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Research Article

CORRELATION OF CLINICAL CARDIAC RISK SCORES, GRACE AND TIMI WITH ANGIOGRAPHIC SYNTAX SCORE IN STEMI

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A R T I C L E I N F O

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A B S T R A C T

Background: Cardiovascular diseases have emerged as a significant health burden and became a leading cause of mortality in developing countries like India. In cardiovascular diseases, acute coronary syndromes (ACS) are the primary cause of morbidity and mortality. Patients with ST-elevation myocardial infarction (STEMI) are a heterogeneous group, with a prognosis that ranges from one with an excellent outcome with modest adjustments in therapeutic regimen to one in which the risk of death or recurrent complications are high, requiring intensive treatment. Accordingly, risk stratification plays a central role in the evaluation and management of patients with STEMI. Different scoring systems are available based on initial clinical history, electrocardiographic and laboratory tests that enable early risk stratification on admission. The risk scores were created and recommended by national and international guidelines to identify patients with a higher probability of adverse events, recommending more intensive treatment and early angiography in this population. Angiography predicts Major Adverse Cardiovascular Events (MACE) in STEMI and helps in deciding revascularization. Clinical predictors like duration of chest pain, age, cardiac biomarker positivity, ST-segment changes in electrocardiogram (ECG), Congestive Heart Failure (CHF) help in predicting the high-risk group. Similarly, clinical risk scores like TIMI (Thrombolysis in Myocardial Infarction) score, and GRACE (Global Registry of Acute Coronary Events) scores have established a role in risk stratification and predicting the prognosis. The SYNTAX (Synergy between Percutaneous Coronary Intervention with TAXUS and cardiac Surgery) score is an anatomical-based risk score that considers features such as thrombus, bifurcations, calcifications, total occlusions, and diffuse disease. This study aim to assess correlation of clinical cardiac scores, GRACE and TIMI with angiographic SYNTAX score in STEMI patients.

Methodology: Single-center, prospective study conducted in the Department of Cardiology, King George Hospital, and Visakhapatnam. The study included 251 patients presented to the department of cardiology, KGH, between January 2020 and December 2021 with a diagnosis of STEMI and who underwent Coronary angiography. TIMI, GRACE scores were calculated based on history, vital parameters, lab investigations & ECG. All patients underwent diagnostic Coronary Angiography (CAG). Using SYNTAX score angiographic assessment of lesion severity was done. The percentage of stenosis and length of the lesion was calculated by using quantitative coronary angiography software. Inferential and descriptive statistical analysis has been carried out in the current study. Results on continuous variables are presented as Mean ± SD (Min-Max), and results on categorical variables are expressed as frequency and percentages (%). Correlation analysis with Pearson's coefficient was done to establish the correlation between risk scores. Multivariate linear regression analysis was done to know the association between clinical predictors and angiographic scores.

Results: Out of 251 patients in our study population, 186 (74.1%) were males and 65 (25.9%) were female. The patient's ages ranged from 23 to 85 years. 53.6±10.6 years were the mean age of the patients, with the majority of the patients were in the age group of 51-60 years and females having a slightly higher age at presentation. In our study population, anterior wall STEMI and anterolateral STEMI constitute most cases, 102 (40.6%), 54 (21.5 %) respectively. Among the study population, 24(9.5%) patients had low TIMI score, 172 (68.5%) had intermediate TIMI score, and 55(22%) had high TIMI score at presentation with a mean TIMI score of 5.1±2.2. Among the study population, 30(11.9%) had a low GRACE score, 73 (29%) had intermediate GRACE score, 148(59%) had high GRACE Score with a mean GRACE SCORE of 152.2±37. All patients in the study group underwent CAG, angiographic score SYNTAX SCORE was calculated, and were stratified into low (≤22), Intermediate (23-32), High (>32).Among the study population, 215(85.6%) had low syntax score, 26 (10%) had intermediate syntax score, and 10 (4%) had a high syntax score with an average SYNTAX score of 11.8±8.7.

Conclusion: Our study confirmed that there was a significant correlation between TIMI and SYNTAX scores (p-value 0.10), between GRACE and SYNTAX scores (p-value<0.001), our study confirmed the correlation between higher clinical risk scores with the severity of coronary artery disease assessed by Syntax scores. The higher scores in TIMI and GRACE scoring systems had a significantly greater angiographic disease when compared to low scores. GRACE risk score had a more significant correlation with Syntax score

INTRODUCTION

Cardiovascular diseases have emerged as a significant health burden and became a leading cause of mortality in developing countries like India.[1] In cardiovascular diseases, acute coronary syndromes are the primary cause of morbidity and mortality, for which timely diagnosis and appropriate therapy are of foremost importance to improve clinical outcomes.[2] Acute chest pain patients in the emergency department can create uncertainty for all treating physicians. The decision to

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discharge a patient where acute coronary syndrome (ACS) cannot be excluded may result in a severe life-threatening outcome, while on the other hand, admission in case of atypical/non-cardiac chest pain can lead to unwarranted treatment and expenditures.[3][4] Nearly 3 million ST-elevation myocardial infarctions are estimated to occur in India per year.[5] Several risk score models for Acute coronary syndromes are being evaluated for years, which may help the attending physician make a timely decision regarding acute management. In a clinical scenario, simple risk scores which can be calculated at the patient's bedside are favorable. [3]

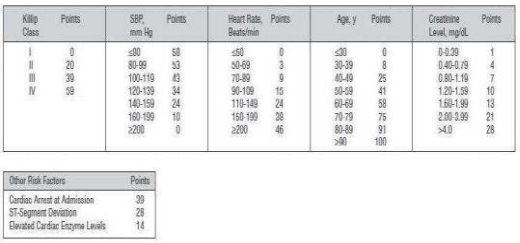
Many of these risk scores are grueling to use, requiring multiple calculations and are only substantiated for a selected group of patients such as Unstable angina or Non-ST elevation myocardial infarction patients in the coronary care unit.[3] The main purpose of these risk scores was not to make a diagnosis but to identify the subset of high-risk ACS patients who are likely to benefit most from timely and appropriate therapies and identify those patients who will be at risk for recurrent ischemic events.[3] As the benefits of aggressive and newer treatments proportional to adverse clinical events, early risk stratification plays a pivotal role [6]. Patients at significant risk for adverse outcomes may derive the most significant benefit from rapid and comprehensive use of effective treatments, including coronary interventional procedures and cardiac medications. Patients with ST-elevation myocardial infarction are a heterogeneous group, with a prognosis that ranges from one with an excellent outcome with modest adjustments in therapeutic regimen to one in which the risk of death or recurrent complications are high, requiring intensive treatment. Accordingly, risk stratification plays a central role in the evaluation and management of patients with STEMI. Different scoring systems are now available based on initial clinical history, electrocardiographic and laboratory tests that enable early risk stratification on admission. The risk scores were created and recommended by national and international guidelines to identify patients with a higher probability of adverse events, recommending more intensive treatment and early angiography in this population. Angiography predicts Major Adverse Cardiovascular Events (MACE) in STEMI and helps in deciding revascularization. Clinical predictors like duration of chest pain, age, cardiac biomarker positivity, ST-segment changes in electrocardiogram (ECG), Congestive Heart Failure (CHF) help in predicting the high-risk group. Similarly, clinical risk scores like TIMI (Thrombolysis in Myocardial Infarction) score, PURSUIT (Platelet Glycoprotein IIb-IIIa in Unstable Angina, Receptor Suppression Using Integrilin Therapy) score, and GRACE (Global Registry of Acute Coronary Events) scores have established a role in risk stratification and predicting the prognosis[7].

Literature Review: EARLY RISK STRATIFICATION — all patients with STEMI should undergo early risk stratification within the first 4 to 6 hours of hospitalization. However, even low-risk patients should undergo primary reperfusion (usually with percutaneous coronary intervention) promptly. A report published in 1998 from the National Registry of Myocardial Infarction (NRMI) evaluated data on 170,143 patients admitted with acute myocardial infarction (MI) (with or without ST-segment elevation) in an attempt to identify patients at high risk[8]. Significant risk factors included age over 70 years, prior MI, Killip class at admission, anterior MI, and the combination of hypotension and tachycardia[8].

GRACE risk model-The GRACE registry, a global registry of acute coronary syndrome (ACS) patients across 14 countries from 94 hospitals, designed risk models to ascertain the risk of in-hospital and 6-month mortality in patients with acute coronary syndromes. The in-hospital model was based on 11,389 patients with either a STEMI or a non-ST elevation ACS[10]. This model was then validated based on an additional 3972 patients from GRACE and 12,142 patients from the GUSTO IIb trial[10]. Almost 90 percent of the prognostic information derived from the eight independent risk predictors:

- Age of the patient
- Killip class at the time of presentation
- Systolic blood pressure
- Presence of ST-segment deviation
- Cardiac arrest during the presentation
- Serum creatinine concentration
- Presence of elevated serum cardiac biomarkers
- Heart rate

Each risk factor assigned point scores and the sum of the point scores calculated to estimate the probability of in-hospital mortality. With the GRACE risk model, a nomogram was published to calculate the risk score[10,12].



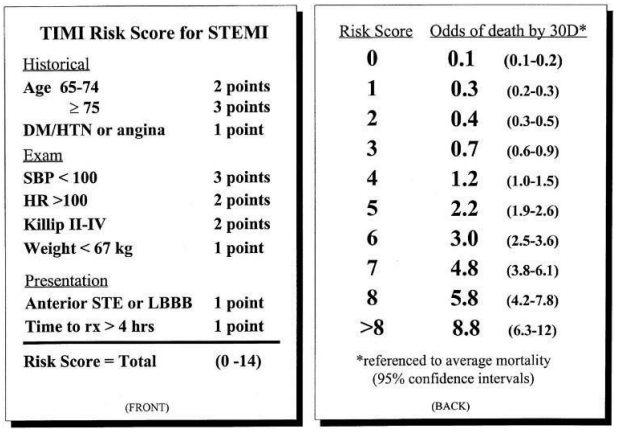
Killip Class	Points	SBP, mm Hg	Points	Heart Rate, Beats/min	Points	Age, y	Points	Creatinine Level, mg/dL	Points
I	0	≤80	58	≤50	0	≤30	0	0-0.39	1
II	20	80-99	53	50-69	3	30-39	8	0.40-0.79	4
III	39	100-119	43	70-89	9	40-49	25	0.80-1.19	7
IV	59	120-139	34	90-109	15	50-59	41	1.20-1.59	10
		140-159	24	110-149	24	60-69	58	1.60-1.99	13
		160-199	10	150-199	38	70-79	75	2.00-3.99	21
		≥200	0	≥200	46	80-89	91	>4.0	28
						≥90	100		

Other Risk Factors	Points
Cardiac Arrest at Admission	39
ST-Segment Deviation	28
Elevated Cardiac Enzyme Levels	14

STE-ACS: In-hospital Mortality

Risk Category (tertiles)	GRACE Risk Score	Probability of Death In-hospital (%)
Low	49-125	<2
Intermediate	126-154	2-5
High	155-319	>5

TIMI risk score — TIMI risk score is the arithmetic sum of independent risk factors related to history, clinical examination, and initial presentation to hospital and derived from data of fifteen thousand patients with STEMI eligible for fibrinolytic therapy [9]:



TIMI Risk Score for STEMI

Historical	
Age 65-74	2 points
≥ 75	3 points
DM/HTN or angina	1 point
Exam	
SBP < 100	3 points
HR >100	2 points
Killip II-IV	2 points
Weight < 67 kg	1 point
Presentation	
Anterior STE or LBBB	1 point
Time to rx > 4 hrs	1 point
Risk Score = Total	(0 -14)

(FRONT)

Risk Score	Odds of death by 30D*	
0	0.1	(0.1-0.2)
1	0.3	(0.2-0.3)
2	0.4	(0.3-0.5)
3	0.7	(0.6-0.9)
4	1.2	(1.0-1.5)
5	2.2	(1.9-2.6)
6	3.0	(2.5-3.6)
7	4.8	(3.8-6.1)
8	5.8	(4.2-7.8)
>8	8.8	(6.3-12)

*referenced to average mortality (95% confidence intervals)

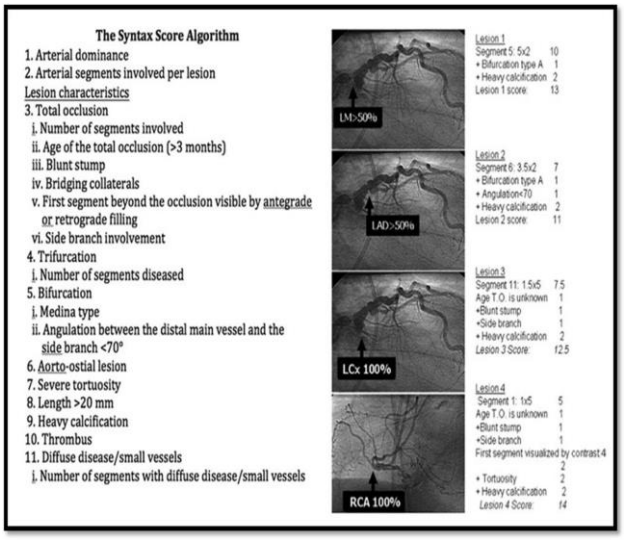
(BACK)

The usefulness of the TIMI risk score to predict in-hospital mortality was validated in a community-based population of 84,029 patients; the predictive accuracy of the TIMI risk score was the same in those treated with fibrinolysis or percutaneous coronary intervention but

underestimated mortality in those not undergoing reperfusion therapy[9].

SYNTAX Score

The SYNTAX score is an anatomical-based risk score that considers features such as thrombus, bifurcations, calcifications, total occlusions, and diffuse disease. Each lesion in coronary vessels with a luminal obstruction of >50% in vessels >1.5mm is scored separately, and the scores are summated to provide the overall SYNTAX score. This is calculated by using dedicated software that integrates the number of lesions with their specific weighting factors, based on the amount of myocardium distal to lesion and the morphological features of each lesion.[11]



Aims and Objectives

Aim

To correlate TIMI and GRACE clinical risk scores with the angiographic SYNTAX score in STEMI

Objectives

1. To calculate TIMI and GRACE risk scores in patients presenting with STEMI
2. To correlate the angiographic severity based on studied independent clinical predictors present in risk scores.
3. To identify the high-risk predictors for early intervention

MATERIALS AND METHODS

Study Design

Single-center, prospective study conducted in the Department of Cardiology, King George Hospital, Visakhapatnam.

Study Population

The study included 251 patients presented to the department of cardiology, KGH, between January 2020 and December 2021 with a diagnosis of STEMI and who underwent Coronary angiography.

Inclusion Criteria

Patients who present and diagnosed as ACS- STEMI and who underwent coronary angiography were included in the study.

Exclusion Criteria

1. Non-ST-elevation myocardial infarction/Unstable Angina
2. Recurrent Myocardial Infarction
3. Chest pain of proven non-ischemic etiology (such as takotsubo syndrome or myocarditis)
4. Prior surgical or percutaneous revascularization
5. In whom CAG was not being done – not willing or contraindications to CAG

Data Collection

History of clinical presentation and demographic characteristics were noted from all patients. Cardiovascular risk factors like smoking, alcohol, hypertension, and diabetes mellitus, etc., were recorded. A thorough initial examination was performed, and a history of past medical illness was recorded. Complete blood count, random blood sugars, and serum creatinine levels were obtained from all patients before conventional coronary angiography. Complete 2 D echo done for quantifications. TIMI, GRACE scores were calculated based on history, vital parameters, lab investigations & ECG. All patients underwent diagnostic Coronary Angiography (CAG). Using SYNTAX score angiographic assessment of lesion severity was done. The percentage of stenosis and length of the lesion was calculated by using quantitative coronary angiography software.

Statistical Methods

Inferential and descriptive statistical analysis has been carried out in the current study. Results on continuous variables are presented as Mean ± SD (Min-Max), and results on categorical variables are expressed as frequency and percentages (%). Correlation analysis with Pearson's coefficient was done to establish the correlation between risk scores. Multivariate linear regression analysis was done to know the association between clinical predictors and angiographic scores. Significance is assessed at a 5 % level of significance (95% Confidence Interval). Few assumptions are made on data,

Significant figures

P value: $0.05<P<0.10$ (Suggestive significance).
* P value: $0.01<P<0.05$ (Moderately significant)
** P value: $P\leq0.01$ (Strongly significant)

Statistical software

The Statistical software, namely SAS version 9.4, was used to analyze the data, and Microsoft Excel and Microsoft word have been used to generate tables, graphs, etc.

RESULTS

Study Population Characteristics

Sex: Out of 251 patients in our study population, 186 (74.1%) were males and 65 (25.9%) were female.

Age: In our study, the patient's ages ranged from 23 to 85 years. 53.6±10.6 years were the mean age of the patients, with the majority of the patients were in the age group of 51-60 years. The p-Value for the Chi-square test is 0.1513. Hence can be concluded that Age and Gender are independent.

Clinical Presentation: In our study population, anterior wall STEMI and anterolateral STEMI constitute most cases, 102 (40.6%), 54 (21.5 %) respectively, followed by inferior 42(16.7%), inferoposterior 20(8%) and combined inferoposterior and right ventricular STEMI .Isolated lateral wall STEMI and isolated posterior STEMI diagnosed in 0.8%

and 0.4% respectively.

Baseline Characteristics of population

Our study population mean age at presentation was 53.8±10.6 years, with females having a slightly higher age at presentation.

Mean ejection fraction (EF) was 50.2±9.1%, with females having slightly low EF.

Mean Serum Creatinine was 1.0±0.3 mg/dl, with the female having slightly low serum creatinine at admission.

Mean random blood sugar (RBS) was 175.5±85.5 mg/dl with females having high RBS at admission.

Left Ventricular Function

In our study population, out of 251 patients, 126 (50.2%) had EF of >50%, and 32.7%,13.9%, 3.2% had mild, moderate, severe Left ventricular systolic dysfunction respectively.

BMI: (Asian Standards)

In our study population of 251 patients, 101(40.2%) had normal BMI followed by 26.3%, 25.1% had overweight and Pre-obese respectively, with 5.2% had underweight and 3.2% had obesity Grade 1.

Distribution of Major Risk Factors for STEMI

In study population, 90 (35.9%) were alcoholics, 96(38.2%) were smokers/tobacco chewers,107(42.6%) were diabetics and 122 (48.6%) were hypertensive patients.

Distribution of Clinical Predictors

Among the study population, 44 (17.5%) were aged ≥ 65 years, 51 (20.3%) were had tachycardia,121 (48.2%) were in Killip II-IV, and 18(7.2%) were in cardiogenic shock at the time of initial presentation. Among the study population, 203(80.9%) patients presented 4 hours after onset of symptoms, and 194 (77.3%) were weighing <67kgs.

Distribution of Clinical Risk Scores

Risk scores were calculated for all patients in the study group, and based on clinical risk score, patients were stratified into high, intermediate, and low-risk groups. Among the study population,24(9.5%) patients had low TIMI score, 172 (68.5%) had intermediate TIMI score, and 55(22%) had high TIMI score at presentation with a mean TIMI score of 5.1±2.2 Among the study population, 30(11.9%) had a low GRACE score,73 (29%) had intermediate GRACE score,148(59%) had high GRACE Score with a mean GRACE SCORE of 152.2±37.

Coronary Angiogram

Coronary angiogram was done in all patients in our study population. Out of all the patients, 39.8% had single-vessel disease,22.7% had double vessel disease, 21.1% had triple vessel disease, and 12.8% had insignificant or normal coronary vessels.

Table 1 Pattern of involvement of coronary Arteries

Disease Vessel	Frequency	Percentage
LMCA	1	0.4%
LAD	83	33.1%
LCX	10	4.0%
RCA	24	9.6%
LAD+LMCA	3	1.2%
LAD+LCX	19	7.6%
LAD+RCA	25	10.0%
LCX+LMCA	0	0.0%
LCX+RCA	12	4.8%
LAD+LCX+RCA	29	11.6%
LAD+LCX+RCA+LMCA	2	0.8%
RCA+LMCA	0	0.0%
LAD+RCA+LMCA	0	0.0%
LAD+LCX+LMCA	2	0.8%
LCX+RCA+LMCA	1	0.4%
INSIGINIFANT/NORMAL	32	12.7%
DIAGONALS	4	1.6%
OM	0	0.0%
PDA/PLV	4	1.6%
	251	100.0%

Graphic Scores and Coronary Artery Disease Burden

All patients in the study group underwent CAG, angiographic score SYNTAX SCORE was calculated, and were stratified into low (≤22), Intermediate (23-32), High (>32).

Among the study population, 215(85.6%) had low syntax score, 26 (10%) had intermediate syntax score, and 10 (4%) had a high syntax score with an average SYNTAX score of 11.8±8.7.

Table 2 Angiographic scores- Stratification

SYNTAX	MALE(n)	FEMALE(n)	TOTAL(n)
LOW (<=22)	162	53	215
INTERMEDIATE (23-32)	16	10	26
HIGH (>32)	8	2	10
	186	65	251

Table 3 Angiographic Risk Scores - Mean±SD

	Male	Female	Total
Syntax	11.7±8.9	12.3±8.3	11.8±8.7

Management

For the patients in the study group after coronary angiogram depending on the disease burden, 154 (61.4%) patients underwent transluminal coronary angioplasty (PTCA),44 (17.5%) underwent coronary artery bypass graft (CABG), and 53(21.1%) were advised medical management

MEAN±SD For Values of Angiographic Scores For Various Risk Scores

For GRACE score, patients with high score had a statistically significant greater extent of angiographic involvement than low and intermediate score patients determined by SYNTAX score

For TIMI Score, mean SYNTAX scores were low in the intermediate-risk group than low and high-risk groups in our study population.

Table 4 MEAN±SD for values of angiographic scores for various risk scores

Risk score		Frequency	Syntax
TIMI	LOW	24	11.52±8.60
	INTERMEDIATE	172	11.36±8.82
	HIGH	55	13.43±8.51
	TOTAL	251	11.81±8.74
GRACE	LOW	30	8.83±7.85
	INTERMEDIATE	73	9.64±8.26
	HIGH	148	13.49±8.80
	TOTAL	251	11.81±8.74

EAN±SD for Angiographic Scores by Clinical Predictors

Table 5 Mean±SD for angiographic scores by clinical predictors

		SYNTAX
AGE	≥65 YEARS	12.9±7.2
	<65 YEARS	11.6±9.0
PR/min (pulse rate)	>100	14.4±9.3
	≤100	11.2±8.4
KILLIP	II-IV	12.6±8.2
	I	11.1±9.0
WEIGHT	<67 KG	12.3±9.1
	>67 KG	10.2±7.1
WP (window period)	>4 HRS	12.4±8.9
	≤4 HRS	9.3±7.2
SBP	≤90	13.5±9.4
	>90	11.7±8.6
HTN	YES	13.1±9
	NO	10.6±8.4
DM	YES	13.3±9.1
	NO	10.7±8.3
SMOKER	YES	9.9±7.1
	NO	13.0±9.4
ALCOHOLIC	YES	10.2±8.4
	NO	12.7±8.8

Association of Clinical Predictors in Syntax

Table 6 Frequency of risk predictors

		SYNTAX		
		LOW	Intermediae	HIGH
AGE(YEARS)	≥65	38	6	0
	<65	177	20	10
PR(/min)	>100	40	8	2
	≤100	175	18	8
KILLIP	II-IV	99	16	6
	I	116	10	4
WEIGHT	<67 KG	163	21	10
	>67 KG	52	5	0
WP	>4 HRS	172	21	10
	≤4 HRS	43	5	0
SBP	≤90	15	2	1
	>90	200	24	9
HTN	YES	102	14	6
	NO	113	12	4
DM	YES	87	14	6
	NO	128	12	4
SMOKER	YES	88	7	1
	NO	127	19	9
ALCOHOLIC	YES	80	7	3
	NO	135	19	7

Correlation between Risk Scores and Angiographic Scores

- Correlation of clinical risk scores and angiographic scores was done using Pearson coefficient correlation at 95% confidence interval (p-Value < 0.05 considered significant).
- Significant correlation between TIMI and SYNTAX scores (p-Value 0.10), between GRACE and SYNTAX scores (p-Value <0.001)' present in our study.
- The correlation of the GRACE score is more significant than TIMI score with angiographic severity scores.
- On further stratification of clinical risk scores as low, intermediate, and high-risk groups, a significant correlation was present between SYNTAX with TIMI or GRACE Scores, only when TIMI score or GRACE scores is high.
- No significant correlation was present between angiographic and clinical risk scores when clinical risk scores were low or intermediate.
- Correlation between both clinical and both angiographic scores is statistically significant with anterior/anterolateral STEMI
- In non-anterior STEMI, the correlation between TIMI score and SYNTAX or scores is not statistically significant
- In non-anterior STEMI, the correlation between GRACE and SYNTAX score is statistically significant.

Table 7 Correlation between Clinical and Angiographic risk scores

			Timi score	Grace score
Syntax	Pearson Correlation		.162**	.278**
	Sig. (2-tailed) p value		**.010**	**<.001**
	95% Confidence Intervals (2-tailed) ***	Lower	.039	.160
		Upper	.281	.388

***Estimation is based on Fisher's r-to-z transformation
** At the 0.01 level (2-tailed) significant correlation
* At the 0.05 level (2-tailed) significant correlation

Table 8 Correlation of Angiographic risk scores with stratified clinical risk scores

		Timi Low	Timi Inter.	Timi High	Grace Low	Grace Inter	Grace High
Syntax	Coefficient (r)	-0.007	0.134	0.297	-0.012	-0.080	0.226
	p Value	0.976	0.081	0.027	0.948	0.503	0.006

Table 9 Correlation between clinical and angiographic scores in Anterior/Anterolateral STEMI vs. Non-Anterior STEMI

		SCORE	SYNTAX
Anterior/Anterolateral STEMI	TIMI	Coefficient(r)	0.203
		p Value	0.011
	GRACE	Coefficient(r)	0.284
		p Value	0.000
Non-Anterior STEMI	TIMI	Coefficient(r)	0.150
		p Value	0.146
	GRACE	Coefficient(r)	0.303
		p Value	0.003

Multiple Regression Equation with Syntax Score

Significant association demonstrated by multiple regression analysis between SYNTAX score and Age (p 0.018), Pulse rate at presentation (p 0.03), Sr. creatinine (p 0.029), time of presentation from symptom onset (p 0.015), and significant negative association with left ventricular function (p 0.20)

Table 10 Multivariate regression analysis to assess determinants of SYNTAX SCORE

CLINICAL PREDICTOR	Standardized Coefficients Beta	t Value	p-Value
AGE	.147	2.389	.018
EF	-.169	-2.351	.020
PR	.135	3.053	.003
SBP	.099	-.669	.504
KILLIP	-.042	-.542	.588
SR. CREATININE		2.198	.029
RBS		1.647	.101
WP	.150	2.450	.015
WEIGHT(KG)	-.027	-.430	.668
DM	-	1.88	0.061
HTN	-	1.78	1.06

DISCUSSION

Risk scores are simple prognostication schemes that categorize a patient's risk of mortality and morbidity-related ischemic events. Their use can help tailor treatment approaches to match the severity of the patient's disease. This study tried to compare commonly used clinical risk scores (TIMI and GRACE) and individual clinical predictors with angiographic severity (SYNTAX scores) in patients admitted with ST-elevation myocardial infarction and underwent subsequent coronary angiogram at index hospitalization. In our study, most of the population was more than 50 years of age, with a mean age of 53.6±10.9 years, and male (74.1%) patients were more common than female (25.9%) patients.

Table 11 comparison of the study population and mean age

Study	Population	Mean age (years)
Present study	MALES (74.1%)	53.6±10.9
Sofidis *et al*(80)	MALES (76%)	63 ±13
Bekler *et al*(78)	FEMALES (74.9%)	61.9±12.7
Golabchi *et al*(82)	MALES (67%)	60 ± 11.95
Acet *et al* (77)	MALES (74 %)	61.5 ± 14.0

Compared to previous studies, mean age was younger in our study population, with the male gender predominantly affected. In the present study, 90 (35.9%) were alcoholics, 96(38.2%) were smokers,107(42.6%) were diabetics, and 122 (48.6%) were hypertensive patients. The incidence of diabetes was high compared to previous studies in our study.

Table 12 comparison of risk factors in study population

Study	Diabetics	Hypertensives	Smoker	Alcohol
Present	42.6%	48.6%	38.2%	35.9%
Sofidis *et al*(80)	24%	52%	53.6%	-
Bekler *et al*(78)	40.1%	45.3%	31.7%	-

In our study, out of 251 patients, 39.8% had single-vessel disease (SVD), 22.7% had double vessel disease(DVD), 21.1% had triple vessel disease(TVD), and 12.8% had insignificant or normal coronary vessels. This contrasts with Sofidis *et al*. [15], where SVD 26.2%, DVD 32.5%, and TVD 16.1%.

Table 13 comparison of coronary vessel involvement

STUDY	SVD	DVD	TVD	Insignificant/Normal
Present	39.8%	22.7%	21.1%	12.8%
Sofidis *et al* (80)	26.2%	32.5%	25.2%	16.1%

Mean Left ventricular function is marginally high in our study population compared to previous studies at the time of admission.

Table 14 Comparison of mean ejection fraction

	Present	Sofidis *et al*(80)	Bekler *et al*(78)	Golabchi *et al*(82)
EF (%)	50.6±8.9	47.5±11	48.0±9.2	44.05±7.6

In the present study,11.9 %, 29.0%, and 58.9% had low, intermediate, and high GRACE scores, respectively, in comparison to the study by Bekler *et al*. [14] where low, intermediate, and high score groups were 31.3%, 36.2%, and 32.7 % respectively. In present study,85.6 % ,10.3% and 4 % had low, intermediate and high SYNTAX scores respectively which was comparable to 72.7% ,15.8%,11.5% of study by Sofidis *et al*.[15]

The mean TIMI risk score was 5.1±2.2 in our study population, which was higher than in the study by ACET *et al*.[13] and lower than in the study by Golabchi *et al*. [16]

In contrast to studies by Sofidis *et al*. [15] and Bekler *et al*. [78], the mean GRACE risk score was higher in our study and nearly equal to the mean in Acet *et al*. Study. In the present study, mean Syntax score was lower when compared to previous studies[13,14,15,16]

Table 15 comparison of clinical and angiographic risk scores

STUDY	TIMI	GRACE	SYNTAX
Present	5.1±2.2	152±37.7	11.8±8.7
Sofidis *et al*(80)	-	116.26±38.0	16.26±13.4
Bekler *et al*. (78)	-	124.3±35.2	13.4±7.9
Golabchi *et al*. (82)	6.3±2.5	-	-
Acet *et al*(77)	3.9±1.9	155±25.6	19.2±11.6

Correlation of Clinical Risk Scores and Angiographic Scores:

In the present study, a correlation of TIMI risk score was present with SYNTAX score (r 0.162, p-Value 0.10).

Correlation of GRACE risk score was present with SYNTAX (r 0.278, p Value<0.01).The GRACE risk score was strongly correlated than the TIMI risk score with angiographic Syntax .A strong correlation present between TIMI and GRACE risk scores (r 0.782 p-Value<0.001) and syntax score .Contradictory to our results, the study by Sofidis *et al*. [15] concluded that GRACE score could not significantly predict severe CAD in patients with STEMI (AUC – 0.510,95%CI-0.361-0.659)

But, Study by Bekler *et al*. [14] showed that there was a significant positive correlation between Grace risk score and Syntax score (r=0.423, p<0.001).Acet *et al*(77) correlation analysis revealed significant associations Syntax Score (r = 0.24, p < 0.001) TIMI risk score (r = 0.65, p < 0.001), and Grace Risk score (r = 0.74, p = 0.001)

Study Limitations

The sample size was small. Single-center study results cannot be generalized, Results may not be applicable to female dominant groups as our study is male dominance.

CONCLUSION

Our study confirmed that there was a significant correlation between TIMI and SYNTAX scores (p-value 0.10), between GRACE and SYNTAX scores (p-value<0.001).Our study confirmed the correlation between higher clinical risk scores with the severity of coronary artery disease assessed by Syntax scores. The higher scores in TIMI and GRACE scoring systems had a significantly greater angiographic disease when compared to low scores. GRACE risk score had a more significant correlation with Syntax score. Correlation between both clinical and both angiographic scores is statistically significant with anterior/anterolateral STEMI. In non-anterior STEMI, the correlation between TIMI score and SYNTAX is not statistically significant. In non-anterior STEMI, the correlation between GRACE risk score and SYNTAX is statistically significant. Thus, this study emphasizes using clinical risk scores for stratifying patients and tailoring care for each patient. We conclude that TIMI and GRACE risk scores can be good predictors to determine the extent of disease in coronary arteries in STEMI patients.

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