

Original Research Article

Validation study of grace risk score for prognosis in Indian patients with non-STEMI

Rangamanikandan M.*, Shivcharan Jelia, Meena S. R., Shyam Bihari Meena, Devendra Ajmera, Pramod Kumar Chourasiya, Ravi Verma, Manisha Meena

Department of Medicine, Government Medical College Kota, Rajasthan, India

Received: 02 May 2017

Accepted: 29 May 2017

*Correspondence:

Dr. M. Rangamanikandan,
E-mail: rangataz@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Cardiovascular disease has emerged as the single most important cause of death worldwide. Every patient of MI has to be stratified according to the risk factors, so that high risk patients can be identified and can be managed effectively GRACE risk score is one of the score used to calculate the risk in MI. Present study was undertaken to correlate GRACE risk score and mortality in non-STEMI.

Methods: 200 patients of non-STEMI fulfilling the inclusion criteria admitted in wards of NMCH, Kota were recruited. GRACE risk score was calculated for all patients. Each patient monitored closely throughout their hospitalization. Each component of GRACE risk score was studied for statistical significance. Statistical analysis of correlation was done with chi square test and statistical significance was taken $p < 0.05$.

Results: Mean age is 59.45 ± 8.66 years, with male preponderance, male to female ratio 3:1. Maximum GRACE score is 300 and the minimum score is 86. Patients were categorized into low (74 patients), intermediate (60 patients), high risk (66 patients) according to GRACE score. 14 patients were expired and all of them are in high risk category. GRACE score had sensitivity (100%), specificity (72.04%), positive predictive value (21.2%) and negative predictive value (100%). Serum creatinine ($p < 0.001$), heart rate ($p < 0.001$), blood pressure ($p < 0.001$), Killip class ($p < 0.001$), cardiac biomarkers ($p < 0.001$), ST segment changes ($p < 0.001$) were significantly associated with adverse events. Age > 50 ($p < 0.110$) is not significant. Overall grace score demonstrated excellent discrimination ($p < 0.001$), C statistics 0.99, 95% CI 115.742-151.221 for in hospital mortality.

Conclusions: This study has shown GRACE risk score is highly accurate in predicting in hospital mortality in patients of non-STEMI. We should routinely use GRACE risk score in our hospital settings to identify the high-risk patients to decrease mortality.

Keywords: Non-ST elevated myocardial infarction, GRACE (Global Registry of Acute Coronary Syndrome)

INTRODUCTION

Cardiovascular disease has emerged as the single most important cause of death worldwide. In our country, the CVD risk factors rise as a consequence of adverse life style changes accompanying industrialization and urbanization, the rates of CVD mortality and morbidity could rise even higher than the rates predicted solely by

demographic changes. CVD probably represents 25% of all deaths in India. Prevalence of CHD in India recently was estimated at more than 10% in urban areas and 4.5% in rural areas.¹ The survival of patients with acute myocardial infarction has improved considerably during the past 10 years with the advent of PCI and better utilization of anticoagulants, aspirin, and cardioprotective drugs. Despite this improvement, mortality rates after MI

continue to demonstrate an early rise. Therefore, risk stratification is necessary to identify high risk patients. There are so many risk scores to predict mortality and recurrent ischemic events. The TIMI (Thrombolysis in Myocardial Ischemia) risk score identifies seven independent risk factors.² The PURSUIT risk score was developed in a multinational randomized clinical trial.

The GRACE (Global Registry of Acute Coronary Events) risk score is more accurate because it was derived from a multinational registry of unselected patients and includes hospitals in Europe, Asia, north America, south America, Australia and New Zealand.³

Risk assessment should be performed at the time of hospital admission as it gives an idea about probability of in hospital death and also guides the appropriate treatment plan in acute coronary syndrome. It includes age, heart rate, systolic blood pressure, Killip class, Serum creatinine level, cardiac arrest at hospital admission, ST segment deviation in ECG, elevated serum cardiac marker.

Total score is 372 scores for GRACE models were validated for: in hospital death, death within 6 months from admission or death within 6 months of discharge.⁴ NICE guidelines recommend the GRACE risk score for risk stratification of patients with ACS.⁵ The score has been validated >20000 patients in multiple databases and is extremely well studied and supported. Many guidelines recommend earlier invasive management for patients with high scores.⁶

METHODS

200 patients of non-STEMI diagnosed by symptoms and confirmed by ECG and cardiac markers were selected randomly admitted in New hospital medical college Kota for this study.

The patients with unstable angina, STEMI, rheumatic heart disease, previous history of ischemic heart disease was excluded from the present study.

All selected patients were subjected to routine investigations, including complete blood count, lipid profile, blood sugar, blood urea, serum creatinine, electrocardiography, and so on, as needed.

A detailed history and thorough clinical examination was done as indicated in the performa. GRACE risk score was calculated to all the patients. Patients were categorized low, intermediate and high risk according to GRACE score.

Various observations in the study were analysed. All patients received standard treatment as per guidelines.

RESULTS

The maximum numbers of non-STEMI patients in this study were in the 6th and 7th decades, mean age of presentation was 59.45 ± 8.14 (Table 1). Total number of patients in study was 200, out of which 148 were male and 52 were female, with male to female ratio 2.84:1.

Table 1: Age distribution.

| Age (years) | Cases | Percentage |
|-------------|-------|------------|
| 30-39 | 5 | 2.5% |
| 40-49 | 45 | 22.5% |
| 50-59 | 58 | 29.0% |
| 60-69 | 61 | 30.50% |
| 70-79 | 23 | 11.5% |
| 80-89 | 5 | 2.5% |
| 90-100 | 3 | 1.5% |

Out of the many risk factors for ACS, smoking was the most prevalent in this study group with 51%. Dyslipidemia (46%), alcohol ingestion (43%), hypertension (44%), tobacco chewing (49%), family history (26%) and diabetes (21%) were also much prevalent in the study group (Table 2).

Patients were classified into low, intermediate and high risk according to grace risk score (Table 3). 74 patients were in low risk category, 60 patients were in intermediate risk category, 66 patients were in high risk category. 14 patients were expired in our study, all of them were in high risk category. None of the patients were died in low and intermediate risk category. Grace score had 100% sensitivity, 72.04% specificity, 22.22% positive predictive value and 100% negative predictive value.

14 patients were expired. 6 patients expired were in 70-79 age, 4 patients expired were in 80-89 age (Table 4).

Out of 14 patients expired 9 had heart rate more than 150 beats/min, 4 patients had heart rate more than 110 (beats/min) and one patient had heart rate 86 (beats/min) (Table 5).

Table 2: Risk factors.

| Past history | Cases | Percentage |
|-----------------|-------|------------|
| Family history | 52 | 26% |
| Dyslipidemia | 92 | 46% |
| Hypertension | 88 | 44% |
| Smoking | 102 | 51% |
| Alcohol | 86 | 43% |
| Obesity | 60 | 30% |
| Tobacco chewing | 98 | 49% |
| Diabetes | 40 | 20% |

Table 3: Risk categorization.

| Grace risk score | No. of patients | No. of patients expired |
|--|-----------------|-------------------------|
| Low risk category 1-108 for non-STEMI | 74 | 0 |
| Intermediate risk category 109-140 for non-STEMI | 60 | 0 |
| High risk category 141-372 for non-STEMI | 66 | 14 |

Table 4: Distribution of mortality according to age.

| Age | No. of deaths | Percentage |
|--------|---------------|------------|
| <30 | 0 | 0% |
| 30 -39 | 0 | 0% |
| 40-49 | 1 | 7.14% |
| 50-59 | 1 | 7.14% |
| 60-69 | 1 | 7.14% |
| 70-79 | 6 | 42.8% |
| 80-89 | 4 | 28.5% |
| >90 | 1 | 7.14% |

Table 5: Correlate heart rate at the time of admission with mortality.

| Heart rate (beats/min) | No. of patients expired | Percentage |
|------------------------|-------------------------|------------|
| <50 | 0 | 0% |
| 50-69 | 0 | 0% |
| 70-89 | 0 | 0% |
| 90-109 | 1 | 7.1% |
| 110-149 | 4 | 28.5% |
| 150-199 | 9 | 64.2% |
| >200 | 0 | 0% |

Table 6: Correlate systolic BP at the time of admission with mortality.

| Systolic BP (mm hg) | No. of patients expired | Percentage |
|---------------------|-------------------------|------------|
| <80 | 8 | 57.1% |
| 81-100 | 4 | 27.5% |
| 101-119 | 0 | 0% |
| 120-159 | 1 | 7.14% |
| 160-199 | 1 | 7.14% |
| >200 | 0 | 0% |

Out of 14 patients expired 8 had systolic blood pressure less than 80 mm hg, 4 patients had SBP between 80-100 mm hg, two patients had SBP more than 120 mm hg (Table 6).

8 patients were in KILLIP class IV, our patients were in KILLIP class 3 and one patient was in KILLIP class 2 (Table 7).

Three patients were had S. Creatinine more than 4mg/dl and 10 patients had S. Creatinine more than 2mg/dl and one patient had 1.2mg/dl (Table no 8).

Table no 7: Corelate Killip class with mortality.

| Killip class | Number of patients expired | Percentage |
|--------------|----------------------------|------------|
| Class 1 | 1 | 7.14% |
| Class 2 | 1 | 7.14% |
| Class 3 | 4 | 28.5% |
| Class 4 | 8 | 56.5% |

Table no 8: Correlate serum creatinine with mortality.

| Serum creatinine (mg/dl) | No. of patients expired | Percentage |
|--------------------------|-------------------------|------------|
| 0.8 -1.19 | 0 | 0% |
| 1.20-1.58 | 0 | 0% |
| 1.59-1.90 | 1 | 7.14% |
| 2.0-3.99 | 10 | 71.4% |
| >4 | 3 | 21.4% |

In the present study, all patients had ST segment changes and Cardiac markers positivity.

In the present study, none of the patients had cardiac arrest at the time of admission.

P value was calculated to all the components of GRACE score (Table 9).

In this study heart rate >150, SBP <90 mmhg, S. creatinine >2 mg/dl and killip class 4, cardiac markers positivity, ST segment deviation were highly significant to predict mortality.

Table no 9: Significant components of GRACE score in the present study.

| Component | Significant components | P value |
|---|------------------------|---------|
| Age >50 | No | 0.110 |
| HR >150beats/min | Yes | <0.001 |
| SBP <80 mm hg | Yes | <0.001 |
| S. creatinine >2 mg/dl | Yes | <0.001 |
| killip class 4 | Yes | <0.001 |
| Cardiac marker positivity | yes | <0.001 |
| Cardiac arrest at the time of admission | Not studied | - |
| ST segment deviation | Yes | <0.001 |

In this study heart rate >150, SBP <90 mm hg, S.creatinine >2 mg/dl and killip class 4, cardiac markers

positivity, ST segment deviation were highly significant to predict mortality.

Table 10: Group statistics

| Group Statistics | | | | | |
|------------------|---------|-----|--------|----------------|-----------------|
| | Outcome | N | Mean | Std. Deviation | Std. Error Mean |
| Grace score | Dead | 14 | 262.14 | 48.523 | 12.968 |
| | Alive | 186 | 128.66 | 31.018 | 2.274 |

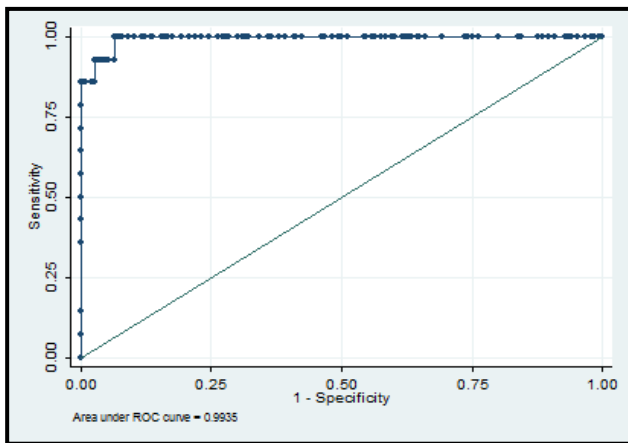


Figure 1: GRACE score statistics.

Grace risk score in the present study is highly significant to calculate in hospital mortality.

DISCUSSION

The study was a hospital based analytic type of observational study carried out 2016 at Government Medical College and Associated group of hospitals, Kota. 200 patients of non-STEMI were enrolled into the study.

The mean age for the cases was 59.45±12.56. The maximum number of cases in this study were in the age group between 60-69 which was followed by age group of 50-59. The youngest case was 33 years old (male) and oldest case was 93 years old. The average age in males was 54.71±11.70. The average age in females was 58.45±14.44. Out of the many risk factors for ACS, smoking was the most prevalent in this study group with 51%. Dyslipidemia (46%), alcohol ingestion (43%), Hypertension (44%), tobacco chewing (49%), family history (26%) and diabetes (21%) were also much prevalent in the study group.

In the present study patients were classified low, intermediate and high-risk category according to the GRACE risk score. 74 (37%) patients were in low risk category. 60 patients (30%) were in intermediate risk category. 66 patients (33%) were in high risk category. 14 patients (7%) were expired. All of them were in high

risk category. This study of patients of non-STEMI at our centre, confirms the prognostic value of several baseline characteristics reported in other studies. It further corroborates the GRACE registry findings that the GRACE score is a good tool to predict in-hospital death/MI across all cases of ACS.

In the present study, increasing age showed a very good association with events and patients aged > 50 years were at a high-risk. A low cut-off age (50 years) to compare prognosis was taken considering the fact that CAD occurs in Indians at a younger age.^{7,8} In the GRACE registry, age has been shown to be a statistically significant predictor of events for every 10 years increase in age (or 1.7/decade).

Like in the GRACE registry (or 1.4 for every 10 mm Hg decrease), our study also showed that a lower SBP at admission is significantly associated with more events.

In this study, a patient presenting in a higher Killip's class was at higher risk for death/MI with the highest risk for Killip's class IV. In the GRACE study also, increasing Killip's class predicted worse prognosis (or 2/class).

In this study, higher heart rate at the time of admission was higher risk of death. In the study In the GRACE registry, increasing HR was associated with worse outcome (or 1.3/30 beats/min increase).

An increasing serum creatinine level has been shown to be prognostically significant in a number of studies.^{9,10} In the GRACE registry, the risk increased for every 1 mg/dL increase in serum creatinine, while in the present study, patients with an initial level >2 mg/dL had a worse prognosis.

ST-segment deviation and positive cardiac biomarkers have long been shown to predict events in cases of ACS. In GRACE registry also, ST-segment deviation (or 1.8) and positive cardiac markers (or 1.6) predicted worse prognosis. The analysis was consistent with these findings and showed statistical significance in predicting events when both these variables were assessed. Cardiac arrest at presentation as a prognostic variable could not be assessed as none of the patient had a cardiac arrest at

presentation. In this study GRACE risk score has high sensitivity and negative predictive value. GRACE risk score has got a statistically significant correlation with in hospital mortality with a P value of < 0.001 with an average GRACE score in death patients being 262.14 fl compared to those who are alive is 128.66. The C statistic for the score in the GRACE registry was 0.99 while in our study it was good and achieved a good discriminatory value (AUC = 0.99). Thus, it has been shown to be a good prognostic tool to predict death/MI.

Moreover, the GRACE score has been developed from registry data and thus is more representative of the general population as compared to scores which have been developed from clinical databases. These clinical databases may suffer from selection bias due to exclusion of high-risk patients like those with coronary heart failure (CHF) or raised serum creatinine.¹¹

Important to a prognostic score are accuracy and ease of use. The GRACE score fulfills these criteria and also includes newer prognostic variables

CONCLUSION

The main parameter studied was GRACE risk score for predicting in hospital mortality. GRACE risk score has got a statistically significant correlation with in hospital mortality with a P value of < 0.001 with an average GRACE risk score in death patients being 262.14 compared to those who alive is 128.66.

In the components of GRACE risk score heartrate, systolic blood pressure, serum creatinine, Killip class, ST segment changes, Cardiac markers positivity have statistically significant correlation (p<0.001) with in hospital mortality.

GRACE risk score had high sensitivity, high specificity, high negative predictive value, low positive predictive value for predicting mortality in high risk patients.

In conclusion, this study has shown GRACE RISK SCORE is highly accurate in predicting in hospital mortality in patients of Acute Coronary Syndrome. We should routinely use GRACE risk score in our hospital settings to identify the high-risk patients to decrease mortality

ACKNOWLEDGEMENTS

The Authors acknowledge the help of NMCH laboratory and medicine ward nursing staff for their cooperation in the study.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Braunwald's heart disease: a textbook of cardiovascular medicine, 10th Edition Chapter Global burden of cardiovascular disease: chapter1; 2015:8.
2. Robert P, Giugliano, Christopher P, Cannon and Eugene Braunwald. Braunwald's Heart disease Chapter 53. non-ST Elevation Acute Coronary Syndromes; 2004:1160.
3. 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. Eu heart J. 2005;26(9):865-72.
4. Bradshaw PJ, Katzenellenbogen JM, Sanfilippo FM, Hobbs MS, Thompson PL, Thompson SC. Validation study of GRACE risk scores in indigenous and non-indigenous patients hospitalized with acute coronary syndrome. BMC cardiovascular disorders. 2015;15(1):151.
5. NICE guidance. Unstable angina and NSTEMI:early management: NICE guidelines:[CG94] 1.2. Assessment of a patient's risk of future adverse cardiovascular events; 2010.
6. Tang EW, Med M, Wong C, Herbison P. Global registry of acute coronary Am Heart J. 2006;10:004.
7. Janus ED, Postiglione A, Singh RB. The modernization of Asia: implications for coronary heart disease. Circulation. 1996;94:2671-3.
8. McKiegue PM, Ferrie JE, Pierpoint T. Association of early-onset coronary heart disease in south Asians men with glucose intolerance and hyperinsulinemia. Circulation. 1993;87:152-61.
9. Al Suwaidi J, Reddan DN, Williams K. Prognostic implications of abnormalities in renal function in patients with acute coronary syndromes. Circulation. 2002;106:974-80.
10. Krumholz HM, Chen J, Wang Y. Comparing AMI mortality among hospitals in patients 65 years of age or older: evaluating methods of risk adjustment. Circulation. 1999;99:2986-92.
11. Bhatt DL, Roe MT, Peterson ED. Utilization of early invasive management strategies for high risk patients with non-ST elevation acute coronary syndromes: results from the CRUSADE Quality Improvement Initiative. JAMA. 2004;292:2096-104.

Cite this article as: Rangamanikandan M, Jelia S, Meena SR, Meena SB, Ajmera D, Chourasiya PK, Verma R, Meena M. Validation study of grace risk score for prognosis in Indian patients with non-STEMI. Int J Adv Med 2017;4:1036-40.