

# World Journal of *Clinical Cases*

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Retrospective Study

# Value of GRACE and SYNTAX scores for predicting the prognosis of patients with non-ST elevation acute coronary syndrome

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## Abstract

### BACKGROUND

GRACE and SYNTAX scores are important tools to assess prognosis in non-ST-elevation acute coronary syndrome (NSTEMI-ACS). However, there have been few studies on their value in patients receiving different types of therapies.

### AIM

To explore the value of GRACE and SYNTAX scores in predicting the prognosis of patients with NSTEMI-ACS receiving different types of therapies.

### METHODS

The data of 386 patients with NSTEMI-ACS were retrospectively analyzed and categorized into different groups. A total of 195 patients who received agents alone comprised the medication group, 156 who received medical therapy combined with stents comprised the stent group, and 35 patients who were given agents and underwent coronary artery bypass grafting (CABG) comprised the CABG group. General information was compared among the three groups. GRACE and SYNTAX scores were calculated. The association between the relationship between GRACE and SYNTAX scores and the occurrence of major adverse cardiovascular events (MACEs) was analyzed. Pearson's correlation analysis was used to determine the factors influencing prognosis in patients with NSTEMI-ACS. Univariate and multivariate analyses were conducted to analyze the predictive value of GRACE and SYNTAX scores for predicting prognosis in patients with NSTEMI-ACS using the Cox proportional-hazards model.

### RESULTS

The incidence of MACE increased with the elevation of GRACE and SYNTAX scores (all  $P < 0.05$ ). The incidence of MACE was 18.5%, 36.5%, and 42.9% in the medication group, stent group, and CABG group, respectively. By comparison, the incidence of MACE was significantly lower in the medication group than in the stent and CABG groups (all  $P < 0.05$ ). The incidence of MACE was 6.2%, 28.0%



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and 40.0% in patients with a low GRACE score in the medication group, stent group, and CABG group, respectively ( $P < 0.05$ ). The incidence of MACE was 31.0%, 30.3% and 42.9% in patients with a medium GRACE score in the medication group, stent group, and CABG group, respectively ( $P > 0.05$ ). The incidence of MACE was 16.9%, 46.2%, and 43.8% in patients with a high GRACE score in the medication group, stent group, and CABG group, respectively ( $P < 0.05$ ). The incidence of MACE was 16.2%, 35.4% and 60.0% in patients with a low SYNTAX score in the medication group, stent group, and CABG group, respectively ( $P < 0.05$ ). The incidence of MACE was 37.5%, 40.9%, and 41.7% in patients with a medium SYNTAX score in the medication group, stent group, and CABG group, respectively ( $P > 0.05$ ). MACE incidence was 50.0%, 75.0%, and 25.0% in patients with a high SYNTAX score in the medication group, stent group, and CABG group, respectively ( $P < 0.05$ ). Univariate Cox regression analyses showed that both GRACE score (hazard ratio [HR] = 1.212, 95% confidence interval [CI]: 1.083 to 1.176;  $P < 0.05$ ) and SYNTAX score (HR = 1.160, 95%CI: 1.104 to 1.192;  $P < 0.05$ ) were factors influencing MACE (all  $P < 0.05$ ). Multivariate Cox regression analyses showed that GRACE (HR = 1.091, 95%CI: 1.015 to 1.037;  $P < 0.05$ ) and SYNTAX scores (HR = 1.031, 95%CI: 1.076 to 1.143;  $P < 0.05$ ) were independent predictors of MACE (all  $P < 0.05$ ).

## CONCLUSION

GRACE and SYNTAX scores are of great value for evaluating the prognosis of NSTEMI-ACS patients, and prevention and early intervention strategies should be used in clinical practice targeting different risk scores.

**Key Words:** GRACE score; SYNTAX score; Non-ST elevation acute coronary syndrome; Prognosis

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**Core Tip:** Risk stratification with a specific risk score can provide an estimate of patient prognosis and optimize clinical strategies. This study discussed the capabilities of GRACE and SYNTAX score in predicting the incidence of different major adverse cardiovascular events (MACEs) in patients with non-ST segment elevation acute coronary syndrome (NSTEMI-ACS). It showed that the incidence of MACE was lower in patients with low and high GRACE and SYNTAX scores who received agents than in patients who underwent stent placement or coronary artery bypass grafting. These data suggest that GRACE and SYNTAX scores have prognostic value in NSTEMI-ACS patients.

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## INTRODUCTION

Acute coronary syndrome (ACS), mainly comprising ST segment elevation myocardial infarction (STEMI) and non-ST segment elevation acute coronary syndrome (NSTEMI-ACS), is a common cardiac disease. Usually these patients present as acute coronary insufficiency and unstable plaque caused by coronary atherosclerosis[1-3]. Rapid progression of NSTEMI-ACS may lead to serious complications. Thus, supplementary aids are needed to estimate the prognosis of patients with NSTEMI-ACS[3,4]. Definite diagnosis and accurate risk stratification are essential for the subsequent treatment of NSTEMI-ACS. Therapies vary in NSTEMI-ACS patients with different major adverse cardiovascular event (MACE) risk[5,6]. Currently, the risk assessment model GRACE score is used to predict the prognosis of patients with NSTEMI-ACS. However, it does



not take the results of patients' coronary angiography into consideration[7-9]. Similarly, SYNTAX score is one of the most promising tools for assessment of coronary artery[10]. It is used to stratify risk of patients with NSTEMI-ACS based on the complexity of coronary artery lesions. To be specific, it can comprehensively assess anatomic features of coronary artery lesions ranging from site of lesion and complexity of severity to bifurcation, calcification, and compensation. This study discusses the value of GRACE and SYNTAX scores for predicting the prognosis of patients with NSTEMI-ACS.

## MATERIALS AND METHODS

### General information

A retrospective analysis was conducted in 386 patients with NSTEMI-ACS admitted to Cangzhou Central Hospital (Hebei Province, China) from March 2017 to December 2020. They were categorized into three groups based on the treatment they received. Of them, 195 patients receiving agents were enrolled in a medication group, 126 patients receiving agents plus stent treatment were enrolled in a stent group, and 35 patients who were administrated with agents and underwent coronary artery bypass grafting (CABG) were enrolled in a CABG group. Enrollment criteria were as follows: patients aged 18-years-old to 75-years-old, diagnosis of NSTEMI-ACS confirmed by clinical symptoms and relevant examination, and single- or multi-vessel stenosis > 50% validated by coronary angiography. Exclusion criteria included: patients with poor physical performance; patients with a previous history of myocardial infarction; patients with comorbidities of heart failure, myocarditis, or cardiomyopathy; patients with arrhythmia; patients with severe kidney, liver, and lung diseases; patients with an infection, malignant tumors, or severe anemia; and pregnant women. Baseline demographic and clinical characteristics data are summarized in [Table 1](#).

### Research methodology

Patients received treatment based on their angiographic features of coronary lesions. All patients were administered enteric aspirin oral 300 mg (Approval No. J20171021; Bayer HealthCare Pharmaceuticals Inc., Whippany, NJ, USA) and clopidogrel 300 mg (approval No. J20180029; Sanofi (Hangzhou) Pharmaceuticals Co. Ltd., Hangzhou, China) for secondary prevention of cardiovascular diseases. Patients in the stent group underwent coronary angiography and conventional stent implantation surgery. Patients in the CABG group were given medicine and CABG surgery.

Baseline data were collected from the three groups including gender, age, history of diseases (hypertension, diabetes, hyperlipidemia), unstable angina or acute non-ST-elevation myocardial infarction. GRACE and SYNTAX scores were calculated. Data on patient prognosis were obtained through telephone follow-up or clinical visits. Hospitalization and coronary angiography were advised for patients with symptoms such as typical chest pain or ischemia. The end points of follow-up were the occurrence of major adverse cardiovascular events (MACEs) after the treatments including cardiac death, non-fatal myocardial infarction, and target lesion revascularization. MACE was estimated. Patients were followed-up for 46 mo.

### Evaluation criterion

The incidence of MACE was investigated in patients with different GRACE scores receiving different treatments. According to the GRACE score, patients were divided into tertiles as low- (0 to 88 points), intermediate- (89 to 117 points), and high ( $\geq 118$  points)-risk groups. Also, the incidence of MACE was examined in patients with different SYNTAX scores receiving different treatments. According to the SYNTAX score, patients were sorted into tertiles as low- (0 to 22 points), intermediate- (23 to 32 points), and high ( $\geq 33$  points)-risk groups. Factors influencing NSTEMI-ACS were analyzed.

### Statistical analysis

SPSS18.0 software was used for the statistical analyses in this study. The logged data were rechecked and analyses were conducted after the outliers were deleted and removed. Measurement data are expressed as the mean  $\pm$  SD, and inter-group differences were compared using the Student's *t*-test. The statistical relationship between the two variables was determined using Spearman's rank correlation coefficient. Count data are expressed as the frequency and percentage. Kruskal-Wallis

**Table 1** Baseline characteristics of patients with non-ST-elevation acute coronary syndrome, *n* = 386

Items	<i>n</i> (%)
Age in yr, mean $\pm$ SD	61.25 $\pm$ 4.09
Gender	
Male	243 (63.0)
Female	143 (37.0)
Unstable angina	327 (84.7)
Hypertension	262 (69.4)
Diabetes	95 (24.6)
Hyperlipidemia	62 (16.1)
Major adverse cardiovascular events	108 (28.0)
Recurrent angina	115 (29.8)
NYHA class I or above	17 (4.4)
Nonfatal recurrent myocardial infarction	8 (2.1)
Target vessel revascularization	22 (5.7)
Death	4 (1.0)
Number of stents	247 (64.0)
CABG	35 (9.1)

CABG: Coronary artery bypass grafting; NSTEMACS: Non-ST elevation acute coronary syndrome; NYHA: New York Heart Association.

test was used for multi-group comparisons. Cox proportional-hazards model was used for univariate and multivariate analyses.  $P < 0.05$  was considered statistically significant. The two-tailed test was performed.

## RESULTS

The incidence of MACE increased with the elevated scores of GRACE and SYNTAX (all  $P < 0.05$ ; Table 2). The rates of MACE were 18.5%, 36.5%, and 42.9% in the medication group, stent group, and CABG group, respectively. The MACE rate was significantly lower in the medication group than in the stent and CABG groups (all  $P < 0.05$ ). However, the difference in MACE rate between the stent group and CABG group was not significant ( $P > 0.05$ ).

The rates of MACE were 6.2%, 28.0%, and 40.0% in patients receiving medication, stent, and CABG, respectively, in the low GRACE score tertile group (all  $P < 0.05$ ; Table 3). The rates of MACE were 31.0%, 30.3%, and 42.9% in patients receiving medication, stent, and CABG, respectively, in the intermediate GRACE score tertile group (all  $P > 0.05$ ). The rates of MACE were 16.9%, 46.2%, and 43.8% in patients receiving medication, stent, and CABG, respectively, in the high GRACE score tertile group (all  $P < 0.05$ ).

The rates of MACE were 16.2%, 35.4%, and 60.0% in patients receiving medication, stent, and CABG, respectively, in the low SYNTAX score tertile group (all  $P < 0.05$ ); 37.5%, 40.9%, and 41.7%, respectively, in the intermediate SYNTAX score tertile group (all  $P > 0.05$ ); and 50.0%, 75.0%, and 25.0%, respectively, in the high SYNTAX score tertile group (all  $P < 0.05$ ; Table 4).

Univariate Cox regression analyses showed that GRACE (hazard ratio [HR] = 1.212, 95% confidence interval [CI]: 1.083 to 1.176;  $P < 0.05$ ) and SYNTAX (HR = 1.160, 95%CI: 1.104 to 1.192;  $P < 0.05$ ) scores were factors contributing to the risk of MACE (all  $P < 0.05$ ). Multivariate analyses of GRACE and SYNTAX scores revealed that GRACE (HR = 1.091, 95%CI: 1.015 to 1.037;  $P < 0.05$ ) and SYNTAX (HR = 1.031, 95%CI: 1.076 to 1.143;  $P < 0.05$ ) scores were independent factors influencing MACE (all  $P < 0.05$ ).

**Table 2** Incidence of major adverse cardiovascular events in patients with different GRACE and SYNTAX scores, *n* = 386

Groups	<i>n</i>	MACE, <i>n</i>	Incidence of MACE, %	<i>Hc</i> value	<i>P</i> value
GRACE scores (points)				7.398	0.031
Low risk group (0-88)	95	13	13.7		
Intermediate risk group (89-117)	151	48	31.7		
High risk group ( $\geq 118$ )	140	47	33.6		
SYNTAX scores (points)				4.381	0.042
Low risk group (0-22)	330	85	25.8		
Intermediate risk group (23-32)	42	17	40.5		
High risk group ( $\geq 33$ )	14	6	42.9		
Treatment				8.123	0.021
Medication group	195	36	18.5		
Stent group	156	57	36.5		
CABG group	35	15	42.9		
Total	386	108	28.0		

*Hc* value: The test statistic for the Kruskal-Wallis test; MACEs: Major adverse cardiovascular events.

**Table 3** Major adverse cardiovascular events rate in patients with different GRACE risk scores receiving different treatments, *n* (%)

GRACE risk scores (points)	<i>n</i>	Medication group		Stent group		CABG group		Overall MACE rate	<i>Hc</i> value	<i>P</i> value
		<i>n</i>	MACE rate	<i>n</i>	MACE rate	<i>n</i>	MACE rate			
Low risk group (0-88)	95	65	4 (6.2)	25	7 (28.0)	5	2 (40.0)	13 (13.7)	5.231	0.041
Intermediate risk group (89-117)	151	71	22 (31.0)	66	20 (30.3)	14	6 (42.9)	48 (31.8)	2.742	0.086
High risk group ( $\geq 118$ )	140	59	10 (16.9)	65	30 (46.2)	16	7 (43.8)	47 (33.6)	5.381	0.040
Total	386	195	36 (18.5)	156	57 (36.5)	35	15 (42.9)	108 (28.0)	4.412	0.044

CABG: Coronary artery bypass grafting; *Hc* value: The test statistic for the Kruskal-Wallis test; MACE: Major adverse cardiovascular events.

**Table 4** Major adverse cardiovascular events rate in patients with different SYNTAX risk scores receiving different treatments, *n* (%)

SYNTAX risk scores (points)	<i>n</i>	Medication group		Stent group		CABG group		Overall MACE rate	<i>Hc</i> value	<i>P</i> value
		<i>n</i>	MACE rate	<i>n</i>	MACE rate	<i>n</i>	MACE rate			
Low risk group (0-22)	330	185	30 (16.2)	130	46 (35.4)	15	9 (60.0)	85 (25.8)	12.213	0.001
Intermediate risk group (23-32)	42	8	3 (37.5)	22	9 (40.9)	12	5 (41.7)	17 (40.5)	1.984	0.214
High risk group ( $\geq 33$ )	14	2	1 (50.0)	4	3 (75.0)	8	2 (25.0)	6 (42.9)	8.432	0.014
Total	386	195	36 (18.5)	156	57 (36.5)	35	15 (42.9)	108 (28.0)	4.412	0.044

CABG: Coronary artery bypass grafting; *Hc* value: the test statistic for the Kruskal-Wallis test; MACE: major adverse cardiovascular events.

## DISCUSSION

The incidence of NSTEMI-ACS is high, which involves about 75% of patients with ACS. Due to the occlusion of multiple coronary arteries and the rapid disease progression, the management of patients with ACS should be performed targeting the stratified risks[11-13]. The GRACE score is one of the most common risk scoring systems in clinical practice to risk stratify ACS patients based on real clinical symptoms and basic patient data; however, it does not take into account ACS[14-16]. The SYNTAX score is

a tool to risk stratify ACS patients based on anatomic features of coronary artery lesions. Nevertheless, it does not analyze clinical features and cannot realize the general characteristics of patients[17-22]. Therefore, this study discussed the significance of GRACE combined with SYNTAX scores for the assessment of prognosis of NSTEMI-ACS.

The findings of this study showed that the incidence of MACE increased with the elevated scores of GRACE and SYNTAX ( $P < 0.05$ ). The incidence of MACE was 18.5%, 36.5%, and 42.9% in the medication group, stent group, and CABG group, respectively, with the medication group lower than the stent and CABG groups ( $P < 0.05$ ). Moreover, the incidence of MACE varied in patients receiving different treatments, particularly in the medication group. The incidence of MACE was 6.2%, 28.0%, and 40.0% in patients with a low GRACE risk score, and 16.9%, 46.2%, and 43.8% in patients with a high GRACE risk score in the medication group, stent group, and CABG group, respectively (all  $P < 0.05$ ). This suggests that it is feasible to use GRACE score for the risk stratification of patients with NSTEMI-ACS. In terms of SYNTAX score, the incidence of MACE was 16.2%, 35.4%, and 60.0% in patients with a low risk score and 50.0%, 75.0%, and 25.0% in patients with a high risk score in the medication group, stent group, and CABG group, respectively (all  $P < 0.05$ ). These data indicate that the SYNTAX score can effectively predict the prognosis of NSTEMI-ACS by stratifying patients into high-, intermediate-, and low-risk groups based on which appropriate care can be given.

Meanwhile, univariate and multivariate Cox analyses showed that GRACE and SYNTAX scores were independent predictors of the occurrence of MACE (all  $P < 0.05$ ). GRACE and SYNTAX scores have significant predictive value for the assessment of prognosis of NSTEMI-ACS. In the current study, no significant difference was discovered in long-term prognosis between patients with an intermediate GRACE risk score and patients with an intermediate SYNTAX risk score. It can be attributed to different treatments based on different patient conditions or relevant factors influencing the treatment such as results bias caused by treatment switching. As a limitation to this study, the limited number of cases in the single-center retrospective study may be not powered enough to completely reflect the real-life situation. Multicenter large sample long-term follow-up studies are warranted in the future to further demonstrate these findings.

## CONCLUSION

In summary, GRACE and SYNTAX scores have significant value for assessing prognosis in NSTEMI-ACS.

## ARTICLE HIGHLIGHTS

### Research background

The GRACE score and SYNTAX score are established clinical risk stratification tools for acute coronary syndromes. However, they were seldomly discussed in patients with non-ST elevation acute coronary syndrome (NSTEMI-ACS) receiving different types of therapies.

### Research motivation

Correct diagnosis and early treatment are critical to improve clinical outcomes in patients with NSTEMI-ACS. Risk stratification may be helpful for the planning of treatment strategy.

### Research objectives

This study tested the ability of the GRACE and SYNTAX scores to predict outcomes in patients with NSTEMI-ACS.

### Research methods

Patients with NSTEMI-ACS who received agents for secondary prevention of cardiovascular diseases, who received medical therapy plus stents or who underwent coronary artery bypass graft (CABG) surgery were enrolled in the study. GRACE and SYNTAX scores were estimated, and patients in the three groups were further

subdivided into GRACE and SYNTAX score tertile groups. Data on prognosis and outcomes of these patients were collected over a 46 mo follow-up period. The incidence of major adverse cardiovascular events (MACEs) was calculated. The relationship between GRACE and SYNTAX scores and prognosis and outcomes of this population were analyzed and the abilities of GRACE and SYNTAX scores to predict prognosis and outcomes especially MACE were tested.

### Research results

The incidence of MACE was lower in patients having low and high GRACE and SYNTAX scores who received agents than in patients who underwent stent placement or CABG. Multivariate Cox regression analyses revealed that GRACE and SYNTAX scores were independent factors influencing the occurrence of MACE in patients with NSTEMI-ACS.

### Research conclusions

GRACE and SYNTAX scores are useful in predicting MACE in risk stratifying patients with NSTEMI-ACS who undergo CABG.

### Research perspectives

The findings need further studies with a larger number of participants to be confirmed.

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