Original Article

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Comparison of Logistic Euroscore with Euroscore II in predicting postoperative mortality in adult cardiac surgical patients

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Abstract

Background: Logistic Euroscore and Euroscore II are widely used in predicting perioperative mortality after cardiac surgery; however the data regarding the superiority of one over the other in predicting outcome regarding 30 days mortality in isolated coronary artery surgeries are not consistent. This study assessed the predictive accuracy of logistic Euroscore versus Euroscore II in determining 30 days mortality after isolated CABG surgery in a single cardiac center of Nepal.

Methods: One hundred and forty-two patients scheduled for isolated coronary artery bypass surgery during the one-year period was taken for this prospective observational study. The predictive post-operative mortality was calculated using both of the scoring system. The actual mortality observed during the 30 day of postoperative period was recorded and the findings were compared with the predictive post-operative mortality according to the scoring systems by using area under the receiver operating characteristics curve (AUC).

Results: One hundred and forty-two patients were enrolled in this study and average cross clamp time was 65.92 +/- 26.39 minutes and total cardiopulmonary bypass time was 102.90 +/- 37.32 minutes. The average hours of ventilator stay was 9.56 +/- 8.45 and total days of ICU stay was 4.96 +/- 2.00. The observed 30 day mortality was 2.11% (95% CI, 1.96-2.36%) which was slightly better predicted by ESL 2.40% (95% CI, 2.04-2.76%) in comparison to ES II 1.44% (95% CI, 1.22-1.66%). The AUC value was 0.917 (0.817-1.000) for ESL and 0.946 (0.887-1.000) for ES II in predicting 30 day postoperative mortality and were comparable.

Conclusion: Both of the logistic Euroscore and Euroscore II are comparable to each other in predicting 30 day postoperative mortality after isolated CABG surgery.

Keywords: Euroscore II, logistic Euroscore, mortality

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Introduction

Risk stratification and prediction of perioperative outcome is essential in counseling and planning the best strategy for cardiac surgical patients. Among various scoring tools most widely used in cardiac surgical patients undergoing coronary artery bypass and valve replacement surgeries are European System for Cardiac Operative Risk Evaluation (Euroscore) logistic model (ESL) and Euroscore II (ESII).

The Euroscore was first published in 1999 and since then has been used in predicting adverse outcomes in coronary artery bypass grafting (CABG) patients. This scale was later revised in 2003 as logistic Euroscore (ESL). However due to the technical advancement in surgery, anesthesiology and perfusion, the accuracy in predicting mortality by these tools gradually declined with time. So ESII was developed in 2012 using only 18 available preoperative, clinical and operation related factors, which offered better predictive value in isolated valve surgeries.

Both ESL and ESII are widely used in predicting perioperative mortality after cardiac surgery; however the data regarding the superiority of one over the other in predicting outcome regarding 30 days mortality in isolated coronary artery surgeries are not consistent. So, the outcome of this study can be used to choose the best scoring system to predict the postoperative outcome and do patient counseling of adult cardiac surgical patients in future in our setup.

The aim of this study is to assess the predictive performance of ESL versus ESII in determining 30 days mortality after isolated CABG surgery in a single cardiac center of Nepal.

Methods

After obtaining institutional review board approval and patient consent all the adult patients requiring isolated CABG surgery were selected for this study.

This was the prospective observational and comparative study performed at Shahid Gangalal National Heart Center of Nepal. All consecutive patients aged more than 18 years scheduled for isolated CABG surgery during the 1 year period from August 2020 to July 2021 were enrolled in the study. The exclusion criteria included patient's refusal and patient under mechanical ventilator prior to

surgery. From previous similar study done by Czub P et al, sample size requirement for inequality tests for two correlations with power of 80% and alpha=0.05 was 128. So, in this study we analyzed the 142 patients who underwent CABG surgery during the 1 year period.

For each patients demographic details, clinical findings, laboratory data, transthoracic echocardiography finding, number of grafts for CABG patients, cross clamp time and cardiopulmonary bypass time were recorded. The components for ESL and ESII score were recorded and calculated in all the patients in preoperative evaluation using the online calculator provided by euroscore.org.

The time of ventilator required in hours was the time from the patient transfer to the ICU till extubation. The number of days of ICU stay was recorded. Any in hospital mortality if present was recorded. For patients who were discharged the 30 day status was inquired by telephone with the patient party and was recorded.

The data collected were recorded and analyzed by using appropriate statistical tools with software SPSS. The p-value less than 0.05 was taken as significant.

Results

During the study period of one year, 142 patients were enrolled in the study. The demographic details of the patients are shown in Table 1. There were predominant male patient in this study of 120 compared to only 22 female patient. The average cross clamp time was 65.92 +/- 26.39 minutes and total cardiopulmonary bypass time was 102.90 +/- 37.32. The average hours of ventilator stay was 9.56 +/- 8.45 and total days of ICU stay was 4.96 +/- 2.00.

The observed 30 day mortality was 2.11% (95% CI, 1.96-2.36%) which was slightly over predicted by ESL 2.40% (95% CI, 2.04-2.76%) and slightly under predicted by ES II 1.44% (95% CI, 1.22-1.66%) as shown in Table 2. However the area under the curve (AUC) value of the Receiver operating characteristic (ROC) curve was 0.917 (0.817-1.000) for ESL and 0.946 (0.887-1.000) for ES II in predicting 30 day postoperative mortality and were comparable as shown in Table 3 and Figure 1 and Figure 2.

Table 1: Demographic data of the patients

Variables	mean +/- SD
Age in Years	57.65 +/- 8.66
Gender Male: Female	22:120
Weight (kg)	63.14 +/- 11.49
Height (cm)	159.32 +/- 9.29
BMI(kg/m$^{2)}$	24.76 +/- 3.60
Cross clamp time (min)	65.92 +/- 26.39
Cardiopulmonary bypass time (min)	102.90 +/- 37.32
Time of Ventilator stay (hours)	9.56 +/- 8.45
Days of ICU stay (days)	4.96 +/- 2.00

Table 2: Comparison of observed and predicted 30 days mortality with 2 scores

	Observed mortality % (95% CI)	Predicted mortality by ESL% (95% CI)	Predicted mortality by ESII % (95% CI)
CABG (95% CI)	2.11 (1.96-2.36)	2.40 (2.04-2.76)	1.44 (1.22-1.66)

Table 3: ROC curve AUC values for 30 day post-operative mortality

	AUC of ESL (95 % CI)	AUC of ES II (95 % CI)
CABG	0.917 (0.817-1.000) <0.001	0.946 (0.887-1.000) <0.000

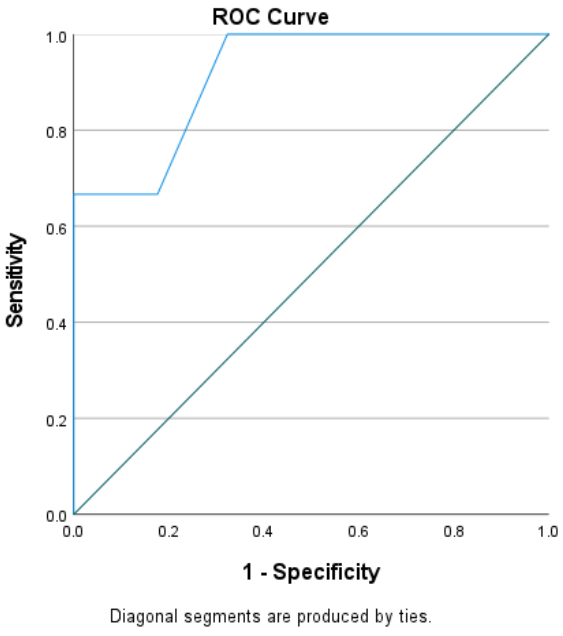

Figure 1: ROC curve of Logistic Euroscore

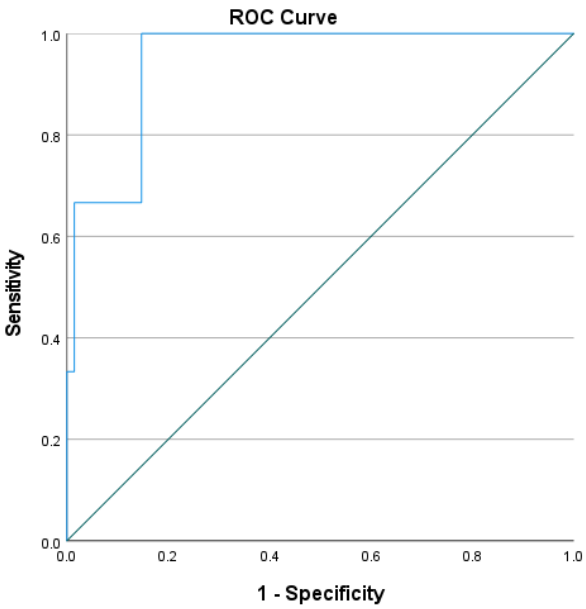

Figure 2: ROC curve of Euroscore II

Discussion

Risk stratification and prediction of perioperative outcome is essential not only for patient counselling but is also helpful in guiding the clinicians for decision making to go for surgical intervention or choose other conservative medical approaches in coronary artery disease patients. Both ESL and ESII is widely used as a tool for risk assessment based on data mainly from European countries, however adequate data regarding the application and validity of these tools in our setup with patients of different genetic, social and cultural background are lacking.

In our study, the observed 30 day mortality was 2.11% (95% CI, 1.96-2.36%) which was slightly over predicted by ESL 2.40%

(95% CI, 2.04-2.76%) and slightly under predicted by ES II 1.44% (95% CI, 1.22-1.66%). Several other studies has also shown that ESL demonstrated an over prediction of postoperative mortality following CABG surgery. In a multicenter prospective validation study done in Spain among 4000 patients undergoing cardiac surgery also concluded that ESL tends to overestimate the risk of mortality whereas ES II under predicted mortality. Similar was the finding of the study done in Hungary by Koszta G et al.

In our study, the area under the curve (AUC) value of the Receiver operating characteristic (ROC) curve was 0.917 (0.817-1.000) for ESL and 0.946 (0.887-1.000) for ES II which showed that both the tools have good calibration and discriminative power in predicting 30 day postoperative mortality among on pump CABG patients. In a study done by Forrokhyar et al the AUC value of ESL in risk prediction for Canadian patients undergoing on pump CABG was 0.81(95% CI 0.71-0.90) showing fair discriminative power. Similar was the finding for ES II in another study done by Garcia-Valentin et al9 where the ROC curve demonstrated good discriminative ability with AUC 0.79 (95% CI 0.76-0.82). However, in a collaborative study done in the Netherlands and United Kingdom showed that ES II was not good in predicting mortality in cardiac surgical patients with AUC of 0.67, indicating poor discriminative power. In another study done by Qadir I et al in Pakistan found that despite having a satisfactory discriminative power, ES II was poorly calibrated and the ESL fared better than ES II among isolated CABG patients. The differences in findings could be due to demographic related factors or other genetic, social or cultural differences.

The major limitation of our study was that our study had male preponderance and the cases were all urgent or elective CABG patients, so we recommend for further study in female population and in emergency cases to generalize the finding in our population.

Conclusion

The Logistic Euroscore is as effective as Euroscore II in predicting 30 day postoperative mortality after isolated CABG surgery. Both of the scoring system can be used preoperatively and the predicted value can be used as a reference to do patient counselling regarding the postoperative outcome in CABG patients. However these scoring system are just a tool to aid rather than to govern clinical decision making.

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Conflict of interest statement: We declare no perceived or potential conflicts of interest within past 36 months related to this study.

Authors' Contributions: SS Parajuli, N Rajbhandari and A Thakur designed the study, took part in acquisition, analysis and interpretation of data, created the initial draft of the manuscript and made critical revisions.

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