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Correlation Between EuroSCORE II and STS Risk Score and Their Distribution in Bangladeshi Isolated CABG Patients

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Abstract

Background: *Coronary artery bypass grafting (CABG) restores blood flow in blocked coronary arteries and is a key intervention for severe coronary artery disease. This study aimed to assess the correlation between EuroSCORE II and STS risk scores and their distribution among Bangladeshi patients undergoing isolated CABG.*

Aim of the study: *The aim of the study was to assess the correlation between EuroSCORE II and STS risk scores and analyze their distribution among Bangladeshi patients undergoing isolated coronary artery bypass grafting (CABG).*

Methods: *This comparative, cross-sectional study at the Department of Cardiac Surgery, National Heart Foundation Hospital and Research Institute (NHFH&RI), Dhaka, Bangladesh (Sept 2020–Aug 2022) included 500 isolated CABG patients. EuroSCORE II and STS scores were calculated preoperatively, CABG performed via median sternotomy, and outcomes monitored postoperatively with 30-day follow-up. Data were analyzed using SPSS v26.*

Results: *Among 500 isolated CABG patients (mean age 60.2 ± 7.5 years; 81.8% male), 74.0% had mild, 17.8% moderate, and 8.2% severe risk by EuroSCORE II (mean 2.51 ± 1.98). By STS risk score, 84.6% were mild, 12.6% moderate, and 2.8% severe (mean 2.42 ± 1.86). A strong positive correlation was observed between EuroSCORE II and STS scores ($r = +0.793$, $p < 0.001$), though their cut-off association was not statistically significant ($p = 0.278$).*

Conclusion: *EuroSCORE II and STS risk scores showed a strong positive correlation, indicating their close alignment and reliability for preoperative risk assessment in Bangladeshi isolated CABG patients.*

Key words: *EuroSCORE II, STS Risk Score, CABG*

1. Introduction

Coronary artery bypass grafting (CABG) is a surgical intervention designed to restore blood flow in the heart by bypassing blocked coronary arteries, thereby improving myocardial perfusion [1]. In cardiac surgery, in-hospital mortality or death related to the procedure serves as a key indicator of the quality of healthcare provided [2]. Failure to achieve adequate heart function during surgery can result in mortality and may lead to early postoperative complications as well as long-term adverse effects [1]. Even with advancements in surgical techniques and anesthesia, open-heart surgery still carries a mortality risk of up to 4% and is associated with both cardiac and non-cardiac complications. It is therefore crucial to carefully consider patient-related risk factors to optimize surgical outcomes and improve overall healthcare quality.

Selecting the most appropriate surgical approach and treatment plan is an essential part of preoperative preparation. Risk stratification models have been developed to identify factors associated with surgical outcomes, thereby enabling better prediction of postoperative events and improving patient care. These models also support clinical decision-making, particularly in managing patients with high-risk profiles, and contribute to enhancing the success rates of surgical interventions [3]. Moreover, risk scoring systems are invaluable for quality assessment, outcome evaluation, and overall clinical management [3]. Among these, the EuroSCORE system has been widely recognized as a reliable tool for assessing both operative and postoperative risk in adult cardiac surgery [4-6].

Despite the development of multiple risk assessment tools for predicting mortality and morbidity in cardiac surgery, the most extensively used remain the European System for Cardiac Operative Risk Evaluation II (EuroSCORE II) and the Society of Thoracic Surgeons (STS) scoring system [7]. EuroSCORE has become a standard worldwide for cardiac surgery risk prediction [8], and its updated version, EuroSCORE II, was introduced in 2011 with improved calibration for predicting in-hospital mortality while maintaining high discriminatory power [9]. Both scoring systems were originally developed using data from Europe and the United States, which raises concerns about their applicability in different populations. Additionally, ongoing debates exist regarding which system provides the most accurate statistical prediction [10]. Consequently, it is important to validate these scoring systems within specific regional populations to ensure their effectiveness in guiding patient management and identifying potential adjustments needed for accurate risk assessment [4,11,12].

Although EuroSCORE II and STS risk scores are widely used internationally, data on their correlation and distribution in Bangladeshi patients undergoing isolated CABG are limited. Most studies have focused on European or American populations, leaving uncertainty about the applicability and predictive accuracy of these models in South Asian settings. Therefore, this study was designed to assess the correlation between EuroSCORE II and STS risk scores and analyze their distribution among Bangladeshi patients undergoing isolated coronary artery bypass grafting (CABG).

2. Objective

- To assess the correlation between EuroSCORE II and STS risk scores and analyze their distribution among Bangladeshi patients undergoing isolated coronary artery bypass grafting (CABG).

3. Methodology & Materials

This comparative, cross-sectional study was conducted at the Department of Cardiac Surgery, National Heart Foundation Hospital and Research Institute (NHFH&RI), Mirpur, Dhaka, Bangladesh, between September 2020 and August 2022. A total of 500 patients who underwent isolated coronary artery bypass grafting (CABG) were included based on specific inclusion and exclusion criteria.

3.1. Inclusion Criteria

- Patients admitted to the Department of Cardiac Surgery, NHFH&RI for CABG.
- Patients willing to participate in the study.

3.2. Exclusion Criteria

- Patients with concomitant valvular or congenital heart disease.
- Patients with thromboembolic events.
- Patients undergoing re-do surgery.

Data were collected using a pre-tested semi-structured questionnaire and a checklist to capture sociodemographic, preoperative, operative, and postoperative variables.

Preoperative data for EuroSCORE II and STS risk scores were extracted from patient files and entered into their respective online calculators. Eligible patients provided informed consent prior to enrollment. CABG was performed via median sternotomy under standard anesthetic protocols, using either on-pump or off-pump techniques, with the left internal mammary artery and reversed saphenous vein grafts. Postoperative monitoring was conducted in the cardiac ICU until extubation, with routine discharge on postoperative day 7 and 30-day follow-up to document complications. Data were checked for completeness and consistency, cleaned, coded, and analyzed using SPSS version 26. Categorical variables were summarized as frequencies and percentages, while continuous variables were expressed as mean ± standard deviation. Comparisons of continuous variables were performed using unpaired t-tests, Pearson's correlation assessed the relationship between EuroSCORE II and STS scores, ROC curves evaluated 30-day mortality prediction, and McNemar's test assessed associations between categorical variables. Statistical significance was set at $p < 0.05$. Ethical approval was obtained from the NHFH&RI Institutional Review Board, written informed consent was secured from all participants, confidentiality was maintained, and participants could withdraw at any time.

4. Results

Table 1. *Demographic Characteristics of the Study Population (n = 500)*

Variable		Frequency (n)	Percentage (%)
Age Group (Years)	30–40	7	1.4
	41–50	44	8.8
	51–60	187	37.4
	61–70	250	50.0
	>70	12	2.4
	Mean ± SD	60.20 ± 7.46	
	Range	34–72	
Gender	Male	409	81.8
	Female	91	18.2

Table 1 shows the baseline distribution of patients according to age and gender. The mean age of the study population was 60.20 ± 7.46 years (range: 34–72 years). Most patients were aged 51–60 years 187 (37.4%) and 61–70 years 250 (50.0%). Males predominated 409 (81.8%), while females accounted for 91 (18.2%) of the cohort.

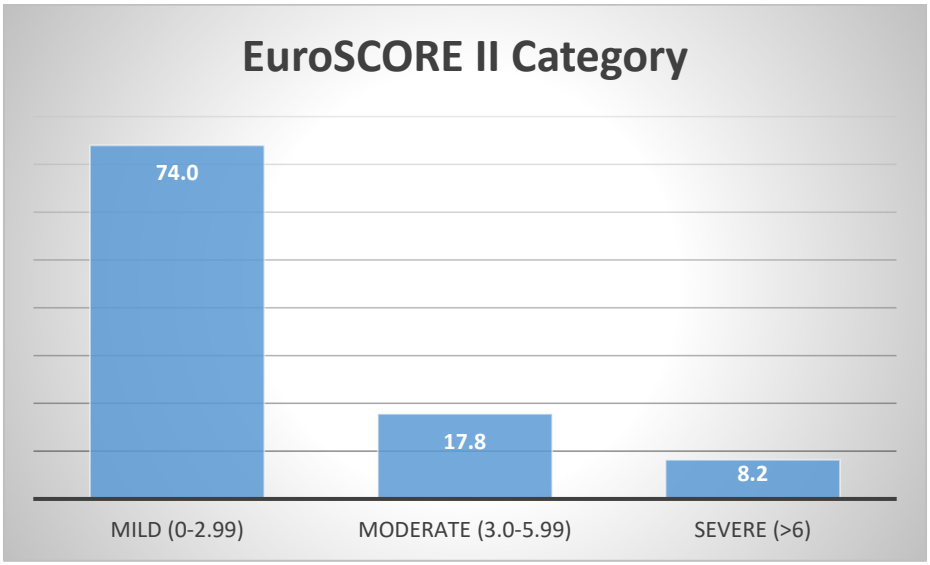

Figure 1. *Distribution of the Study Patients According to EuroSCORE II Categories (n = 500)*

Figure 1 illustrates the distribution of patients based on EuroSCORE II categories. The majority of patients were classified in the mild-risk group (370, 74.0%), followed by the moderate-risk group (89, 17.8%) and the severe-risk group (41, 8.2%). The mean EuroSCORE II value was 2.51 ± 1.98.

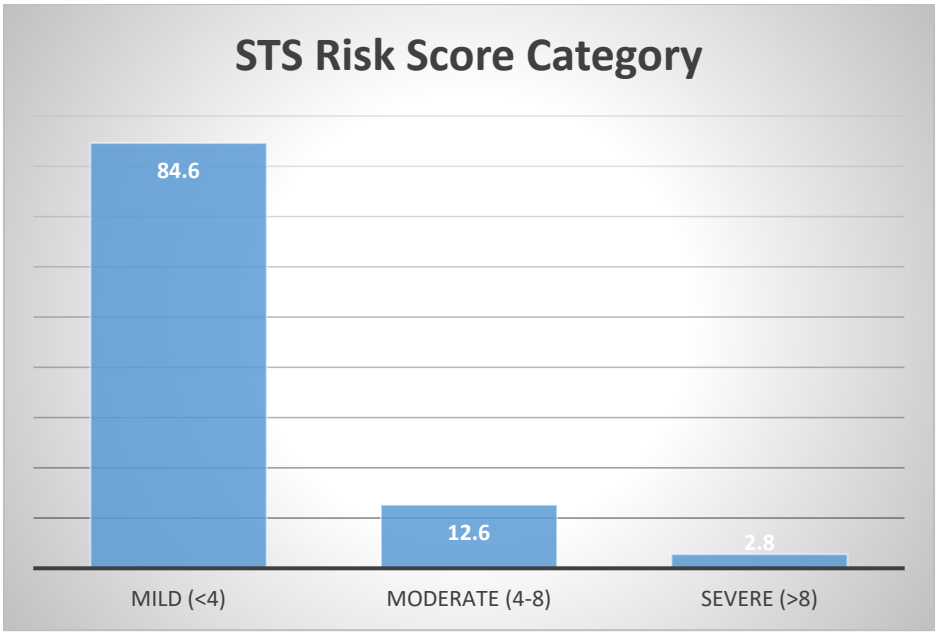

Figure 2. *Distribution of the Study Patients According to STS Risk Score Categories (n = 500)*

Figure 2 shows the distribution of patients based on STS risk score categories. Most patients were in the mild-risk group (<4) comprising 423 (84.6%), while 63 (12.6%) were in the moderate-risk group (4–8) and 14 (2.8%) in the severe-risk group (>8). The mean STS risk score was 2.42 ± 1.86.

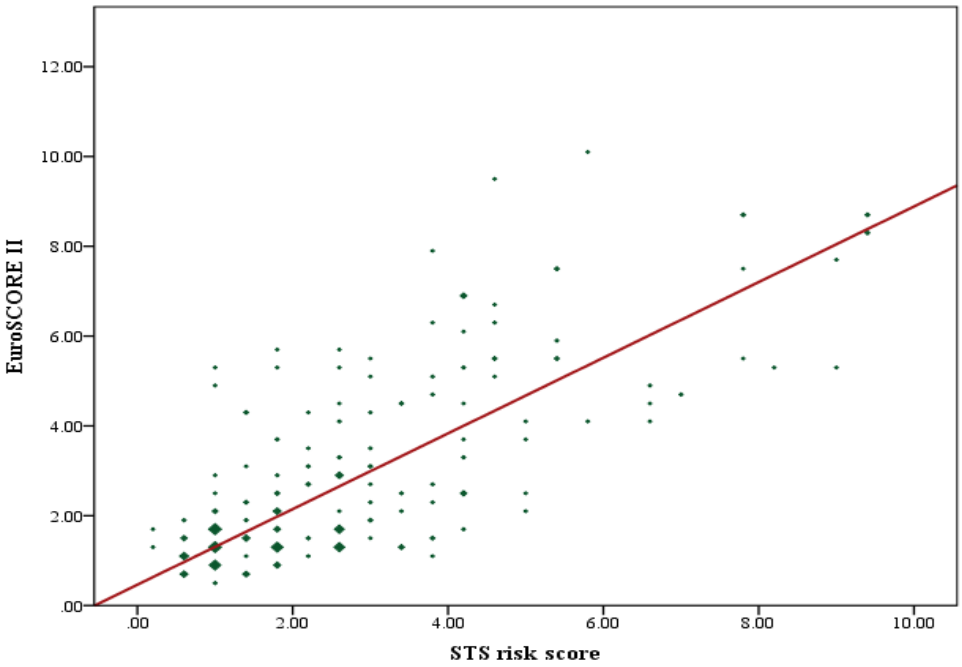

Figure 3. *Correlation Between EuroSCORE II and STS Risk Scores Among Bangladeshi Patients Undergoing Isolated CABG (n = 500)*

Figure 3 illustrates the linear relationship between EuroSCORE II and STS risk scores using a scatter plot. The Pearson correlation analysis demonstrated a strong positive association between the two scoring systems ($r = +0.793$, $p < 0.001$).

Table 2. *Distribution of Patients According to EuroSCORE II and STS Risk Score Cut-off Values (n = 500)*

STS Risk Score	EuroSCORE II ≥ 3.035 (n = 129)	EuroSCORE II < 3.035 (n = 371)	p-value[a]
≥ 2.961	81 (62.8%)	37 (10.0%)	0.278[NS]
< 2.961	48 (37.2%)	334 (90.0%)	

Table 2 demonstrates the distribution of patients based on the defined cut-off values for EuroSCORE II (3.035) and STS risk score (2.961). Among patients with EuroSCORE II ≥ 3.035, 81 (62.8%) also had STS risk score ≥ 2.961, while 48 (37.2%) had STS < 2.961. Conversely, among patients with EuroSCORE II < 3.035, 37 (10.0%) had STS ≥ 2.961 and 334 (90.0%) had STS < 2.961. The association between the two scoring systems was not statistically significant (p = 0.278).

5. Discussion

The correlation and distribution of EuroSCORE II and STS risk scores among Bangladeshi patients undergoing isolated CABG. Coronary artery bypass grafting, a procedure aimed at restoring myocardial perfusion in patients with obstructive coronary artery disease, carries inherent risks of perioperative morbidity and mortality. The findings highlight the predominance of mild-risk patients according to both scoring systems and demonstrate a strong positive correlation between EuroSCORE II and STS scores.

The observed variations in risk classification underscore the importance of accurate preoperative assessment for guiding surgical planning, resource allocation, and patient counseling in the Bangladeshi context.

The present study evaluated the distribution and correlation of EuroSCORE II and STS risk scores among Bangladeshi patients undergoing isolated CABG. Most patients in our cohort were aged between 51 and 70 years (87.4%), with a mean age of 60.20 ± 7.46 years, indicating that middle- to older-aged individuals constitute the primary group requiring surgical revascularization. Male patients predominated (81.8%), reflecting the higher burden of ischemic heart disease among men in this population. These findings are consistent with those of Dassanayake et al.[13], who reported male predominance with median ages of approximately 65 years in males and 66 years in females, and are further supported by Peric et al.[14], who observed about 80% male patients with mean ages of 58.3 ± 8.3 years for males and 61.6 ± 6.1 years for females. The majority of patients in both studies fell within the 50–69-year range. This close similarity suggests that isolated CABG cohorts worldwide share comparable demographic profiles, emphasizing that ischemic heart disease requiring surgical intervention predominantly affects middle-aged and elderly males.

Analysis of EuroSCORE II revealed that most patients were classified in the mild-risk category (0–2.99; 74.0%), followed by moderate risk (3.0–5.99; 17.8%) and severe risk (>6; 8.2%), with a mean score of 2.51 ± 1.98. This distribution aligns with the findings of Silverborn et al.[15], who stratified a large CABG cohort into low (<4%), intermediate (4–8%), and high (>8%) risk groups and observed that most patients clustered in the lower-risk categories. Similarly, Mastroiacovo et al.[16] reported that in cardiac surgery cohorts, including isolated CABG, risk scores tended to cluster in the low to moderate range, with relatively few patients in the highest-risk extremes. The predominance of patients in the mild-risk category in our cohort reflects a general trend observed internationally, supporting the validity of our stratification approach. The relatively small proportion of severe-risk patients also highlights prior observations that EuroSCORE II may underperform or miscalibrate at high-risk extremes, underscoring the need for careful interpretation for this subgroup.

Similarly, STS risk scores demonstrated a predominance of patients in the mild-risk category (<4; 84.6%), with fewer in moderate (4–8; 12.6%) and severe (>8; 2.8%) categories, and a mean score of 2.42 ± 1.86. This closely mirrors the results reported by Saka et al.[17], who observed 84.5% of isolated CABG patients in the mild-risk category, 13.5% in moderate, and 2.0% in severe, with an identical mean score. Hassan et al.[18] further confirmed the effectiveness of the STS score in risk stratification for isolated CABG patients. The clustering of most patients in the mild-risk category reflects a common pattern in CABG populations, where most patients present with relatively low predicted operative risk, while fewer occupy high-risk extremes. These findings reinforce the utility of STS scoring for preoperative risk assessment in the Bangladeshi isolated CABG population.

Correlation analysis demonstrated a strong positive association between EuroSCORE II and STS risk scores (r = +0.793, p < 0.001), indicating that higher values in one scoring system closely correspond with higher values in the other. This is consistent with Silverborn et al.[15], who reported a similar correlation (r = 0.82) in a large CABG cohort, with a mean EuroSCORE II of 2.51 ± 1.98, closely matching our values. Gao et al.[19] also demonstrated excellent predictive abilities for both scoring systems in stratifying in-hospital mortality,

supporting their complementary use in isolated CABG populations. Shales et al.[20] highlighted subtle differences in calibration, noting that EuroSCORE II slightly overpredicts mortality while STS scores slightly underestimate it, a nuance that clinicians should consider when interpreting risk. Overall, these results confirm that EuroSCORE II and STS scores are strongly aligned in predicting operative risk and are reliable tools for preoperative assessment.

Cross-classification of patients according to EuroSCORE II and STS cut-off values showed that among those with EuroSCORE II ≥ 3.035, 62.8% also had STS scores ≥ 2.961, whereas 90.0% of patients with EuroSCORE II < 3.035 had STS scores < 2.961 ($p = 0.278$). This concordance highlights the consistency between the two scoring systems in categorizing operative risk. Chen et al.[21] similarly found that EuroSCORE II and STS scores were widely used and closely aligned in preoperative risk assessment among cardiac surgery patients. The overlap in classification demonstrates that patients identified as higher risk by one model are generally recognized as higher risk by the other, while lower-risk patients are consistently categorized. These findings further validate the concurrent use of both EuroSCORE II and STS scores in clinical practice for risk stratification of isolated CABG patients.

6. Limitations of the Study

The study had a few limitations:

- Patient outcomes were not evaluated under a single surgeon, which may have introduced variability in surgical technique and results.
- The study utilized purposive sampling, and therefore randomization was not performed.

7. Conclusion

This study found that Bangladeshi patients undergoing isolated CABG were predominantly middle-aged males, most of whom fell into the mild-risk category in both EuroSCORE II and STS scoring systems. A strong positive correlation was observed between the two scores, indicating that higher risk predicted by one model was generally reflected by the other. Although their categorical association was not statistically significant, the overall findings suggest that EuroSCORE II and STS risk scores perform in close alignment and serve as reliable, complementary tools for preoperative risk assessment in this population.

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