doi: 10.5505/abantmedj.2015.48344

Abant Medical Journal

Orijinal Makale / *Original Article*

Volume Cilt 4 *Issue* Sayı 3 *Year* Yıl 2015

The relationship between the GRACE risk score and the severity of coronary artery disease in patients with non-ST elevated acute coronary syndrome

ST elevasyonu olmayan akut koroner sendrom hastalarında koroner arter hastalığı yaygınlığı ile GRACE risk skoru arasındaki ilişki

Adem Bekler[1], Gökhan Erbağ[2], Hacer Şen[2], Muhammed Turgut[3], Alper Özkan[3], Ali Ümit Yener[3], Tolga Kurt[3], Emine Gazi[3]

[1]Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi, Kardiyoloji Anabilim Dalı, Çanakkale
[2]Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi, İç Hastalıkları Anabilim Dalı, Çanakkale
[3]Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi, Kalp Damar Cerrahisi Anabilim Dalı, Çanakkale

Özet

Amaç: Akut koroner olayların global kaydı (GRACE) risk skorunun koroner arter hastalığı (KAH) hastalarındaki prognostik değeri daha önce gösterilmiştir. Biz burada ST elevasyonu olmayan akut koroner sendrom hastalarında (STEO-AKS), KAH varlığı ve yaygınlığı öngörüsünde GRACE risk skoru (GRS) ile Gensini skorunun (GS) karşılaştırılmasını amaçladık.

Yöntem: Çalışmaya toplam 154 STEO-AKS hastası alındı. GRS ile ilgili skorlar başvurudaki spesifik değişkenlerle hesaplandı. KAH yaygınlığı GS ile değerlendirildi ve Hastalar GRS' ye göre düşük (GRS140) olarak 3 gruba ayrıldı. GRS ve GS arasındaki ilişki için spearman korelasyon analizi uygulandı.

Bulgular: Tüm hastalarda düşük, orta ve yüksek risk gruplarında ortalama yaş ($p<0.001$), kalp hızı ($p = 0.004$), GS ($p<0.001$), anlamlı farklıydı. Hemoglobin ve lenfosit düzeyleri düşük risk grubunda, orta ve yüksek risk grubuyla karşılaştırıldığında anlamlı yüksekti ve yüksek duyarlılıklı troponin-T düzeyleri yüksek risk grubunda düşük ve orta risk grubuyla karşılaştırıldığında anlamlı yüksekti (sırasıyla, $p = 0.022$, $p = 0.020$, $p = 0.036$). Korelasyon analizinde, GRS ile GS arasında pozitif anlamlı korealsyon vardı ($r = 0.353$, $p<0.001$).

Sonuç: STEO-AKS hastalarında KAH ciddiyetini öngörmek için yüksek GRS yardımcı olabilir.

Anahtar Kelimeler: Akut koroner sendrom, Gensini skoru, GRACE risk skoru.

Abstract

Objective: The prognostic value of the Global Registry of Acute Coronary Events (GRACE) risk score has been reported in patients with coronary artery diseases (CAD). We aimed to compare the GRACE risk score (GRS) with the Gensini score (GS) in predicting the extent and severity of CAD in patients with non-ST elevated acute coronary syndrome (NSTE-ACS).

Method: A total of 154 patients with NSTE-ACS were included in the study. The GRS relevant scores on the indices were calculated on admission using specified variables. The severity of the CAD was evaluated using the GS. The patients were divided into low (GRS140) risk groups according to based on the GRS. A spearman correlation analysis was used for the relation between GRS and GS.

Results: There were significantly difference, the mean age ($p<0.001$), heart rate ($p = 0.004$), and GS ($p<0.001$), in all patients between the low, intermediate and high risk groups. Hemoglobin and lymphocyte levels were significantly higher in the low risk group compared to the intermediate and high risk groups, and high sensitive troponin-T levels were significantly higher in the high risk group compared to the low and intermediate risk groups ($p = 0.022$, $p = 0.020$, $p = 0.036$, respectively). In correlation analysis, there were a positive significant correlation between the GRS and the GS ($r = 0.353$, $p<0.001$).

Conclusion: The high GRS may be helpful for the predicting the severity of the CAD in patients with NSTE-ACS.

Keywords: Acute coronary syndrome, Gensini score, GRACE risk score.

Introduction

Despite significant advances in cardiovascular medicine in recent years, acute coronary syndrome (ACS) is still among the leading causes of mortality and morbidity in developed and developing countries. ACS, generally, covers the clinical spectrum of unstable angina, non-ST elevation myocardial infarction and ST elevation myocardial infarction. The risk assessment in patients with ACS and having an idea about short-and long-term mortality of patients have been important area of study for those interested in cardiovascular medicine, and some risk classification systems and scoring systems have been developed in order to determine high risk patients, and nowadays these systems have been used quite often (1-4). One of these scoring systems is GRACE risk score (GRS). GRS was tested to predict early and late mortality previously, and its validity has been shown by numerous studies.

İletişim Bilgisi / Correspondence
Yard. Doç. Dr. Adem Bekler, Çanakkale Onsekiz Mart Üniversitesi Tıp Fakültesi, Kardiyoloji Anabilim Dalı, Çanakkale
E-mail: adembekler27@gmail.com

Geliş tarihi / *Received*: 09.07.2014 **Kabul tarihi / Accepted:** 08.09.2014 **Çıkar Çatışması / Conflict of Interest:** Yok / None

Determination of the presence and the prevalence of CAD in patients with ACS provides important clues for risk stratification of ACS. Therefore, detection or prediction the patients with multivessel disease and complex lesions with diagnostic tools such as coronary angiography which is an invasive procedure, is important. For this purpose, scoring systems such as Gensini (5) and SYNTAX (6) those detect the presence and severity of CAD and also capable of predicting short and long-term mortality were developed and have been used frequently in clinical practice. Our study aimed to predict the presence and severity of CAD in patients with ACS with the help the GRS obtained from some clinical, electrocardiographic and laboratory parameters of patients on admission to the emergency room. In this study, we wanted to show the relationship between GRS and Gensini score (GS) which is an objective scoring system.

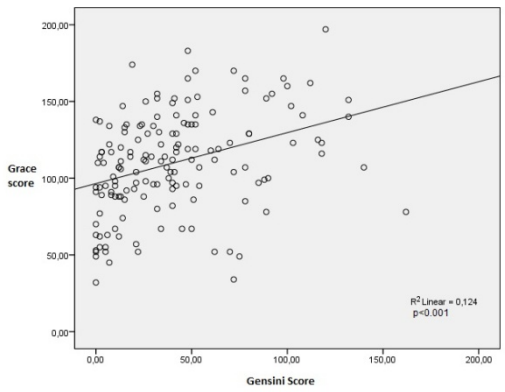


Figure 1. The relationship between the GRACE risk score and Gensini score in patients with non-ST elevated acute coronary syndrome.

Materials and Methods

Patients with ACS who were admitted to the coronary care unit of our institution between May 2012 and July 2013 were retrospectively evaluated in this study. Patients with history of coronary artery bypass surgery, whose have missing data for calculated the GRS, and whose an systolic blood pressure (SBP) of more than 180 mm Hg or diastolic blood pressure (DBP) of more than 110 mm Hg were excluded from the study. Therefore, a total of 154 patients diagnosed with NSTE-ACS were included in the analysis. The study protocol was approved by the Local Ethics Committee of our hospital.

Table 1: The characteristics of all patients.

Parameters	All patients (n = 154)
Age, years	63.5 (19-85)
Heart rate, bpm	72 (51-132)
Creatinine, mg/dL	0.76 (0.46-1.62)
Blood urea nitrogen, mg/dL	11 (5-21)
Systolic blood pressure, mmHg	125 (100-175)
Diastolic blood pressure, mmHg	80 (60-110)
Body mass index, kg/m2	23 (18.3-37.5)
Ejection fraction, (%)	50 (30-70)
Gender, Female, % (n)	26 (40)
Current smoker, % (n)	31.2 (48)
GRACE score	109.9±32.8
Gensini score	33.5 (0-162)
Diabetes mellitus, % (n)	33.8 (52)
Hypertension, % (n)	42.9 (66)
Culprit lesion, % (n)	
Left anterior descending	40.3 (62)
Circumflex	40.3 (62)
Right coronary artery	19.4 (30)
Glucose (mg/dL)	118 (78-454)
Low-density lipoprotein, mg/dL	126.9±35.9
High-density lipoprotein, mg/dL	40 (4-98)
Triglyceride, mg/dL	120 (42-374)
Hemoglobin, g/dL	13.6 (7.3-19)
Neutrophil, (103/mm3)	6.8 (2.3-18.1)
Lymphocyte, (103/mm3)	2.7 (0.6-18)
Neutrophil-lymphocyte ratio	2.1 (0.6-12.4)

Table 2: The baseline characteristics and laboratory findings of patients according to GRACE risk score with low, intermediate and high risk groups.

Variable	Low risk (1-108) n = 72	Intermediate risk (109-140) n = 55	High risk (>140) n = 27	P value
Age, years	53 (19-79)a,b	69 (53-85)b,c	73 (50-85)a,c	<0.001
Heart rate, bpm	68 (51-102)a,b	75 (53-132)b,c	79 (51-117)a,c	0.004
Creatinine, mg/dL	0.75 (0.46-1.62)	0.79 (0.47-1.62)	0.85 (0.62-1.23)	0.188
BUN, mg/dL	11 (5-21)	11 (5-21)	12 (5-21)	0.852
Systolic BP, mmHg	125 (100-175)	122 (100-175)	150 (105-175)	0.521
Diastolic BP, mmHg	80 (60-110)	80 (65-110)	95 (65-110)	0.278
Body mass index, kg/m2	22.8 (19.4-35.5)	23 (18.3-37.2)	23.8 (18-37.5)	0.749
Left ventricle EF, %	45 (30-70)	50 (30-70)	50 (30-70)	0.641
Gender, Female, % (n)	18.1 (13)	29.1 (16)	40.7 (11)	0.058
Smoking, % (n)	29.2 (21)	29.1 (16)	40.7 (11)	0.497
GRACE score	81.9±20.4a,b	123.2±9.2b,c	157.3±13.2a,c	<0.001
Gensini score	21 (0-162)a,b	33 (0-132)b,c	53 (14-132)a,c	<0.001
Diabetes mellitus, % (n)	29.2 (21)	36.4 (20)	40.7 (11)	0.488
Hypertension, % (n)	44.4 (32)	38.2 (21)	48.1 (13)	0.646
Culprit lesion, % (n)				
LAD	36.1 (26)	43.6 (24)	44.4 (12)	0.615
Cx	47.2 (34)	34.5 (19)	33.3 (9)	0.255
RCA	16.7 (12)	21.9 (12)	22.3 (6)	0.689
Glucose, mg/dL	117 (78-454)	117 (78-447)	132 (83-449)	0.461
LDL, mg/dL	128.5±34.6	124.7±33.3	126.7±44.5	0.841
HDL, mg/dL	40.5 (4-98)	40 (28-78)	41 (25-68)	0.391
Triglyceride, mg/dL	125.5 (42-374)	120 (50-268)	120 (66-367)	0.416
Hemoglobin, g/dL	13.8 (9.3-17)a,b	13.3 (8.6-19)b	13.2 (7.3-16.1)a	0.022
Neutrophil, 103/mm3	7.3 (2.9-18.1)	6.1 (2.3-18)	7.6 (3.2-11.1)	0.448
Lymphocyte, 103/mm3	3 (0.7-18)a	2.8 (0.8-12)c	1.9 (0.6-13.5)a,c	0.020
NLR	2 (0.6-12.4)	1.9 (0.8-8.8)	2.5 (0.8-12.4)	0.051
Hs-TnT, ng/L	70.8 (3-6102)a	88.6 (3-1636)c	231 (8-6000)a,c	0.036

Abbreviations: : a; p <0.05 between the low and high risk groups, b; p <0.05 between the low and intermediate risk groups, c; p <0.05 between the intermediate and high risk groups, BP; blood pressure, bpm; beat per minute, BUN; blood urea nitrogen, Cx, circumflex; EF; ejection fraction, HDL; high densiity lipoprotein, Hs-TnT; high sensitive troponin-T, LAD; left anterior descending, LDL; low density lipoprotein, NLR; neutrophil-lymphocyte ratio, RCA; right coronary artery.

The patients were divided into low (GRS <109, n = 72), intermediate (GRS 109-140, n = 55), and high (GRS >140, n = 27) risk groups according to based on the GRS. The GRS was calculated on admission using specified variables. The hemogram parameters and other biochemical measurements were determined using standard biochemical techniques, with the Beckman Coulter LH 780 (Beckman Coulter Ireland Inc. Mervue, Galway, Ireland) device in the hematology laboratory of our institution. Transthoracic echocardiography was performed on each patient immediately in the coronary care unit.

Simpson's method was used to assess the left ventricular ejection fraction (LVEF), as recommended by the American Society of Echocardiography (7).

The diagnosis of NSTE-ACS was based on the criteria of the Joint European Society of Cardiology/American College of Cardiology Foundation/American Heart Association/Word Heart Federation Task definition (8). NSTE-ACS was diagnosed according to the following criteria: typical chest pain and/or electrocardiographic changes without new ST elevation indicating myocardial ischemia with negative or elevated cardiac enzymes. Typical chest pain was evaluated as follows: more than 20 minutes (min) in duration, new-onset angina, and an increase in its frequency and duration or severity. Demographic information, cardiovascular history, and risk factors, i.e., smoking, hypertension (HT), and diabetes mellitus (DM) were obtained from the patients' medical records. Patients who had been treated with antihypertensive drugs or those whose baseline blood pressure exceeded 140/90 mmHg were diagnosed with HT (9). Patients with DM were defined as being prediagnosed, and/or being antidiabetic medications or newly diagnosed if fasting plasma glucose was ≥126 mg/dL or blood glucose was ≥200 mg/dL at any time (10). For each patient, GRS was calculated by using specific variables (age, heart rate, SBP, creatinine, Killip class, cardiac arrest at admission, elevated cardiac markers and ST-segment deviation) collected at admission.

Angiographic data of the patients were obtained from catheter laboratory records and were evaluated by using this data. Coronary angiography was performed to all patients by femoral approach using the standard Judkin's technique. 6F diagnostic catheter and Iopromide, as a contrast agent (Ultravist-370, Bayer Schering Pharma, Germany) was used in all subjects. Diameter stenosis calculated as ≥%70 with quantitative angiography was accepted as significant. GS was used to define the angiographic characteristics of the coronary atherosclerotic lesion (5). GS equals the sum of all segment scores (each segment score equals segment weighting factor multiplied by a severity score), as previously described. Segment weighting factors are between 0.5 and 5.0. Severity scores reflecting the specific percentage luminal diameter reduction of the coronary artery segment are 32,16, 8, 4, 2 and 1 respectively for 100%, 99%, 90%, 75%, 50%, and 25%.

All statistical studies were carried out with the SPSS program (version 17.0, SPSS, Chicago, Illinois). Quantitative variables were expressed as the mean value ± standard deviation and qualitative variables were expressed as percentages (%). A comparison of parametric values between the groups was performed using the One-way Anova and Tukey test for post-hoc analysis. Categorical variables were compared by the likelihood ratio chi-square test. Spearman correlation analysis was used for determinate association between GRS and GS. P value < 0.05 was considered statistically significant.

Results

A total of 154 patients [40 females (26%), mean age 63.5 (19-85) years] were enrolled in this study. The mean GRS was 109.9±32.8 and GS was 33.5 (0-162). Table 1 demonstrates the characteristics of all patients.

There were no statistically differences regarding DM, HT, culprit lesion, smoking, gender, body mass index, LVEF, blood urea nitrogen, creatinine, lipid parameters, and glucose and neutrophil levels between the risk groups. There were significantly difference, the mean age (53, 69, 73, p<0.001), heart rate (68, 75, 79, p = 0.004), and GS (21, 33, 53, p<0.001), in all patients between the low, intermediate and high risk groups. Hemoglobin (13.8 vs. 13.3, 13.2, p = 0.022) and lymphocyte (3 vs. 2.8, 1.9, p = 0.020) levels were significantly higher in the low risk group compared to the intermediate and high risk groups, and high sensitive troponin-T (hs-TnT) (231 vs. 70.8, 88.6, p = 0.036) levels were significantly higher in the high risk group compared to the low and intermediate risk groups. Table 2 demonstrates the baseline characteristics and laboratory findings of patients according to GRS with low, intermediate and high risk groups.

In correlation analysis, there were a positive significant correlation between the GRS and the GS (r = 0.353, p<0.001). The relationship between the GRS and GS in patients with NSTE-ACS demonstrated in Figure 1.

Discussion

Our study results demonstrate that high GRS is positively significant correlated with severity of CAD by assessing GS in patients with NSTE-ACS. Futhermore, hs-TnT, one of the laboratory parameters that predicts the extent and severity of coronary disease (11,12), was significantly higher in high GRS group in patients with NSTE-ACS.

Because, GRACE scoring has been shown to be predictor of major adverse cardiac events in patients with ACS (13), it is frequently used in clinical practice. GRS includes variety of clinical, laboratory and electrocardiographic parameters. Because the angiographic findings are not in these parameters, scoring systems those predict the prevalence and severity of CAD such as GS began to be used in the clinic to contribute the risk stratification (14).

When we scanned the literature about the subject of our study, we saw many studies showing that besides many of the known factors such as age, gender, creatinine levels, diabetes mellitus and hypertension, other parameters are also effective in predicting prevalence and severity of CAD, have been published. For example, in patients with diabetes mellitus and impaired fasting glucose,after 9-15 months follow-up, abnormal glucose metabolism has been shown to be related with extent and severity of CAD calculated by Gensini and SYNTAX score(15). In another study done in 605 patients and published recently by Bai et al., it was shown that abnormal thyroid metabolism is associated with the severity of CAD (16). We compared our study with the first and only study examined the relationship between GRS and GS in patients with NSTE-ACS done by Cakar et al. (17) recently, and although we detected some differences, the results of his study were consistent with the results of our study. In the first study, DM, HT and EF values were different significantly between the GRACE risk groups. In our study, these values were different between the groups, but did not reach the level of statistical significance. This situation can be explained by the small number of patient population of our study compared to the first study.

As a result, besides GRS can predict the short and long-term mortality, we think that because it is easy, cheap and convenient, it may help to predict the prevalence and severity of CAD in patients with NSTE-ACS on admission to the emergency room.

Our study has some limitations. First, this was a retrospective study based on a relatively small number of patients and the study population was from a single center. Second, because of the retrospective nature of our study, intravascular ultrasonography was not used.

References

1. Simoons ML, GUSTO IV-ACS Investigators. Effect of glycoprotein 2b/3a receptor blocker abciximab on outcome in patients with acute coronary syndromes without early coronary revascularization: The GUSTO 4-ACS randomised trial. Lancet 2001; 357: 1915–1924.
2. Boersma E, Pieper KS, Steyerberg EW, Wilcox RG, Chang WC, Lee KL, Akkerhuis KM, Harrington RA, Deckers JW, Armstrong PW, Lincoff AM, Califf RM, Topol EJ, Simoons ML. Predictors of outcome in patients with acute coronary syndromes without persistent ST-segment elevation. Results from an international trial of 9461 patients. The PURSUITS Investigators. Circulation 2000; 101: 2557-2567.
3. Sabatine MS, Antman EM. The thrombolysis in myocardial infarction risk score in unstable angina pectoris/non-ST-segment elevation myocardial infarction. J Am Coll Cardiol 2003; 41: 89S–95S.
4. de Araújo Gonçalves P, Ferreira J, Aguiar C, Seabra-Gomes R. TIMI, PURSUIT and GRACE risk scores: sustained prognostic value and interaction with revascularization in NSTE-ACS. Eur Heart J 2005; 26: 865–872.

5. Gensini GG. A more meaningful scoring system for determining the severity of coronary heart disease. Am J Cardiol, 1983; 51: 606.
6. Sinning C, Lillpopp L, Appelbaum S, Ojeda F, Zeller T, Schnabel R, Lubos E, Jagodzinski A, Keller T, Munzel T, Bickel C, Blankenberg S. Angiographic score assessment improves cardiovascular risk prediction: the clinical value of SYNTAX and Gensini application. Clin Res Cardiol, 2013; 102: 495-503.
7. Lang RM, Bierig M, Devereux RB, Flachskampf FA, Foster E, Pellikka PA, Picard MH, Roman MJ, Seward J, Shanewise J, Solomon S, Spencer KT, St John Sutton M, Stewart W. Recommendations for chamber quantification. Eur J Echocardiogr 2006; 2: 79–108.
8. Thygesen K, Alpert J S, White HD, Jaffe AS, Apple FS, Galvani M, on behalf of the Joint ESC/ACCF/AHA/WHF Task Force for the redefinition of myocardial infarction. Universal definition of myocardial infarction. Eur Heart J 2007; 28: 2525–2538.
9. James PA, Oparil S, Carter BL, Cushman WC, Dennison-Himmelfarb C, Handler J, Lackland DT, LeFevre ML, MacKenzie TD, Ogedegbe O, Smith SC Jr1, Svetkey LP, Taler SJ, Townsend RR, Wright JT Jr, Narva AS, Ortiz E. 2014 evidence-based guideline for the management of high blood pressure in adults: report from the panel members appointed to the eighth Joint National Committee (JNC 8). JAMA 2014; 311: 507-520.
10. American Diabetes Association. Diagnosis and classification of diabetes mellitus. Diabetes Care 2011; 34: 62-69.
11. Ndrepepa G, Braun S, Schulz S, Mehilli J, Schömig A, Kastrati A. High sensitivity troponin T level and angiographic severity of coronary artery disease. Am J Cardiol, 2011; 108: 639–643.
12. Gravning J, Smedsrud MK, Omland T, Eek C, Skulstad H, Aaberge L, Bendz B, Kjekshus J, Mørkrid L, Edvardsen T. Sensitive troponin assays and N-terminal pro-B-type natriuretic peptide in acute coronary syndrome: prediction of significant coronary lesions and long-term prognosis. Am Heart J, 2013; 165: 716–724.
13. 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. Am Heart J 2007; 153: 29-35.
14. Sianos G, Morel MA, Kappetein AP, Morice MC, Colombo A, Dawkins K, van den Brand M, Van Dyck N, Russell ME, Mohr FW, Serruys PW. The SYNTAX Score: an angiographic tool grading the complexity of coronary artery disease. Eurointervention 2005; 1: 219–227.
15. Wang H, Tang Z, Li X, Hu B, Feng B. Angiographic evaluation of glucose metabolic status on coronary artery lesions in patients with coronary artery disease. 2014 Jul 1. doi: 10.1111/1753-0407.12188. [Epub ahead of print].
16. Bai MF, Gao CY, Yang CK, Wang XP, Liu J, Qi DT, Zhang Y, Hao PY, Li MW. Effects of thyroid dysfunction on the severity of coronary artery lesions and its prognosis. J Cardiol. 2014 Jun 17. pii: S0914-5087(14)00104-X. doi: 10.1016/j.jjcc.2014.03.009. [Epub ahead of print].
17. Cakar MA, Sahinkus S, Aydin E, Vatan MB, Keser N, Akdemir R, Gündüz H. Relation between the GRACE score and severity of atherosclerosis in acute coronary syndrome. J Cardiol. 2014; 63: 24-28.