

Risk Prediction in Cardiac Surgery

To Operate or Not — SAAPM
Seminar
23 July 2015



Government of South Australia

SA Health

Greg Rice
Cardiac and Thoracic Surgery
Flinders Medical Centre

Risk Prediction Scores

- Huge degree of variability in perioperative risk
- Raw outcome measures poor markers of quality
- Scores developed for risk prediction; also used for risk adjustment for outcome measures
- Now widely used in public reporting of risk-adjusted outcomes (SCTS, New York State, others)



- 40 year-old
- Mitral regurgitation
- No other medical issues
- Normal LV function



- 85 year-old
- Aortic stenosis
- Previous CAG
- Moderate LV dysfunction

Risk Prediction Scores

- Huge degree of variability in perioperative risk
- Raw outcome measures poor markers of quality
- Scores developed for risk prediction; also used for risk adjustment for outcome measures
- Now widely used in public reporting of risk-adjusted outcomes (SCTS, New York State, others)

Risk Prediction Scores

- Early — Parsonnet, Cleveland Clinic, French, Pons, Ontario
- EuroSCORE (I and II)
- STS Predicted Risk Calculator
- Others — TuScore, AusScore

Early Scoring Systems

Name	Year	Type	No. of Patients
Parsonnet	1989	Single centre, retrospective	3,500
Cleveland Clinic	1992	Single centre, retrospective	5,051
French	1995	Multi-centre, prospective	7,181
Pons	1996	Multi-centre, prospective	916
Ontario	1995	Multi-centre, retrospective	6,213



European Journal of Cardio-thoracic Surgery 16 (1999) 9–13

EUROPEAN JOURNAL OF
CARDIO-THORACIC
SURGERY

European system for cardiac operative risk evaluation (*EuroSCORE*)[☆]

S.A.M. Nashef^{*}, F. Roques, P. Michel, E. Gauducheau, S. Lemeshow, R. Salamon,
the *EuroSCORE* study group

Papworth Hospital, Cambridge CB3 8RE, UK

Received 21 September 1998; accepted 29 March 1999

EuroSCORE

- European System for Cardiac Operative Risk Evaluation
- Developed from data set of 13,302 patients September to December 1995; validated in 1,479
- Initially additive:

0–2	Low risk
3–5	Medium risk
6+	High risk
- Logistic score 2003
- Online calculator available at <http://www.euroscore.org/calcold.html>

EuroSCORE

Patient Factors

- Age
- Sex
- COPD
- PVD
- Neurological dysfunction
- Previous cardiac surgery
- Renal impairment
- Active endocarditis
- Critical preoperative state

Cardiac Factors

- Unstable angina
- LV dysfunction
- Recent MI
- Pulmonary hypertension

Procedural Factors

- Emergency
- Non-isolated CABG
- Thoracic aortic surgery
- Post-infarct VSD

EuroSCORE II

- Recognition that EuroSCORE overestimates risk
- Updated model, presented at EACTS meeting 2011
- 22,381 patients, May to July 2010; validated in 5,553 patients
- Adds 'poor mobility' & insulin-dependent diabetes, as well as more detail on functional status (NYHA & CCS classes)

Limitations

- Risk factors determined by multivariate analysis
- Predominantly isolated coronary artery surgery
- Rare factors not incorporated into models but may represent significant increase in perioperative risk
- Multiple reoperations
- Liver dysfunction, coagulopathy
- Right ventricular dysfunction
- Weight (over or under)
- Arrhythmias
- Predicts mortality only, not morbidity

STS Score

- Society of Thoracic Surgeons Adult Cardiac Surgery Database
- Derived from data for patients undergoing surgery between 1 Jan 2002 and 31 Dec 2006 (60% development, 40% validation):
 - 774,881 isolated CAG procedures
 - 109,759 isolated valve procedures
 - 101,661 combined CAG & valve procedures
- Data used to determine risk of mortality, plus 5 morbidity outcomes (stroke, renal failure, reoperation, DSWI, prolonged ventilation) and prolonged length of stay
- Online calculator at <http://riskcalc.sts.org>



Procedure Type

<input checked="" type="radio"/> CAB Only
<input type="radio"/> AV Replacement
<input type="radio"/> MV Replacement Only
<input type="radio"/> MV Repair
<input type="radio"/> AV Replacement + CAB
<input type="radio"/> MV Replacement + CAB
<input type="radio"/> MV Repair + CAB

Patient Age

Sex

<input checked="" type="radio"/> Male	<input type="radio"/> Female
---------------------------------------	------------------------------

Height (cm)

RISK SCORES

[About the STS Risk Calculator](#)

Procedure: CAB Only

Risk of Mortality: 0.781%

Morbidity or Mortality: 8.79%

Long Length of Stay: 3.213%

Short Length of Stay: 56.242%

Permanent Stroke: 1.102%

Prolonged Ventilation: 5.715%

DSW Infection: 0.322%

Renal Failure: 0.885%

Reoperation: 3.455%

PRINT

CLEAR

STS Score

Patient Factors

- Age
- Sex
- Race
- Height, weight
- Renal failure
- COPD
- Cerebrovascular disease
- PVD
- Diabetes
- Hypertension
- Immunosuppression
- Endocarditis
- Critical preoperative state

Cardiac Factors

- Heart failure
- Unstable angina or MI
- Arrhythmia
- Valvular disease

Procedural Factors

- Non-elective
- Reoperative status

Limitations

- Only predicts outcomes for certain procedures:
 - Isolated CAG
 - Isolated AVR
 - Isolated MVR
 - Isolated MV repair
 - CAG & AVR
 - CAG & MVR
 - CAG & MV repair
- Omits certain factors (liver dysfunction, coagulopathy, RV dysfunction, pulmonary hypertension)
- More complex

An Australian risk prediction model for 30-day mortality after isolated coronary artery bypass: The AusSCORE

Christopher Reid, PhD,^a Baki Billah, PhD,^a Diem Dinh, PhD,^a Julian Smith, MBBS,^b Peter Skillington, MBBS,^c Michael Yui, MBBS,^d Seven Seevanayagam, MBBS,^e Morteza Mohajeri, MBBS,^f and Gil Shardey, MBBS^b

The Journal of Thoracic and Cardiovascular Surgery • October 2009

Case Example

- 60 year-old man
- Previous CAG, patent LIMA to LAD, occluded native coronary arteries, LVEF 18%, dual-chamber AICD in situ
- Reoperative MVR September 2014 with mechanical prosthesis
- Prosthetic valve endocarditis with *S. epidermidis* April 2015
- Now referred for redo MVR for severe paravalvular leak with recurrent heart failure on maximal therapy, with worsening renal failure (Cr 350)
- What is his risk?

Case Example

- EuroSCORE II

60.98%

- STS

27.05%