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Association Between Clinical Risk Scores (GRACE, HEART) and Angiographic Disease Complexity Among Women with Non-ST Elevation Myocardial Infarction

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A B S T R A C T

Objectives: To determine the correlation of GRACE score and HEART score with angiographic disease complexity, as indicated by SYNTAX score in females with NSTEMI.

Methodology: This cross-sectional study was conducted at Fauji Foundation Hospital, Rawalpindi in six months from June 2024 to November 2024. After informed consent, 170 females who presented with NSTEMI were enrolled by convenient sampling. The GRACE and HEART scores of the patients were calculated. The patients then underwent primary percutaneous coronary angiography and SYNTAX score was estimated to determine angiographic disease complexity. Patients were divided into two groups: Group I having SYNTAX score <33 and Group II with SYNTAX score >33. Correlation of GRACE and HEART scores was seen with the SYNTAX score. The statistical analysis was carried out by the Statistical Package of the Social Sciences (SPSS) version 25.

Results: There was a significant difference in age, diabetes mellitus and hypertension between the patients with SYNTAX score <33 and >33.A significant difference existed in GRACE and HEART scores between the two groups, with higher scores in patients with SYNTAX score >33. When the correlation was seen between GRACE Score and SYNTAX score, the Pearson correlation coefficient was 0.605 showing strong correlation and p-value was significant (0.001). The Pearson correlation coefficient was 0.508 for HEART and SYNTAX scores with moderate significant correlation (p-value=0.001).

Conclusion: There is a strong and significant correlation between GRACE and angiographic disease severity, as indicated by SYNTAX score. Similarly, the association between HEART and SYNTAX scores is moderately significant. The GRACE and HEART scores are significantly higher in patients with SYNTAX score >33.

Keywords: GRACE score, HEART score, Angiographic disease complexity, SYNTAX score, Non-ST elevation myocardial infarction; NSTEMI.

Introduction

Coronary artery disease (CAD) poses a significant challenge to healthcare systems due to continued increase in its prevalence.[1] It is responsible for causing a considerable proportion of deaths worldwide. The disease is common in high-income and low- to middle-income countries (LMIC). Middle-East countries still face the highest disease burden.[2] The management of CAD includes diagnostic tests, lifestyle changes, medications, invasive procedures, and cardiac rehabilitation. The primary percutaneous coronary intervention (P-PCI) has altered the outcomes of patients with CAD dramatically with lesser chances of restenosis.[1]

Non-ST-elevation myocardial infarction is a frequent entity of acute coronary syndrome. It is important to stratify patients with NSTEMI at higher risk of developing advent events and treat them on priority basis including invasive management, if eligible for their better prognosis.[3] The invasive revscularization strategies have a well-established role in treatment of NSTEMI. But the timing of invasive management is really crucial in this context. Literature reveals that early invasive management with 24 hours has potential advantages in high risk patients with NSEMI.[4]

Various risk scores are used to determine the extent of coronary artery disease. Among these, the Global Registry of Acute Coronary Events (GRACE), thrombolysis in myocardial infarction (TIMI) and History, ECG, Age, Risk factors and Troponin (HEART) scores are commonly used across the world.[5] The GRACE score has long been used for predicting mortality and major adverse cardiovascular events (MACE) in patients with acute coronary syndrome (ACS) at long-term follow-up. But it also has a better discriminative ability to particularly stratify risk in patients with ACS, aligning the risk to treatment guidelines.[6] Recent literature shows that just like GRACE and TIMI scores, the HEART score has also been validated for use in acute emergency setting in patients with ACS. It identified patients of ACS as low risk and high risk with a sensitivity of 99.5% and a specificity of 90.9%.[7]

This study was conducted to determine the correlation of GRACE score and HEART score with angiographic disease complexity, as indicated by SYNTAX score in females with NSTEMI. Most of the studies conducted in the literature evaluated the correlation of GRACE and HEART scores in acute coronary syndrome which in addition to NSTEMI also included patients with ST elevation myocardial infarction (STEMI) and unstable angina. In addition, in these studies majority of the patients were males due to increased prevalence of CAD in males. But our study included female patients with NSTEMI to see the association of risk scores in them. The results of the study would help us to use GRACE and HEART scores in future to predict the angiographic disease severity and treat them on priority basis to prevent adverse cardiac events and improve disease prognosis.

Methodology

This cross-sectional study was conducted at Fauji Foundation Hospital, Rawalpindi in six months from June 2024 to November 2024 after ethical approval Ref no. 848/RC/FFH/RWP. After informed consent, 170 females who presented with NSTEMI were enrolled by convenient sampling. The diagnosis of NSTEMI was made based on clinical history, raised troponin levels and ST segment depression and T wave inversion on electrocardiogram (ECG). Male patients and those with STEMI or unstable angina were excluded. The age, body mass index (BMI) and co-morbidities such as diabetes mellitus (DM), hypertension (HTN), smoking, dyslipidemia & family history of CAD) were noted. The GRACE and HEART scores of the patients were calculated.

The GRACE score has 8 parameters. These are age, heat rate, systolic blood pressure, creatinine concentration, Killip class, elevated troponin, cardiac arrest on admission and deviation of ST-segment deviation. It has a total score of 372 points. Patients are divided into low risk (≤108 score), intermediate risk (109–139 score) and high risk (≥140 score).[6] The HEART score has 5 parameters of history, ECG findings, age, risk factors, and initial troponin levels, with 2 points for each. This makes the total score of 10. Patients are classified as low risk with score 0-3, intermediate-risk with score 4-6, and high risk with score 7–10.[7]

The patients then underwent primary percutaneous coronary angiography and SYNTAX score was estimated to determine angiographic disease severity. It is calculated by summing up the score given to individual lesions in the coronary tree (which is divided into 16 segments). The segments with >1.5 mm diameter are included with ≥50% occlusion. The score ranges from 0 to >60. Scores <22 are labeled as low risk, 22-32 as intermediate and >33 as high risk.[8] Patients were divided into two groups: Group I having SYNTAX score <33 and Group II with SYNTAX score >33. The demographic variables, co-morbidities, and risk scores were compared between the two groups. Correlation of GRACE and HEART scores was seen with the SYNTAX score.

The statistical analysis was carried out by the Statistical Package of the Social Sciences (SPSS) version 25. Qualitative and quantitative variables were expressed using frequency (percentage) and mean (standard deviation). The demographic variables, co-morbidities, and risk scores were compared between the two groups of patients using student t-test for quantitative and chi-square test for qualitative variables. Correlation of GRACE and HEART scores was seen with the SYNTAX score using the Pearson correlation coefficient. The

correlation is weak if correlation coefficient (ρ) is <0.4, moderate if ρ ranges from 0.4-0.59, strong with ρ from 0.6-0.79 and very strong with ρ from 0.8 to 1. The significant p-value was <0.05.

Results

The mean age of the patients was 58.65 ± 6 years and their mean BMI was 27.87 ± 1.37 kg/m^2. Out of 170 patients, 75(44.1%) patients were hypertensive, 66(38.8%) were diabetic, 15(8.8%) were hookah smokers, 14(8.2%) had dyslipidemia and 22(12.9%) had a positive family history of CAD. When these variables were compared between two groups, they differed significantly in age, DM and HTN. The difference in these variables between the two groups is shown in Table I.

Table I: Demographic variables & Co-morbidities in Group I and II.

Variable	Group I SYNTAX < 33	Group II SYNTAX > 33	p-value
Age (Years)	57.08 ± 4.49	67.34 ± 5.95	0.001*
BMI (kg/m^2)	28.84 ± 1.38	28.06 ± 1.30	0.448
Diabetic	49(28.8%)	17(10%)	0.003*
Hypertensive	59(34.7%)	16(9.4%)	0.05*
Dyslipidemia	12(7%)	2(1.2%)	0.91
Smoking	13(7.6%)	2(1.2%)	0.825
Family History of CAD	17(10%)	5(2.9%)	0.299

*Statistically significant

Table II: Risk Scores in Patients of Group I (n = 144) and II (n = 26)

Risk Score	Group I SYNTAX < 33	Group II SYNTAX > 33	p-value
GRACE score	104.93 ± 17.38	135.11 ± 16.92	0.001*
Low Risk	75(44.1%)	4(2.4%)	0.001*
Intermediate Risk	51(30%)	0(0%)	
High Risk	18(10.6%)	22(12.9%)	
HEART score	4.13 ± 1.73	6.88 ± 1.79	0.001*
Low Risk	44(25.9%)	2(1.2%)	0.001*
Intermediate Risk	86(50.6%)	3(1.8%)	
High Risk	14(8.2%)	21(12.4%)	
SYNTAX score	18.67 ± 5.29	34.34 ± 2.85	0.001*

*Statistically Significant

The mean GRACE score was 109.5 ± 20.41. 79(46.5%) of the patients had low, 51(30%) had intermediate and 40(23.5%) had high risk score. The mean HEART score was 4.55 ± 2 with 46(27.1%) of the patients having low, 89(52.4%) intermediate and 35(20.6%) having high risk score. The mean SYNTAX score was 21.07 ± 7.54. Eighty (47.1%) of the patients had low, 64(37.6%) had

intermediate and 26(15.3%) had high SYNTAX score. A significant difference existed in mean GRACE and HEART scores between the two groups, with higher scores in patients with SYNTAX score >33. Similarly, the two groups also differed in low, intermediate and high risk GRACE and HEART scores with statistical significance (Table II).

When the correlation was seen between GRACE Score and SYNTAX score (indicating angiographic disease severity), the Pearson correlation coefficient was 0.605 showing strong correlation and p-value was significant (0.001). The Pearson correlation coefficient was 0.508 for HEART and SYNTAX scores with moderate significant correlation (p-value=0.001). Figure A & B
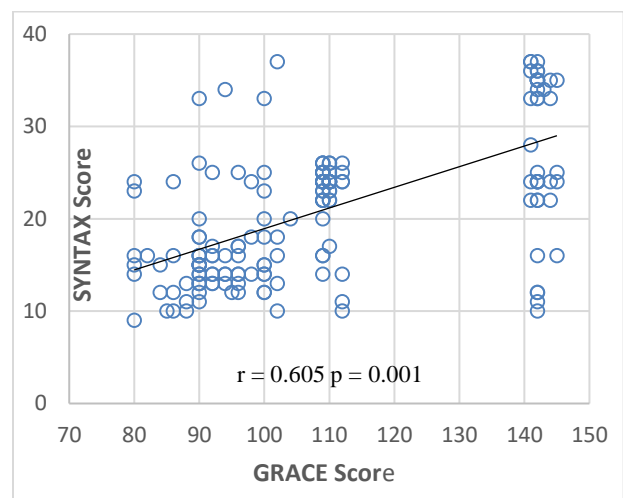

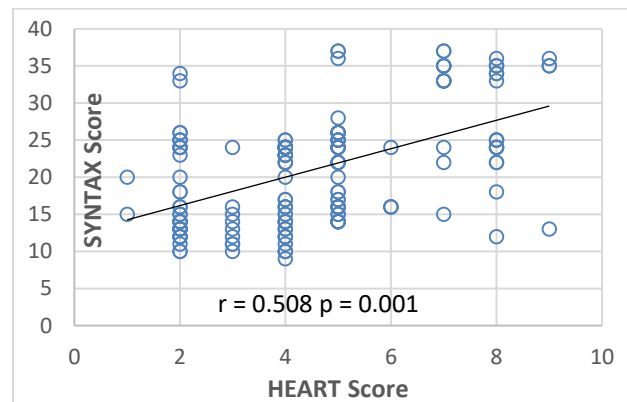Figure 1 (A): Association between SYNTAX Score and GRACE Score.

Figure (B). Association between SYNTAX Score and HEART Score.

Discussion

Risk stratification is an essential component of management of NSTEMI for optimization of outcomes in patients. This is because P-PCI is the treatment of choice in high risk patients. Various scores are being used for

risk assessment but implementing the right risk score with a high predictive role is a great challenge.[9]

The average age of the patients was 58.6±6 years in our study. In another study, study participants had an average age of 58.42 ± 12.42 years.[10] Rahman et al. reported the average age of 54.8 ± 9.2 years.[11] Similarly, the mean age was 57.2 ± 11.6 years in a study.[12] The mean age was higher i.e. 62.09±9.74 years and 63 ± 13 years in two other studies.[13,14] In most of the studies, majority of the participants were males.[10-14] but in our study, all the participants were females. In our study, hypertension was the most common co-morbidity affecting 44.1% of the patients followed by DM (38.8%). Almost 8% of the patients had dyslipidemia & were smokers and 12.9% had a positive family history of CAD. Similarly, hypertension was most common among the study population in some other studies but the prevalence of co-morbidities was very high compared to our study. In a study, 60% of the study participants were hypertensive, 40% diabetic, 25% smokers and 35% had dyslipidemia.[10] Rahman et al. reported HTN in 56% and DM in 44% of the patients.[11] Hypertension, smoking and diabetes were found in 62%, 51% and 47% of our patients, respectively.[15] But unlike our study, the most common co-morbidity was smoking (60.4%) followed by dyslipidemia (44.4%) and diabetes (31.7%) in a study by Nimazi et al.[12]

In our study, the mean GRACE score was 109.5±20.41 with 46.5% of the patients having low, 30% intermediate and 23.5% had high risk score. In another study, the study participants had a mean GRACE score of 133.92 ± 27.56 and 20% of them had low, 46% had intermediate and 34% had high score.[11] According to the study by Sofidis et al., the mean GRACE score was 116 ± 38 and 42.1% of the patients were low-risk, 31.2% intermediate-risk and 26.7% had high-risk.[14] In another study, the mean score was 114.5 ± 26.2 with low, intermediate and high risk scores in 48.5%, 37.6% and 13.9% of the patients respectively.[12] The mean score was 118.05±32.41 reported by Khawaja et al. with 19.2%, 60.43% and 20.14% of the participants in low, intermediate and high risk score categories.[13] Hammari er al. revealed low risk score in 36%, intermediate score in 35% and high risk score in 29% of the patients.[15] Our results showed that the mean HEART score was 4.55±2 with 46(27.1%) of the patients having low, 89(52.4%) intermediate and 35(20.6%) having high risk score. The mean HEART Score was 5.76 ± 1.56 with low, intermediate and high scores in 6%, 62% and 32% of the

patients.[10] The mean SYNTAX score was 21.07±7.54. Eighty (47.1%) of the patients had low, 64(37.6%) had intermediate and 26(15.3%) had high SYNTAX score. The mean score was 14.82 ± 11.42 in a study by Salimi et al. and 11.18±9 in a study by Hammari et al.[10,15] The mean SYNTAX score was 16.2 ± 13.4 in another study with 72.7% of the patients having low, 15.8% had intermediate and 11.5% having high SYNTAX score.[14] In a study, 85.1% of the patients had low SYNTAX score and 14.9% had intermediate score. None of them had high risk score. The mean score of the patients was 15.1 ± 5.9.[12] The mean score was 24.73±13.73 with low score in 35.3%, intermediate in 42.4% and high in 21.6% of the participants.[13] When these variables were compared between patients having SYNTAX score < 33 and score > 33, they differed significantly in age, DM and HTN. A significant difference existed in mean GRACE and HEART scores between the two groups, with higher scores in patients with SYNTAX score >33. Similarly, in a study by Sofidis et al., there was a significant difference in age, HTN, DM and GRACE score between the two groups.[14]

In our study, a strong and significant correlation was seen between GRACE and SYNTAX scores. Sofidis et al. reported a weak significant relation between the two scores (r = 0.32) in all patients with ACS.[14] Another study found a very strong correlation between GRACE and SYNTAX scores (r = 0.867) with statistical significance but the study enrolled all patients with ACS.[12] Khawaja et al. revealed a positive correlation between the two scores in patients with NSTEMI and unstable angina.[13] In two studies, there was a significant positive but weak correlation between the two scores (r=0.23 & 0.18).[15,16] A study conducted in NICVD, Karachi, Pakistan revealed no correlation between GRACE risk score and SYNTAX score in patients with NSTEMI (r=0.179) with p-value as 0.068.[17] In a study by Rahman et al., the severity of CAD was determined by Gensini score, rather than Syntax score. The correlation was strong and significant between the two scores.[11] In another study, a weak insignificant association was seen between GRACE and GENCINI scores (r = 0.322).[18] Our study revealed a moderate significant correlation between HEART and SYNTAX scores (r = 0.508). Similarly, a study also found moderate correlation between the two scores with the correlation coefficient of 0.493 with significant results in all patients with ACS.[10] Another study reported a weak positive but significant association between the two scores (r = 0.29).[16] A study determined the association of HEART score and CAD severity,

indicated by GENCINI score with a significant but weak correlation (r = 0.39).[18]

Conclusion

There is a strong and significant correlation between GRACE and angiographic disease severity, as indicated by SYNTAX score. Similarly, the association between HEART and SYNTAX scores is moderately significant. The GRACE and HEART scores are significantly higher in patients with SYNTAX score >33.

Strengths and limitations of the study: The study determined the correlation of both GRACE and HEART scores with the angiographic disease complexity, as indicated by SYNTAX score primarily focusing on female NSTEMI patients. But the receiver operating curve (ROC) analysis was not performed and sensitivity & specificity of the risk scores were not calculated to determine their role in predicting angiographic disease severity.

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