Development and Validation of a Risk Calculator for Intensive Care Unit Admission after Total Hip Arthroplasty

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Introduction

- The purpose of this study was to develop and validate a risk calculator to determine the risk of a patient requiring ICU admission following primary and revision THA

Methods

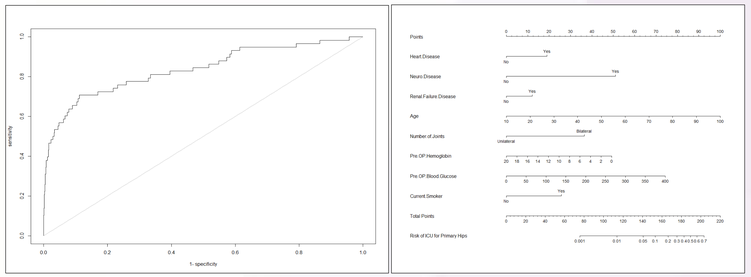
- Utilizing a database of 12,342 total hip arthroplasty procedures, with 132 ICU admissions, from 2005-2017, we developed models of ICU admission risk based on previously identified pre-operative factors.
- Numerous risk factors were evaluated that included age, heart disease, neurologic disease, renal disease, unilateral vs bilateral surgery, pre-operative hemoglobin, pre-operative blood glucose, and smoking status.
- Prior to developing the calculator, a set of logistic regressions were analyzed to determine weight and scoring for each variable.
- Once developed, we validated the risk calculator utilizing a second independent institution.

Table 1: Risk Calculator Prediction Examples

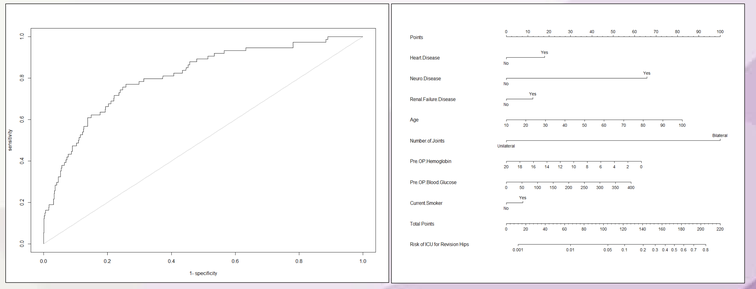
Calculator	Variables	% ICU Admission	95% CI
Primary Hip	1. Age 50 2. Unilateral 3. No Health Conditions or Smoker 4. Pre OP HgB of 16 5. Pre OP Blood Glucose of 100	0.01%	0.04% - 0.02%
Revision Hip	1. Heart Disease 2. Age of 74 3. Unilateral 4. Pre OP Hemoglobin of 8 5. Pre OP Blood Glucose of 200 6. Smoker	28.1%	11.4% - 54.1%

Figure 1:

AUC (A) and Table Build (B) for Primary THA



AUC (A) and Table Build (B) for Revision THA



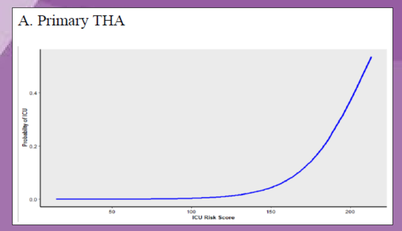
Results

- A separate risk calculator was developed for primary hip and revision arthroplasty.
- The area under the curve (AUC) for primary THA was 0.808 (95%) and revision THA was AUC 0.795 (0.740-0.850).
- As an example, the primary THA risk calculator had a Total Points scale of 220, with 50 points associated with a 0.1% chance of ICU admission, and 205 points associated with a 95% chance of ICU admission.
- Validation with an external cohort demonstrated satisfactory AUCs, sensitivities, and specificities for both Primary THA (AUC 0.794, sensitivity 0.750, specificity 0.722) and Revision THA (AUC 0.703, sensitivity 0.704, specificity 0.671).

Conclusions

- The externally validated risk calculators developed in this study can accurately predict ICU admission following primary and revision THA based on a number of readily available pre-operative factors

A. Primary THA



B. Revision THA