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Haitham Alkady
Lecture (fellow) OF cardiology for Benha Teaching Hospitals, Benha, Egypt

Ahmed Said Abdelmonaim Saad
Lecture (fellow) OF cardiology for Shebin Elkoum Teaching Hospital Department, Shebin Elkoum, Egypt

Mahmoud Shawky Abd El Moneum
Professor of Cardiology Faculty of Medicine - Benha University, Banha, Egypt

Ehab Kamal Elmelegy
Lecture (fellow) OF cardiology for Shebin Elkoum Teaching Hospital Department, Shebin Elkoum, Egypt

Corresponding Author:
Haitham Alkady
Lecture (fellow) OF cardiology for Benha Teaching Hospitals, Benha, Egypt

Comparison between GRACE, TIMI and CHA_2DS_2-VAS_C scores in predicting severity of coronary artery disease in patients with non ST- Elevation myocardial infarction

Haitham Alkady, Ahmed Said Abdelmonaim Saad, Mahmoud Shawky Abd El Moneum and Ehab Kamal Elmelegy

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Abstract
Background: TIMI and GRACE risk scores show promise as coronary artery disease (CAD) prognostic markers. Using the SYNTAX score as a benchmark, this study aimed to determine if clinical risk scores were associated with the angiographic severity and extent of coronary artery disease (CAD) in a group of Egyptian persons. A secondary objective of the study was to ascertain if the GRACE, TIMI, and CHA2DS2-VASc scores could be helpful in predicting the outcomes of angiography in hospitalized patients with NSTEMI.
Methods: This observational, cross-sectional study was carried out on 146 patients with a diagnosis of NSTEMI admitted to Wadi El Neel Hospital. All patients were subjected to full history taken including [personal history, past history and drug history], biochemical tests and electrocardiography and echocardiography.
Results: patients with a CHA_2DS_2-vasc score > 2 have a four-fold to have "high" SYNTAX score. Patients with a GRACE score > 121 have a four-fold to have "high" SYNTAX score. Patients with a TIMI score > 4 have a five-fold to have "high" SYNTAX score. A CHA_2DS_2-vasc score > 2 in a patient with NSTEMI is an independent predictor of "high" SYNTAX score. A GRACE score > 121 in a patient with NSTEMI is an independent predictor of "high" SYNTAX score.
Conclusions: Along with correlating with the SYNTAX score-measured amount of coronary disease, GRACE, TIMI, and CHA2DS2-VASc scores can also foretell a more complex case of coronary artery disease (defined as a SYNTAX score of 22 or higher).

Keywords: GRACE Score, TIMI Score, CHA_2DS_2-VASC score, coronary artery disease, non ST-elevation myocardial infarction

Introduction
In patients with coronary artery disease (CAD), two risk scores—TIMI and GRACE—have demonstrated predictive utility. Now the CHA2DS2-VASc score can be used to predict adverse outcomes in patients with non-valvular atrial fibrillation and other cardiovascular disorders by gauging their risk of thromboembolic events. This score is based on the following factors: Criteria include being female, having hypertension (HTN), type 2 diabetes, vascular illness, and being 65-74 years old. Further consideration is given to a patient's history of stroke or TBI **[1].**
Given the complexity of CAD, it is hard to disentangle the clinical risk. It is possible to alter the therapeutic decision, intervention timing, and intensity by estimating the probable severity of CAD prior to coronary angiography [2]. The relationship between coronary anatomy and prognostic clinical risk scores has been investigated in a small number of studies, with conflicting findings [3].
Predicting the complexity of CAD in patients with non-ST-elevation myocardial infarction (NSTEMI) has so far been the subject of few trials that have integrated GRACE and TIMI scores [4].
The researchers in this study set out to do two things: first, see how well GRACE, TIMI, and CHA2DS2-VASc scores predicted angiographic data in patients hospitalized with NSTEMI;

and second, see how a population of Egyptians' clinical risk scores related to the SYNTAX score-a measure of the extent and severity of coronary artery disease-correlated with these scores.

Patients and Methods

This observational, cross-sectional study was carried out on 146 patients with a diagnosis of NSTEMI admitted to Wadi El Neel hospital between March 2022 and August 2022 with a diagnosis of NSTEMI will be included in the study. An Informed written consent was obtained from the patients. The study was done after approval from the Ethics Committee of the Faculty of Medicine, Benha University and Wadi El Neel Hospital (approval code:).

Inclusion criteria participated in the study if they were hospitalized with a diagnosis of NSTEMI and were scheduled to undergo coronary angiography. Participants could be of either sex and of varying ages. The absence of persistent ST-segment elevation in cases of acute chest pain is known as NSTEMI. Temporary changes in electrocardiogram (ECG) findings can include an elevated ST-segment, a depressed ST-segment, an inverted T-wave, flat or pseudo-normalized T-waves, or the ECG could show no changes at all. Traditional troponin levels should be positive and dynamically rise or fall.

Exclusion criteria individuals who were found to have a history of severe allergies or anaphylaxis, those who have unstable angina, those who have undergone previous surgical or percutaneous revascularization, those who refuse to provide written informed verbal consent prior to enrollment, and those who experience chest pain with a non-ischemic cause (such as takotsubo syndrome or myocarditis) after coronary angiography and magnetic resonance imaging.

All patients were subjected to full history taken including [Personal history: (age and sex, analysis of the complaint), past history and drug history including (past history of HTN, diabetes, angina pectoris, medications used, smoking and exercise habits)] and biochemical tests including (lipid profile, haemoglobin A1c, CBC, coagulation profile, kidney function tests and cardiac markers).

Electrocardiography and Echocardiography: Standard 12-lead surface ECG was requested for all patients to exclude any evidence of presence of STEMI. Transthoracic echocardiography was requested to evaluate the cardiac state and exclude mechanical complications.

Confirming the diagnosis of NSTEMI: The absence of persistent ST-segment elevation in cases of acute chest pain was deemed as a NSTEMI. Temporary changes in the ECG can include an elevated ST-segment, a depressed ST-segment, an inverted T-wave, flat or pseudo-normalized T-waves, or the ECG could show no changes at all. Traditional troponin levels should be positive and dynamically rise or fall.

Calculation of clinical risk scores

We excluded patients with a history of coronary revascularization (CABG or PCI) from this study to better understand the motivations behind the development of GRACE and the SYNTAX scores for patients with native CAD, as well as the relationships between these scores and the complexity of native vascular disease. Scores for GRACE, TIMI, and CHA2DS2-VASc were calculated upon hospital admission.

To calculate the GRACE score, the following vital signs were recorded at admission: age, heart rate, blood pressure, initial serum creatinine (Cr), Killip classification, cardiac arrest at presentation, initial cardiac enzyme positive, and ST-segment deviation. Individual TIMI scores were based on seven criteria: People who are 65 years old or older and who have the following conditions: CAD risk factors, coronary stenosis (a narrowing of the coronary arteries) greater than 50%, aspirin use within the past week, severe angina (two occurrences in a 24-hour period), and a positive cardiac marker.

When calculating the CHA2DS2-VASc score, however, the following criteria were taken into account: Factors to consider include: female gender, age 65-74, history of vascular disease, type 2 diabetes, heart failure, hypertension, being 75 years old or older (doubled), and having a stroke or TIA in the past (doubled).

Invasive coronary angiography: Angiographic apparatuses (GE 2100 and Philips Cardio Vascular-Allura Centron) were used to conduct selective coronary angiography by radial or femoral approaches according to the Judkins method. The right coronary artery (RCA) was photographed twice, while the left anterior descending coronary artery (LAD) was photographed four times each subject. This computer-aided design (CAD) complexity study employed the Syntax score, and the spiral angiography was recorded in accordance with the Digital Imaging and Communications in Medicine (DICOM) standard. While the Syntax score's original intent was to assist in the evaluation of CABG and PCI operation risks, it is currently used as a stand-alone measure of disease complexity. When deciding if percutaneous coronary intervention (PCI) is technically feasible, factors such the degree of vascular stenosis, the classification of the lesion, its location and impact on blood flow, and the diameter and calcification of the arteries are taken into account. Cholangitis, occlusions, bifurcation, trifurcation lesions, calcification, tortuosity, thrombus, and structural features are all considered in the Syntax score. We get the overall Syntax score by scoring each coronary lesion that causes luminal stenosis of 50% or more in arteries that are 1.5 mm or larger in diameter. By utilizing the online calculator available at http://www.syntaxscore.com, we were able to determine the Syntax score, which is indeed associated with cardiovascular outcomes.

Two seasoned invasive cardiologists reviewed all coronary angiograms visually while maintaining complete anonymity from other clinical data. The cardiologists independently determined each patient's SYNTAX score, and the analysis utilized the average of their scores.

Sample Size

A sample size of at least 146 cases achieved a power of 80% to detect a Pearson r of at least 0.23 using a two-sided hypothesis test with a significance level of 0.05.

Statistical analysis

Data was imported into a personal computer, coded, tabulated, and revised using SPSS 25: Statistical Package for the Social Sciences. Depending on the type of data obtained, the proper presentation and analysis of data was done for each parameter. Parametric numerical data is

typically represented by the median and interquartile range (IQR), whereas non-parametric numerical data is typically expressed by the mean, standard deviation (±SD), and range. Statistical distribution of non-numerical variables. Analyzing content: To find out if there was a significant difference, the Student T Test was used to compare the two groups' means. Rank correlation, the statistical dependency between the rankings of two variables, can be studied using Pearson's method in correlation analysis as a nonparametric approach. As a notation for the correlation coefficient, "Rho" describes the degree and direction of the relationship between two variables. A Rho value of 0-0.19 indicates a weak relationship. The relationship is modest if Rho is between 0.22 and 0.39. Rho reaches a modest correlation of 0.40-0.59. Rho values between 0.60,000 and 0.79 show a statistically significant correlation. Rho = 0.8-1 indicates a very significant connection. An indication of the level of significance is the p-value. A p-value is deemed less significant (NS) if it exceeds 0.05, and significant (S) if it is less than 0.05. Holds great significance (HS) when the p-value is less than 0.01. To begin, we used univariate linear regression analysis to find the independent variables that significantly correlated with complex CAD, also known as a "high" SYNTAX score. Step two involved putting these independent variables into a multivariate linear regression model. This study used receiver operating characteristic (ROC) analysis and area under the curve (AUC) computation to find the best GRACE, TIMI, and CHA2DS2-VASc score threshold for identifying a "high" SYNTAX score. In every significance test, only two-tailed designs were used. We considered a p-value below 0.05 to be statistically significant.

Results

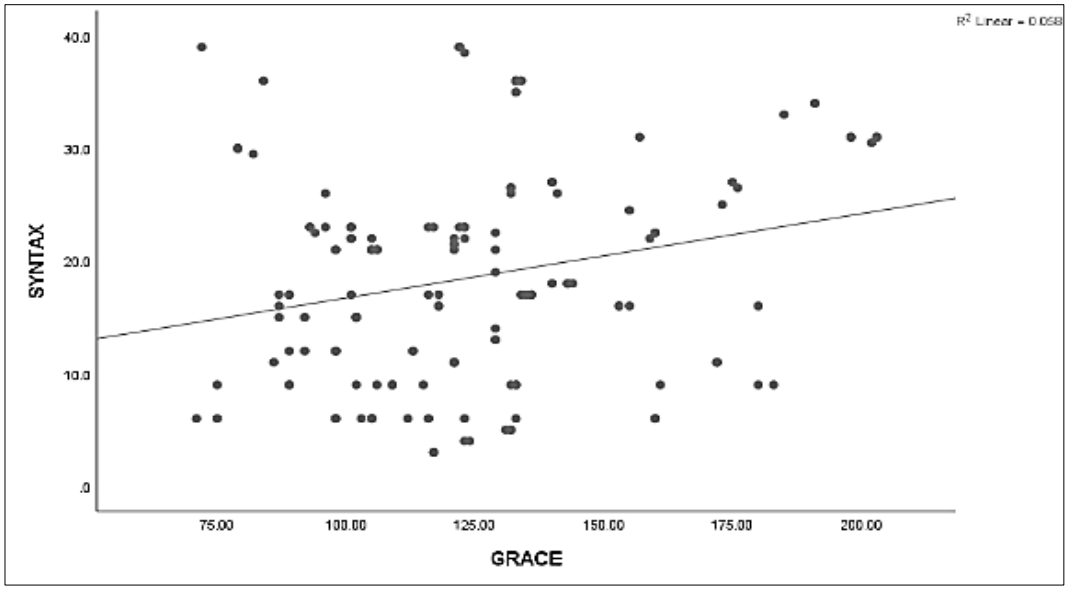
Table 1 shows the medical history, prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate and blood pressure, LDL-cholesterol, Coronary involvement after evaluation by coronary angiography and classification of SYNTAX score for the study sample. Classification of SYNTAX score of the study sample into 3 tertiles: low (SYNTAX score = 0 - 16), intermediate (SYNTAX score = 16 - 22) and high (SYNTAX score > 22). The high tertile represents 33.6% while the low and intermediate tertiles represent 66.4%.

Table 1: Medical history, prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate and blood pressure, LDL-cholesterol, coronary involvement after evaluation by coronary angiography and classification of SYNTAX score for the study sample

				N=146
Medical history	Age			58.25±10.4
	Sex		Male	114
			Female	32
	HTN			109
	DM			74
	Smoking			92
Admission heart rate				89.75±11.89
Admission blood pressure				143.01±16.04
LDL-cholesterol				131.16±31.87
GRACE score				123.99±30.2
TIMI score				3.48±1.06
CHA_2DS_2-Vasc score				2.08±1.33
SYNTAX score				18.51±9.42
Coronary involvement	LM vessel		12	8.2%
	Number of vessels	0	8	5.5%
		1	26	17.8%
		2	57	39.0%
		3	50	34.2%
		4	5	3.4%
Classification of SYNTAX score	SYNTAX score	Low	57	39.0%
		Intermediate	40	27.4%
		High	49	33.6%
	SYNTAX score	Low and Intermediate	97	66.4%
		High	49	33.6%

Data are presented as mean±SD or frequency (%). HTN:hypertension, DM:diabetes mellitus. LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main

Figure 1 indicates that SYNTAX score is significantly connected with prognostic scores (GRACE, TIMI, and CHA2DS2-vasc scores), although only TIMI and CHA2DS2-vasc scores are significantly correlated with increases in the number of coronary arteries involved.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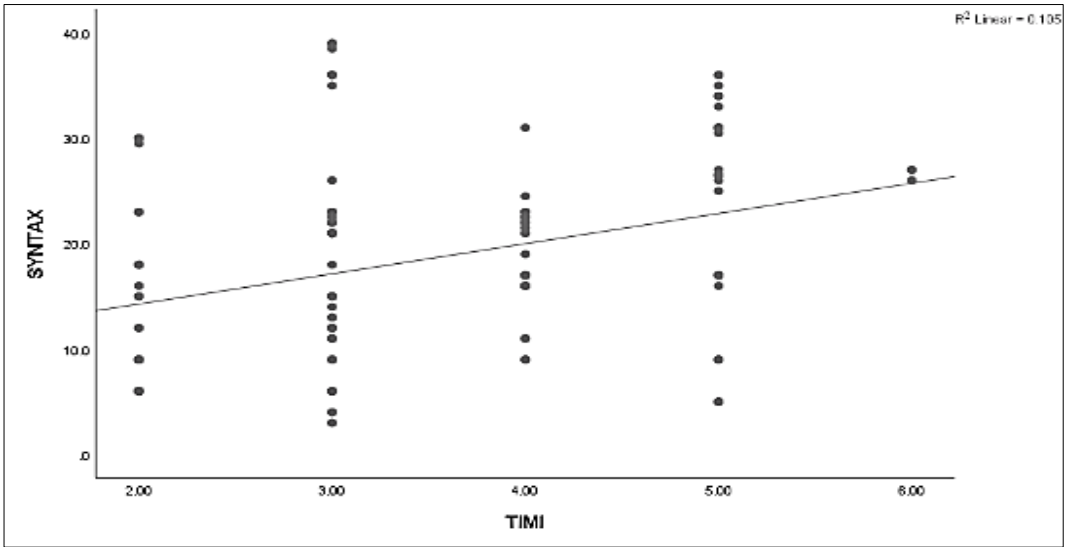
SYNTAX
40.0
30.0
20.0
10.0
.0
75.00
100.00
125.00
150.00
175.00
200.00
GRACE

A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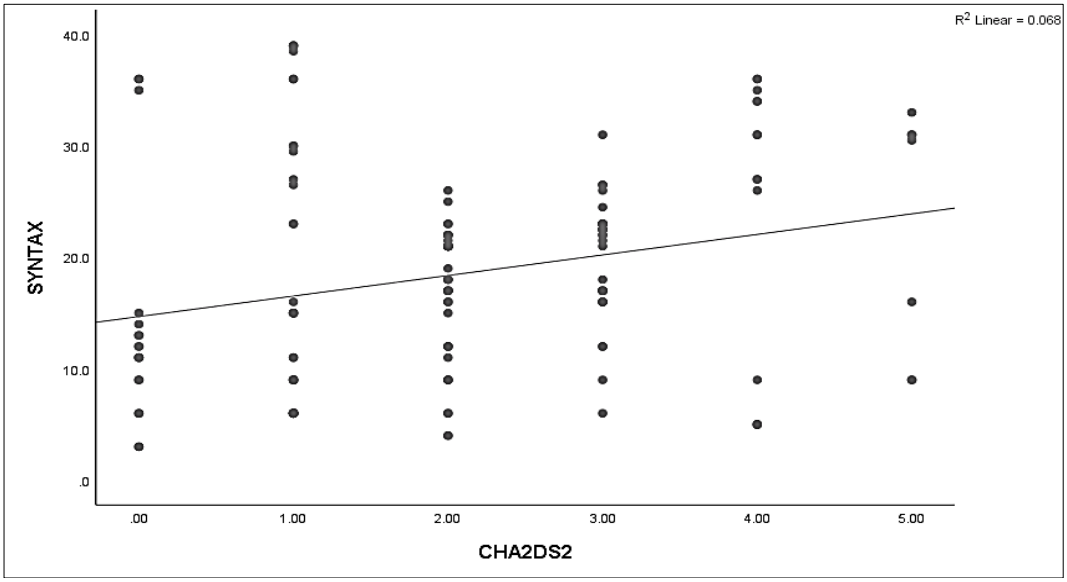
4.00
5.00
6.00
TIMI

B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SYNTAX
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30.0
20.0
10.0
.0
.00
1.00
2.00
3.00
4.00
5.00
CHA2DS2

C

Fig 1: (A): Correlation between GRACE with SYNTAX score and number of involved coronary vessels, (B): Correlation between TIMI with SYNTAX score and number of involved coronary vessels, (C): Correlation between CHA_2DS_2-vasc scores with SYNTAX score and number of involved coronary vessels

Table 2 Demonstrated that the level of LDL-cholesterol and SYNTAX score are significantly correlated with the involvement of LM coronary vessel. The admission heart rate, admission blood pressure, TIMI score, CHA_2DS_2-vasc score are significantly correlated with male sex of the study sample.

Table 2: Correlation between Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate, admission blood pressure and LDL-cholesterol with involvement of left main coronary vessel and with sex of the study sample

	LM vessel		t test		Male	Female	t test	
	No	Yes	t	p value			t	p value
Admission heart rate	89.8±12.17	89.17±8.47	0.18	0.861	90.85±12.05	85.81±10.56	2.14	0.034*
Admission blood pressure	143.6±15.92	136.42±16.59	1.49	0.137	141.52±16.58	148.34±12.75	-2.15	0.033*
LDL-cholesterol	129.65±32.35	148.08±19.89	-2.89	0.010	131.4±33.9	130.31±23.69	0.21	0.836
GRACE score	124.37±30.76	119.75±23.66	0.51	0.613	122.04±31.19	130.97±25.58	-1.48	0.140
TIMI score	3.48±1.1	3.5±0.52	-0.13	0.901	3.37±0.98	3.88±1.26	-2.10	0.042*
CHA_2DS_2-vasc score	2.12±1.35	1.58±1	1.34	0.182	1.78±1.28	3.13±0.91	-6.71	<0.001*
SYNTAX score	17.7±9.11	27.58±8.32	-3.62	<0.001	18.2±9.77	19.61±8.11	-0.75	0.457

Data are presented as mean±SD or frequency (%).HTN:hypertension, DM:diabetes mellitus. LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main * significant as P-value ≤ 0.05.

Table 3 Demonstrated that TIMI score and CHA_2DS_2-vasc score are significantly correlated with the presence of diabetes mellitus (DM) in the study sample. CHA_2DS_2-vasc score and admission blood pressure are significantly correlated with the presence of HTN in the study sample.

Table 3: Correlation between Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate, admission blood pressure and LDL-cholesterol with presence of DM and with presence of HTN in the study sample

	No DM	DM	t test		No HTN	HTN	t test	
			t	p value			t	p value
Admission heart rate	88.21±11.98	91.24±11.69	-1.55	0.124	89.11±8.43	89.96±12.89	-0.46	0.646
Admission blood pressure	143.94±16.37	142.11±15.76	0.69	0.491	134.7±17.19	145.83±14.66	-3.82	<0.001
LDL-Cholesterol	135.22±29.96	127.22±33.36	1.52	0.130	136.57±31.26	129.33±32.01	1.20	0.234
GRACE score	124.38±30.66	123.62±29.95	0.15	0.881	120.78±25.03	125.08±31.79	-0.75	0.456
TIMI score	3.04±1	3.91±0.95	-5.35	<0.001	3.24±0.8	3.56±1.13	-1.86	0.066
CHA_2DS_2-vasc score	1.38±1.25	2.76±1.02	-7.33	<0.001	0.89±1.07	2.48±1.16	-7.32	<0.001
SYNTAX score	18.01±10.77	18.99±7.94	-0.62	0.534	18.77±10.31	18.42±9.15	0.19	0.847

Data are presented as mean ±SD or frequency (%). HTN:hypertension, DM:diabetes mellitus. LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main* significant as P-value ≤ 0.05.

Table 4 Demonstrated that prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), admission heart rate and admission blood pressure are significantly correlated with the presence of smoking in the study sample.

Table 4: Correlation between Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate, admission blood pressure and LDL-cholesterol with presence of smoking in the study sample

	No Smoking	Smoking	t test	
			t	p value
Admission heart rate	87.22±10.57	91.23±12.42	-1.98	0.049
Admission blood pressure	146.5±10.72	140.97±18.2	2.31	0.022
LDL-Cholesterol	121.3±27.78	136.96±32.83	-2.94	0.004
GRACE score	132.07±26.92	119.25±31.14	2.52	0.013
TIMI score	3.83±1.13	3.27±0.97	3.17	0.002
CHA_2DS_2-vasc score	2.69±1.27	1.72±1.23	4.52	<0.001
SYNTAX score	18.38±9.01	18.59±9.7	-0.13	0.898

Data are presented as mean±SD or frequency (%).HTN:hypertension, LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE:Global Registry of Acute Coronary Events, LM: left main * significant as P-value ≤ 0.05.

Table 5 Demonstrated the following: GRACE score is significantly correlated with other scores (TIMI, CHA_2DS_2-vasc and SYNTAX scores), age and admission heart rate. TIMI score is significantly correlated with other scores (CHA_2DS_2-vasc and SYNTAX scores), age, admission heart rate and number of involved coronary vessels. CHA_2DS_2-vasc score is significantly correlated with SYNTAX scores and number of involved coronary vessels. SYNTAX score is significantly correlated with age and number of involved coronary vessels. Age is significantly correlated with admission blood pressure and LDL-cholesterol.

Table 5: Correlation between Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, age, admission heart rate, admission blood pressure and LDL-cholesterol and number of involved coronary vessels

		TIMI score	CHA_2DS_2-vasc score	SYNTAX score	Age	Admission heart rate	Admission blood pressure	LDL-Cholestrol	Number of vessels
GRACE score	Rho	0.638	0.393	0.218	0.561	0.018	-0.291	0.081	-0.098
	p value	<0.001	<0.001*	0.008*	<0.001*	0.826	<0.001	0.331	0.238
TIMI score	Rho		0.675	0.336	0.574	0.104	-0.064	-0.010	0.186
	p value		<0.001*	<0.001*	<0.001*	0.210	0.444	0.904	0.024*
CHA_2DS_2-vasc score	Rho			0.293	0.654	0.102	0.133	-0.047	0.176
	p value			<0.001*	<0.001*	0.219	0.109	0.572	0.034*
SYNTAX score	Rho				0.342	0.093	0.146	0.25	0.614
	p value				<0.001*	0.262	0.079	0.002*	<0.001*
Age	Rho					-0.138	0.213	0.187	0.057
	p value					0.096	0.010*	0.024*	0.497
Admission heart rate	Rho						0.145	0.089	0.106
	p value						0.081	0.284	0.204
Admission rate	Rho							0.126	0.099
	p value							0.131	0.235
LDL-cholesterol	Rho								0.069
	p value								0.405

Data are presented as mean±SD or frequency (%).HTN:hypertension, LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main * significant as P-value ≤ 0.05.

Table 6 Demonstrated that Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores) and LDL-cholesterol are significantly correlated with high SYNTAX score.

Table 6: Correlation between Prognostic scores (GRACE, TIMI and CHA_2DS_2-vasc scores), SYNTAX score, admission heart rate, admission blood pressure and LDL-cholesterol with high SYNTAX score

	SYNTAX score Low and Intermediate	SYNTAX score High	t test	
			t	p value
Admission heart rate	89.08±11.5	91.06±12.66	-0.95	0.344
Admission blood pressure	142.02±14.96	144.98±17.97	-1.05	0.294
LDL-Cholesterol	124.86±29.54	143.65±32.93	-3.49	0.001*
GRACE score	118.13±24.37	135.59±36.88	-3.00	0.004*
TIMI score	3.25±0.94	3.94±1.16	-3.61	0.001*
CHA_2DS_2-vasc score	1.82±1.2	2.57±1.44	-3.12	0.003*
SYNTAX score	13.16±5.73	29.09±5.53	-16.05	<0.001*

Data are presented as mean ±SD or frequency (%).HTN:hypertension, LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main * significant as P-value ≤ 0.05.

Figure 2 Demonstrated that a cutoff values of the following prognostic scores are predictive of the presence of “high” SYNTAX score. The cutoff values are as follows: GRACE score with a cutoff value > 121 is predictive of a “high” SYNTAX score (AUC=0.646; 95% confidence interval [CI] 0.563 to 0.724; P = 0.005; sensitivity=71.43%; specificity=62.89%; +PV=49.3% and -PV=81.3%). TIMI score with a cutoff value > 4 is predictive of a “high” SYNTAX score (AUC=0.666; 95% confidence interval [CI] 0.583 to 0.742; *P*<0.001; sensitivity=40.82%; specificity=88.66%; +PV=64.5% and -PV=74.8%). CHA_2DS_2-vasc score with a cutoff value > 2 is predictive of a “high” SYNTAX score (AUC=0.651; 95% confidence interval [CI] 0.568 to 0.728; P = 0.003; sensitivity=59.18%; specificity=75.26%; +PV=54.7% and -PV=78.5%).

Table 7 demonstrates that patients with a CHA2DS2-vasc score greater than 2 are four times more likely to have a "high" SYNTAX score. Patients who have a GRACE score greater than 121 are four times more likely to have a "high" SYNTAX score. Patients who have a TIMI score greater than 4 are five times more likely to have a "high" SYNTAX score. A "high" SYNTAX score is independently predicted by a CHA2DS2-vasc score > 2 in a patient with NSTEMI. In a patient with NSTEMI, a GRACE score exceeding 121 is an independent predictor of a "high" SYNTAX score.

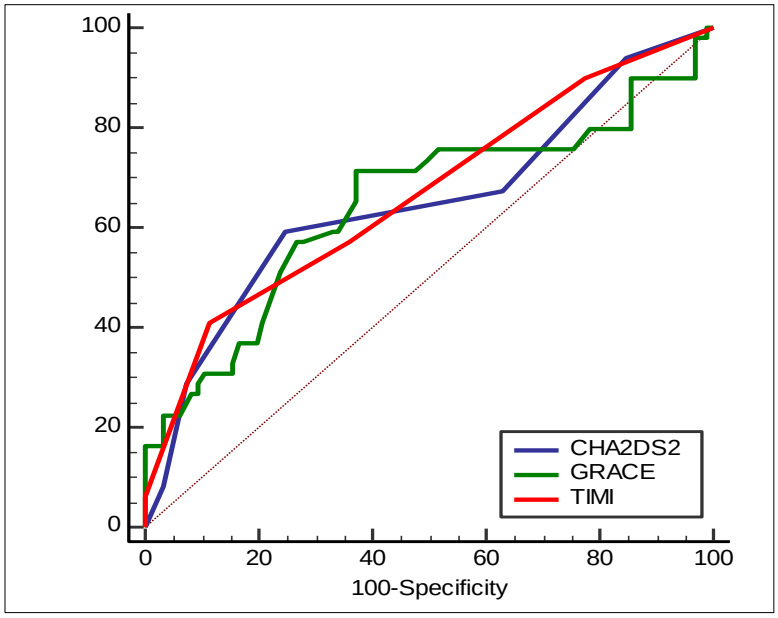

Fig 2: ROC curves of CHA_2DS_2-vasc, GRACE and TIMI scores to detect "high" SYNTAX score

Table 7: Regression analysis between Prognostic scores (GRACE, TIMI and CHA2DS2-vasc scores) and "high" SYNTAX score

		SYNTAX score		Chi square test		Univariate	Multivariate	
		Low and Intermediate (N %)	High (N %)	X2	p value	OR (95% CI)	OR (95% CI)	p value
CHA_2DS_2-vasc score	>2	73 (78.5%)	20 (21.5%)	X2 =16.7	**<0.001***	4.41 (2.12 - 9.18)	2.51 (1.02 - 6.15)	0.045
	<=2	24 45.3%	29 (54.7%)					
GRACE score	>121	61 (81.3%)	14 (18.7%)	X2 =15.35	**<0.001***	4.24 (2.01 - 8.92)	2.47 (1.02 - 5.95)	**0.044***
	<=121	36 (50.7%)	35 (49.3%)					
TIMI score	>4	86 (74.8%)	29 (25.2%)	X2 =16.91	**<0.001***	5.39 (2.31 - 12.58)	1.74 (0.57 - 5.34)	0.333
	<=4	11 (35.5%)	20 (64.5%)					

Data are presented as mean±SD or frequency (%). HTN:hypertension, DM:diabetes mellitus. LDL: Low-density lipoprotein, TIMI: Thrombolysis in myocardial infarction, GRACE: Global Registry of Acute Coronary Events, LM: left main* significant as P-value ≤ 0.05.

Discussion

The SYNTAX score for individuals with CAD can be used to predict the success rate of PCI or CABG surgery. The score provides a numerical representation of the lesion's characteristics, such as its complexity, shape, and position within the coronary artery system [5]. The coronary morphology and features are included in both the GRACE and TIMI scores, which are determined by adding together the independent factors. Previous research has shown that it is useful for predicting complications after ACS [6].

When looking at patients with NSTEMI, we found the following correlations: GRACE score and SS (r=0.218, p = 0.008), TIMI score and SS (r=0.336, $p<0.001$), and CHA2DS2-vasc score and SS (r=0.293, $p<0.001$). Statistical analysis revealed that both scores were favorable. Compared to GRACE and CHA2DS2-vasc, the results showed a greater correlation between SS and the TIMI score.

Additionally, in patients who did not undergo ST-elevation myocardial infarction (NSTEMI), a high coronary anatomical complexity was associated with higher GRACE scores, TIMI scores, and CHA2DS2-vasc scores (t= -3.12, p = 0.003), all of which were statistically significant (t= -3.00, p = 0.004).

Finally, individuals who experienced non-ST-elevation myocardial infarction (NSTEMI) exhibited a higher degree of coronary morphological complexity when their TIMI score (>4), GRACE score (>121), and CHA2DS2-vasc score (>2) were all elevated.

Finally, the likelihood of coronary anatomical complexity being higher was four times higher in non-ST-elevation myocardial infarction (NSTEMI) patients whose GRACE scores were greater than 121, five times higher in patients whose TIMI scores were greater than 4, and four times higher in patients whose CHA2DS2-vasc scores were greater than 2.

Fifthly, although TIMI score was not determined to be an independent predictor of higher coronary anatomical complexity, a GRACE score greater than 121 and a CHA2DS2-vasc score greater than 2 were both independent predictors of higher coronary anatomical complexity in NSTEMI patients.

The GRACE score is a useful tool for ACS patients in predicting the occurrence of serious adverse cardiac events [7], Clinical practice often makes use of it. The GRACE risk score takes a number of ECG, lab, and clinical factors into account. Clinicians have started using scoring systems like SS, which predict prognosis, prevalence, and complexity of CAD, to help with risk stratification in lieu of angiographic findings, since these parameters do not include them [8].

A study done by Barbosa CE, *et al.* [9] explored the correlation between the NSTE-ACS risk scores and the GRACE, TIMI, and Gensini tools. An advantageous and statistically significant correlation was found between the GRACE risk score and the Gensini score. However, they

also found that GRACE risk score could not predict obstructive CAD with this level of significance. Also, Cakar *et al.* [10] Compared to the Gensini score, the GRACE score significantly enhanced the capacity to assess the severity and extent of coronary artery stenosis (r=0.189, p=0.03).

The researchers also provided additional evidence that GRACE is discriminatoryly significant for left main disease (AUC 0.65; 95% CI 54-76, p=0.012) and multi-vessel disease (AUC 0.72; 95% CI 64-80, p=0.001).

We were unable to find any research that directly compared the GRACE and TIMI scores for predicting the SYNTAX score for CAD complexity in patients with NSTEMI [11].

Bekler *et al.* [12] explored the correlation between the SYNTAX score for coronary artery disease complexity, TIMI and GRACE scores, and individuals with acute myocardial infarction (ACS), including ST-elevation and non-ST-elevation myocardial infarction. Results suggested that GRACE and SYNTAX had a positive relationship, in contrast to TIMI and SYNTAX. They continued by saying that age, heart rate, and systolic blood pressure are better indicators of CAD severity and extent than the TIMI score. Research revealed by Acet *et al.* [6] is positively correlated with SS (r=0.24, p<0.001) when the TIMI Risk Index is high.

Consistent with these findings, we observed that NSTEMI patients with higher GRACE, TIMI, and CHA2DS2-vasc scores exhibited a high degree of coronary complexity when analyzed using SS. A stronger correlation between the TIMI score and SS was observed when compared to the GRACE and CHA2DS2-vasc scores.

Surprisingly, we found that, in comparison with study done by Rania Hammami *et al.* [3], the degree of coronary anatomical complexity and obstructive CAD could both be predicted by the clinical risk score. This could be because of the unique traits of CAD in Egypt's population as well as the ethnic diversity within it.

In addition, our most recent study showed that the CHA2DS2-vasc score of non-ST-elevation myocardial infarction (NSTEMI) patients was linked to a higher degree of coronary anatomical complexity, as assessed by an SS>22 (t= -3.12, p = 0.003), a higher number of involved coronary vessels (r=0.176, p = 0.034), and several metabolic risk factors which include hypertension and diabetes. An estimated fourfold greater chance of having more complex coronary architecture was associated with a CHA2DS2-vasc score of >2, with a 95% confidence interval of 2.12 to 9.18 and a p-value of less than 0.001.

This was consistent with the study done by Alparslan Kurtul and Sadik Kadri Acikgoz [13] identified a correlation between a higher CHA2DS2-vasc score and acute coronary syndrome (ACS) patients with a stroke severity (SS) score of 23 or higher. The researchers showed that a high SS was significantly predicted by a CHA2DS2-vasc score of 4 or above (odds ratio [OR] 3.048, 95% confidence interval 1.658 to 5.617, p<0.001).

Imran Ali *et al.* [14] The relation between the GRACE and TIMI scores of STEMI patients and the probability of developing severe CAD during primary percutaneous coronary intervention (PCI) was critically evaluated. The GRACE score did correlate with SS more strongly than the TIMI score, but not strongly enough to establish GRACE as a reliable and independent predictor of CAD severity. Our findings indicate that TIMI showed a more robust association with SS compared to GRACE and CHA2DS2-vasc rankings. More complex coronary anatomy was predicted by GRACE and CHA2DS2-vasc scores, but not by TIMI score. Therefore, GRACE score and CHA2DS2-vasc score are superior in predicting when the angiography will be conducted.

As a result of our research, we now know that there is a correlation between clinical risk scores like GRACE (>121), TIMI (>4), and CHA2DS2-vasc (>2), and we have also established cutoffs for these scores that indicate a higher level of CAD complexity. If a patient's prognostic score is below a certain threshold, an invasive strategy may not be necessary; however, if a patient's score indicates severe angiographic disease, a more aggressive approach may be considered.

Clinical practice that employs the clinical risk scores (CHA2DS2-vasc scores, TIMI, and GRACE) could provide insight into the anticipated complexity of CAD prior to coronary angiography, in addition to examining the incidence of in-hospital and 6-month to 3-year mortality in ACS patients. As a result, clinicians may be prompted to either expedite the patient's transfer to a center that can perform PCI or take a more forceful approach to therapy during the clinical evaluation of patients with ACS (particularly NSTEMI) in the ED, as higher GRACE, TIMI, or CHA2DS2-vasc scores may suggest more advanced CAD.

This study has a few caveats: it only included one center, so its results may not apply to all patients who have a non-ST-elevation myocardial infarction (NSTEMI), and the complexity of CAD was estimated using operator visual assessment.

Conclusions

In addition to correlating with the SYNTAX score's assessment of coronary disease extent, GRACE, TIMI, and CHA2DS2-VASc scores can also predict a higher level of CAD complexity, which is defined as a SYNTAX score of 22 or higher. Interestingly, higher complexity of coronary artery disease (defined as a SYNTAX score of 22 or higher) is independently predicted by GRACE and CHA2DS2-VASc scores.

Therefore, Multi-centere studies are recommended.

References

1. Gu Y, Zhang Y, Yao D, Shen H, Pan X, Gong K. Prognostic value of TIMI risk score combined with systemic immune-inflammation index and lipoprotein (a) in patients with ST-segment elevation myocardial infarction after percutaneous coronary intervention. International Journal of Cardiology Heart and Vasculature. 2025;56:10-15.
2. Avci BK, Ikitimur B, Tok OO, Cimci M, Erturk E, Omar TB, *et al.* The role of GRACE score in the prediction of high-risk coronary anatomy in patients with non-ST elevation acute coronary syndrome. Kardiologia Polska. 2015;73:592-597.
3. Hammami R, Jdidi J, Mroua F, Kallel R, Hentati M, Abid L, *et al.* Accuracy of the TIMI and GRACE scores in predicting coronary disease in patients with non-ST-elevation acute coronary syndrome. Revista Portuguesa de Cardiologia (English Edition). 2018;37:41-49.
4. Rahmani R, Majidi B, Ariannejad H, Shafiee A. The value of the GRACE score for predicting the SYNTAX score in patients with unstable angina/non-ST elevation

myocardial infarction. Cardiovascular Revascularization Medicine. 2020;21:514-517.
5. Wykrzykowska JJ, Garg S, Girasis C, De Vries T, Morel MA, Van Es GA, *et al.* Value of the SYNTAX score for risk assessment in the all-comers population of the randomized multicenter LEADERS (Limus Eluted from A Durable versus Erodable Stent coating) trial. Journal of the American College of Cardiology. 2010;56:272-277.
6. Acet H, Ertaş F, Akıl MA, Özyurtlu F, Polat N, Bilik MZ, *et al.* Relationship between hematologic indices and global registry of acute coronary events risk score in patients with ST-segment elevation myocardial infarction. Clinical and Applied Thrombosis/Hemostasis. 2016;22:60-68.
7. Tang EW, Wong CK, Herbison P. Global Registry of Acute Coronary Events (GRACE) hospital discharge risk score accurately predicts long-term mortality post acute coronary syndrome. American Heart Journal. 2007;153:29-35.
8. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins KD, *et al.* The SYNTAX score: an angiographic tool grading the complexity of coronary artery disease. EuroIntervention. 2005;1:219-227.
9. Barbosa CE, Viana M, Brito M, Sabino M, Garcia G, Maraux M, *et al.* Accuracy of the GRACE and TIMI scores in predicting the angiographic severity of acute coronary syndrome. Arquivos Brasileiros de Cardiologia. 2012;99:18-24.
10. Cakar MA, Sahinkus S, Aydin E, Vatan MB, Keser N, Akdemir R, *et al.* Relation between the GRACE score and severity of atherosclerosis in acute coronary syndrome. Journal of Cardiology. 2014;63:24-28.
11. Rahmani R, Majidi B, Ariannejad H, Shafiee A. The value of the GRACE score for predicting the SYNTAX score in patients with unstable angina/non-ST elevation myocardial infarction. Cardiovascular Revascularization Medicine. 2020;21:514-517.
12. Bekler A, Erbağ G, Şen H, Turgut M, Özkan A, Yener AÜ, *et al.* The relationship between the GRACE risk score and the severity of coronary artery disease in patients with non-ST elevated acute coronary syndrome. Abant Medical Journal. 2015;4:216-221.
13. Kurtul A, Acikgoz SK. Validation of the CHA2DS2-VASc score in predicting coronary atherosclerotic burden and in-hospital mortality in patients with acute coronary syndrome. American Journal of Cardiology. 2017;120:8-14.
14. Ali I, Shabbir M, Shehram M, Khan AN, Uz Zaman Q, Khan IA. Prediction of coronary artery disease extent and severity on the basis of GRACE and TIMI scores in patients presented with ST elevation myocardial infarction undergoing primary percutaneous coronary intervention. Pakistan Armed Forces Medical Journal. 2019:40-46.

CABG	Coronary artery bypass graft surgery
CAD	Coronary artery disease
CHF	Congestive heart failure
Cr	Creatinine
DICOM	Digital Imaging and Communications in Medicine
DM	Diabetes mellitus
ECG	Electrocardiogram
GRACE	Global Registry of Acute Coronary Events
HR	Heart rate
HTN	Hypertension
LAD	Left anterior descending coronary artery
LCx	Left circumflex coronary artery
LDL	Low-density lipoprotein
LM	left main
NSTEMI	Non-ST-elevation myocardial infarction
PCI	Percutaneous coronary intervention
PCI	Percutaneous coronary intervention
SBP	Systolic blood pressure
TIMI	Thrombolysis in myocardial infarction

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