mainly in the high-risk group. However, none of the differences were statistically significant ($p > 0.05$).

Complication	Low Risk	Intermediate Risk	High Risk	P value
AHF/PE	0(0.0%)	3(21.4%)	0(0.0%)	0.167
VT/VF requiring intervention	0(0.0%)	0(0.0%)	1(7.1%)	0.574
Cardiogenic shock	0(0.0%)	0(0.0%)	2(14.3%)	0.316
All-cause mortality	0(0.0%)	1(7.1%)	2(14.3%)	0.777

Table 7. Patients with Composite MACE by TIMI Risk Group

TIMI Risk Group	n(%)
Low (n = 12)	0 (0.0%)
Intermediate (n = 92)	4 (4.3%)
High (n = 26)	5 (19.2%)
Overall (n = 130)	9 (6.9%)

The primary composite MACE endpoint, defined as the occurrence of acute heart failure/pulmonary edema, VT/VF requiring intervention, cardiogenic shock, or all-cause mortality during hospitalization, was observed in **9 of 130 patients (6.9%)**. Composite MACE occurred in **0 (0.0%)** patients in the low-risk group, **4 (4.3%)** patients in the intermediate-risk group, and **5 (19.2%)** patients in the high-risk group, indicating an increasing frequency of adverse cardiovascular events with increasing TIMI risk category.

DISCUSSION

This prospective observational study describes TIMI risk stratification and in-hospital outcomes in 130 patients with ACS. The cohort was predominantly male and middle-aged to elderly, with a substantial burden of hypertension and diabetes. NSTEMI was more common than STEMI. Most patients were categorized as intermediate or high risk, indicating that the admitted population had considerable baseline cardiovascular risk. The distribution of events was clinically consistent with the intended role of TIMI scoring: low-risk patients had minimal reported adverse outcomes, whereas ventricular arrhythmia, cardiogenic shock, and mortality were observed in higher-risk categories. In the STEMI subgroup, mortality rose from 0% in low-risk patients to 7.1% in intermediate-risk patients and 14.3% in high-risk patients. Nevertheless, none of the individual outcome comparisons reached statistical significance. The small STEMI subgroup, sparse event counts, and resulting limited statistical power are plausible explanations for this finding.

Previous studies have reported associations between higher TIMI scores and adverse outcomes in ACS. Rahman et al. described greater post-MI complications in higher TIMI categories among STEMI patients [24].

Elemary et al. reported relationships between higher TIMI-related indices and adverse in-hospital outcomes in STEMI patients undergoing primary PCI [26]. In NSTEMI populations, Kumar et al. reported acceptable discrimination for short-term mortality [28], while Al-Bugami et al. found more limited discriminatory performance in a Saudi cohort [25]. These differences emphasize that local validation should assess not only risk-group trends but also formal predictive performance. The present findings therefore support the practical clinical utility of TIMI as a bedside stratification framework, but the available analysis is insufficient to establish predictive validation in the strict statistical sense. A validation manuscript would ideally report receiver-operating-characteristic area under the curve with 95% confidence intervals, sensitivity, specificity, calibration, and—where appropriate—multivariable or logistic regression analyses for a clearly defined composite MACE endpoint.

STRENGTHS AND LIMITATIONS

Strengths include prospective data collection, use of a standardized risk assessment framework, inclusion of both STEMI and NSTEMI presentations, and assessment of clinically relevant in-hospital outcomes in a real-world teaching-hospital setting. Important limitations include the single-center design, modest sample size, small number of outcome events, absence of long-term follow-up, lack of comparison with another risk score, and absence of formal discrimination and calibration statistics.

CONCLUSION

In this cohort of patients with ACS, most participants were classified as intermediate or high risk by TIMI scoring. Adverse in-hospital outcomes were concentrated in higher-risk categories, while low-risk patients had few or no reported events. Although these patterns suggest clinical usefulness for early bedside risk stratification, statistically significant associations were not demonstrated in the reported analyses. TIMI may therefore be useful as a pragmatic risk-stratification tool in this setting, but larger studies with verified outcome data and formal predictive-performance analyses are required to establish local validation.

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