

CORRELATION OF THE GRACE SCORE WITH CORONARY ANGIOGRAPHY IN PATIENTS WITH ACUTE CORONARY SYNDROMETamberi Parag¹, Kulkarni S. S.*², Sathe Ajit³, Patil Abhijit⁴ and Atodharia Jayveer⁵^{1,3,4,5}Resident, Department of Medicine, Krishna Institute of Medical Sciences, Karad.²Professor, Department of Medicine, Krishna Institute of Medical Sciences, Karad.***Corresponding Author: Dr. Parag Tamberi**

Resident, Department of Medicine, Krishna Institute of Medical Sciences, Karad.

Article Received on 02/04/2018

Article Revised on 22/04/2018

Article Accepted on 13/05/2018

ABSTRACT

Background: The GRACE risk score is a strong predictor of in hospital mortality across the spectrum of Acute coronary syndrome. The GRACE risk score can be useful to assist decision making with regard to management options in patients with ACS. The aim of the present study was to assess the correlation of GRACE risk score with coronary angiography in acute coronary syndrome patients. **Material and Methods:** A total of 105 patients with diagnosis of acute coronary syndrome were studied. GRACE risk score of all the patients was calculated bedside on admission and patients were categorized into different risk groups. Coronary angiography was performed once patients were stabilized. The score was then compared with coronary angiography. **Results:** On coronary angiography, 48.57% patients were diagnosed single vessel disease, 27.62% were double vessel disease and 22.86% were triple vessel disease. Majority of the patients were in the high risk category (63.81%) followed by intermediate risk group (24.76%) and low risk group (11.43%). On correlation between GRACE score with coronary angiography using Gensini score it was seen that there was positive and statistically significant association of Gensini score with the GRACE score. **Conclusion:** GRACE risk score is a reliable and easy tool in predicting the extent and severity and hence morbidity and mortality in ACS.

KEYWORDS: Coronary artery disease, GRACE score, Angiography, Gensini score, Acute coronary syndrome.**INTRODUCTION**

Chest pain is one of the most common symptom with which patients present to the emergency department. An acute coronary syndrome (ACS) needs to be distinguished from a variety of other cardiac and non-cardiac diseases that may cause chest pain. In a number of cases, a diagnosis can be made quickly, in particular in case of ST-segment elevation acute myocardial infarction (STEMI).^[1]

The challenge in the emergency department is not only to identify patients at the highest risk, but also to identify patients who need urgent intervention.

Several scoring methods have been developed in order to distinguish patients in the emergency department or coronary care unit who are at the highest risk of an ACS or an adverse outcome, who may benefit most from aggressive therapies.^[2]

The GRACE score (Global Registry of Acute Coronary Events) was developed from a large multinational prospective patient registry.^[3,4] The GRACE risk score addresses the flaw in the handling of patient treatment by providing clinicians with a powerful yet user friendly means of identifying high risk patients at the time of

their presentation. The present study was conducted to study the correlation of GRACE score with coronary angiography in acute coronary syndrome patients.

MATERIAL AND METHODS

The present study was a cross sectional study carried out on 105 patients selected by simple random sampling with diagnosis of acute coronary syndrome admitted to a tertiary care centre.

Based on the pilot study and previous researches, the prevalence of acute coronary syndrome was taken as 30%.^[4] Sample size was estimated at 5% level of significance with an allowable error of 10%, using the formula: $n=4pq/L^2$. So, $n=84$. Hence, a total of 105 patients with evidence of Acute Myocardial Infarction (according to the WHO criteria) were enrolled in the present study. Patients with past history of ACS and Non Cardiac chest pain were excluded from the study.

GRACE Score: Risk assessment was done using the GRACE score. The variables that constitute the GRACE score are: Age, Heart rate, Systolic blood pressure (SBP), Serum creatinine, Killip class, Cardiac arrest at admission, Elevated cardiac markers, ST-segment deviation.

Table 1: Risk categories according to GRACE score.

Risk Category (tertiles)	GRACE Risk Score
Low	1-108
Intermediate	109-140
High	141-372

GRACE risk score of all patients was calculated bedside on admission using the points mentioned in Table 1. Patients were then categorized into risk groups as mentioned in Table 1.

Coronary angiography was performed once patients were stabilized using Siemens AXIOM Artis U Machine and Iohexol (OMNIPAQUE) dye. Patients were followed up for the combined endpoint till the time of discharge or in hospital mortality.

The score was compared with coronary angiography among patients who underwent the test. The severity of coronary lesions on doing coronary angiography was assessed according to the Gensini score. A secondary analysis correlating the GRACE score to the severity of coronary artery disease (CAD) on angiogram was also performed.

Descriptive statistical analysis was carried out. Chi-square test and Fisher Exact test has been used whenever the data presented in terms of frequency, and student t-test has been used to test significance when the results are presented as mean \pm standard deviation (SD). Odds ratio (OR) and its confidence interval (CI) was computed for event of interest. Multivariate logistic regression analysis has been used to assess the risk factors for predicting the event. P value <0.05 was considered statistically significant. Receiver operating characteristics (ROC) curve analysis has been performed to know the predictive value of GRACE score for predicting the events. The statistical software namely SPSS 21.0 has been used for the analysis of the data.

RESULTS

In the present study which was conducted among patients of 105 patients with evidence of Acute Myocardial Infarction (according to the WHO criteria), majority of patients were in age group 60-69 followed by 50-59. The mean age of the study population was 58.63 ± 10.94 yrs. Majority of the patients were males (60.95%) and 39.05% females with 1.56:1. On coronary angiography 48.57% patients were diagnosed single vessel disease, 27.62% were diagnosed double vessel disease and 22.86% were diagnosed triple vessel disease (Figure 1). It was seen that the mean GRACE score was 153.67 with standard deviation of 37.73. Median and Mode were 153 and 142 respectively. The minimum score observed was 90 whereas maximum score was 264 with a range of 174 (Table 2).

Majority of the patients were in the high risk category (63.81%) followed by intermediate risk group (24.76%) and low risk group (11.43%). The mean Gensini score

was 27.81 with Standard Deviation of 28.98. Median and Mode were 19 and 32 respectively with minimum score of 0 and maximum score of 151 and range of 151 (Table 3).

The value of R is 0.6327. This is a moderate positive correlation, which means there is a tendency for high X variable scores with high Y variable scores (and vice versa). The value of R², the coefficient of determination, is 0.4003. ROC was plotted to estimate the need of re-vascularisation and it was seen that the cut off was at the 129 with AUC of 0.847 and 95% CI of 0.764 to 0.910. The sensitivity at the cut off level was observed to be 74.2% and specificity of 100%. It was seen that out of total 105 cases in the present study, mortality was seen in 5 (4.76%) patients of high risk group. Rest all the patients were discharged (Table 4).

Table 2: Distribution according to the risk categories.

Risk Category (tertiles)	GRACE Risk Score	No. of patients	Percent
Low	1-108	12	11.43
Intermediate	109-140	26	24.76
High	141-372	67	63.81

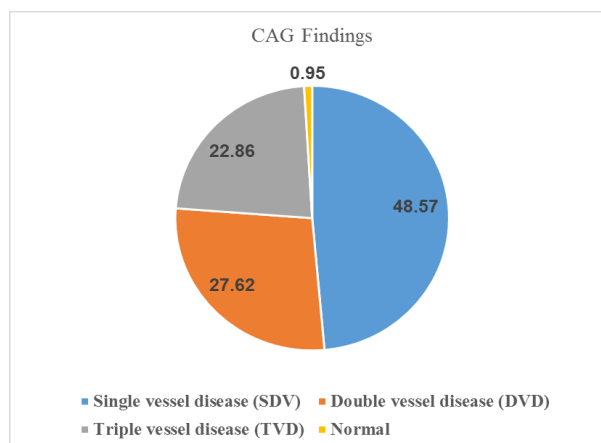
Table 3: Correlation of GRACE score with coronary angiography using the Gensini score.

R	R ²	P value	Statistical significance
0.6327	0.4003	<0.00001	Statistically significant

Table 4: Prediction of need for re-vascularisation from GRACE score by using the ROC (AUC).

Area under the ROC curve (AUC)	0.847
Standard Error ^a	0.0439
95% Confidence interval ^b	0.764 to 0.910
z statistic	7.905
Significance level P (Area=0.5)	<0.0001
Associated criterion (cut off level)	>129
Sensitivity	74.23
Specificity	100.00

a. DeLong et al methodology b. Binomial exact

**Figure 1: Distribution according to the coronary angiogram (CAG) findings.**

DISCUSSION

Several risk stratification schemes like PURSUIT and TIMI has been correlated with the severity of coronary artery disease.^[2] However, using variables like serum creatinine, heart rate and killip class, GRACE risk model showed better diagnostic information with regard to active and extensive coronary artery disease in patients with ACS.^[5]

It was seen that on coronary angiography 48.57% patients were diagnosed with single vessel disease and 27.62% were diagnosed double vessel disease and 22.86% were diagnosed triple vessel disease. Abu-Assi E et al,^[6] Vengatesh Munusamy,^[7] de Araujo Goncalves P et al.^[8] also observed single vessel disease as a more common finding on CAG.

The GRACE score has been found to be superior to even sophisticated tools such as dobutamine stress echocardiography and myocardial perfusion scanning in predicting long term CV mortality.^[9] Since the GRACE score predicts mortality, theoretically it should be an excellent tool to even predict if a patient is likely to have an angiographic lesion that warrants treatment. Although a decision on taking up a patient for invasive procedures is dependent on several other factors besides the angiographic lesion such as patient preference, cost factor, operator intuition and judgement, it is still worthwhile to have a preliminary idea if a patient is likely to have a lesion that requires immediate invasive procedures such as CABG or PCI.^[9,10]

It was seen that the mean GRACE score was 153.67 with standard deviation of 37.73. The minimum score observed was 90 whereas maximum score was 264. The median GRACE score (153) for the total sample was similar to that calculated by González-Ferreira et al.^[11] and Elbarouni et al.^[12]

It was seen that majority of the patients were in the high risk category (63.81%) followed by intermediate risk group (24.76%) and low risk group (11.43%). The findings were comparable with Abu-Assi E et al^[6] where Low risk were 22.7%, Intermediate, were 28.2% and High risk were 49%. Similar observations were also reported by Vengatesh Munusamy,⁷ de Araujo Goncalves P et al.^[8]

Several studies have defined the relationship between coronary artery disease risk factors and severity of coronary artery lesions. It has been seen that some risk factors may influence the development of coronary atherosclerosis at different levels of its evolution. There are different opinions about which stage of atherosclerosis is affected by DM and HTN. Although some studies suggesting that HTN and DM may affect early stages of atherosclerosis, other results do not support that idea.^[13,14] Additionally, renal function is also an important predictor of the presence and severity of angiographic CAD and creatinine level has an

incremental value over traditional CAD risk factors.^[15,16] The increased prevalence of atherosclerotic coronary stenosis with the progression of age in both sexes has also been reported before in autopsy studies. The rate of this increase was, however, more prominent in men between 30 and 49 years of age, whereas a steady increase with age was encountered in women.^[17] Recent data demonstrated a significant positive correlation between coronary angiographic scores and age, creatinine level, DM, and smoking, but not with blood pressure.^[18] In the present study also we studied the relationship of coronary artery risk group with the various risk factors.

While studying the correlation between GRACE score with coronary angiography using Gensini score it was seen that there was positive and statistically significant association of Gensini score with the GRACE score. Thus the significant linear relationship between Gensini score and GRACE score is reported with ($r = 0.6327$, $p = 0.0000$). Thus, with the increasing GRACE score demonstrates more severe coronary atherosclerosis with increasing Gensini score.

CONCLUSIONS

According to the results of the present study, patients with high GRACE score have more severe CAD. GRACE score predicts mortality; theoretically it should be an excellent tool to even predict if a patient is likely to have an angiographic lesion that warrants treatment. The risk stratification score is safe and easy to use for rapid assessment of mortality and MI risk, despite its low probability of predicting the outcome.

Conflict of Interest: None to declare.

Source of funding: Nil.

REFERENCES

1. Lee TH, Goldman L. Evaluation of the patient with acute chest pain. *N Engl J Med*, 2000; 342: 1187-95.
2. Lakhani MS, Qadir F, Hanif B, Farooq S, Khan M. Correlation of thrombolysis in myocardial infarction (TIMI) risk score with extent of coronary artery disease in patients with acute coronary syndrome. *J Pak Med Assoc*, 2010; 60(3): 197-20.
3. Granger CB, Goldberg RJ, Dabbous OH, et al. for the Global Registry of Acute Coronary Events Investigators. Predictors of hospital mortality in the global registry of acute coronary events. *Arch Intern Med*, 2003; 163: 2345-53.
4. Fox KA, Dabbous OH, Goldberg RJ, et al. Prediction of risk of death and myocardial infarction in the six months after presentation with acute coronary syndrome: prospective multinational observational study (GRACE). *BMJ*, 2006; 333: 1091.
5. Nakachi T, Kosuge M, Hibi K, Ebina T, Tsukahara K, Okuda J, et al. comparison of grace risk score versus timi risk score on angiographic findings in

- patients with non-ST-segment elevation acute coronary syndrome. ACC Poster Contributions Georgia World Congress Center, March 15, 2010.
6. Abu-Assi E, García-Acuña JM, Peña-Gil C, González-Juanatey JR. Validation of the GRACE Risk Score for Predicting Death Within 6 Months of Follow-Up in a Contemporary Cohort of Patients With Acute Coronary Syndrome. *Rev Esp Cardiol*, 2010; 63(6): 640-8.
 7. Munusamy V, George M, Jena A, Sridhar A, Dhandapani VE. A Retrospective Study on the Utility of GRACE and TIMI Score to Predict Coronary Revascularization among Patients with Acute Coronary Syndrome. *IOSR J Dent Med Sci*, 2016; 15(10): 01-07.
 8. 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 NSTEMI-ACS. *Eur Heart J*, 2005 May; 26(9): 865-72.
 9. Van der Zee PM, Verberne HJ, Cornel JH, Kamp O, van der Zant FM, Bholasingh R, et al. GRACE and TIMI risk scores but not stress imaging predict long-term cardiovascular follow-up in patients with chest pain after a rule-out protocol. *Neth Heart J*, 2011; 19: 324–30.
 10. Wang JY, Goodman SG, Saltzman I, Wong GC, Huynh T, Dery J-P et al. Cardiovascular Risk Factors and In-hospital Mortality in Acute Coronary Syndromes: Insights From the Canadian Global Registry of Acute Coronary Events. *Can J Cardiol*, 2015; 31: 1455–61.
 11. Ferreira-Gonzalez I, Permanyer-Miralda G, Heras M, Cunat J, Civeira E, Arós F, et al. Patterns of use and effectiveness of early invasive strategy in non-ST-segment elevation acute coronary syndromes: An assessment by propensity score for the MASCARA study group. *Am Heart J*, 2008; 156: 946-53.
 12. Elbarouni B, Goodman SG, Yan RT, Welsh RC, Kornder JM, Deyoung JP, et al. Validation of the Global Registry of Acute Coronary Event (GRACE) risk score for in-hospital mortality in patients with acute coronary syndrome in Canada. Canadian Global Registry of Acute Coronary Events (GRACE/ GRACE(2)) Investigators. *Am Heart J*, 2009; 158: 392-9.
 13. Saito D, Shiraki T, Oka T, Kajiyama A, Doi M, Masaka T. Morphologic correlation between atherosclerotic lesions of the carotid and coronary arteries in patients with angina pectoris. *Jpn Circ J*, 1999; 63: 522–6.
 14. Matsumori R, Shimada K, Kiyonagi T, Hiki M, Fukao K, Hirose K, Ohsaka H, et al. Clinical significance of the measurements of urinary liver-type fatty acid binding protein levels in patients with acute coronary syndrome. *J Cardiol*, 2012; 60: 168-73.
 15. Abaci A, Sen N, Yazici H, Tulmac M, Türkoglu S, Tavitil Y, Yalcin R. Renal dysfunction is the most important predictor of the extent and severity of coronary artery disease in patients with diabetes mellitus. *Coron Artery Dis*, 2007; 18: 463-9.
 16. Dohi T, Kasai T, Miyauchi K, Takasu K, Kajimoto K, Kubota N, Amano A, Daida H. Prognostic impact of chronic kidney disease on 10-year clinical outcomes among patients with acute coronary syndrome. *J Cardiol*, 2012; 60: 438–42.
 17. Giannoglou GD, Antoniadis AP, Chatzizisis YS, Damvopoulou E, Parcharidis GE, Louridas GE. Sex-related differences in the angiographic results of 14,500 cases referred for suspected coronary artery disease. *Coron Artery Dis*, 2008; 19: 9-14.
 18. Mi SH, Su G, Li Z, Yang HX, Zheng H, Tao H, Zhou Y, Tian L. Comparison of glycemic variability and glycosylated hemoglobin as risk factors of coronary artery disease in patients with undiagnosed diabetes. *Chin Med J (Engl)*, 2012; 125: 38-43.