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Euro SCORE as a Predictor of Extended Intensive Care Unit Stay After Cardiac Surgery

Aleksandar Nikolic [1,*]

[1]Center for Cardiac Surgery, Clinical Center of Montenegro, Podgorica, Montenegro

*Corresponding author: Aleksandar Nikolic, Center for Cardiac Surgery, Clinical Center of Montenegro, Podgorica, Montenegro. Tel: +38-220412528, +38-163500089, E-mail: dralek-sandarnikolic@gmail.com

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Background: Risk stratification models allow preoperative assessment of individual patients cardiac surgical risk and enable analysis of postoperative outcome in the intensive care unit (ICU) as well.

Objectives: The aim of this single-center study was to explore the prediction of extended ICU stay after cardiac surgery using the European System for Cardiac Operative Risk Evaluation (Euro SCORE).

Patients and Methods: A retrospective cross-sectional study was conducted. We collected clinical data of 1841 consecutive patients undergoing cardiac surgery. The outcome measure was the duration of ICU stay in days. The predictive performance of Euro SCORE was analyzed by the discriminatory power of a receiver operating characteristic (ROC) curve.

Results: Overall observed mortality was 3.5% (57/1841). Patients had a median ICU stay of 3 days and a mean ICU stay of 3.1 days. Mean additive Euro SCORE was 4.36% (range: 0-21) and logistic Euro SCORE was 4.81% (range: 0.88-44.28). The logistic Euro SCORE model yielded an area under the ROC curve of 0.832, 0.768 and 0.643 for each ICU length of stay, respectively (7, 5, 3 days). Values of Euro SCORE and ICU stay were positively correlated ($P < 0.001$).

Conclusions: In our center, prolonged length of stay in the ICU correlated positively with Euro SCORE. The overall predictive performance of Euro SCORE is acceptable and provides both surgeons and intensivists with a good estimate of patient risk in terms of ICU stay.

Keywords: Cardiac Surgery; Intensive Care Units; Length of Stay; Risk Factors

1. Background

Euro SCORE – European System for Cardiac Operative Risk Evaluation developed in 1999 is a predictive model for 30-days (operative) mortality risk in adults (1).

Initially, the Euro SCORE was based on additive system subsequently, the logistic Euro SCORE was proposed as a more sound approach to risk prediction (2). This model uses the same suite of risk factors, but assigns quite different weightings to each factor, and the final risk prediction is derived from these weightings using a more complex formula. There was some evidence that this logistic model can slightly provide more accurate results, especially for the high-risk patient. On October 2011 a new version of the Euro SCORE, named Euro SCORE II, was presented at the EACTS Lisbon meeting. The Euro SCORE II is the result of a totally new development series of patients, and carries a number of differences with respect to the previous version. Some new factors were included, others were excluded and yet some others were more detailed in their definition. Euro SCORE includes:

Patient-related factors (age, gender, chronic pulmonary disease, extra cardiac arteriopathy, neurological dysfunction, previous cardiac surgery, serum creatinine, acute endocarditis, critical preoperative state)

Cardiac-related factors (instable angina on iv nitrates, LV function EF 30-50, EF ≤ 30, recent infarct, systolic PA pressure ≥ 60)

Operation-related factors (emergency, other than isolated CABG, surgery on thoracic aorta, postinfarct septal rupture)

The first known national system of risk stratification dealing with detailed analysis of various risk factors and their effect on result of surgical treatment was created in the United States of America during the 1980's. It was the STS (The society of thoracic surgeons) System and it was widely accepted among all the members (3). Parsonnet developed his own system of risk stratification, which was first applied in the USA and all over the world (4).

2. Objectives

The aim of this single-centre study was to explore the prediction of extended intensive care unit (ICU) stay after cardiac surgery using both the additive and logistic model of Euro SCORE.

3. Patients and Methods

A retrospective cross-sectional study was conducted.

We collected 1841 consecutive patients undergoing cardiac surgery (coronary, valvular and combined surgery) over a 5-year period at the Clinical Center of Montenegro, Podgorica. The outcome measure was the duration of ICU stay in days. The predictive performance of Euro SCORE was analyzed by the discriminatory power of receiver operating characteristic (ROC) curve. Three subsequent ICU stays were defined as prolonged: more than 3, 5 and 7 days. ROC curves were constructed for both additive and logistic model.

In statistical analysis, SPSS (ver.13) program and the following methods were used: descriptive statistics (mean, median), histogram of frequencies, regression analyses and ROC analyses. P value less than 0.05 was considered as statistically significant.

4. Results

Data were collected for 1841 patients. The mean age of operated patients was 62 years (SD 8.6, range 27-81), and majority of patients were males (73.8%, 1359/1841). There were 70.6% of patients with only CABG surgery (1300 patients), 20.0% with valve surgery (368 patients) and 9.4% of patients with combined CABG and valve surgery (173 patients).

Overall observed mortality was 3.1% (57 patients). Mean expected additive Euro SCORE was 4.3% (SD 2.7, range 0-19) and logistic Euro SCORE was 4.8% (SD 6.3, range 0.88-80.6).

Patients had a median ICU stay of 3 days and a mean ICU stay of 3.1 days. (SD 2.3, range 1-21 days). Three subsequent ICU stays were defined as prolonged: more than 3, 5 and 7 days. ICU stays more than 3 days had 25.9% of all operated patients (477 patients), more than 5 days 7.8% of patients (144 patients) and more than 7 days 3.3% of patients (61 patients).

There was positive correlation (r = 0.297) between expected mortality according to additive Euro SCORE and number of days in ICU ($P < 0.001$). The trend line formula is $Y = 2.12 + 0.24\ X$, for each percentage of expected mortality, the ICU stay is prolonged for a 0.24 days. There was also positive correlation (r = 0.249) between expected mortality according to logistic Euro SCORE and number of days in ICU ($P < 0,001$). The trend line formula is $Y = 2.66 + 0.10\ X$ ($P < 0,001$), for each percentage of expected mortality, the ICU stay is prolonged for a 0.10 days (Figure 1).

The predictive performance of Euro SCORE was analyzed by the discriminatory power of receiver operating characteristic (ROC) curve. Three subsequent ICU stays were defined as prolonged: more than 3, 5 and 7 days. ROC curves were constructed for both additive and logistic model and all three cut points.

In the additive Euro SCORE model, a ROC discriminatory value of 0.821 for an ICU stay of more than 7 days (with best Euro SCORE cut-point of 5.5%; sensitivity 0.883, specificity 0.747) 0.758 for an ICU stay more than 5 days (with best Euro SCORE cut-point of 4,5%; sensitivity 0.781, specificity 0.640) and 0.643 for ICU stay more than 3 days (with best Euro SCORE cut-outpoint of 3,5%; sensitivity 0.685, specificity 0.520) were found. The logistic Euro SCORE model yielded an area under the ROC curve of 0.832 (with best Euro SCORE cut-point of 5 6%; sensitivity 0.800, specificity 0.801), 0.768 (with best Euro SCORE cut-point of 3 8%; sensitivity 0.781 specificity 0.680) and 0.643 (with best Euro SCORE cut-point of 3 3% ; sensitivity 0.558, specificity 0.643) for each ICU length of stay, respectively Figure 2.

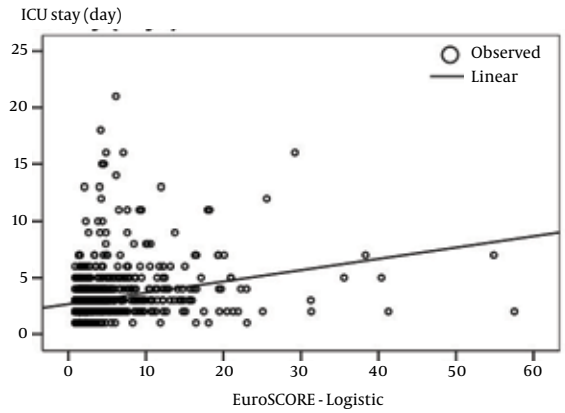

Figure 1. Scatter Diagram of ICU Stay and Logistic Euro SCORE

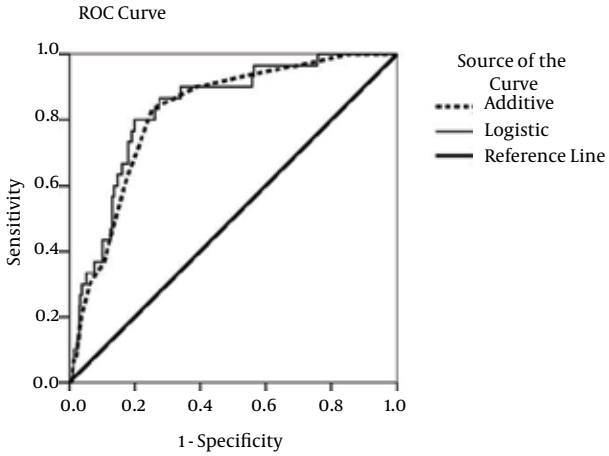

Figure 2. ROC Analyses of ICU Stay More Than 7 Days

5. Discussion

One of the first studies dealing with effects of risk factors on the outcome of cardiac surgery treatment and the length of ICU stay was the multicenter study in Canada (5). It included over 13000 patients who had undergone cardiac surgery in the period from 1991 to 1993. It was concluded in nine centres for adult surgery. The model was additive. Their conclusion was that patients

with the higher score of the risk factors had higher mortality rate and were treated longer in ICU. Some authors analyzed even the influence of seasonal variation on postoperative outcome. Shuhaiber et al. concluded that the Euro SCORE is useful for prediction of ICU LOS after coronary surgery, but the winter season correlates with increased duration (6). Nilsson at al. (7) in their study included 3404 patients, and concluded that the probability of an ICU stay exceeding 2 days was more than 50% at a Euro SCORE of 14 or more.

In our centre, prolonged length of stay in ICU correlated positively with Euro SCORE. The logistic model was slightly more discriminatory than the additive in tracing extended ICU stay. The overall predictive performance of Euro SCORE is acceptable and provides both surgeons and intensivists with a good estimate of patient risk in terms of ICU stay.

References

1. Roques F, Nashef SA, Michel P, Gauducheau E, de Vincentiis C, Baudet E, et al. Risk factors and outcome in European cardiac surgery: analysis of the EuroSCORE multinational database of 19030 patients. *Eur J Cardiothorac Surg.* 1999;**15**(6):816–22.
2. Roques F. The logistic EuroSCORE. *European Heart Journal.* 2003;**24**(9):882.
3. Clark RE. Calculating risk and outcome: The Society of Thoracic Surgeons database. *Ann Thorac Surg.* 1996;**62**(5 Suppl):S2–5.
4. Parsonnet V. Risk stratification in cardiac surgery: is it worthwhile? *J Card Surg.* 1995;**10**(6):690–8.
5. Tu JV, Jaglal SB, Naylor CD. Multicenter validation of a risk index for mortality, intensive care unit stay, and overall hospital length of stay after cardiac surgery. Steering Committee of the Provincial Adult Cardiac Care Network of Ontario. *Circulation.* 1995;**91**(3):677–84.
6. Shuhaiber JH, Goldsmith K, Nashef SA. The influence of seasonal variation on cardiac surgery: a time-related clinical outcome predictor. *J Thorac Cardiovasc Surg.* 2008;**136**(4):894–9.
7. Nilsson J, Algotsson L, Hoglund P, Luhrs C, Brandt J. EuroSCORE predicts intensive care unit stay and costs of open heart surgery. *Ann Thorac Surg.* 2004;**78**(5):1528–34.