Research Article

# Comparison of Euro SCORE II and ACS NSQIP as Risk Assessment Scores in Coronary Artery Bypass Surgery Patients

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## Abstract

**Introduction:** Cardiovascular Diseases (CVSs) have become the leading cause of death in India over the last century. This epidemiological shift is primarily due to an increase in the prevalence of CVSs and CVD risk factors in India. Cardiac surgeries are among the high risk surgeries and associated with mortality and morbidity. Euro SCORE and ACS NSQIP (American College of Surgeon and National Surgical Quality Improvement Program) is useful for predicting mortality associated with surgery. **Methods:** The present study was carried out in consecutive 206 patients. The study was carried out in adult patients who were scheduled to undergo coronary artery bypass surgery. **Results:** Both ACS NSQIP score and EuroSCORE II were reasonably successful in assessing this risk, but their performance was to some extent less predictive than that reported for the overall cardiac surgical population, with the ACS NSQIP more consistently better in predicting the risk than the EuroSCORE II. **Conclusion:** Our study showed better discrimination and calibration with the ACS NSQIP scoring system in comparison with Euro SCORE II.

**Keywords:** Cardiovascular diseases; Euro SCORE; ACS NSQIP

## Introduction

In India, Cardiovascular Disease (CVD) is the main cause of death [1]. The expanding worldwide burden of cardiovascular disease makes it even more important to close gaps in access to diagnostic, prophylactic, and curative services in order to better understand the prevalence of cardiovascular disease, detect it more quickly, and adequately treat it. To correctly classify patients prior to surgery, a variety of risk score systems have been created. These methods have been used not just to identify the most susceptible patients, but also to provide patient and family counselling about the surgical risk and potential negative outcomes, to monitor the hospital's standard of care, and for continuous medical education and research.

EuroSCORE was first implemented in 1999 [2]. It is useful for predicting surgical mortality and is considered the gold standard for evaluating surgical practises, with over 1300 citations in the modern medical literature. Recent findings have shown that breakthroughs and improvements in knowledge and practises over the decade after its inception may have led to overestimation in some subgroups [3]. EuroSCORE II was launched in 2011 to address the shortcomings of the prior edition [4].

Between 2006 and 2010, a study was conducted to determine the prognostic accuracy of EuroSCORE I and II in 2931 consecutive patients who had valvular surgery. The average age of these patients was 64 ± 16. Valvular surgery performed on 70% of these patients. In the remaining individuals, it was linked to coronary intervention and/or aorta surgery. At 30 days, mortality was 5.5% (162 points), with a mean Euro SCORE I of 8.8% ± 9.9% and a mean Euro SCORE II of the 5.9% ± 7.5%. EuroSCORE I had a C-index of 0.77 (0.74-0.8) while EuroSCORE II had a C-index of 0.81 (0.77-0.84). When comparing anticipated and observed mortality, Euro SCORE I ($p<0.0001$) indicated a significant difference (overestimation of predicted mortality), whereas Euro SCORE II ($p=0.33$) showed no difference ($p=0.33$) [5].

The Euro SCORE II and the previous logistic Euro SCORE scores were used to evaluate 865 patients who underwent isolated CABG surgery. When compared to the original logistic Euro SCORE, Euro SCORE II (AUC 0.863, Brier score 0.030) predicted operational mortality the best (AUC 0.849, Brier score 0.033). EuroSCORE II had an overall anticipated to observed mortality ratio of 1.1, while the original logistic EuroSCORE had a ratio of 1.7.



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EuroSCORE II predicted ≥ 5-day ICU stay (AUC 0.786), prolonged inotrope use (AUC 0.746), stroke (AUC 0.646), de novo dialysis (AUC 0.810), and low output syndrome (AUC 0.810). (AUC 0.715). Furthermore, a high EuroSCORE II quintile was found to be a strong predictor of late mortality (p<0.0001) [6].

The ACS NSQIP calculator (American College of Surgeons and National Surgical Quality Improvement Program) is a free online tool that combines procedure-specific surgical risk with 20 patient characteristics. The programme assesses the risks of 15 different outcomes, which are graphed and compared to the risk of an ordinary patient [7].

The National Surgical Quality Improvement Program (ACS NSQIP) of the American College of Surgeons now has a new resource to help them enhance surgical quality for their patients. The ACS QVP is a standards-based verification tool that uses NSQIP risk-adjusted data to help sites improve quality across surgical departments. The addition of ACS QVP to ACS NSQIP acknowledges ACS NSQIP hospitals' commitment to quality and encourages them to use ACS QVP to advance to the next level of quality improvement. It's apparent that ACS NSQIP facilities are already dedicated to providing high-quality care. Hospitals will be able to make better use of their data, reports, and quality improvement initiatives by adding QVP to the foundation laid by NSQIP.

We planned a prospective observational study to compare the EuroSCORE II with the ACS NSQIP score in adult cardiac bypass surgical patients because the ACS NSQIP calculator has not been investigated much in adult cardiac surgical operations.

Preoperative risk assessment and perioperative factors may enable the identification of patients who are more likely to experience postoperative difficulties and allow for postoperative care techniques that enhance patient outcomes. This article summarizes historical and more modern grading systems for predicting patients who will have higher postoperative morbidity and death.

## Methods

After receiving clearance from the institutional ethical committee and getting written and informed consent from the patients, a prospective observational study was conducted. This was done in 206 patients who were scheduled for elective coronary artery bypass surgery at the same time. The operative risk was calculated using EuroSCORE II (http://www.euroscore.org) and ACS NSQIP (https://riskcalculator.facs.org) after a thorough history, physical examination, and investigations. The EuroSCORE II risked mortality, whereas the ACS NSQIP risked mortality, significant complications, any complications, readmission, return to the operating room, and discharge to a nursing or rehab facility. Patients were prospectively fallowed up in the postoperative period for the course of their hospital stay.

### Statistical analysis

All these statistical analysis were done using SPSS version 19.0.

## Results

The mean EuroSCORE in our study population was 2.7 ± 1.79 mean ACS NSQIP score was 2.38 ± 1.4. The mean EuroSCORE in survived and expired was 2.604 ± 2.552 and 3.67 ± 3.33 (p=0.004), whereas the ACS NSQIP in same population was 2.149 ± 2.556 and 4.903 ± 2.995 (p=0.0001) [Table 1].

The discriminative capacities of both scoring systems were analyzed by ROC curves and AUC of the both scoring systems were calculated. The ACS NSQIP (C static=0.834) [Figure 1] scoring system has better discriminatory capacity than EuroSCORE II (C static=0.676) [Figures 2 and 3, Table 2].

The correlation of the both the scoring system was statistically significant (Pearson correlation coefficient=0.545, p<0.0001). The calibration of EuroSCORE II and ACS NSQIP score by Hosmer-Lemeshow test showed good calibration for both (p=0.032 and p<0.001 respectively), but the calibration was better in ACS NSQIP score in compared to EuroSCORE II [Table 3].

## Discussion

For collaborative surgical decision making, patient counselling, performance clinical research, benchmarking, evaluation of new medicines, and quality assurance, reliable 'Risk Assessment Tools' are increasingly being used. Differences in the population used to create scoring systems, the number of institutions involved, the number of nations involved, countries in the same geopolitical space, and, last but not least, prospective participants. The disparity between these ratings was caused by retrospective data. While most Risk Assessment Tools focus

**Table 1: Group statistics.**

| | Actual death | N | Mean | Std. Deviation | t |
|---|---|---|---|---|---|
| EuroSCORE II | Mortality | 18 | 3.667 | 3.325 | 1.64 |
| | Survived | 188 | 2.604 | 2.552 | p=0.004 |
| Risk of Death by ACS NSQIP | Mortality | 18 | 4.833 | 2.995 | 4.195 |
| | Survived | 188 | 2.149 | 2.556 | p<0.001 |

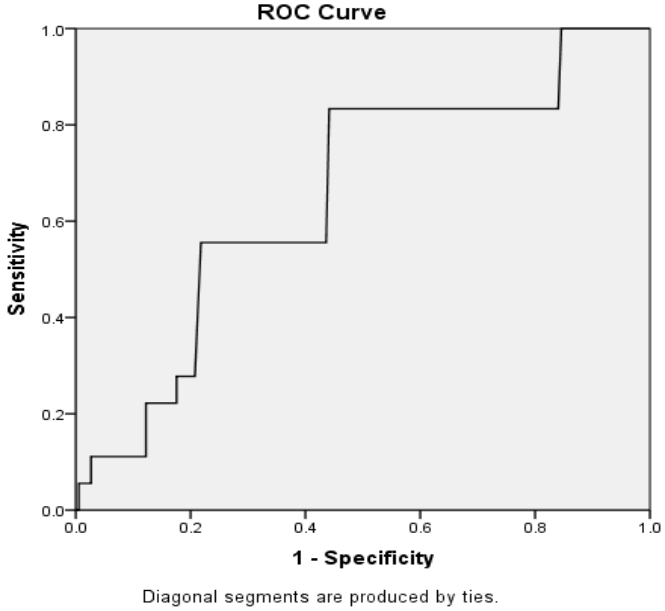


**Figure 1:** ROC curve of EuroSCORE II.

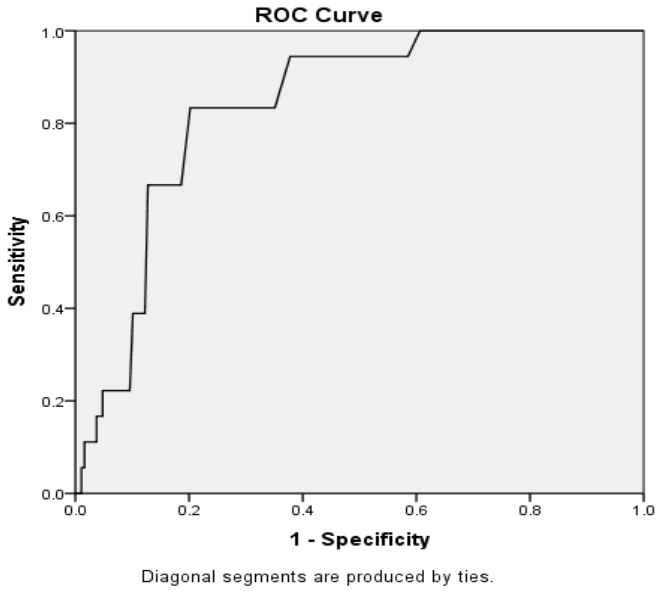


**Figure 2:** ROC curve of ACS NSQIP score.

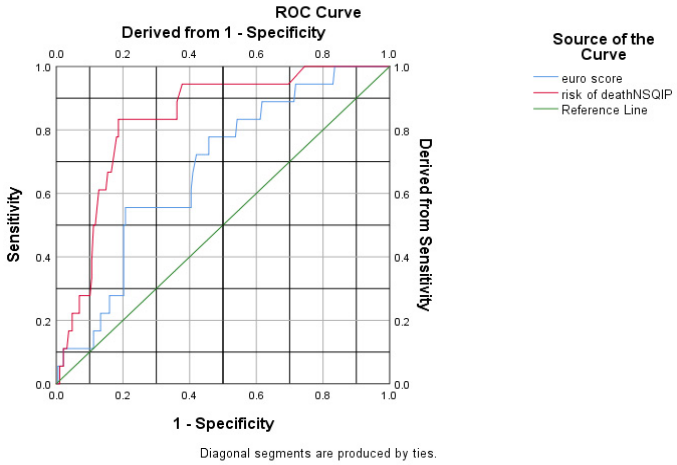


**Figure 3:** ROC Curves of both EUROSCORE II and ACS NSQIP scoring systems.

**Table 2: Area under the Curve (AUC).**

| Test Result Variable(s) | AUC | Std. Error | Asymptotic Sig. | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| EuroSCORE II | 0.653 | 0.065 | 0.032 | 0.526 | 0.781 |
| risk of death by ACS NSQIP score | 0.837 | 0.039 | 0 | 0.761 | 0.913 |

**Table 3: ROC Curves of Both EuroSCORE II and ACS NSQIP Scoring Systems.**

| | ACS NSQIP score | EuroSCORE II |
|---|---|---|
| Number of patients | 206 | 206 |
| Deaths | 18 | 18 |
| Observed Mortality | 8.73 | 8.73 |
| Expected mortality | 12(5.8%) | 15 (7.28%) |
| AUC | 0.837 | 0.653 |
| H-L Statistics | <0.001 | 0.032 |

solely on patient characteristics, NSQIP was one of the first to attribute weightage to the intrinsic risk of surgical procedures such as CABG. The EuroSCORE II scoring system underwent extensive validation trials in European and North American populations, whereas the ACS NSQIP scoring system relied on data from a variety of North American institutions.

Both the ACS NSQIP score and the EuroSCORE II risk score have been widely validated in foreign populations and both provide similar risk scores [8-12]. For EuroSCORE and EuroSCORE II, we discovered three studies in the Indian population. The first was EuroSCORE (n=1000), which shown that this scoring system is well-predictable in low and moderate-risk Indian patients, but not so well in high-risk Indians [13]. The second (n=1000) and third (n=1098) investigations on EuroSCORE II indicated that low and intermediate risk populations had reasonable predictability, whereas high risk populations had overestimated risk [14,15]. We discovered a paucity of studies on the ACS NSQIP scoring method in cardiac surgery patients around the world, as well as in the Indian community. Only one study (n=2254) found that the ACS NSQIP scoring system had high discrimination performance as well as good data fit [16]. Our research sought to determine the predictability of the ACS NSQIP scoring system in comparison to the EuroSCORE II scoring system in the Indian population, as well as to add to the current knowledge.

According to our ROC curve analysis, the ACS NSQIP scoring system has a superior discrimination capacity than EuroSCORE II. In the case of the ACS NSQIP score, the AUC values were comparable to other studies, but not in the case of the EuroSCORE II score [14,16]. The possible cause of the discrepancy observed in the case of EuroSCORE II was a difference in the type of studies (previous studies were retrospective and our study was prospective). The Hosmer-Lemeshow test fit to data showed good fit for both scoring systems, which is consistent with previous publications.

Both the ACS NSQIP score and the EuroSCORE II were reasonably successful in assessing this risk, but their performance was less predictive than that reported for the overall cardiac surgical population, with the ACS NSQIP more consistently better in predicting the risk than the EuroSCORE II. The EuroSCORE II always deduces significantly higher risk scores than the ACS NSQIP score in the same patients.

Using the ACS NSQIP score or EuroSCORE II to assess the risk of postoperative in-hospital mortality after CABG allows for more informed decisions, which should encourage more patients at low risk to proceed with CABG and those at high risk to consider alternative therapies. It should also make benchmarking surgical outcomes in these patients easier, and it may help with patient selection for the much-needed trial comparing CABG to Percutaneous Coronary Intervention (PCI) in patients with severe LV dysfunction.

## Conclusion

In comparison to EuroSCORE II, our study found that the ACS NSQIP scoring system provided better discrimination and calibration. As a result, the ACS NSQIP scoring system can be used as a predictor in patients undergoing coronary artery

bypass grafting surgery.

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