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The Correlation between Clinical Risk Score (Heart, Grace and TIMI) and Angiographic Coronary Artery Complexity in NSTEMI

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Abstract **Original Research Article**

The GRACE, HEART and TIMI scores have been well validated for assessment of prognosis in non-ST- elevation acute coronary syndrome (NSTE-ACS). However, their value in predicting coronary artery disease (CAD) has been little studied. In this paper, we aimed to assess the relationship between these scores and the extent of coronary disease, by studying 183 cases with NSTEMI, from cardiology department in Mohamed VI university hospital center in Marrakesh. Results showed a positive correlation between the SYNTAX and the HEART and GRACE scores, but the correlation with TIMI reached no statistical significance.

Keywords: Heart, Grace and TIMI, (NSTE-ACS), coronary artery disease (CAD).

INTRODUCTION

The clinical scores Heart, Grace and TIMI constitutes a useful tool for risk stratification in patients with non-ST elevation acute coronary syndrome (Non-ST ACS), while the SYNTAX score determines the complexity of coronary artery disease (CAD). However, the ability of these scores to discriminate the angiographic complexity of CAD has not been clearly established.

OBJECTIVES

This study aims to evaluate the correlation between TIMI, GRACE, and HEART scores and the complexity of coronary artery disease revealed by coronary angiography in patients with Non-ST ACS.

METHODS

Transversal retrospective cohort encompassing 183 patients with diagnosis of Non-ST ACS in the department of cardiology, Mohamed VI university hospital center , Marrakesh, between January 2018 and August 2021. Data was analyzed using Microsoft excel software 2016.

RESULTS

From January 2018 to August 2021, 183 patients admitted with ACS and eligible for inclusion in the study were admitted. Of the 183 patients analyzed, 63.4% were male with a mean age of 58 ± 8 years. The median of GRACE, TIMI, and HEART scores were 134 (96.5- 167.7), 4 (2-5) e 5 (4-6), respectively, whereas the median SYNTAX was 11.

Significant coronary stenosis was not observed in 18.3% of patients, while 39.7% of patients required multiple grafts. All three clinical scores were higher in patients with moderate or high SYNTAX score than in those with low SYNTAX score.

HEART greater than 5 showed 92% sensitivity and 56 % specificity to evaluate high SYNTAX (>32). When greater than 6, it presented 92 % sensitivity, with 56% specificity.

Grace greater than 147 gave 55% sensitivity and 83% specificity for HIGH SYNTAX. Thus, using both scores (GRACE and HEART), a more accurate assessment was possible to predict anatomical complexity.

There was a positive correlation between the SYNTAX and the HEART and GRACE scores, but the correlation with TIMI reached no statistical significance.

Table 1: Characteristics of the Participants at Baseline

	Total
N (%)	183 (100)
Male, n (%)	116 (63.4)
Age, mean ± SD	58 ±8
BMI, mean ± SD	28 (15.3)
Obesity, n (%)	23 (12.5)
Diabetes, n (%)	61 (33.3)
Dyslipidemia, n (%)	69 (48.6)
Hypertension, n (%)	87 (47.5)
Smoking, n (%)	119 (65)
Sedentarism, n (%)	37 (20)
Creatinine	9 (5-14)
Diagnosis, n(%)	
Unstable angina	8 (4.3)
NSTEMI	175 (95.7)

DISCUSSION

The HEART score has been increasingly used in patients with acute chest pain in the emergency room due to its high negative predictive value and ability to reduce unnecessary hospitalizations. However, high values of HEART score are known to predict unfavorable events so that it is worth investigating whether HEART score is associated with anatomical complexity [2].

Some studies have already evaluated the association between TIMI and GRACE scores with the number of affected arteries.

Table 2: Variables present in GRACE, HEART and TIMI score [6]

Variables		GRACE score	HEART score	TIMI score
Age		X	X	X
Gender				
History	Suspicious (physicians' opinion)		X	
	Severe angina (≥2 events in last 24 h)			X
	Use of aspirin last 7 days			X
	Killip class	X		
Physical examination	Heart rate	X		
	Systolic blood pressure	X		
ECG	ST deviation	X	X	X
	Repolarization disorder, LBBB or pacemaker		X	
	Cardiac arrest at admission	X		
Laboratory results	Creatinin level	X		
	Positive cardiac enzyme*	X	X	X
Risk factors	Previous atherosclerotic disease†		X	
	Previous coronary artery disease ≥50%			X
	Current smoking‡		X	X
	Diabetes mellitus		X	X
	Family history of cardiovascular disease		X	X
	Hypercholesterolemia		X	X
	Hypertension		X	X
	Obesity (body mass index >30)		X	

ECG: electrocardiogram, LBBB: left bundle branch block.
* Troponin or creatin kinase–MB.
† Previous atherosclerotic disease was defined as myocardial infarction, coronary arterial bypass grafting, percutaneous coronary intervention, stroke or transient ischemic attack, peripheral artery disease.
‡ Smoking in the HEART –impact trial was defined as smoking currently or stopped <3 months.

Mahmood *et al.*, [1] found that TIMI > 4 or GRACE > 133 are associated with a higher probability of the patient requiring multiple grafts or having significant stenosis in the left main coronary artery ($p < 0.05$). Bakler *et al.*, evaluated the association of clinical score with anatomical complexity using the SYNTAX score. A positive linear association between SYNTAX score and GRACE score was observed, with a ratio coefficient of $r = 0.43$ ($p < 0.01$) and AUC of 0.65 (CI 95% 0.56-0.74; $p < 0.001$). TIMI score was not associated with SYNTAX score ($r = 0.121$, $p = 0.121$), and HEART score was not evaluated. It should be noted that patients with STEMI (46% of the sample) were included, and these patients are not usually evaluated using the GRACE score [3]. Hammami *et al.*, [4] retrospectively evaluated the GRACE and TIMI scores of 238 patients and observed that both scores showed a positive correlation with the SYNTAX score. In 2021, Vianna Cedro *et al.*, [5] used HEART and GRACE on 138 patients and concluded that it offers good accuracy for detecting angiographic complexity.

Sharadindu Shekhar Roy [7] *et al.*, found in their study of 205 patients, a positive correlation of the vessel score and Gensini score with both the GRACE and TIMI risk scores ($p = <0.001$). The GRACE score

(r = 0.55) correlated better than the TIMI score (r = 0.51). The GRACE score presented area under the Receiver Operating Characteristic (ROC) curve (0.943; 95% CI = 0.893–0.993) significantly superior to the area under the ROC curve (0.892; 95% CI = 0.853–0.937) of the TIMI score.

In our study, when the HEART score was greater than 6, the sensitivity was 92%, with a specificity of 56%; and when GRACE greater than 147 the sensitivity is 55% and specificity is 83% for high SYNTAX. Therefore, this study hypothesizes that, in specific scenarios of high clinical risk scores (GRACE> 147 and HEART> 6, the team and the patient can prepare for a surgical approach, due to the higher probability of high SYNTAX, by elevated SYNTAX.

Study Limitations

Though adequate number of study population was used, we believe that it is still limited to generalize the results and it was conducted in a single center.

CONCLUSION

GRACE, TIMI and HEART scores have been previously validated to predict serious untoward events among patients with non-ST elevation acute coronary syndrome (Non-ST ACS). However, the ability of these scores to discriminate the angiographic complexity of coronary artery disease has not been clearly established. The clinical scores presented a positive, although modest, association with the SYNTAX score. The combined use of HEART and GRACE offers good accuracy for detecting angiographic coronary artery complexity.

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