Validation of EuroSCORE II in post-cardiac surgery patients at the Prince of Wales Hospital – 10-year retrospective single-center study

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BACKGROUND

Western population

EuroSCORE

- widely used and validated in 1999
- based on a large dataset comprising over 19,000 patients across 128 hospitals in 8 European countries (Roques et al., 1999)

EuroSCORE II

- updated version introducted in 2012
- derived from 22,381 consecutive patients who underwent major cardiac surgery across 154 hospitals in 43 countries during a 12-week span (May-July 2010) (Nashef et al., 2012)

Asian population

- no widely recognized scoring system
- Limited research on EuroSCORE II effectiveness in Asia (P.-H. Liu et al., 2022; Shen et al., 2018; Zhang et al., 2013)
- Uncertainty on its validity for the HK population
- Local validation of its predictive utility is required

EuroSCORE II risk stratification (Silverborn et al., 2023):

Risk stratification	EuroSCORE II
Low-risk	≤4%
Intermediate-risk	4-8%
High-risk	>8%

Enhance the identification of high-risk patients!

OBJECTIVES

CABG

Valve

Major aortic

01 To assess the predictive performance of EuroSCORE II to predict the postoperative mortality after 3 main index cardiac procedures in PWH

02 EuroSCORE II's **discriminatory** performance:

- Test accuracy (sensitivity, specificity, negative predictive value, accuracy)
- Area under the receiver operating characteristic curve (AUROC)

03 EuroSCORE II's **calibration** performance:

- Hosmer-Lemeshow tests

METHOD

Study design

Retrospective cohort study between January 01, 2013 – December 31, 2023 (inclusive)

Source of data

- Quantitative method
- Secondary data sourced from Dendrite Clinical Systems

Participants

4,180 adult (≥18 years old) patients undergoing the following cardiac surgery with or without cardiopulmonary bypass (CPB) in Prince of Wales Hospital (PWH)

- CABG
- Valve (e.g. aortic valve replacement (AVR), mitral valve replacement (MVR), tricuspid valve repair)
- Aortic
- Isolated (e.g. isolated CABG) or combined procedure (e.g. CABG + ASD closure, CABG + valve, Valve + LA clip)

METHOD

A. Patient-related factors

- age
- sex
- active endocarditis
  - reason for repeat valve replacement
  - native valve pathology
- preoperative renal impairment
  - Cockcroft-Gault creatinine clearance (ml/min)
- critical preoperative state
  - renal function/dialysis
  - preoperative heart rhythm
  - intravenous inotropes prior to anaesthesia
  - preoperative ventilation
  - preoperative cardiogenic shock
  - preoperative intra-aortic balloon pump (IABP) used
- chronic lung disease
- extracardiac arteriopathy
- poor mobility
- number of previous heart operations
- diabetes on insulin

B. Cardiac-related factors

- CCS Class 4 Angina pre-surgery
- left ventricular ejection fraction (LVEF) category
- recent myocardial infarction (MI) within 90 days
- pulmonary hypertension
  - PA systolic pressure (PASP) in mmHg
- New York Heart Association (NYHA) class
  - dyspnoea status pre-surgery

C. Operation-related factors

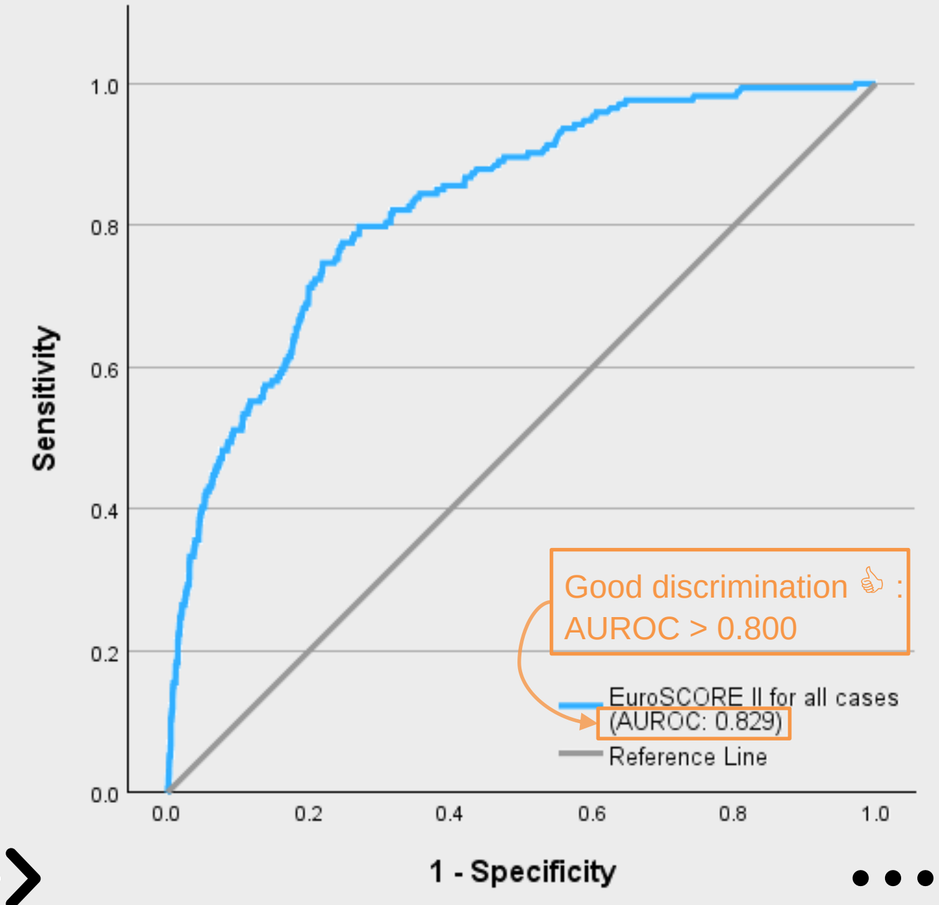
- surgery on thoracic aorta
- timing of surgery
- weight of the intervention

Remarks: pre-operative risk factors in EuroSCORE II (Nashef et al., 2012)

RESULTS

1. Overall analysis

EuroSCORE II's Discriminatory performance:



Measures of test accuracy	
Sensitivity	0.776
Specificity	0.751
Negative Predictive Value	0.987
Accuracy	0.752

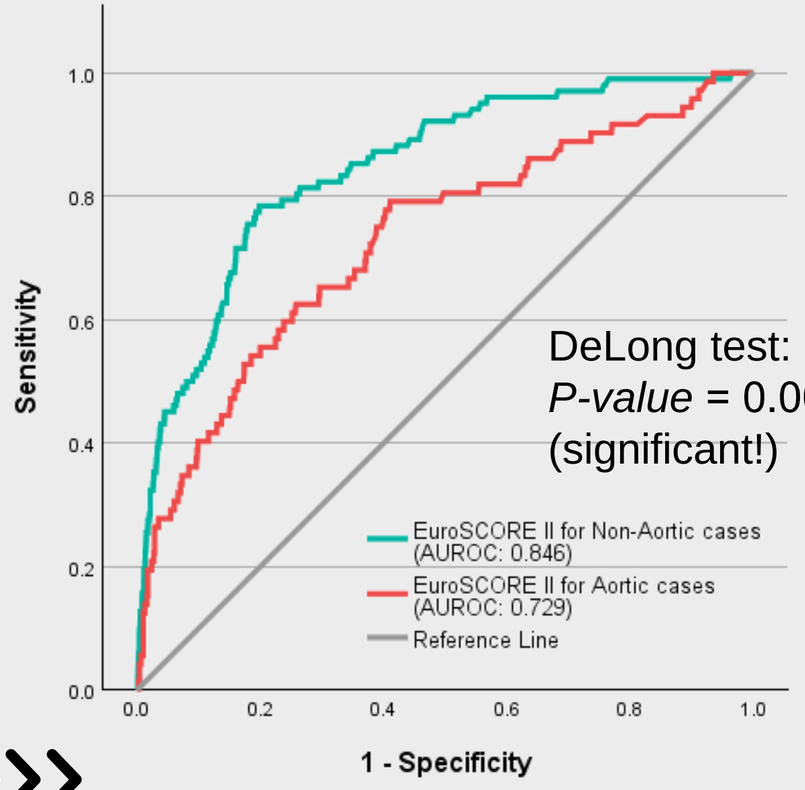
Remarks: Maximum Youden's Index cutoff point of 5.0150

RESULTS

2. Stratified analysis

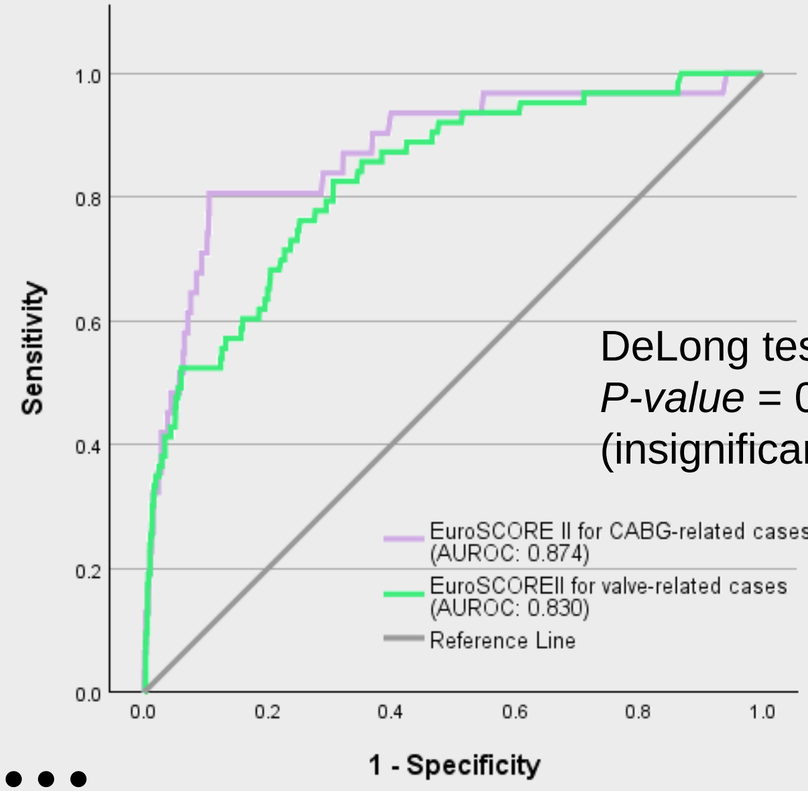
EuroSCORE II's Discriminatory performance:

2a. Aortic vs Non-Aortic cohort



DeLong test:
P-value = 0.003* ≤ 0.05
(significant!)

2b. CABG-related vs valve-related cohort



DeLong test:
P-value = 0.329 > 0.05
(insignificant!)

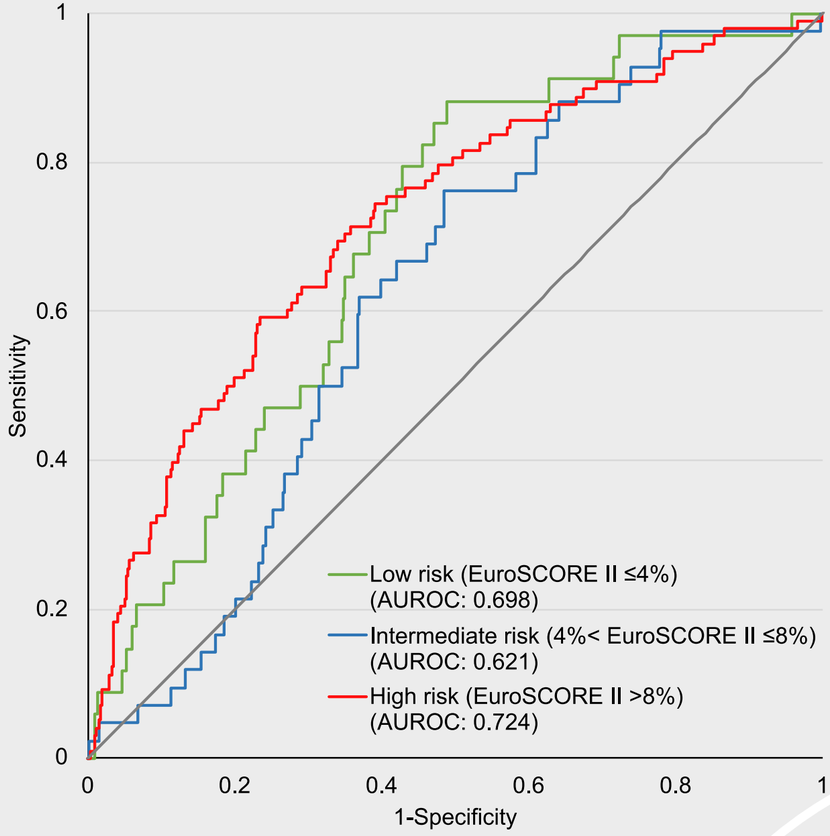
RESULTS

2. Stratified analysis

EuroSCORE II's Discriminatory performance:

2c. EuroSCORE II risk stratification
(Silverborn et al., 2023)

Difference on AUROCs	*P-value* for DeLong test
Low (≤4%) & Intermediate (>4% but ≤8%)	0.146
Intermediate (>4% but ≤8%) & High (>8%)	0.025*
Low (≤4%) & High (>8%)	0.588

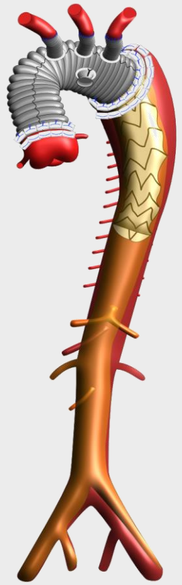


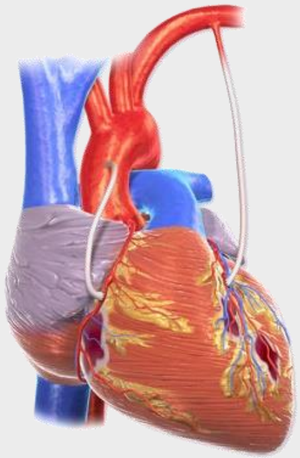
RESULTS

EuroSCORE II's Calibration performance:

Hosmer-Lemeshow test:

- Statistical test for goodness of fit and calibration for logistic regression models
- Assesses whether or not the observed event rates match expected event rates in the overall cohort or subgroups
- Good calibration 👍 : *P-value* > 0.05
  - Aortic cohort (*P-value* = 0.667)
  - CABG-related cohort (*P-value* = 0.119)





DISCUSSION

- EuroSCORE II is a **reliable** tool for risk stratification and decision-making
- This study contributes to the **ongoing validation and refinement** of risk assessment models in cardiac surgery, enhancing the quality of care and patient outcomes.
- The study's **single-center** design provides a focused analysis of EuroSCORE II's utility within a specific hospital setting, highlighting its **limitations** in a consistent patient population.
- The implications of this study extend to **clinical practice by reinforcing the value of risk stratification tools** like EuroSCORE II in guiding treatment decisions, optimizing resource allocation, and improving patient care outcomes.
- **Future research** could explore the incorporation of additional variables or the development of personalized risk models to further enhance predictive accuracy and tailor interventions for post-cardiac surgery patients.

CONCLUSION

- EuroSCORE II effectively predicts postoperative mortality, especially in non-aortic cardiac surgeries at our center.
- This could enhance high-risk patient identification for adverse outcomes, prompting exploration of alternative treatment therapies.

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THANK YOU