International Surgery Journal
Al-Nimari MZ et al. Int Surg J. 2025 Dec;12(12):2120-2125
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20253836

Original Research Article

Comparison of EuroSCORE II and the society of thoracic surgeons risk score for predicting 30-day mortality among Bangladeshi patients undergoing isolated coronary artery bypass grafting at a single center

M. Zafar Al-Nimari[1]*, Nittyananda Pal[2], Dewan Iftakher Raza Chowdhury[3], Ahmad Pear Salahuddin[3], Mohammad Azizul Islam[2], Satyajit Sharma[1], Oindril Saha[1], Anowarul Azim[1]

[1]Department of Cardiac Surgery, National Heart Foundation Hospital and Research Institute (NHFH and RI), Dhaka, Bangladesh
[2]Department of Cardiac Surgery, Khwaja Yunus Ali Medical College and Hospital, Sirajganj, Bangladesh
[3]Department of Cardiac Surgery, TMSS Medical College and Rafatullah Community Hospital, Bogura, Bangladesh

Received: 19 October 2025
Accepted: 14 November 2025

***Correspondence:**
Dr. M. Zafar-Al-Nimari,
E-mail: dr.zafarjimc@gmail.com

ABSTRACT

Background: There are many risk stratification models have been developed to predict short-term morbidity and mortality after cardiac surgery. This study compared the European system for cardiac operative risk evaluation (EuroSCORE) II and the society of thoracic surgeons (STS) risk score to predict 30-days mortality in patients undergoing isolated coronary artery bypass grafting (CABG).
Methods: This comparative cross-sectional study was carried out in department of cardiac surgery of national heart foundation hospital and research institute, Dhaka, from September 2020 to August 2022. Ethical approval was taken from the institutional review board of NHFH and RI. Following informed written consent, preoperative EuroSCORE II and STS risk score were assessed among total of 500 patients who underwent isolated CABG. Patients were followed up after 30-days to see the outcome. Data were analyzed by SPSS-26. Risk model comparison was done by calculating Z score of area under receiver operator curves, unpaired t test and McNemar's test. $P \leq 0.05$ was considered statistically significant.
Results: Mean±SD age of the study was 60.20±7.46 (SD) years. Maximum patients were male (81.8%), overweight (55.6%), hypertensive (63.6%) and diabetic (44.2%). Mean EuroSCORE II and STS risk score of all patients was 2.51±1.98 and 2.42±1.86, respectively. Overall, 30-days mortality was 1.4% (n=7). Both EuroSCORE II and STS risk score had similar capability in predicting 30-days mortality among isolated CABG patients with excellent accuracy (as area under curve was 0.936 and 0.922, respectively).
Conclusions: Both EuroSCORE II and STS risk score are similarly effective to predict 30-days mortality in isolated CABG patients.

Keywords: EuroSCORE II, STS risk score, Coronary artery bypass grafting, Mortality prediction, Risk stratification, Cardiac surgery

INTRODUCTION

To evaluate operational mortality and morbidity, scoring systems are a crucial component of current cardiac surgical practice. Researchers are constantly updating and changing the risk-stratification algorithms that are now in use due to changes in the case mix, surgical methods, and clinical results in cardiac surgery.[1]

Making risk stratification scores is like attempting to strike a "moving and speeding" target; one can aim at a specific place, but by the time the shot is fired, the target will have moved on, rendering the attempt pointless.[2] In order to accurately anticipate (hit) the real mortality of a surgical procedure (a moving and speeding target), how does one design a risk score (a "gun")? Especially when developing an algorithm to forecast a patient's mortality in the future necessitates collecting data on hundreds of thousands of patients over the course of years.[3,4] No one oppose that developing a risk score is challenging, but using a new risk score is equally mysterious.[5] On the receiving end clinicians must accept the newest risk score on the assumption that it must be superior to the previous one and approving the new score in their own minds.[2]

Risk prediction models have been preowned by cardiac surgery for over 30 years.[6] Many models are used to assess early mortality and also morbidity, including the Parsonnet score, ACEF (Age, creatinine, ejection fraction) score, veterans administration (VA) risk score, STS risk score and EuroSCORE.[7] The most familiar risk prediction models in adults worldwide are the EuroSCORE and the STS score.[8]

These models enable medical professionals to assess a patient's surgical preparedness. In addition to estimating the impact of certain clinical parameters on outcomes, risk prediction models for cardiac surgery are beneficial for patient counseling, selection of treatments, comparing postoperative outcomes, and quality improvement.[3]

EuroSCORE was developed using a database of individuals who had undergone cardiac surgery at the end of 1995 and released in 1999. It was based on all sorts of cardiac procedures, approximately one-third of patients that received valve surgery, whereas the majority of patients had CABG. It was obtained from a dataset from eight European nations. After that, The European association for cardiothoracic surgery (EACTS) conference in Lisbon announced the EuroSCORE II on October 3, 2011, and the online calculator (www.EuroSCORE.org) has been modified to reflect this new risk stratification model. The EuroSCORE was successfully adopted and implemented throughout Europe, North America, and Asia in the years after its release. This updated EuroSCORE II, making it more relevant to a wider range of surgical operations and using fewer variables than the STS risk score.[9] Similar approach is used in EuroSCORE II, but it is drawn from more recent data and has been improved to integrate evidence-based changes and better reflect modern cardiac surgery practice. This score reduces the previous EuroSCORE I's overestimation of the probability and impact.[4]

The objective of this study was to determine the best scoring system between EuroSCORE II and STS risk score for predicting morality in patients undergoing isolated CABG.

METHODS

This comparative cross-sectional study was conducted at the department of cardiac surgery, national heart foundation hospital and research institute (NHFH and RI), Dhaka, Bangladesh. The study period spanned from September 2020 to August 2022. A total of 500 patients who underwent isolated CABG during this time were included.

Inclusion criteria

Patients admitted for isolated CABG at NHFH and RI, willingness to participate and provide written informed consent and age ≥18 years, irrespective of gender were included.

Exclusion criteria

Concomitant valvular or congenital heart diseases, redo cardiac surgery cases and patients with thromboembolic complications were excluded.

Data collection and study procedure

Data were collected prospectively using a structured records form. Preoperative demographic details, comorbidities, laboratory results, echocardiographic parameters, and operative urgency were recorded from the patient files and verified by direct chart review. Euro SCORE II and STS datasheets were used as reference instruments for the standardized variable definitions. Renal function was evaluated through serum creatinine and creatinine clearance rate, while cardiac function was assessed via NYHA class, ejection fraction, and pulmonary artery pressure. All patients underwent CABG via median sternotomy using standard on-pump or off-pump techniques. Data accuracy and completeness were ensured by double-checking the entries after each case and verifying discrepancies against the source documents.

Ethical consideration

Ethical clearance was obtained from the institutional review board (IRB) of the NHFH and RI. Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the research process, and the data were used solely for academic purposes.

Statistical analysis

Data were analyzed using SPSS version 26.0. Categorical variables are presented as frequencies and percentages, and continuous variables as means±standard deviations (SD). Statistical significance was set at $p<0.05$. Descriptive statistics were used to summarize the preoperative characteristics of the study population.

RESULTS

Table 1 shows that the distribution of the patients by age in years. Mean age of all patients was 60.20±7.46 years (range: 34-72 year) with majority belonged to 51-70 years of age (87.4%).

Major part of the patients was male (81.8%) with a male:female ratio 4.5:1.

Table 2 shows that mean BMI of all patients was 23.62±1.49 kg/m^2. Maximum study patients were overweight (51.6%). 41.4% patients were in normal weight. Only 5% patients were obese.

Table 3 shows that hypertension (63.6%) and diabetes mellitus (44.2%) were the most common comorbidities among study patients.

Table 4 shows that mean EuroSCORE II of all patients was 2.51±1.98 (range: 0.62-9.67) wherein majority were in mild category (74%).

Table 5 shows that mean STS risk score of all patients was 2.42±1.86 (range: 0.32-9.51) wherein majority had mild risk (84.6%).

Both EuroSCORE II and STS risk score had similar performance in predicting 30-days mortality among isolated CABG patients (as p>0.05) with excellent accuracy (as area under curve was 0.936 and 0.922, respectively) (Figure 2).

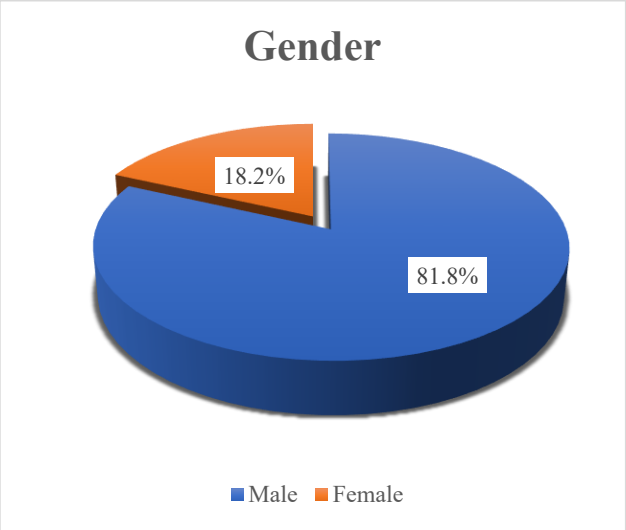
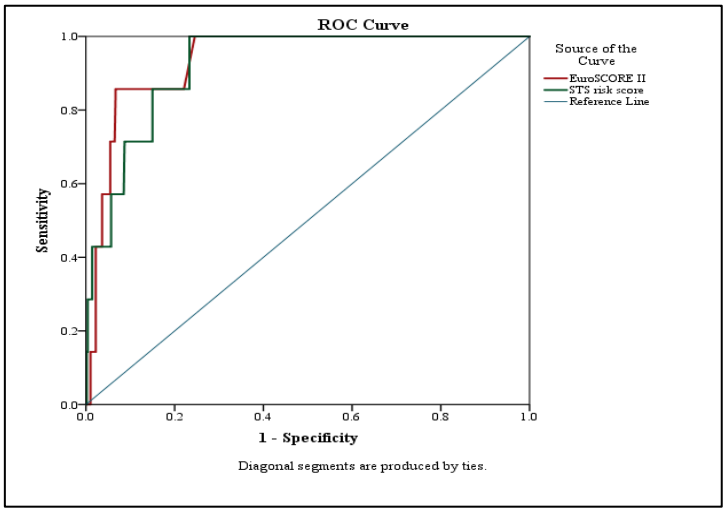


Figure 1: Gender distribution of the study patients, (n=500).



	AUC	Standard error	Z-score	p value
uroSCORE II	0.936	0.028	0.335	0.629
TS risk score	0.922	0.031		

Figure 2: Comparison of receiver operating characteristic curve of EuroSCORE II and STS risk score performance in predicting 30-days mortality among isolated CABG patients, (n=500).

Table 1: Age distribution of study patients, (n=500).

Age group (in years)	N	Percentage (%)
30-40	7	1.4
41-50	44	8.8
51-60	187	37.4
61-70	250	50.0
>70	12	2.4

Table 2: BMI of study patients (n=500).

BMI (kg/m^2)	N	Percentage (%)
Underweight (<18.5)	10	2
Normal (18.5-22.99)	207	41.4
Overweight (23-27.5)	258	51.6
Obese (>27.5)	25	5.0
Mean±SD	23.62±1.49	

Table 3: Comorbidities of study patients (n=500).

Comorbidities*	N	Percentage (%)
Hypertension	318	63.6
Diabetes mellitus	221	44.2
Chronic lung disease	31	6.2
Cerebrovascular disease	13	2.6

*Multiple response considered

Table 4: Category of study patients in EuroSCORE II (n=500).

EuroSCORE II	N	Percentage (%)
Mild (0-2.99)	370	74.0
Moderate (3.0-5.99)	89	17.8
Severe (>6)	41	8.2
Mean±SD	2.51±1.98	

Table 5: Category of study patients in STS risk score (n=500).

STS score	N	Percentage (%)
Mild (<4)	423	84.6
Moderate (4-8)	63	12.6
Severe (>8)	14	2.8
Mean±SD	2.42±1.86	

Table 6: Comparison of groups of EuroSCORE II and STS risk score with outcome (n=500).

Variables	Outcome		P value
	Death (n=7) (%)	Survived (n=493) (%)	
EuroSCORE II			
Mild (0-2.99)	-	1.52±0.53	-
Moderate (3.0-5.99)	3.04±0.0	4.25±0.96	0.215
Severe (>6)	7.69±0.91	7.70±1.00	0.978
Total	7.02±1.94	2.44±1.91	<0.001(S)
STS risk score			
Mild (<4)	3.44±0.78	1.79±0.94	0.013
Moderate (4-8)	5.02±0.60	5.16±1.21	0.867
Severe (>8)	9.41±0.17	9.04±0.50	0.235
Total	6.45±2.87	2.37±1.79	<0.001(S)

*Values are expressed within parenthesis percentage (%) over column in total. P value was obtained by Unpaired t-test. S=Significant.

Table 6 shows patients who died had significantly higher mean of total EuroSCORE II (7.02±1.94 vs 2.44±1.91) and STS risk score (6.45±2.87 vs 2.37±1.79) than patients who survived (as p<0.05).

DISCUSSION

In this study, mean age of the study patients was 60.20±7.46 years (range: 34-72 year) with the majority belonged to 51-70 years of age (87.4%). Previous studies also reported that elderly population are particularly susceptible to cardiovascular disease.[10-15] However, the risk of developing cardiovascular diseases in increased age are compounded by additional factors, including frailty, obesity, hypertension and diabetes. In present study, male was the predominant gender (81.8%) which was also supported by previous studies.[10,11,15] Although in a previous Bangladeshi study by Mahmud et al and in a

Malaysian study by Sazlina et al observed female predominance among cardiac patients.[14,16] However, in both men and women, the risks associated with CVD increase with age, and these correspond to an overall decline in sex hormones, primarily of estrogen and testosterone. In current study, hypertension (63.6%) and diabetes mellitus (44.2%) were the most common comorbidities among study patients. In line with my study findings, previous studies found high prevalence of diabetes and hypertension among cardiac patients.[10,17] The close association of diabetes and hypertension in cardiovascular diseases is likely due to the shared risk factors such endothelial dysfunction, vascular inflammation, arterial remodeling, atherosclerosis, dyslipidemia, and obesity.[18] In current study, maximum study patients were overweight (51.6%) which was also supported by several studies from Carbone et al and Khan et al.[19,20] Hence, lifestyle modification, strict control of blood glucose and blood pressure is key part to prevent cardiac diseases, as well as to reduce morbidity and mortality in patients undergoing CABG.

In this study, 30-days mortality was found to be 1.4%. In a Bangladeshi study by Ranjan et al., reported that the 30-day postoperative mortality was 3.58%, and the in-hospital mortality rate was approximately 2.89% among CABG patients.[11] In an Indian study by Shales et al reported that the 30-day postoperative mortality was 1.5% in CABG patients.[21] According to multiple validated studies that had been conducted in different regions of world, showed a mortality rate ranging upto 4.85%.[15,17] However, the lower rate mortality rate in this study might be because of lower rate (1%) of emergency CABG.

In this research project, mean EuroSCORE II of all patients was 2.51±1.98 (range: 0.62-9.67) wherein majority were in mild category (74%). Patients who died had significantly higher frequency of severe EuroSCORE II (85.7% vs 17.8%) than patients who survived. Overall, the predictive power of EuroSCORE II for 30-days mortality was excellent (AUC=0.936, 95% CI 0.881-0.992). In accordance with my study findings, Singh et al (2019, p=1670) also found almost similar area under the curve (AUC) of the EuroSCORE II in isolated CABG patients (AUC=0.934, 95% CI: 91.6-94.9, p<0.0001). Similarly, previous other studies also showed that EuroSCORE II had good discriminatory power (AUC>0.75).[7,9,16,17,22,23] Moreover, some studies also found EuroSCORE II scoring system as an independent predictor for early comorbidities as well as late mortality in the high-risk group patients.[2,22,24] However, few studies from Pakistan, China, Netherlands and United Kingdom showed that EuroSCORE II was not good in predicting mortality in cardiac surgical patients with AUC<0.70, indicating poor discriminative power.[5,25,26] This can be attributed to various demographic-related factors (genetic, social or cultural differences) or even study bias as current study had male preponderance and the cases were all urgent or elective CABG patients. Hence, further study in female population and in emergency cases to generalize the finding in our population is needed. In this study, mean STS risk score of all patients was 2.42±1.86 (range: 0.32-9.51) wherein majority had mild risk (84.6%). Patients who died had significantly higher frequency of severe STS risk score (42.9% vs 2.2%) than patients who survived. Overall, the predictive power of STS risk score for 30-days mortality was excellent (AUC=0.922, 95%CI 0.86-0.984). In line with my study analysis, Singh et al (2021, p=600) also demonstrated the almost similar AUC of the STS Score (AUC=0.921, 95% CI: 90.2-93.7, p=0.0001). Several other studies also indicated a good prediction ability of the STS risk score in cardiac surgery patients.[3,15,27]

Limitations

This study was conducted at a single tertiary center using a purposive sample of patients undergoing isolated CABG, which may limit its generalizability to all cardiac surgical populations in Bangladesh. The analysis was descriptive and did not explore the associations between risk factors and outcomes.

CONCLUSION

This study found that both EuroSCORE II and the STS risk score models have performed with excellent accuracy to predict correctly 30-days mortality undergoing isolated coronary artery bypass grafting (CABG). Hence, when choosing between the EuroSCORE II and STS risk score, doctors should use their judgement and pick the method that best captures the individual characteristics of the patient.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Kunt AG, Kurtcephe M, Hidiroglu M, Cetin L, Kucuker A, Bakuy V, et al. Comparison of original EuroSCORE, EuroSCORE II and STS risk models in a Turkish cardiac surgical cohort. Interact Cardiov Thor Surg. 2013;16(5):625-9.
2. Kieser TM, Rose MS, Head SJ. Comparison of logistic EuroSCORE and EuroSCORE II in predicting operative mortality of 1125 total arterial operations. Europ J Cardio-Thoracic Surg. 2016;50(3):509-18.
3. Ad N, Holmes SD, Patel J, Pritchard G, Shuman DJ, Halpin L. Comparison of EuroSCORE II, original EuroSCORE, and the society of thoracic surgeons risk score in cardiac surgery patients. Ann Thorac Surg. 2016;102(2):573-9.
4. Nashef SA, Roques F, Sharples LD, Nilsson J, Smith C, Goldstone AR, Lockowandt U. Euroscore ii. European journal of cardio-thoracic surgery. 2012;41(4):734-45.

5. Bai Y, Wang L, Guo Z, Chen Q, Jiang N, Dai J, et al. Performance of EuroSCORE II and SinoSCORE in Chinese patients undergoing coronary artery bypass grafting. Interactive Cardiov Thor Surg. 2016;23(5):733-9.
6. Borde D, Gandhe U, Hargave N, Pandey K, Khullar V. The application of European system for cardiac operative risk evaluation II (EuroSCORE II) and Society of Thoracic Surgeons (STS) risk-score for risk stratification in Indian patients undergoing cardiac surgery. Ann Cardiac Anaesth. 2013;16(3):163-6.
7. Nezic D, Spasic T, Micovic S, Kosevic D, Petrovic I, Lausevic-Vuk L, et al. Consecutive observational study to validate EuroSCORE II performances on a single-center, contemporary cardiac surgical cohort. J Cardioth Vascular Anesth. 2016;30(2):345-51.
8. Rahman MM, Karim MR, Rahman MH, Siraj M, Uddin J, Amin MN, et al. Early and mid-term outcome of CABG surgery in diabetic and non-diabetic patients in a tertiary care hospital in Bangladesh. Bang Med Res Council Bull. 2019;45(3):155-62.
9. Stavridis G, Panaretos D, Kadda O, Panagiotakos DB. Validation of the EuroSCORE II in a Greek cardiac surgical population: a prospective study. Open Cardiov Med J. 2017;11:94.
10. Ranjan R, Adhikary AB. Outcome of coronary artery bypass graft surgery with coronary endarterectomy. Bang Med Res Council Bull. 2018;44(3):124-31.
11. Ranjan R, Adhikary D, Mandal S, Saha SK, Hasan K, Adhikary AB. Performance of EuroSCORE II and logistic EuroSCORE in Bangladeshi population undergoing off-pump coronary artery bypass surgery: a prospective cohort study. JRSM Cardiov Dis. 2019;8:2048004019862125.
12. Curtis AB, Karki R, Hattoum A, Sharma UC. Arrhythmias in patients≥ 80 years of age: pathophysiology, management, and outcomes. J Am College Cardiol. 2018;71(18):2041-57.
13. North BJ, Sinclair DA. The intersection between aging and cardiovascular disease. Circulation research. 2012;110(8):1097-108.
14. Sazlina SG, Sooryanarayana R, Ho BK, Omar MA, Krishnapillai AD, Mohd Tohit N, et al. Cardiovascular disease risk factors among older people: Data from the National Health and Morbidity Survey 2015. PLoS One. 2020;15(10):e0240826.
15. Boukhmis A, Nouar ME, Guerchani MK. Applicability of the commonly used risk scores for coronary bypass surgery in Algeria. J Saudi Heart Assoc. 2022;34(1):24.
16. Mahmud AU, Sazzad MF, Wadud MA, Chowdhury IR, Rahman MH, Chowdhury HR, et al. Performance of EuroSCORE II in Predicting Early Mortality after Mitral, Aortic or Mitral and Aortic Valve Surgery Patients in National Heart Foundation Hospital and Research Institute. Bang Heart J. 2019;34(1):11-24.
17. Musa AF, Cheong XP, Dillon J, Nordin RB. Validation of EuroSCORE II in patients undergoing coronary artery bypass grafting (CABG) surgery at the National Heart Institute, Kuala Lumpur: a retrospective review. F1000Research. 2019;7:534.
18. Petrie JR, Guzik TJ, Touyz RM. Diabetes, hypertension, and cardiovascular disease: clinical insights and vascular mechanisms. Can J Cardiol. 2018;34(5):575-84.
19. Carbone S, Canada JM, Billingsley HE, Siddiqui MS, Elagizi A, Lavie CJ. Obesity paradox in cardiovascular disease: where do we stand? Vascular Health Risk Manag. 2019;81:9-100.
20. Khan SS, Ning H, Wilkins JT, Allen N, Carnethon M, Berry JD, et al. Association of body mass index with lifetime risk of cardiovascular disease and compression of morbidity. JAMA Cardiol. 2018;3(4):280-7.
21. Shales S, Uma Maheswara Rao S, Khapli S, Ghorai PA, Behera SK, Ghosh AK, et al. Comparison of European System for Cardiac Operative Risk Evaluation (EuroSCORE) and the Society of Thoracic Surgeons (STS) score for risk prediction in Indian patients undergoing coronary artery bypass grafting. Indian J Thoracic Cardiovascular Surg. 2021;37(6):623-30.
22. Garcia-Valentin A, Mestres CA, Bernabeu E, Bahamonde JA, Martín I, Rueda C, et al. Validation and quality measurements for EuroSCORE and EuroSCORE II in the Spanish cardiac surgical population: a prospective, multicentre study. Eur J Cardio-Thoracic Surg. 2016;49(2):399-405.
23. Paparella D, Guida P, Di Eusanio G, Caparrotti S, Gregorini R, Cassese M, et al. Risk stratification for in-hospital mortality after cardiac surgery: external validation of EuroSCORE II in a prospective regional registry. Eur J Cardio-Thoracic Surg. 2014;46(5):840-8.
24. Barili F, Pacini D, Capo A, Rasovic O, Grossi C, Alamanni F, Di Bartolomeo R, Parolari A. Does EuroSCORE II perform better than its original versions? A multicentre validation study. Eur Heart J. 2013;34(1):22-9.
25. Parajuli SS, Rajbhandari N, Thakur A. Comparison of Logistic Euroscore with Euroscore II in predicting postoperative mortality in adult cardiac surgical patients. Nepalese Heart J. 2022;19(1):7-9.
26. Qadir I, Alamzaib SM, Ahmad M, Perveen S, Sharif H. EuroSCORE vs. EuroSCORE II vs. Society of Thoracic Surgeons risk algorithm. Asian Cardiov Thoracic Ann. 2014;22(2):165-71.
27. Yamaoka H, Kuwaki K, Inaba H, Yamamoto T, Kato TS, Dohi S, et al. Comparison of modern risk scores in predicting operative mortality for patients undergoing aortic valve replacement for aortic stenosis. J Cardiol. 2016;68(2):135-40.

Cite this article as: Al-Nimari MZ, Pal N, Chowdhury DIR, Salahuddin AP, Islam MA, Sharma S, et al. Comparison of EuroSCORE II and the society of thoracic surgeons risk score for predicting 30-day mortality among Bangladeshi patients undergoing isolated coronary artery bypass grafting at a single center. Int Surg J 2025;12:2120-5.