Application of operative risk scoring in cardiac surgery

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Risk scoring?

Prognostic tool
Conditions:

Left: คุณยายมี วัย 86 ปี
Underlying: DM, CKD
Plan: CABG x5 + AVR

Right: นายหน้า วัย 37 ปี
No underlying disease
Plan: MVR
• มีโอกาสเสี่ยงที่วิธีมีขึ้นครับ?
• ฝากน้ำขายนะในนัก?
• เกิดภาวะระนาบพักงานจ่ายเงินได้รับหนังสือไม่?
• ฐานะของพยาบาลวนันมีขึ้นครับ?
Preoperative risk score

- Risk assessment
- Plan of treatment
- Cost benefit analysis
- The study of therapy trends.
Risk score

- Euro score
- STS score
- Parsonnet score
- Cleveland Clinic score
- French score
- Pons score
- Ontario Province Risk score

Risk stratification in heart surgery: comparison of six score systems
Hans J. Geissler*, Department of Cardiothoracic Surgery, University of Cologne, Germany
Evaluation factors

- Patient data: age, gender, BW
- Cardiac status: NYHA, arrhythmia, MI, valvular heart
- Pulmonary: COPD, asthma
- Renal: CKD, dialysis, creatinin
- Other: anemia, DM, liver disease, stroke
- Preoperative status: ventilation, inotropic, cardiogenic shock
- Operation: comitant surgery, urgent, emergency, reoperation
Risk stratification in heart surgery: comparison of six score systems

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Received 6 September 1999; received in revised form 25 January 2000; accepted 8 February 2000

Abstract

Objective: Risk scores have become an important tool in patient assessment, as age, severity of heart disease, and comorbidity in patients undergoing heart surgery have considerably increased. Various risk scores have been developed to predict mortality after heart surgery. However, there are significant differences between scores with regard to score design and the initial patient population on which score development was based. It was the purpose of our study to compare six commonly used risk scores with regard to their validity in our patient population. Methods: Between September 1, 1998 and February 28, 1999, all adult patients undergoing heart surgery with cardiopulmonary bypass in our institution were preoperatively scored using the initial Parsonnet, Cleveland Clinic, French, Euro, Pons, and Ontario Province Risk (OPR) scores. Postoperatively, we registered 30-day mortality, use of mechanical assist devices, renal failure requiring hemodialysis or hemofiltration, stroke, myocardial infarction, and duration of ventilation and intensive care stay. Score validity was assessed by calculating the area under the ROC curve. Odds ratios were calculated to investigate the predictive relevance of risk factors. Results: Follow-up was able to be completed in 504 prospectively scored patients. Receiver operating characteristics (ROC) curve analysis for mortality showed the best predictive value for the Euro score. Predictive values for morbidity were considerably lower than predictive values for mortality in all of the investigated score systems. For most risk factors, odds ratios for mortality were substantially different from ratios for morbidity. Conclusions: Among the investigated scores, the Euro score yielded the highest predictive value in our patient population. For most risk factors, predictive values for morbidity were substantially different from predictive values for mortality. Therefore, development of specific morbidity risk scores may improve prediction of outcome and hospital cost. Due to the heterogeneity of morbidity events, future score systems may have to generate separate predictions for mortality and major morbidity events. © 2000 Elsevier Science B.V. All rights reserved.
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<tr>
<td>Unstable angina</td>
<td>1</td>
<td>0.96</td>
<td>0.5–1.8</td>
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</tr>
</tbody>
</table>

<sup>a</sup> EF, ejection fraction; V-tach, V-fib, ventricular tachycardia, fibrillation; BMI, body mass index; MI, myocardial infarction.
Actual mortality 4%
I don’t know
Risk scoring

- EuroSCORE II
- STS score
EuroSCORE II

- European System for Cardiac Operative Risk Evaluation
- is launched at the 2011 EACTS meeting in Lisbon
- Factors
  - Patient
  - Cardiac
  - Operation
EuroSCORE II

- **Outcome**: mortality rate
- [http://www.euroscore.org/calc.html](http://www.euroscore.org/calc.html)
**Important:** The previous additive \(^1\) and logistic \(^2\) EuroSCORE models are out of date. A new model has been prepared from fresh data and is launched at the 2011 EACTS meeting in Lisbon. The model is called EuroSCORE II \(^3\); this online calculator has been updated to use this new model. If you need to calculate the older “additive” or “logistic” EuroSCORE please visit the old calculator by clicking **here**.

<table>
<thead>
<tr>
<th>Patient related factors</th>
<th>Cardiac related factors</th>
<th>Operation related factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (^1) (years)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Gender</td>
<td>select</td>
<td>0</td>
</tr>
<tr>
<td>Renal impairment (^2)</td>
<td>normal (CC &gt; 85 ml/min)</td>
<td>0</td>
</tr>
<tr>
<td>Extracardiac arteriopathy (^3)</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Poor mobility (^4)</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Chronic lung disease (^6)</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Active endocarditis (^6)</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Critical preoperative state (^7)</td>
<td>no</td>
<td>0</td>
</tr>
<tr>
<td>Diabetes on insulin</td>
<td>no</td>
<td>0</td>
</tr>
</tbody>
</table>

**EuroSCORE II**

**Note:** This is the 2011 EuroSCORE II

<table>
<thead>
<tr>
<th></th>
<th>EuroSCORE II</th>
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</tr>
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<tbody>
<tr>
<td></td>
<td>0</td>
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<table>
<thead>
<tr>
<th></th>
<th>Calculate</th>
<th>Clear</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patient related factors</td>
<td>Cardiac related factors</td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>Age (years) 50</td>
<td>NYHA IV 5597923</td>
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<tr>
<td>Gender</td>
<td>CCS class 4 angina yes 2226147</td>
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<tr>
<td>Renal impairment normal (CC &gt; 85 ml/min)</td>
<td>LV function very poor (LVEF 20% or less) 9346813</td>
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<tr>
<td>Extracardiac arteriopathy yes</td>
<td>Recent MI yes 1528943</td>
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</tr>
<tr>
<td>Poor mobility yes</td>
<td>Pulmonary hypertension severe (PA systolic &gt; 55 mmHg) 3491475</td>
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</tr>
<tr>
<td>Previous cardiac surgery yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic lung disease yes</td>
<td>Urgency emergency 7033121</td>
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<tr>
<td>Active endocarditis yes</td>
<td>Weight of the intervention 3 procedures 9724533</td>
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<tr>
<td>Critical preoperative state yes</td>
<td>Surgery on thoracic aorta yes 6527205</td>
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</tr>
<tr>
<td>Diabetes on insulin yes</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EuroSCORE II** 13.20 %
| **Age** (years) | 86 | 0.77 | **NYHA** | II | .1070545 |
| **Gender** | female | .2196434 | **CCS class 4 angina** | no | 0 |
| **Renal impairment** | severe (CC <50) | 8592256 | **LV function** | moderate (LVEF 31%-50%) | .3150652 |
| **Extracardiac arteriopathy** | no | 0 | **Recent MI** | yes | .1528943 |
| **Poor mobility** | no | 0 | **Pulmonary hypertension** | no | 0 |
| **Previous cardiac surgery** | no | 0 | **Operation related factors** | | |
| **Chronic lung disease** | no | 0 | **Urgency** | elective | 0 |
| **Active endocarditis** | no | 0 | **Weight of the intervention** | 2 procedures | .5521478 |
| **Critical preoperative state** | no | 0 | **Surgery on thoracic aorta** | no | 0 |
| **Diabetes on insulin** | yes | .3542749 | | | |
| **EuroSCORE II** | | | | | 11.98 % |
• the Society of Thoracic Surgeons (STS) score

• Operation
  • CABG Only
  • AVReplaced or MVReplaced or MVRepaired
  • AVReplaced+CABG or MVReplaced+CABG or MVRepaired +CABG

• http://riskcalc.sts.org/STSWebRiskCalc273/de.aspx
STS score

- Procedure
- Patient
- Risk factors
- Previous CV intervention
- Preoperative cardiac status
- Preoperative medications
- Hemodynamic and cath
- Operative status
<table>
<thead>
<tr>
<th>Procedure</th>
<th>Risk (2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary Artery Bypass</td>
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</tr>
<tr>
<td>Yes</td>
<td>18.171%</td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td></td>
</tr>
<tr>
<td>Valve Surgery</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60.463%</td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td></td>
</tr>
<tr>
<td>Aortic</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>35.098%</td>
</tr>
<tr>
<td>No</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td></td>
</tr>
<tr>
<td>Aortic Procedure</td>
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</tr>
<tr>
<td>Replacement</td>
<td>41.157%</td>
</tr>
<tr>
<td>Repair/Reconstruction</td>
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<tr>
<td>Root Reconstruction with valved conduit</td>
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</tr>
<tr>
<td>Replacement and insertion aortic non-valved conduit</td>
<td></td>
</tr>
<tr>
<td>Resuspension Aortic Valve without replacement of ascending</td>
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</table>

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Risk (2013)</th>
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<tbody>
<tr>
<td>Long Length of Stay</td>
<td>3.625%</td>
</tr>
<tr>
<td>Short Length of Stay</td>
<td></td>
</tr>
<tr>
<td>Permanent Stroke</td>
<td>7.152%</td>
</tr>
<tr>
<td>Prolonged Ventilation</td>
<td>0.537%</td>
</tr>
<tr>
<td>DSW Infection</td>
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<tr>
<td>Renal Failure</td>
<td>39.364%</td>
</tr>
<tr>
<td>Reoperation</td>
<td>17.514%</td>
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<tr>
<td>Procedure Name</td>
<td>Percentage</td>
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<td>-----------------------------</td>
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<tr>
<td>Risk of Mortality</td>
<td>18.171%</td>
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<tr>
<td>Morbidity or Mortality</td>
<td>60.463%</td>
</tr>
<tr>
<td>Long Length of Stay</td>
<td>35.098%</td>
</tr>
<tr>
<td>Short Length of Stay</td>
<td>3.625%</td>
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<tr>
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<td>Medical</td>
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Summary

- Risk scoring → prognostic tool

Assessment patient

Plan treatment

Communication