Angiographic Analysis and Clinical Evaluation of TIMI and GRACE Scores in NSTEMI and Unstable Angina: A Comprehensive Study

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Abstract:
Cardiovascular disease (CVD) is a major global health threat, particularly affecting low- and middle-income countries, where it accounts for a significant number of premature deaths. Risk factors such as smoking, unhealthy diet, and sedentary lifestyles contribute to its prevalence. Clinical scoring systems like TIMI, GRACE, and HEART scores, alongside biomarker assessments, aid in the early identification of high-risk individuals, facilitating timely interventions to prevent adverse outcomes. Those with advanced age, prior myocardial infarction (MI), and impaired left ventricular function are at increased risk and may benefit from invasive procedures like coronary artery bypass grafting (CABG). Early detection and management of CVD risk factors are pivotal for effective prevention and treatment strategies.
This study analyzes angiographic characteristics and evaluates the clinical effectiveness of TIMI and GRACE scores in guiding treatment and predicting outcomes for patients with NSTEMI and Unstable Angina. This was conducted at a tertiary hospital in Ahmedabad over one year. The study population comprised inpatient cases diagnosed with Non-ST Elevation Myocardial Infarction (NSTEMI) and Unstable Angina. The majority of NSTEMI patients had double vessel disease with left anterior descending artery involvement, while UA patients predominantly had single vessel disease with similar artery involvement.
NSTEMI patients had a significantly higher mortality rate (14.55%) compared to UA patients (4.44%). Mortality was higher in males (15.52%) compared to females (2.38%).
Male gender and higher TIMI and GRACE scores are associated with increased mortality and decreased discharge rates. Revascularization may be necessary for patients with higher TIMI risk scores to reduce mortality risk.

Keywords: NSTEMI, UA, TIMI, GRACE, PCI

INTRODUCTION:
According to the American College of Cardiology (ACC) and American Heart Association (AHA), Non-ST elevation myocardial infarction (NSTEMI) is defined as an acute coronary syndrome (ACS) characterized by symptoms of myocardial ischemia (chest pain or discomfort) and elevations of cardiac biomarkers (such as troponin) but with no significant ST-segment elevation on the electrocardiogram (ECG). [1]Unstable angina (UA) is defined as a type of ACS characterized by symptoms of myocardial ischemia that are new or differ from previous symptoms and are associated with an increased risk of developing a heart attack or dying.[2]It is typically characterized by recurrent chest pain or discomfort at rest or with minimal exertion and is not accompanied by ST-segment elevation on ECG.

To assess this risk, various clinical scoring systems such as those developed by the Thrombolysis in Myocardial Infarction (TIMI) Trials, the Global Registry of Acute Coronary Event (GRACE) and the HEART (history, electrocardiogram, age, risk factors, troponin) score are used. The use of multiple biomarkers are being increasingly used to better understand the underlying pathophysiology of the patient's presentation and for more accurate risk

stratification.[3-6]Early risk assessment can help identify patients who would benefit the most from an early invasive strategy.

Risk stratification identifies patients who are most likely to benefit from subsequent revascularization. Patients with left main disease or multivessel CAD with reduced LV function are at high risk for adverse outcomes and are likely to benefit from CABG. Clinical evaluation and noninvasive testing aid in the identification of most patients at high risk because they often have ≥1 of the following high-risk features: advanced age (>70 years of age), prior MI, revascularization, ST deviation, HF, depressed resting LV function (ie, LVEF ≤40%) on the noninvasive study, or noninvasive stress test findings, including magnetic resonance imaging. Any of these risk factors or diabetes mellitus may aid in the identification of high-risk patients who could benefit from an invasive strategy. [7]

AIMS AND OBJECTIVES:
1. To analyze the angiographic characteristics of individuals diagnosed with Non-ST Elevation Myocardial Infarction (NSTEMI) and Unstable Angina, focusing on characteristics such as coronary artery involvement and severity of stenosis.
2. To evaluate the clinical effectiveness of TIMI and GRACE scores in facilitating therapeutic decision-making and predicting outcomes for patients hospitalized due to NSTEMI and Unstable Angina.

MATERIAL AND METHOD:
This prospective observational study was conducted at a tertiary hospital in Ahmedabad over one year. The study focused on inpatient cases diagnosed with Non-ST Elevation Myocardial Infarction (NSTEMI) and Unstable Angina, who were evaluated within the hospital's Department of General Medicine and Cardiology. A sample size of 100 patients was selected from admitted patients in the ward/ICU. Patients or their caregivers provided informed consent before participation. Prior approval of the thesis protocol was obtained from the institutional review board.

Eligibility criteria:
Inclusion criteria: Adults >18 years, both genders, diagnosed with NSTEMI or Unstable Angina per ACC/AHA guidelines [1,2], admitted to a tertiary care teaching hospital and willing to participate.

Exclusion criteria: Patients unwilling to participate, those with ECG showing ST elevation.

STATISTICAL ANALYSIS:
Data collected via predesigned forms in Microsoft Excel 2019 underwent analysis using SPSS, applying relevant statistical tests for association. Significance levels were determined using p-values.

RESULTS AND DISCUSSION:
In this study, 100 patients' data were considered, of which 55 patients had NSTEMI, and 45 were diagnosed with Unstable   Angina.
Table 1 shows that 79% had coronary angiography; UA had higher rates (95.56%) than NSTEMI (65.45%). NSTEMI had more double vessel disease (47.22%) than UA (25.58%). Both had similar LAD involvement; UA had more LCX (68.35%), while NSTEMI had more RCA (47.22%).

Table 1: Distribution of patients undergone coronary angiography (CAG) in accordance to the number of arteries & culprit arteries involved

	NSTEMI (n=55)	UA (n=45)	TOTAL (n=100)
CAG DONE	36 (65.45%)	43 (95.56%)	79 (79.00%)
NUMBER OF ARTERY INVOLVED			
SVD	16 (44.44%)	20 (46.51%)	36 (45.57%)
DVD	17 (47.22%)	11 (25.58%)	28 (35.44%)
TVD	3 (8.33%)	2 (4.65%)	5 (6.33%)
NORMAL	0(00%)	10(23.26%)	10(12.66%)
CULPRIT ARTERY INVOLVED			
LAD	27 (75.00%)	27 (62.79%)	54 (68.35%)
LCX	15 (41.67%)	7 (16.28%)	22 (27.85%)
RCA	17 (47.22%)	14 (32.56%)	31 (39.24%)

Table 2 displays patient outcomes by diagnosis (NSTEMI, UA) and gender. Among NSTEMI patients, 14.55% died, while 85.45% were discharged; for UA patients, 4.44% died, and 95.56% were discharged. The odds ratio for death in NSTEMI vs. UA was 3.659 (p = 0.113). Among males, 15.52% died, and 84.48% were discharged; among females, 2.38% died, and 97.62% were discharged. The odds ratio for death in males vs. females was 7.530 (p = 0.060), showing a trend towards significance.

Table 2: Outcome of the patients

	OUTCOME		95% CI	P VALUE
	DEATH (n=10)	DISCHARGE (n=90)		
NSTEMI (n=55)	8 (14.55%)	47 (85.45%)	0.74-18.19	0.113
UA (n=45)	2 (4.44%)	43 (95.56%)		
GENDER WISE				
MALE (n=58)	9(15.52%)	49(84.48%)	0.915-61.94	0.060
FEMALE (n=42)	1(2.38%)	41(97.62%)		

Table 3 For the GRACE score, higher risk categories had lower discharge rates but higher death rates. Low-risk patients had 100% discharge and no deaths, while high-risk patients had 75.76% discharge and 24.24% death (p = 0.003). Conversely, for the TIMI score, discharge rates didn't significantly differ among risk categories. However, death rates slightly increased with higher TIMI scores, ranging from 0% to 12.90% (p = 0.625).

Table: 3 Distributions of patient's outcome by risk stratification by Grace Score & Timi score

	TOTAL (n=100)	DISCHARGE (n=90)	DEATH (n=10)	P VALUE
GRACE SCORE				
LOW (≤108)	27	27 (100.00%)	0 (0.00%)	**0.003***
INTERMEDIATE				
(109 - 140)	40	38 (95.00%)	2 (5.00%)	
HIGH (>140)	33	25 (75.76%)	8 (24.24%)	
TIMI SCORE				
LOW (0 - 2)	11 (11.00%)	11 (100.00%)	0 (0.00%)	0.625
MODERATE				
(3 - 4)	58 (58.00%)	52 (89.66%)	6 (10.34%)	
HIGH (5 - 7)	31 (31.00%)	27 (87.10%)	4 (12.90%)	

Table 4 depicts that the death rates in low, moderate, and high TIMI risk categories of 52 patients who underwent PCI were 0%, 6.25%, and 12.5% and of the 48 patients who did not undergo PCI death rates were 0%, 11.54%, 13.34% respectively as the TIMI risk score increases, need of revascularization and probability of death increases which is clinically significant but statistically not significant.

Table 4: Outcome in accordance to Timi risk categories & PCI

	OUTCOME	TIMI RISK CATEGORY			P VALUE
		LOW (n=11)	MODERATE (n=58)	HIGH (n=31)	
PCI DONE (n=52)	DEATH	0(00%)	2(6.25%)	2(12.50%)	0.707
	DISCHARGE	4(100.00%)	30(93.75%)	14(87.50%)	
PCI NOT DONE (n=48)	DEATH	0 (00%)	3(11.54%)	2(13.34%)	0.840
	DISCHARGE	7(100%)	23(88.46%)	13(86.66%)	

CONCLUSION:

This study highlights significant differences in coronary artery disease (CAD) presentation and outcomes between non-ST segment elevation myocardial infarction (NSTEMI) and unstable angina (UA) patients. NSTEMI patients tend to have more severe diseases with higher mortality rates, particularly in males. Risk stratification using GRACE and TIMI scores shows promise in predicting outcomes, although further research is needed. Additionally, while percutaneous coronary intervention (PCI) may mitigate mortality risk, its impact varies across different risk categories. Overall, individualized treatment strategies based on risk assessment are crucial in managing CAD effectively.

Further studies over a larger and more varied population are needed for further evaluation.

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