Original article

Comparison of European system for cardiac operative risk evaluation (EuroSCORE) II with the postoperative outcomes in patients undergoing cardiac surgery

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ABSTRACT

Background: Models have been developed to predict a variety of outcomes, for all cardiac surgery and also for specific cardiac surgery procedures. The most broadly utilized model for anticipating mortality in cardiovascular surgery was EuroSCORE I which has been upgraded in recent times to EuroSCORE II. The objective of the present study was to evaluate the efficacy of the EuroSCORE II in anticipating the mortality in patients experiencing cardiac surgery.

Subjects and methods: Cross-sectional observational study from a sample of 101 cardiac surgery patients was conducted to evaluate the outcomes (length of stay at ICU and hospital and mortality) of postoperative cardiac surgery in relation to EuroSCORE II at Punjab Institute of Cardiology Lahore from 22nd April, 2016 to 15th December, 2016.

Results: Mean values of WBCs, serum creatinine and bilirubin total were significantly increased from preoperative to postoperative-I and a minor decrease on the postoperative II readings whereas mean values of hemoglobin and platelets constantly (p-value<0.01) declined after surgery. Mean values of blood urea and ALT increased sequentially during preoperative, postoperative-I and postoperative-II laboratory investigations. In addition, positive relationship of EuroSCORE II with ICU stay (r = 0.205, p-value<0.05) and ventilation time (r = 0.232, p-value<0.05) were observed. In addition to these results, there were 98 (97.0%) patients discharged after cardiac surgery and 3 (3.0%) patients expired.

Conclusion: The risk prediction from EuroSCORE II is best suited for low and medium risk group patients but it was not appropriate for high risk patients.

Keywords:

EuroSCORE II, Cardiac Surgery, Outcomes, Mortality, Risk.

INTRODUCTION

Various models have been developed to predict a variety of outcomes, for all cardiac surgeries as well as for specific cardiac surgery procedures.[1] The principal heart surgery hazard forecast model was the Parsonnet score which was produced on information from more than 3000 cardiovascular surgery patients.[2] The Parsonnet score was published as an additive model. It initially demonstrated good performance,[3] and was subsequently updated.[4] However the initial score did not include respiratory ailment, which most medical practitioner view as a significant risk factor meaning its clinical validity was questioned. The predictive ability of the Parsonnet model was subsequently shown to be Poor.[5] Thus a venture intended to build up an Europe wide hazard display for heart surgery was introduced and the European System for Cardiac Operative Risk Evaluation (EuroSCORE) model was distributed as an added substance score in 1999.[6] The EuroSCORE model was produced using information from 14781 patients from eight European nations gathered in 1995.[7] The added substance model was at first evaluated in various distinctive nations both inside and outside Europe and was observed to be legitimate.[8] However the exactness of the added substance display especially in high-hazard patients was thus addressed[9] and the full calculated "EuroSCORE" was distributed in 2003.[10] The logistic had the advantage of improved calibration, particularly in high-risk patients but required a computer programme to calculate. Despite retaining good discriminatory ability, the original "EuroSCORE" models have been found to significantly over-predict

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the risk of cardiac surgery in recent years.[11] Various inadequacies as for the face legitimacy of the EuroSCORE have additionally been recognized. These incorporate its treatment of renal impedance and the attribution of a similar level of incremental hazard for all methods other than coronary corridor surgery. This treatment of different methodology prompts to the anticipated mortality of patients with a similar hazard variables experiencing minor techniques and complex various systems having the same anticipated hazard. The "EuroSCORE II" has recently been developed in an attempt to address the shortcomings of the original "EuroSCORE" models for contemporary cardiac surgery.[12] Early validations of the "EuroSCORE II" have so far been positive.[13] There is striking similarity between the two models however there are a number of key differences between the two. In "EuroSCORE II", renal impairment has been split into categories rather than dichotomized, neurological dysfunction has been replaced with poor mobility and the level of dyspnea and diabetes are now included. Post-infarct septal rupture is no longer included and both the operation type and urgency have been re-classified.[14-16]

In present research, we evaluated the preoperative risk factors after computing EuroSCORE II of the patient's undergone cardiac surgery and determined its correlation with postoperative clinical outcome like mortality, hospital stay, ICU stay, use of blood products, and laboratory investigations.

SUBJECTS AND METHODS

An analytical cross-sectional observational study was conducted to investigate the outcomes of postoperative cardiac surgery in relation to EuroSCORE II at Punjab Institute of Cardiology (PIC) Lahore from 22nd April, 2016 to 15th December, 2016. Patients with all procedures of cardiac surgeries were included whereas the patients with age less than 15 years or those with surgical procedure of total correction and PDA were excluded from the study. A sample of 101 cardiac surgery patients was determined after incorporating the parameters, (p =proportion of overall patients with cardiac surgery = 2043/27563 = 0.07; α = 0.05 and e = level of precision = 0.05) into Cochran's formula of sample size.[17]

A standardized self-report questionnaire was used to investigate the post-operative outcomes of cardiac surgery and results of EuroSCORE II. The main components of EuroSCORE II are patient related factors, cardiac related factors and operation related factors.[18] There were laboratory investigations at three different time points; pre-operative, post-operative I (investigations made on the same day after surgery) and post-operative II (investigations made on second day of surgery) including white blood cells, hemoglobin, platelets, blood urea, creatinine, total bilirubin, alanine-aminotransferase (ALT) and alkaline phosphatase (ALP). Investigations about ICU Inotropic support were made on adrenaline and dopamine. There were question about procedures about cardiac surgery whether it is CABG, valve repair or replacement and replacement of part of aorta. Preoperative ejection fraction of patients was noted. In the end, EuroSCORE II was calculated online and outcome status of the patients was noted whether the patients were discharged alive or expired. All the data were entered, screened and analyzed in SPSS v24. Descriptive (frequency, percentage) and inferential (correlation, ANOVA) statistical tools were used to analyze the data.

Table 1. Demographic characteristics and risk factors of cardiac surgery

Characteristics	Frequency (%)
Gender	
Male	76 (75.2)
Female	25 (24.8)
Monthly family income (PKR)	
<10,000	49 (48.5)
≥10,000	52 (51.5)
Residential area	
Urban	62 (61.4)
Rural	39 (38.6)
City	
Lahore	41 (40.6)
Other	60 (59.4)
Risk factors of cardiac surgery	
Hypertension	49 (48.5)
Smoking	37 (36.6)
Hyperlipidemia	20 (19.8)
Family history	40 (39.6)
COPD	5 (5.0)
Diabetes mellitus	23 (22.8)
Alcohol intake	1 (1.0)
Obesity	18 (17.8)
History of stroke/ TIA	6 (5.9)
Renal failure/dialysis	8 (7.9)
Extra cardiac arteriopathy	42 (41.6)
Poor mobility	31 (30.7)
Previous cardiac surgery	5 (5.0)
Critical preoperative state	3 (3.0)
Recent myocardial infarction	14 (13.9)
Canadian Cardiovascular Society Class	21 (20.8)

RESULTS

The majority (75.2%) of the patients were male and reported mostly (61.4%) from urban area. Out of 101 patients, 4 (4.0%) were less than 20 years old, 21 (20.8%) were between 20-40 years, 56 (55.4%) were between 41 to 60 years and 20 (19.8%) were above 60

years of age. From 101 patients, 49 (48.5%) had less than Rs.10000 (USD=70.78) and 52 (51.5%) had more than Rs.10000 (USD=70.78) of their monthly family income (Table 1).

Following risk factors were noted among the patients: hypertension in 49 (48.5%), smoking in 37 (36.6%), hyperlipidemia in 20 (19.8%), family history of cardiac disease in 40 (39.6%), COPD in 5 (5.0%), diabetes in 23 (22.8%), alcoholic 1 (1.0%), obesity in 18 (17.8%), history of stroke in 6 (5.9%), renal failure in 8 (7.9%), extra cardiac arteriopathy in 42 (41.6%), poor mobility in 31 (30.7%), history of cardiac surgery in 5 (5.0%), critical preoperative state in 3 (3.0%), recent MI in 14 (13.9%), and CCS Class in 21 (20.8%) patients. Majority of the patients including 71 (70.3%) had NHYA-II Class followed by 19 (18.8%) NHYA-III Class, 9 (8.9%) NHYA-I Class and 2 (2.0%) NHYA-IV Class. In addition, majority of the patients were with Coronary Artery Bypass Grafting (CABG) 66 (65.3%), valve repair or replacement procedure in 33 (32.7%) or replacement of part of aorta in 2 (2.0%) patients. Moreover, based on the calculated values of EuroSCORE II, 80 (79.2%), 15 (14.9%), 3(3.0%) and 3(3.0%) of the patients were classified with low, medium, high or very high risk group patients respectively (Table 1).

Majority of the patients 89 (88.1%) received support of Adrenaline or Dopamine. Out of 89 patients, 66 (65.3%) received adrenaline, 2 (2.0%) received dopamine while 21 (20.8%) received support of the both drugs. About 98 (97.0%) patients required whole blood infusions and 3 (3.0%) required PCVs. There were 15 (14.9%) patients required FFPS and 2 (2.0%) were in need of platelets. In addition to these results, there were 98 (97.0%) patients discharged after cardiac surgery and 3 (3.0%) patients expired.

Table 3 depicted that a significant (p-value<0.01) increase in the mean values of WBCs, Serum creatinine and bilirubin total on I postoperative day and a minor decrease on the II postoperative day whereas mean values of hemoglobin and platelets constantly significantly (p-value<0.01) declined after surgery. Mean values of blood urea and ALT increased sequentially during preoperative, postoperative-1 and postoperative-II laboratory investigations.

A positive significant relationship of EuroSCORE II was observed with ICU stay (r = 0.205, p-value<0.05) and ventilation time (r = 0.232, p-value<0.05) while positively related with hospital stay. In addition to these results, there was a statistically significant (Z=-2.801, p- value<0.05) difference in the mean scores of EuroSCORE II of discharged and expired patients and group of expired patients were high risk patients.

Table 2. ICU ionotropic support provided to the patients

Type of support	Frequency (%)
Support of adrenaline/dopamine	
Yes	89 (88.1)
No	12 (11.9)
Drug	
Adrenaline	66 (65.3)
Dopamine	2 (2.0)
Both	21 (20.8)
None	12 (11.9)
Adrenaline dose	
None	14 (13.9)
Mild	75 (74.3)
Moderate	10 (9.9)
High	2 (2.0)
Adrenaline days	
1 day	20 (19.8)
2 days	41 (40.6)
3 days	14 (13.9)
4 days	4 (4.0)
5 days	4 (4.0)
6 days	4 (4.0)
Not taken	14 (13.9)
Dopamine dose	
None	78 (77.2)
Mild	21 (20.8)
Moderate	2 (2.0)
Dopamine days	
1 day	3 (3.0)
2 days	4 (4.0)
3 days	7 (6.9)
4 days	4 (4.0)
5 days	1 (1.0)
6 days	4 (4.0)
Not taken	78 (77.2)

DISCUSSION

In current medication, the utilization of hazard scores as indicators of cardiovascular occasions is entrenched. Without a doubt, the consolidation of the EuroSCORE on key administrations in Europe inferred the "Hawthorne" impact, clarifying that not a lot has enhanced results in cardiovascular surgery toward the start of the century, as checking by EuroSCORE.[19-20] After some time, the rebuilding of the Euro-SCORE for nations that joined its required utilize would be legitimate and therefore, the EuroSCORE II has stimulated. The assessment of the value of EuroSCORE II in surgical populaces is in progress and its prevalence over EuroSCORE (standard on the other hand strategic) in foreseeing mortality is still wrangled about.[21] Significant (p-value<0.05) differences were observed in laboratory investigation during pre-operative, post-operative I and post-operative II times.[22]

Table 3. Comparison of pre-operative, post-operative I and post-operative II laboratory investigations of the patients

Lab tests	Preoperative	Postoperative- I	Postoperative-II
White blood cells**	8.67±2.53	16.8±5.5	15.6±5.80
Hemoglobin**	137.9±19.3	119.4±21.1	104.4±20.7
Platelets**	245.5±82.9	205.8±73.9	154.4±57.9
Blood urea**	30.0±11.4	32.7±11.1	34.8±15.9
Serum creatinine**	0.87±0.21	1.06±0.3	1.00±0.40
Bilirubin total**	0.69±0.61	1.15±0.8	0.99±1.08
ALT(SGPT)*	31.7±18.4	34.1±15.2	34.7±21.3

* p<0.05; ** p<0.01

Table 4. Descriptive and correlation results of EuroSCORE II with ventilation time, ICU stay and hospital stay

Postoperative outcomes	Min	Max.	Mean	S.D	Relationship with EuroSCORE II	
					R	p-value
Ventilation time (hours)	3	696	20.83	75.54	0.232	0.020
ICU stay (days)	1	29	4.20	3.72	0.205	0.040
Hospital stay (days)	1	75	9.18	7.99	0.143	0.153

EuroSCORE II and ventilation time of patients have a positive linear relationship, it means patients with higher value of EuroSCORE II have long duration during ventilation.[23] EuroSCORE II and ICU stay of patients have a positive linear relationship, it means patients with higher value of EuroSCORE II have long period of stay at ICU. As the value of EuroSCORE II increases the ICU stay of patients tends to increase gradually.[24] EuroSCORE II and hospital stay of patients have a positive linear but not significant relationship, it means patients with higher value of EuroSCORE II have long period of stay at hospital and with the value of EuroSCORE II increases the hospital stay of patients tends to increase gradually.[25]

CONCLUSION

Risk prediction models play an important role in cardiovascular surgery. Risk prediction models for mortality can be used to risk-adjust surgical outcomes and facilitate clinical decision making. Cardiac risk models may not be sufficiently accurate for high-risk patient groups such as those undergoing emergency surgery and specific emergency models may be required. It is concluded from the present study that risk prediction from EuroSCORE II is best suited for low and medium risk group patients but it is not appropriate for high risk patients. Whereas both discharged and expired patients have different mean scores of EuroSCORE II. Most of the patients were from poor category whose expenses are brought about by government. Policy makers should plan to minimize the stay of patients after surgery in-order to overcome the expenses. As EuroSCORE II, preoperatively predicts the length of stay at ICU and hospital of patients after surgery. Continuing research into new risk factors and model outcomes is needed and risk prediction models may play an increasing role in clinical decision making in the future.

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