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Correlation of Clinical Risk Scores for Unstable Angina with the Angiographic Extent and Severity of Coronary Artery Disease

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ABSTRACT

Objective: In patients presenting with Unstable Angina the correlation of clinical risk predictors and clinical risk scores with angiographic extent of Coronary Artery Disease (CAD) is less well understood. The objective is to assess the correlation of various clinical risk scores for unstable angina and individual clinical risk factors with the extent and severity of coronary artery disease as assessed by coronary angiography.

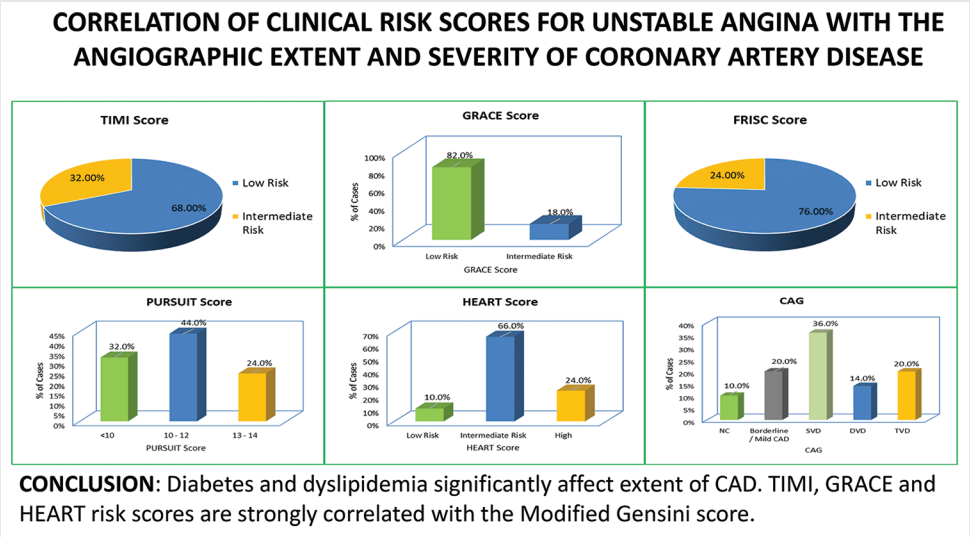
Materials and Methods: The present study was a single centre, hospital based, observational, cross-sectional, descriptive study conducted at a tertiary care teaching and research institute in South India. One hundred and fifty patients presenting with chest pain consistent with unstable angina were assessed for existence of independent clinical predictors and calculations were done for their 5 clinical risk scores. Coronary angiography was performed in all the patients leading to the generation of Modified Gensini score and its correlation with the various clinical risk scores was done.

Results: Presence of dyslipidemia and diabetes were stronger predictors of Modified Gensini score. TIMI, GRACE& HEART risk scores had moderate correlation with angiographic severity while FRISC and PURSUIT scoring systems had a weak correlation.

Conclusion: Presence of dyslipidemia and diabetes significantly affect the extent of CAD. Thus their presence in patients presenting with unstable angina assign them to the high risk category. Angiographic extent of CAD was strongly correlated with TIMI, GRACE and HEART risk scores, thus emphasizing on their use in risk stratification and in identifying the category of patients likely to make the most out of an early invasive strategy.

Keywords: Risk scores, Angiographic extent, Coronary artery disease

ABSTRACT IMAGE



INTRODUCTION

Despite the decline in age-adjusted cardiovascular disease mortality over the past three decade, ischemic heart disease remains the leading cause of death worldwide, affecting 197 million individuals and is responsible for 9.14 million deaths annually with more disability life-years lost (182 million) than any other cause worldwide in 2019.[1] Approximately 2–2.5 million hospital admissions across the globe each year are attributed to non-ST segment elevation acute coronary syndromes. Patients who present with features of high risk unstable angina are at increased risk for death, myocardial infarction (MI) or recurrent ischemic events. Coronary angiography (CAG) is invaluable in prediction of major adverse cardiovascular events (MACE) in unstable angina and dictates the decision regarding revascularization.[2] Clinical predictors for the high risk group include duration of age, chest pain, ST segment depression in electrocardiogram (ECG), congestive heart failure (CHF), and cardiac biomarker positivity.[3] Moreover, in patients who demonstrate multivessel coronary artery disease (CAD) on CAG, percutaneous coronary intervention (PCI) is the preferred treatment modality.[4,5] Importantly, clinical risk scores, including thrombolysis in MI (TIMI) score, platelet glycoprotein IIb-IIIa in unstable angina receptor suppression using integrilin therapy (PURSUIT) score, global registry of acute coronary events (GRACE) score, fast revascularization in instability in coronary disease (FRISC) score, and HEART risk score, have been proven in risk stratification and informing prognosis in patients with unstable angina.[6-9]

Aim of study

The aim of the study was to assess the correlation of TIMI, PURSUIT, GRACE, FRISC, and HEART risk scores with angiographic extent of CAD as assessed by the modified Gensini score, and to prognosticate the angiographic severity based on the various independent clinical predictors (age, sex, smoking, dyslipidemia, hypertension, diabetes, and ECG changes).

MATERIALS AND METHODS

The present study was a single center, hospital-based, observational, cross-sectional, and descriptive study conducted at a tertiary care teaching and research institute in South India. One hundred and fifty patients were enrolled between September 2021 and December 2021. Inclusion criteria for the study comprised of patients presenting with chest pain consistent with unstable angina with the latest episode of angina taking place within 72 h of hospital admission. Unstable angina was defined as angina or its equivalent with at least one of the three features: (1) Sudden onset of symptoms at rest (or with minimal exertion) that last at least 10 min unless treated promptly; (2) severe pain, pressure or discomfort in the chest; and (3) an accelerating pattern of angina that develops more frequently, with greater severity, or that awakens the patient from sleep.[2] Patients were excluded if >72 h had elapsed since their last episode of chest pain, or if there was a history of having a documented MI, or having undergone a percutaneous transluminal coronary angioplasty or coronary artery bypass grafting. Patients having a history of allergic or anaphylactic reaction to iodinated contrast media were also excluded

from the study. Furthermore, patients presenting with chest pain and ECG features consistent with unstable angina were excluded from the study; if on laboratory evaluation, they had elevated cardiac serum markers such as creatine kinase-muscle brain enzyme or Troponin T or I (markers of myocardial necrosis). These patients were reclassified as non-ST elevation MI (NSTEMI) and were thus excluded from the study. Informed and written consent was obtained from each patient. The study was approved by the Institutional Ethical Committee. All patients were evaluated by application of a standard questionnaire regarding the presence of main risk factors (hypertension, diabetes, dyslipidemia, and smoking). All patients underwent a detailed clinical examination, 12 lead surface ECG, routine biochemical tests including lipid profile, cardiac serum markers, and two dimensional echocardiography. TIMI, GRACE, PURSUIT FRISC, and HEART Scores were calculated based on history, vital parameters, laboratory investigations, and ECG.

Diagnostic CAG was performed for all patients. All stenotic lesions were imaged in two orthogonal views and lesions having ≥50% visual diameter stenosis were considered significant. Investigator had specified the risk factors and risk scores before comparing them with CAG findings. Modified Gensini score was calculated based on the findings of the CAG and was used for the assessment of the severity of CAD. The method for calculation of the modified Gensini score has already been described in detail elsewhere.[10,11]

Statistical analysis

The modified Gensini score was evaluated in the form of mean and standard deviation. Multiple linear regressions were used for the assessment of the correlation of the six independent clinical risk predictors with the modified Gensini score. Categorization of high, intermediate, and low risk was done for the various scores. For the TIMI score, low risk was a score of 0–2, intermediate risk 3–5, and high risk 6–7; GRACE score was low risk if ≤108, intermediate risk 109–140, and high risk >104; FRISC score of 0–2 was low risk, 3–4 intermediate risk, and 5–7 high risk; HEART score of 0–2 was low risk, 3–6 intermediate risk, and 7–10 high risk; for the PURSUIT score four quartiles were defined as score <10, 10–12, 13–14, and >14. The relationship of these five risk scores with the Modified Gensini Score was assessed using the Pearson's coefficient "r". Student's *t*-test and Pearson's coefficient "r" were used to gauge the association of the clinical risk scores with the modified Gensini score.

RESULTS

Mean age ± SD of the study population was 58 ± 37 years with the range being 35–75 years. About 6% of the patients were ≤45 years of age, 60% were in 46–60 years age group, and 34% were 61 years and above. Out of total patient population, 74% were males and 26% were females.

About 72% of the patients were hypertensive, 50% of the patients were diabetic, and only 6% of the patients had dyslipidemia on presentation. About 10% of the patients had a history of smoking. About 52% of patients had presence of ST depression on ECG at the time of presentation.

For the TIMI risk score, 68% of patients were in the low risk category whereas 32% of patients were in the intermediate risk category. The mean Modified Gensini Score (±Standard deviation) for the low-risk category was 71.8 (±51.1), and for the intermediate risk category was 111.9 (±68). With regard to the GRACE risk score, 82% of the patients were in the low risk category versus 18% of the patients in the intermediate risk category. The low risk category had a mean Modified Gensini Score (±Standard deviation) of 83.9 (±64.3), while for patients in intermediate risk category, it was 87.8 (±60.2). About 76% of patients were in the low-risk FRISC category while 24% were in the intermediate risk category. The mean Modified Gensini Score (±Standard deviation) for the low-risk category was 81 (±58.6), and for the intermediate risk category was 95.8 (±77.3). About 32% of the patients fell in the lowest quartile of the PURSUIT risk score of <10, 44% were in the 10–12 score quartile, as opposed to 24% being in the third quartile of 13–14 score. The mean Modified Gensini Score (±Standard deviation) was 59.4 (±56.4), 87.7 (±65.3), and 112.5 (±58.5), respectively, for the score quartiles of <10, 10–12, and 13–14. For the HEART risk score, 10%, 66%, and 24% of the patients were in the low, intermediate, and high risk categories, respectively. The corresponding mean Modified Gensini Score (±Standard deviation) was 24 (±16.7), 78.8 (±56), and 125.8 (±69.6).

For the subgroup analysis of males versus females, the mean Modified Gensini Score (±Standard deviation) for males in the TIMI low-risk category (n = 81) was 69.3 (± 51.7) and for the intermediate risk category (n = 30) was 103 (± 72.3). For females in the TIMI low-risk category (n = 21), it was 81.3 (±78.8), and for the intermediate risk category (n = 18) was 126.7 (±62.8). For the GRACE risk score, males in the low-risk category (n = 96) had mean Modified Gensini Score (±standard deviation) of 79.1 (±59.8), and in the intermediate risk category (n = 15) had score of 72 (±59). The respective scores for females were 101.1 (±80.1) (n = 27), and 105 (±65.6) (n = 12). Males in low (n = 75) and intermediate risk scores (n = 36) of the FRISC had respective mean Modified Gensini Score (±standard deviation) of 70 (±47.3) and 95.8 (±77.3), while females in the low-risk category (n = 39) had score of 102 (±73.2) with no female falling in the intermediate or high FRISC score category. For the PURSUIT risk score, males in the score quartiles of <10 (n = 36), 10–12 (n = 48), and 13–14 (n = 27) had respective mean Modified Gesini

Score (±standard deviation) of 66.7 (±56.8), 71.9 (±56.5), and 105.6 (±63.8). The respective scores for females were 37.5 (±56.8) (n = 12), 130 (±73.5) (n = 18), and 133.3 (±40.4) (n = 9). For males falling in the low (n = 12), intermediate (n = 78), and high (n = 21) HEART risk score categories the respective mean Modified Gensini Risk Scores (±Standard deviation) were 30 (±11.5), 72.7 (±50.8), and 127.1 (±74.3). For females, the respective scores were 0 (n = 3), 72.2 101.4 (±72.2) (n = 21), and 124 (±70.9) (n = 15).

Out of the total 150 patients, 10% had normal coronaries on CAG, 20% had borderline CAD, 36% had single vessel disease (SVD), 14% had double vessel disease (DVD), whereas triple vessel disease (TVD) was found in 20% of the patients. The mean (±Standard deviation) Modified Gensini Score for patients with borderline/mild CAD was 37 (±25.8), for SVD 65 (±25), for DVD 128.6 (±16.8), and for TVD 179 (±30.4).

Results of multiple linear regression analysis suggested a significant association of dyslipidemia (P = 0.042) and diabetes (P = 0.036) with the Modified Gensini score. All the other independent clinical risk factors, including male sex (P = 0.243), hypertension (P = 0.157), smoking (P = 0.842), and ST depression (P = 0.065), did not have a statistically significant association with the Modified Gensini score.

Pearson's correlation coefficient "r" of the five Risk Scores with Modified Gensini Score, at 95% confidence intervals, were – TIMI risk score: 0.404, GRACE risk score: 0.322, PURSUIT risk score: 0.262, FRISC risk score: 0.246, and HEART risk score: 0.390. There is a moderate positive correlation of TIMI, GRACE, and HEART risk scores with Modified Gensini Score whereas PURSUIT and FRISC risk scores showed weak positive correlation.The P value for the association of the various risk scores with the Modified Gensini score was – TIMI risk score: 0.034, GRACE risk score: 0.869, FRISC risk score: 0.484, PURSUIT risk score: 0.081, and HEART risk score: 0.005. Thus, TIMI and HEART risk scores had a statistically significant association with the angiographic score [Figure 1].

DISCUSSION

Risk scores are useful for risk stratification of unstable angina patients and selection of the appropriate management strategy in the high risk group. The present study is directed at evaluating the predictive value of the various risk scores with respect to the angiographic severity of CAD. This study is among the preliminary ones to compare the array of clinical risk scores available hitherto for unstable angina with the angiographic severity. The novelty in the present study is the use of the modified Gensini score for the assessment of the angiographic severity. In addition, individual risk stratification factors are evaluated for their prognostic value as opposed to just low/intermediate or high risk group.

In the present study, it is shown that out of the various independent clinical predictors, presence of dyslipidemia and diabetes affect the Modified Gensini Score significantly. In addition, it shows that among the various risk scoring systems, TIMI, GRACE, and HEART have moderate correlation with angiographic severity while FRISC and PURSUIT scoring systems had a weak correlation.

In the study performed by de Araújo Gonçalves *et al.*, it was shown that the clinical risk scores have good accuracy

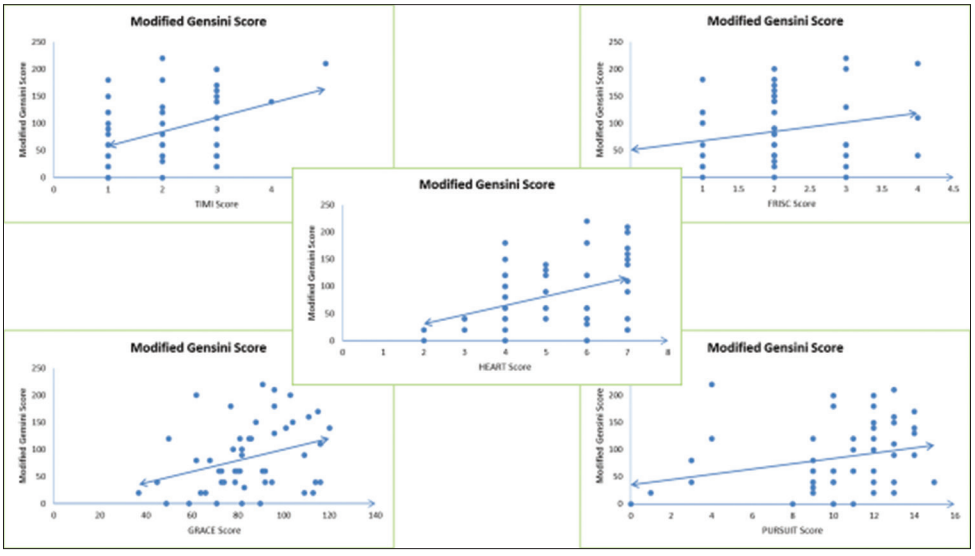


Figure 1: Correlation of various clinical risk scores with the Modified Gensini Score.

for prediction of death or MI at 1 year and facilitated the selection of high-risk subsets of patients who are likely to benefit the most from percutaneous intervention performed during the index hospital stay.[12] The study conducted by Zhao *et al*., revealed significant lowering of combined cardiovascular events in patients with NSTEMI having moderate and high TIMI risk score who underwent early invasive strategy compared to an early conservative strategy.[13] In a study by Walsh *et al*., symptomatic and mortality benefit was demonstrated in elderly population with high-risk TIMI scores undergoing PCI.[14] The afore mentioned studies revealed a good predictive value of the risk scoring systems for risk stratification and prognosis. Since MACEs are independently influenced by the angiographic severity, predicting the angiographic extent of CAD from various independent clinical risk predictors and appropriate risk scoring systems would be helpful.

Mathew *et al*. demonstrated the correlation of the angiographic extent of CAD with the risk stratification in accord with the Agency for Health Care Policy and Research guidelines, such that angiographically significant CAD was likely in patients at intermediate and high risk.[15] Garcia *et al*. studied the correlation between clinical risks and extent of CAD in NSTEMI and revealed that normal coronaries or borderline CAD was seen in patients with low clinical risk, whereas patients in high clinical risk had higher prevalence of severe CAD or left main artery disease compared with patients in low risk, thus exhibiting the existence of a clear relation between TIMI risk score and angiography score in patients with NSTEMI.[16] Angiographic severity was based on single/double/TVD in these studies. Whereas Modified Gensini score was used in the present study, which is a more elaborate score that includes both the number of diseased vessels and the severity of stenosis in each vessel.[11]

In a study by Khandelwal *et al*., use of aspirin, age ≥65 years, presence of CHF, and presence of elevated cardiac enzymes were the major predictors of the magnitude of CAD, and the extent of CAD was better predicted by the PURSUIT and GRACE risk scores.[17] Kumar *et al*., studied that the correlation of TIMI, GRACE, and PURSUIT risk scores in patients of unstable angina/NSTEMI and the angiographic extent was assessed using the Syntax Score. They showed significantly greater angiographic disease in patients with higher TIMI, GRACE, and PURSUIT scores. Furthermore, the presence of CHF, >2 anginal episodes within 24 h, and the presence of elevated biomarkers were strong predictors of the extent of CAD, whereas the presence of CHF and higher GRACE scores had a significant correlation with MACE at 6–month follow-up.[18]

The study conducted by Sebastian *et al*., evaluating multiple risk scores in unstable angina/NSTEMI patients for the assessment of medium-to-long-term clinical outcomes, patients treated with coronary interventions having less complex multivessel CAD, the SYNTAX score II (SSII), age, creatinine, and ejection fraction and clinical SYNTAX score risk scores predicted favorable outcomes. With respect to all-cause mortality and MACE, better predictive performance was shown for the SSII score. Whereas, mortality and MACE was predicted poorly by scores based only on the extent of atherosclerosis (SS, residual SYNTAX score (rSS), and SYNTAX revascularization index (SRI)).[19]

Limitation

The limitation of this study is the lower than expected frequency of smoking and dyslipidemia in the study population which may have affected the statistical significance of their correlation with the angiographic score. Furthermore, this being a single-center study, the sample size is small thus limiting the generalizability of the results to the general population.

CONCLUSION

The presence of dyslipidemia and diabetes significantly affect the extent of CAD. Thus, their presence in patients presenting with unstable angina assign them to the high risk category. Angiographic extent of CAD was strongly correlated with TIMI, GRACE, and HEART risk scores, thus emphasizing on their use in risk stratification and in identifying the category of patients likely to make the most out of an early invasive strategy.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Roth GA, Mensah GA, Johnson CO, Addolorato G, Ammirati E, Baddour LM, *et al*. Global burden of cardiovascular diseases and risk factors, 1990-2019: Update from the GBD 2019 study. J Am Coll Cardiol 2020;76:2982-3021.
2. Braunwald E, Antman EM, Beasley JW, Califf RM, Cheitlin MD, Hochman JS, *et al*. ACC/AHA guidelines for the management of patients with unstable angina and non ST segment elevation myocardial infarction: A report of the ACC/AHA task force on practice guidelines (Committee on the management of patients with Unstable Angina). J Am Coll Cardiol 2000;36:970-2.

3. Granger CB, Goldberg RJ, Dabbous O, Pieper KS, Eagle KA, Cannon CP, *et al*. Predictors of hospital mortality in the global registry of acute coronary events. Arch Intern Med 2003;163:2345-53.
4. Authors/Task Force members; Windecker S, Kolh P, Alfonso F, Collet JP, Cremer J, *et al*. 2014 ESC/EACTS guidelines on myocardial revascularization: The task force on myocardial revascularization of the European society of Cardiology (ESC) and the European association for cardio-thoracic surgery (EACTS). Developed with the special contribution of the European association of percutaneous cardiovascular interventions (EAPCI). Eur Heart J 2014;35:2541-619.
5. Levine GN, Bates ER, Blankenship JC. 2015 ACC/AHA/SCAI focused update on primary percutaneous coronary intervention for patients with ST-elevation myocardial infarction: An update of the 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention and the 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: A report of the American College of Cardiology/American heart association task force on clinical practice guidelines and the society for cardiovascular angiography and interventions. Circulation 2016;133:1135-47.
6. Antman EM, Cohen M, Bernink PJ, McCabe CH, Horacek T, Papuchis G, *et al*. The TIMI risk score for unstable angina/non-ST elevation MI: A method for prognostication and therapeutic decision making. JAMA 2000;284:835-42.
7. Boersma E, Pieper KS, Steyerberg EW, Wilcox RG, Chang WC, Lee KL, *et al*. Predictors of outcome in patients with acute coronary syndromes without persistent ST-segment elevation. Results from an international trial of 9461 patients. The PURSUIT investigators. Circulation 2000;101:2557-67.
8. Lagerqvist B, Diderholm E, Lindahl B, Husted S, Kontny F, Ståhle E, *et al*. FRISC score for selection of patients for an early invasive treatment strategy in unstable coronary artery disease. Heart 2005;91:1047-52.
9. Six AJ, Backus BE, Kelder JC. Chest pain in the emergency room: Value of the HEART score. Neth Heart J 2008;16:191-6.
10. Gensini GG. The Pathological Anatomy of the Coronary Arteries of Man. Coronary Arteriography. Ch. 10. Mount Kisco: Futura Publishing Co; 1975. p. 271-4.
11. Rampidis GP, Benetos G, Benz DC, Giannopoulos AA, Buechel RR. A guide for Gensini Score calculation. Atherosclerosis 2019;287:181-3.
12. 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;26:865-72.
13. Zhao MZ, Hu DY, Ma CS, Jiang LQ, Huo Y, Zhu TG, *et al*. The relationship between TIMI (thrombolysis in myocardial infarction) risk score and efficacy of conservative or interventional strategy in patients with non-ST-segment elevation acute coronary syndromes. Zhonghua Xin Xue Guan Bing Za Zhi 2006;34:1001-4.
14. Walsh SJ, McAuley K, Johnston PW. Percutaneous coronary intervention in the elderly. Ulster Med J 2007;76:18-21.
15. Mathew V, Farkouh M, Grill DE, Urban LH, Cusma JT, Reeder GS, *et al*. Clinical risk stratification correlates with the angiographic extent of coronary artery disease in unstable angina. J Am Coll Cardiol 2001;37:2053-8.
16. Garcia S, Canoniero M, Peter A, de Marchena E, Ferreira A. Correlation of TIMI risk score with angiographic severity and extent of coronary artery disease in patients with non-ST-elevation acute coronary syndromes. Am J Cardiol 2004;93:813-6.
17. Khandelwal G, Jain A, Rathore M. Prediction of angiographic extent of coronary artery disease on the basis of clinical risk scores in patients of unstable angina. J Clin Diagn Res 2015;9:C13-6.
18. Kumar NV, Rajasekhar D, Vanajakshamma V, SreedharNaik K, Suresh T. Correlation of clinical risk scores with angiographic extent of coronary artery disease in patients with non ST-elevation myocardial infarction/unstable angina and their effects on 6 month outcomes. IOSR J Dent Med Sci 2019;18:55-9.
19. Sebastian G, Pillai V, Manzil A, Damodara R, Kalra I, Abdul Z, *et al*. Comparison of multiple risk scores in assessing medium- to long-term clinical outcomes in unstable angina/non-ST-elevation myocardial infarction patients undergoing multi vessel percutaneous coronary intervention: An observational, registry-based study in India. Indian Heart J 2021;73:555-60.

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