PREDICTION OF CORONARY ARTERY DISEASE EXTENT AND SEVERITY ON THE BASIS OF GRACE AND TIMI SCORES IN PATIENTS PRESENTED WITH ST ELEVATION MYOCARDIAL INFARCTION UNDERGOING PRIMARY PERCUTANEOUS CORONARY INTERVENTION

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ABSTRACT

Objective: To determine the correlation of Global Registry for Acute Coronary Events (GRACE) and Thrombolysis in Myocardial Infarction (TIMI) scores with Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery (SYNTAX) score (SS) to predict the extent and severity of coronary artery disease (CAD) in patients presented with first onset STE levation Myocardial Infarction (STEMI) undergoing Primary Percutaneous Coronary Intervention (PPCI).

Study Design: Descriptive cross-sectional study.

Place and Duration of Study: Inpatient departments of Armed Forces Institute of Cardiology/ National Institute of Heart Diseases (AFIC/NIHD), Rawalpindi, from Jan 2019 to Jun 2019.

Methodology: Ethical approval was taken from Institutional Ethical Review Board (IERB), AFIC/NIHD. Patients of any age and both genders who presented with chest pain and satisfied criteria for Type 1 Myocardial Infarction (MI), as stated in 4th Universal Definition of MI, were included in study by non-probability consecutive sampling technique. Patients with a previous history of ischemic heart disease, Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Graft (CABG) surgery were excluded. Both TIMI and GRACE scores for STEMI were calculated at time of admission.

The extent and severity of CAD were assessed by the SS-I. Each coronary lesion with a diameter stenosis of at least 50%, in vessels of at least 1.5 mm, were scored. Data was analyzed using the Statistical Package for Social Sciences (SPSS) version 25.

Results: Out of 376 patients, 327 (86.9%) were male and 49 (13.1%) were female. Anterior wall MI was the most common presentation 164 (43.6%). Among risk factors for CAD, hypertension was the most common one 215 (57.2%). A positive correlation was found between SS and GRACE low, intermediate and high-risk groups (0.145).

Conclusion: Patients having high GRACE and TIMI scores were more likely to have severe CAD. In comparison with TIMI score, GRACE score was found to have better correlation with SS, but degree of that association was not strong enough to make it a reliable and sole predictor of CAD severity.

Keywords: Acute coronary syndrome, ACS, TIMI, GRACE, Primary PCI, STEMI, SYNTAX.

INTRODUCTION

Both American Heart Association and European Society of Cardiology clinical practice guidelines recommend the use of the Global Registry for Acute Coronary Events (GRACE) or the Thrombolysis in Myocardial Infarction (TIMI) risk scores for risk assessment among patients presenting with Acute Coronary Syndrome (ACS)[1-4]. Their validity have been depicted in prospective cohort studies[5,6]. These scoring systems provide important information regarding early and late mortality and thus help guide optimal treatment strategy. However, these scores are not intended to predict the extent and severity of coronary artery disease (CAD). The Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery (SYNTAX) score (SS) is one of the scoring systems to determine the extent and severity of CAD[7], but it requires invasive approach. By knowing the strength of association between a

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clinical risk scoring system and catheterization laboratory findings, one can predict the possible coronary anatomy before performing coronary angiography which may lead to change in therapeutic decisions, including the timing and intensity of interventions, and could even avoid an invasive strategy. This approach becomes even more important in setting of acute ST Elevation Myocardial Infarction (STEMI), where prompt assessment and decision making not only shorten the total ischemic time but also guide appropriate management approach.

The aim of the current study is to determine the correlation between SYNTAX score and GRACE and TIMI scores to predict the extent and severity of CAD in patients presented with first onset ST elevation myocardial infarction (STEMI) undergoing Primary Percutaneous Coronary Intervention (PPCI).

METHODOLOGY

It was a descriptive cross sectional study conducted at inpatient departments of Armed Forces institute of cardiology and National institute of heart diseases, Rawalpindi from Jan 2019 to Jun 2019. Ethical approval was taken from Institutional Ethical Review Board (IERB), AFIC/ NIHD. Patients of any age and both genders who present within 12 hours of onset of chest pain or within 12 to 24 hours of onset of chest pain having ongoing symptoms who satisfied criteria for type 1 Myocardial Infarction (MI), as stated in 4th Universal Definition of Myocardial Infarction, 8 were included in study by non-pro-bability consecutive sampling technique.

Table-I: Baseline clinical parameters.

n=376		
Age (Mean ± SD)		59.4 ± 11.8
Gender	Male n(%)	327 (86.9%)
	Female n(%)	49 (13.1%)
Risk Factors	Diabetes Mellitus n(%)	136 (36.1%)
	Hypertension n(%)	215 (57.2%)
	Family History of IHD n(%)	17 (4.5%)
	Current Smoking n(%)	130 (34.5%)
S. Cholesterol mg/dL (Mean ± SD)		178.8 ± 46.3
S. Triglycerides mg/dL (Mean ± SD)		170 ± 120.4
HDL-C mg/dL (Mean ± SD)		37.4 ± 10.1
LDL-C mg/dL (Mean ± SD)		108.6 ± 37.9
VLDL-C mg/dL (Mean ± SD)		30.8 ± 19.1
STEMI	Anterior walln (%)	164 (43.6%)
	Anterior-lateral walln (%)	43 (11.4)
	Inferior walln (%)	151 (40.1%)
	Lateral walln (%)	18 (4.8%)

Table-II: Correlation between risk (grace and timi) scores and syntax score.

n=376		**Syntax score (Mean ± SD)**	**r**
GRACE score (Mean ± SD)	148.5 ± 30.9	22.5 ± 9.1	0.176
TIMI score (Mean ± SD)	3.7 ± 2.1	22.5 ± 9.1	0.162

Table-III: Comaprison of means of syntax score among grace and timi scores groups.

n=376	**Low Risk**	**Intermediate Risk**	**High Risk**	**r**	***p***
GRACE score	19.7 ± 10.3	22.7 ± 7.8	23.8 ± 10.0	0.145	0.25
TIMI score	22.5 ± 9.0	22.3 ± 9.7	23.2 ± 7.5	0.003	0.97

Patients with a previous history of ischemic heart disease, previous Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Graft (CABG) surgery were excluded from study.

Informed written consent was taken from patients and/or patients' family. Risk factors assessment for CAD was done through detailed medical history and clinically relevant laboratory investigations.

Thrombolysis in Myocardial Infarction (TIMI) and GRACE scores for STEMI were calculated at the time of admission for each patient by using specific variables (age, risk factors for CAD, heart rate, weight, time to treatment, systolic blood pressure, serum creatinine, Killip class, cardiac arrest at admission, elevated cardiac markers, and ST elevation/ new onset LBBB on ECG).

The extent and severity of CAD was assessed by the SS-I. All angiographies were seen by 2 cardiologists and SS were calculated by consensus. Occluded infarct-related arteries were scored as occlusions of less than 3 months in duration. Each coronary lesion with a diameter stenosis of at least 50%, in vessels of at least 1.5 mm, were scored (http://www.SYNTAXscore.com). Data obtained were converted into variables and were analyzed using the Statistical Package for Social Sciences (SPSS) version 25. Low, intermediate and high-risk groups were made based on GRACE scores (49-125, 126-154 and 155-319, respectively) and TIMI scores (0-4, 5-7 and more than 7, respectively). Mean of SS for each group were compared using one-way ANOVA and Tukey test for post hoc analysis considering GRACE and TIMI scores as independent variables and correlation between SS and GRACE and TIMI scores were calculated using Pearson's correlation.

RESULTS

A total of 376 patients were included in our study. Minimum age recorded was 25 years and maximum 90 years. Male subjects were 327 (86.9%) while female were 49 (13.1%), with male to female ratio 6.6:1. Anterior wall MI was the most common presentation 164 (43.6%), followed by inferior wall MI 151 (40.1%), anterior-lateral MI 43 (11.4%) and lateral wall MI 18 (4.8%). Among risk factors for CAD, hypertension was the most common one 215 (57.2%) followed by diabetes mellitus 136 (36.1%) and current cigarette smoking 130 (34.5%) (table-I).

A positive correlation was noted between both of GRACE and TIMI scores for STEMI and SS. A positive correlation was found among SS for GRACE low, intermediate and high-risk groups (0.145) (table-III, fig-1).

Figure-1: Comaprison of mean syntax score among grace scores groups.

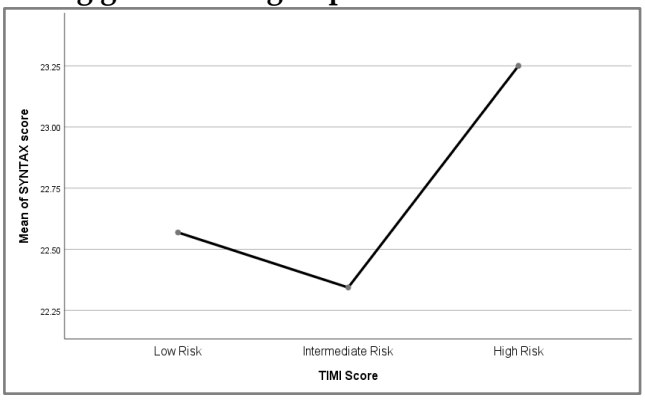

Figure-2: Comaprison of mean syntax score among timi scores groups.

The assumption of homogeneity of variance was tested for both GRACE and TIMI scores and were found tenable using Levene's Test F (2, 115) = 0.175, and F (2, 115) = 0.79, although *p*-value calculated were insignificant 0.25 and 0.97, respectively for GRACE and TIMI scores (table-III).

DISCUSSION

Current study was done with an aim to find the strength of association between risk scoring systems and severity of CAD. Synergy between Percutaneous Coronary Intervention with Taxus and Cardiac Surgery (SYNTAX) score quantifies the properties of lesion including complexity, morphology and location in the coronary tree and predicts outcome after PCI or CABG surgery in patients with CAD[9,10].

Both GRACE and TIMI scores are calculated as sum of independent variables but do include coronary anatomy and properties. Their role in predicting adverse events following ACS have been validated in previous studies[11-13].

A significantly positive correlation was found between GRACE scores and SS (r=0.176) and also between TIMI scores and SS (r=0.162) (table-II).

Bekler *et al* have reported similar findings in consideration to GRACE score and SS (r=0.423), TIMI risk index and SS (r=0.121)[14]. Study reported by Acet *et al* has shown a positive correlation between a high TIMI Risk Index and SS (r=0.24, $p<0.001$)[12].

Studies reported by Cakar MA[16] and Barbosa CE[17] have also reported similar relationships between risk scoring systems and severity of CAD among Non-STEMI patients.

This study has also shown a rising trend of SS in relation to rising GRACE score, and has given a positive correlation of SS among low, intermediate and high-risk groups for GRACE scores (r=0.145), but the result was not statistically significant (p=0.25). Cakar *et al*[16] has also found GRACE score to be a better predictor of CAD severity.

In our study, TIMI score was, although, found to have an overall positive correlation with SS, but changing trends among low, intermediate and high-risk groups were not found to have well correlated and neither this changing trend was statistically significant (r=0.003, p=0.97) (table-III, fig-1 & 2). In contrary to this finding, PRISM-PLUS studyhave found more severe CAD wasin patients with high TIMI score comparing with low TIMI score among NSTEMI patients[18].

Santos *et al*[19] had noted higher frequency of three vessel or left main coronary disease in NSTEMI patients having higher TIMI scores.

Although this study gives an insight to an account of relationship between clinical risk scores and CAD severity, but there are number of limitations to this study. First, it is a single center study and number of subjects included might not be enough to make outcomes generalized to all patients presented with STEMI. Secondly, estimation of CAD severity involved operator visual assessment without physiological evaluation.

CONCLUSION

Both the GRACE and TIMI risk scores were found to have good predictive value for assessing severity of CAD in subjects presented with STEMI. Patients having high GRACE and TIMI scores were more likely to have severe CAD. In comparison with TIMI score, GRACE score was found having better correlation with SS, but degree of that association was not strong enough to make it a reliable and sole predictor of CAD severity.

CONFLICT OF INTEREST

This study has no conflict of interest to declare by any author.

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