A simple index predicted cardiac complications in elective major noncardiac surgery

Lee TH, Marcantonio ER, Mangione CM, et al. **Derivation and prospective validation of a simple index for prediction of cardiac risk of major noncardiac surgery.** Circulation. 1999 Sep 7;100: 1043-9.

QUESTION
How accurate is a simple index (Revised Cardiac Risk Index [RCRI]) for estimating the risk for cardiac complications of elective major noncardiac surgery?

DESIGN
2 cohort studies: 1 for derivation and 1 for validation of the index results.

SETTING
A tertiary-care teaching hospital in Boston, Massachusetts, United States.

PATIENTS
4315 patients ≥ 50 years of age (mean age 66 y) who were having elective major noncardiac surgery with ≥ 2 days of hospital stay. 2893 patients (53% women) were in the derivation cohort, and 1422 (51% men) were in the validation cohort. Follow-up was for 1 year after surgery.

DESCRIPTION OF PREDICTION GUIDE
The RCRI was developed to divide patients into 4 risk classes (class I, II, III,

and IV) for major cardiac complications. 1 point was given to each of 6 variables: high-risk surgery (intraperitoneal, intrathoracic, or suprainguinal vascular surgery), coronary artery disease, congestive heart failure, history of cerebrovascular disease, insulin treatment for diabetes mellitus, and preoperative serum creatinine level > 2.0 mg/dL. A score of 0, 1, 2, or ≥ 3 correlated to class I, II, III, or IV, respectively.

MAIN OUTCOME MEASURES
Major cardiac complications (myocardial infarction, pulmonary edema, ventricular fibrillation or primary cardiac arrest, and complete heart block) were determined by an assessor blinded to the preoperative clinical data.

MAIN RESULTS
Major cardiac complications occurred in 2% of patients in the derivation cohort and 2.5% in the validation cohort. The derivation cohort had 37%, 38%, 17%, and 7% of patients in classes I, II, III, and IV, respectively; similar proportions were

seen in the validation cohort (34%, 40%, 18%, and 8%, respectively). Only 4 of 6 factors remained significant in the derivation cohort (high-risk surgery, coronary artery disease, congestive heart failure, and history of cerebrovascular disease). Rates of major cardiac complications for patients in classes I, II, III, and IV were 0.5%, 1.3%, 3.6%, and 9.1%, respectively, in the derivation cohort, and 0.4%, 0.9%, 6.6%, and 11%, respectively, in the validation cohort.

CONCLUSION
In patients having elective major noncardiac surgery, the Revised Cardiac Risk Index predicted the risk for cardiac complications.

COMMENTARY
Predicting major cardiac complications of noncardiac surgery is an inexact process. Previously published risk indices have shown a consistent association between cardiac complications after surgery and some clinical variables (1, 2), often with suboptimal accuracy; Palda and Detsky (3) have advocated combining index scores with noninvasive testing to derive risk estimates (3). This study by Lee and colleagues uses a sizable, prospective cohort of patients to show again that clinical data, expressed using the RCRI, have predictive power for myocardial infarction, pulmonary edema, and arrhythmia after surgery.

Although similar to previous indices, the RCRI differs from them in 2 important ways. First, its variables are simple; they reflect only the presence or absence of 4 conditions instead of estimating disease severity. Second, the RCRI was derived from a general cohort of mostly nonemergent surgical patients who had a low prevalence of some well-known risk factors for postoperative complications. The behavior of the RCRI in a population referred specifically for preoperative evaluation to internists or cardiologists is less predictable.

No risk index has applications in all perioperative settings. Experienced clinicians integrate risk indices, diagnostic testing as necessary, and such risk-reduction strategies as β-blockade (4). They adapt these to individual situations rather than rigidly applying an

index score alone when estimating perioperative risk. Risk indices are usually most useful as general guides for new perioperative consultants. Once mastered, these models, with their faults, are only part of the practice of effective perioperative medical consultation.

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