

Value of GRACE score in predicting benefit from invasive strategy in acute coronary syndrome patient

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Abstract

Background: To evaluate in-hospital and six-month death rates among patients hospitalised for acute coronary syndrome, the Global Registry of Acute Coronary Syndrome (GRACE) risk score is employed (ACS). **Methods:** These findings show that the GRACE score is accurate in a contemporary cohort of 200 patients who were diagnosed with an acute coronary syndrome (ACS) and received either invasive or conservative treatment between January and August 2021 at the National Heart Institute or the Coronary Care Unit of the Cardiology Department of Benha University. By analysing the Hosmer–Lemeshow test's calibration and discriminatory power, the GRACE risk score was tested for its relevance in predicting benefit from invasive approach in patients with acute coronary syndromes. More than half of the 200 patients in this research were hospitalised for ST-elevation myocardial infarction (STEMI), whereas less than a third were admitted for non-STEMI myocardial infarction (MI). A total of 120 patients chose an intrusive technique, whereas only 80 chose a medicinal strategy. 33 of the 80 patients in the conservative group (A) had issues in the hospital, whereas 37 of the 120 patients in the invasive group (B) did the same. PATIENT HAS DEVELOPED A HOSPITAL COMPLICATED. For group A, the GRACE risk score had an AUC of 0.76338 (95 percent CI: 0.65518-0.85127) and for group B, it was 0.63986 (95 percent CI: 0.54719-0.72545). This indicates that the GRACE risk score is sufficiently discriminatory. The GRACE score was shown to be valid in predicting the benefit of an invasive method in patients with an acute coronary syndrome, and it was suggested that it be utilised on a regular basis.

Keywords: GRACE risk score, acute coronary syndrome, invasive strategy in ACS.

1. Introduction

Disclosure: The authors state that they have no competing interests.

There was no particular grant provided for this study by any funding body.

In line with the modified Declaration of Helsinki, this research was carried out and authorised by the local ethics committee, National Medical Research Register in compliance with the ethical standards (NMRR-19-3476-51813; IIR).

Please contact the relevant author to get the data that support this research. Due to privacy or ethical concerns, the data cannot be made accessible to the general public.

This is a retrospective research that has been given ethical clearance and written permission to publish the results. This retrospective study does not need informed consent.

The TIMI score, the Global Registry of Acute Coronary Events (GRACE) risk score, and the Platelet glycoprotein IIb/IIIa in Unstable angina: Receptor Suppression Using Integrilin (eptifibatide) Therapy (PURSUIT) score are all risk scores used to predict mortality risk in patients admitted for acute coronary syndrome (ACS).

A worldwide registry of ACS patients from 94 hospitals in 14 countries, the GRACE registry, established two models to assess the probability of in-hospital and 6-month death in all patients with the condition. 1 GRACE

2

After release from the hospital, the GRACE risk score predicts the patient's 6-month mortality. It makes use of an eight-variable prognostic logistic model (Supplementary Material Figure 2) to estimate a patient's risk of mortality during the first six months after discharge from hospital. 3

When transferring the GRACE study's risk score to different populations, we must keep in mind the study's geographical limitations and the unique features of the patients in order to prevent inaccurate risk assessments.4

2. Materials and Methods

Study participants aged 18 and older with an acute coronary syndrome (ACS) hospitalised to a coronary care unit or national heart institute between January and August 2021 got either an invasive or a conservative first therapy plan. Twelve patients, or six percent, of the original 212 participants were eliminated from the study because they lacked the necessary data to calculate the GRACE score. All patients brought to the hospital with chest discomfort suspected of being caused by ACS were included in the research. The symptoms, ECG, and cardiac biomarkers all pointed to ACS as the likely cause. Dual antiplatelet treatment, anticoagulants, statins, ACE inhibitors, angiotensin-receptor blockers, and -blockers were used in all patients, when feasible.

The majority of the data was gathered between January and April 2018 from an internal database, which contained 10 GRACE score characteristics connected to patients, 5 cardiac-related variables, and 3 operation-related variables. Patients' outpatient clinic records were used to gather information on their health outside of the hospital, such as death or issues that occurred later.

A total of eight prognostic variables were used to calculate the GRACE score, including age, history of heart failure, history of acute myocardial infarction (AMI), heart rate and SBP at admission, ST-segment depression, serum creatinine at admission, and elevated myocardial necrosis markers or enzymes (Supplementary Material Figure 1).

3. Statistical Analysis

Universal sampling was used. Data were entered into a Microsoft Excel database and analysed using SPSS

version 22.0. Continuous variables are reported as the mean \pm SD. Univariate analysis of dichotomous variables was performed using the χ^2 or Fisher's exact test. Pearson and Spearman tests were used for correlational analyses of continuous variables.

Receiver operating characteristic (ROC) curve analysis was performed to estimate the discriminant ability of the risk scoring method to predict immediate

postoperative adverse events. The calibration of the risk-scoring method was estimated as the area under the ROC curve (AUC) with 95% CIs. Survival analysis was performed by the Kaplan–Meier method. ROC curve analysis was used to estimate the performance of the risk score in predicting mortality at the 6-month follow-up. P-value of <0.001 was considered statistically significant.

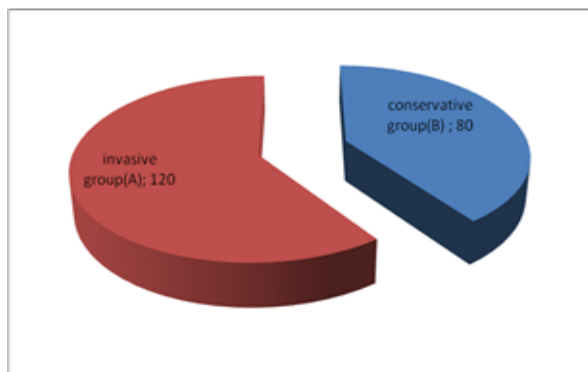


Fig. (1) Study Sub Groups.

Variable	Value
Age	50-59
HR	50-69
SBP	120-139
Creat.	1.2-1.59
CHF	I (no CHF)
Cardiac arrest at admission	<input type="checkbox"/>
ST-segment deviation	<input type="checkbox"/>
Elevated cardiac enzymes/markers	<input type="checkbox"/>
Probability of In-hospital Death	0.4%
Probability of In-hospital Death or MI	4%
Probability of To 6 months Death	1%
Probability of To 6 months Death or MI	10%

Fig. (2) Grace Risk Score Variables

4. Risk Score

The GRACE score was calculated using the online calculator (Version 2.0; <https://www.mdcalc.com/grace-acs-risk-mortality-calculator>), as described previously.^{5,6} The eight variables that constitute the GRACE score are age, history of heart failure, history of acute MI, heart rate and systolic blood pressure (SBP) at admission, ST-segment depression, serum creatinine at admission and elevated myocardial necrosis markers or enzymes.

Data Collection

For this retrospective study, a database was created to collect relevant data, which were then stored in spreadsheets, and in accordance with the Baseline Characteristics

The baseline characteristics of the study population are provided in Supplementary Material Table 1. Of the 80 patients in group A in this study, 60 (75%) were male while of 120 patients of group B 83 (70%) were them. Most patients of both groups had hypertension and nearly half had diabetes with dyslipidaemia.

Of the 80 patients in group A in this study, 64 (80%) were admitted for unstable angina, 10 (13%) were admitted for NON ST-elevation MI (NSTEMI) and 6 (7%) were admitted with ST-elevation MI (STEMI). 6 (7%) patients had a cardiac arrest upon arrival at hospital.

Of the 120 patients in group B in this study, 8 (4%) were admitted for unstable angina, 22 (11%) were admitted for NON ST-elevation MI (NSTEMI) and 90 (75%) were admitted with ST-elevation MI (STEMI). 13 (11%) patients had a cardiac arrest upon arrival at hospital. The frequencies of GRACE risk score variables in our cohort are presented in Supplementary Material Table 2.

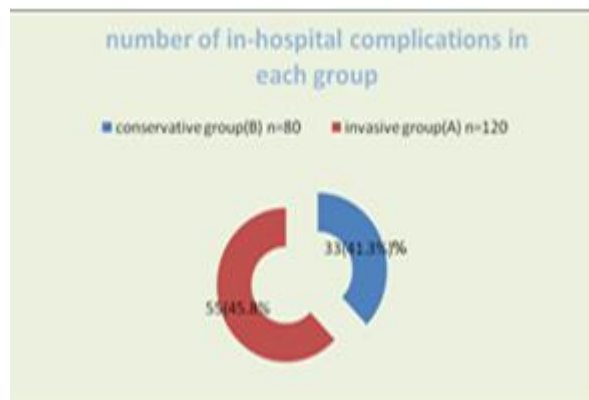
In-hospital complications

In group (A), 33 (41%) patients vs 55 (45%) in group (B) developed in-hospital complications. Figure 1 shows the number of mortalities at the end of the 6-month follow-up period, whereas Figure 2 shows the distribution of mortality at 6 months in each of the low-, intermediate- and high-risk categories. The complication rate increased significantly as the GRACE risk category increased in

absence of invasive tool . these data can be more clear with notice of the OPTIMAL CUTOFF POINT based on ROC curve (FNcost=FPcost) in the conservative group (A)

****Cutoff point was : 100**

Sensitivity: Se= 66.7% (95% CI: 49.6 to 80.2) (Wilson)
Specificity: Sp= 83.0% (95% CI: 69.9 to 91.1) (Wilson)
While in other invasive group(B)



The Optimal Cutoff Point Based On Roc Curve (Fncost=Fpcost)

** Cutoff point was: 130

Sensitivity: Se= 52.7% (95% CI: 39.8 to 65.3) (Wilson)

Specificity: Sp= 76.9% (95% CI: 65.4 to 85.5) (Wilson)

*** from the above mentioned data ...we can conclude that with invasive approach the cut off point of GRACE risk score was significantly higher than that for the conservative approach.

Factors Affecting Prognosis

Univariate and multivariate analyses were conducted to assess the risk associated with the baseline characteristics and to evaluate the predictive accuracy of the composite GRACE risk score (Tables 1 and 2).

Table (1) Univariate Analysis for Association of Risk Factors with Event (in-hospital complications).

Risk Factor	SE	Wald χ^2	p-value	OR [95% CI]
Age >65 years	0.277	22.27	<0.001	3.686 [2.143–6.340]
Sex: male	0.289	0.483	0.487	1.223 [0.694–2.155]
Diabetes	0.272	4.531	0.033	0.561 [0.329–0.955]
Hypertension	0.298	0.657	0.148	0.785 [0.438–1.409]
Dyslipidaemia	0.268	1.702	0.192	0.705 [0.417–1.192]
Smoking	0.269	0.818	0.366	0.784 [0.462–1.329]
Previous history of IHD	0.269	0.137	0.711	1.105 [0.652–1.874]
Family history of IHD	0.380	3.065	0.080	1.943 [0.924–4.089]
Cardiac biomarkers	0.279	5.769	0.016	0.512 [0.296–0.884]
systolic blood pressure	0.537	13.142	<0.001	0.143 [0.050–0.409]
Heart rate	0.252	1.779	0.182	1.400 [0.854–2.295]
ST-segment deviation	0.273	7.376	0.007	0.476 [0.278–0.813]
Serum creatinine level	0.296	8.544	0.003	2.373 [1.329–4.236]
Killip class:				
I		30.342	<0.001	
II	0.391	18.803	<0.001	0.183 [0.085–0.395]
III	0.485	8.358	0.004	0.246 [0.095–0.636]
IV	0.575	0.273	0.601	1.350 [0.438–4.163]

Table (2) Multivariate Logistic Regression Analysis for Predicting the Event (in-hospital complications).

Risk Factor	SE	Wald χ^2	p-value	Adjusted OR
Age >65 years	0.277	26.630	<0.001	9.642
Sex: male	0.289	0.629	0.411	0.679
Diabetes	0.272	1.936	0.160	1.79
Hypertension	0.298	2.377	0.120	0.476
Dyslipidaemia	0.268	5.047	0.025	2.812
Smoking	0.269	1.409	0.235	1.744
Previous history of IHD	0.269	4.858	0.028	3.786

Family history of IHD	0.380	0.722	0.396	0.522
Cardiac biomarkers	0.279	3.316	0.069	3.265
systolic blood pressure	0.537	4.445	0.035	0.337
Heart rate	0.342	1.636	0.201	1.550
ST-segment deviation	0.428	1.491	0.222	1.686
Serum creatinine level	0.529	0.396	0.529	0.717
Killip class:				
I		8.323	0.040	
II	0.749	1.070	0.301	0.461
III	0.856	0.043	0.836	0.837
IV	0.922	1.958	0.162	3.631

Age

The in-hospital complications increased with increasing age, with multivariate analysis revealing a good association between age and death (OR 9.642, 95% CI [4.077–22.803], $p < 0.001$). In this study, we used a cut-off value of 65 years and compared GRACE risk scores between those aged ≥ 65 and < 65 years. The mean GRACE risk score was significantly ($p < 0.001$) higher for patients aged ≥ 65 than < 65 years (116.17 ± 30.16 versus 84.85 ± 34.32 , respectively).

Dyslipidaemia

Dyslipidaemia is strongly associated with cardiovascular in-hospital complications. In the present study, 97 (48%) patients had high cholesterol, and this showed a trend towards statistical significance.

Chronic Kidney Disease

The median serum creatinine level in our study population was 107 mmol/l. Multivariate analysis indicated that patients with chronic kidney disease (CKD) had a poorer prognosis.

Systolic Blood Pressure

The mean SBP in the study population was 122 ± 25 mmHg. There was a significant difference in mean SBP between patients who developed in-hospital complications and who did not. Multivariate analysis revealed that decreasing SBP was associated with in-hospital complications.

Killip Class

A higher Killip class was associated with higher in-hospital complications and worse prognosis. In the present study, Killip class I was statistically significant compared with in-hospital complications, but this was most likely due to most patients (49%) being in Killip class I, which skewed the statistical calculations.

Calibration and Discrimination

Model calibration was excellent for our cohort population, with the validated model showing an adequate capacity for discrimination after calibration (Hosmer–Lemeshow goodness-of-fit test).

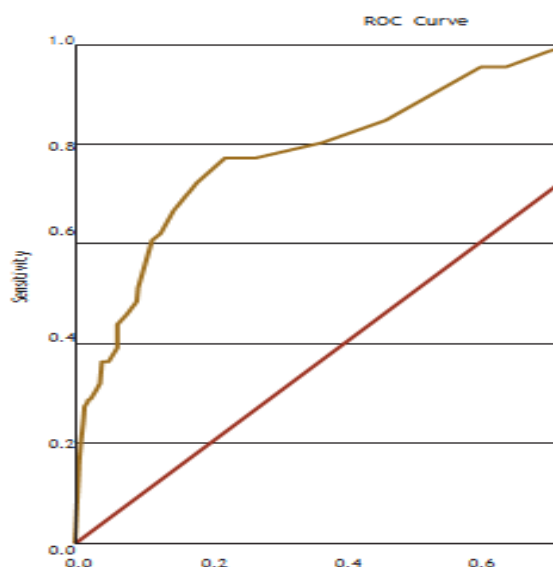


Fig. (3) Receiver Operating Characteristic Curve Analysis of the Capacity of Discrimination of the GRACE Risk Score.

Patients above the age of 65 were shown to be more vulnerable to in-hospital problems in this research. When it comes to clinical trial participation and treatment, elderly people with advanced sclerotic (ACS) are underrepresented and underserved. 11

As a result, we settled on 65 as the study's cutoff age. It was shown that the average GRACE risk score for

patients aged 65 and above was considerably ($p < 0.001$) greater than the average GRACE risk score for patients aged 65 and less.

Lower SBP upon admission was linked to a higher 6-month mortality rate, same as was shown in the GRACE registry (OR of 1.4 for every 10 mmHg drop in SBP).

3 Studies also reveal that individuals with CKD, regardless of whether or not they undergo continuous hemodialysis, have a prognostically greater mortality rate. As a result of their more complicated situations and the dearth of well prepared randomised clinical trials, patients with ACS or CKD have worse long- and short-term outcomes than other patients. 12,13

Patients hospitalised for ACS are at an increased risk of developing dyslipidaemia, which is characterised by abnormally high levels of total cholesterol, LDL cholesterol, triglycerides, and HDL cholesterol.

14 According to current recommendations, people in the extremely high-risk category should aim for an LDL level of 1.4 mmol/l in order to improve their prognosis. 15

We found that LDL levels were a substantial predictor of in-hospital problems, and our analysis was consistent with these results.

There are a number of ways to express this:

In the receiver operating characteristic curve, the area under the receiver operating characteristic curve was 0.831. Ties create diagonal sections.

5. Discussion

Appropriate and optimised therapies in ACS need accurate risk prediction. Clinical studies have shown that the GRACE risk score outperforms other comparable ACS risk models in terms of accuracy and ease of use. [8] GRACE may be used to assess the risk of ACS in both STEMI and non-STEMI situations. The GRACE risk score has also been validated in a number of other demographic samples from across the world.[8]

Clinical practise guidelines advise the use of the GRACE score.

[9, 10] In order to verify that the scoring system provides accurate data and probabilities, it must first be validated within the relevant context. Validation of GRACE risk score in relation to connection between invasive approach and GRACE risk score to evaluate effect on in-hospital complications is the first validation study of the GRACE risk score With an AUC of 0.831 (95 percent CI [0.778–0.884]), the Hosmer–Lemeshow goodness-of-fit test used in this investigation was used to calibrate the GRACE risk score. This implies that the model provides an effective calibration of the chance of death from in-hospital complications after ACS admission in our study sample.

In the current investigation, ACS patients should have a family history of the condition, particularly if they are younger or did not initially have elevated high-sensitivity troponin T concentrations. [16, 17] A significant risk factor is having a first-degree relative with ischemic heart disease. Being related to someone who has heart disease ($p=0.035$) increased the risk of cardiovascular events.

An investigation on the relationship between the GRACE score and the degree of atherosclerosis in acute coronary syndrome was conducted by Cakar M.A et al [22]. A total of 356 individuals with NSTEMI-ACS were admitted to the ER. Specific factors obtained upon entry were used to generate the GRACE score for each patient. The GRACE score was used to classify patients into three groups: low, middle, and high. Within five days of being

admitted, all patients had coronary angiography, whether it was urgent, early, or elective (mean 3 days). The GRACE score was shown to be a robust predictor of CAD severity in the presence of additional risk factors, according to Gensini scoring. Pearson's correlation demonstrated a substantial relationship between the GRACE score and the corresponding angiographic Gensini score (2-tailed).

Preventing the main result was not significantly different from preventing the composite secondary outcomes of mortality, myocardial infarction, or nonrefractory ischemia when early intervention was compared to delayed intervention in high-risk individuals. This is somewhat in line with our research on the benefits of an invasive technique in those with greater GRACE risk.

287 patients with ACS were included in the research by Bekler A. et al. [23] (154 with non-ST elevated ACS (NSTEMI-ACS) and 133 with ST raised myocardial infarction (STEMI)). The GRS and the SS showed a statistically significant association ($r=0.427$, $p=0.001$).

A greater SYNTAX score was reported by Hammami R. et al. (24), who found that patients with a higher GRACE or TIMI score were more likely to be at risk. Furthermore, the GRACE and SYNTAX scores ($r=0.23$, $p=0.001$) and the TIMI and SYNTAX scores ($r=0.2$, $p=0.002$) showed a strong positive connection. Obstructive CAD is rather well predicted by both clinical ratings (area under the GRACE curve [AUC]: AUC 0.599, $p=0.015$; TIMI score AUC 0.639, $p=0.001$), however the severity of the condition is not. A GRACE score of 120 and a TIMI score of 2 were predictive of obstructive CAD with a sensitivity of 57% and 75.7 percent, respectively, and a specificity of 61.8 and 47.9 percent, respectively..

According to our findings,.

Early coronary intervention was linked with improved results only in individuals with a low-intermediate GRACE risk score (155), whereas early invasive technique was associated with the poorest outcome in high-risk patients (155), according to findings from subgroup analysis of TRANSFER-AMI.

When compared to patients with low GRACE risk scores in Chotechuan Y., et al. [25] studies, patients with delayed coronary intervention at institutions with restricted PCI capability had worse clinical outcomes at 30 days and six months. For patients with intermediate-high GRACE risk scores at PCI-capable hospitals, an early coronary intervention following fibrinolytic therapy, particularly on the index admission, may serve as a guidance for the restricted PCI-capable hospital scenario.

An example of this may be seen in Elbarouni et al. [26]. More than a thousand Canadians with ACS participated in the study; the GRACE risk score (c statistic 0.84, 95 percent CI 0.82–0.86, $P=0.001$) was shown to be a good predictor of in-hospital death.

GRACE risk score does not include NYHA class ($p=0.050$) in the current investigation, despite a strong connection between mortality and NYHA class ($p=0.050$). The higher the NYHA class, the more important it is to pay attention to the patient's condition upon admission. 19 Severe angiographic coronary artery disease and poorer

ventricular function are linked to a higher Killip class. 20 It is possible that only Killip class I was a significant predictor of death in the current research, and this might be because the majority of patients were in Killip class I and had several hospitalizations due to MI complications, such as heart failure, or other non-cardiac conditions.

GRACE's prognostic score calculator meets all three of the most important prognostic score criteria: accuracy, usability, and generalizability.

Constraints on Your Ability to Learn

In light of the study's single-center design and the study's smaller database, several of the prognostic factors may not be statistically significant, despite their strong correlation to mortality. This means that risk scores need to be updated constantly in order to provide a more dynamic evaluation in real-world practise since risk stratification is a continual process.

6. Conclusion

The GRACE risk score for predicting in-hospital complications has been validated in our cohort and may be used to quantify the risk for our ACS patients. Our results and the GRACE risk score parameters need to be confirmed in more research, ideally in many locations.

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