

Cardiac Risk Indices Compared

Gilbert K, Larocque BJ, Patrick LT. Prospective evaluation of cardiac risk indices for patients undergoing noncardiac surgery. *Ann Intern Med* 2000;133:356-9.

Study Overview

Objective. To assess the comparative utility of 4 different indices used to predict cardiovascular complications in patients undergoing noncardiac surgery.

Design. Prospective cohort study.

Setting and participants. Patients were recruited at 2 different teaching hospitals in Ontario, Canada, between 1995 and 1997. All subjects had been referred for a medical consultation and were followed until discharge by the internist who recorded clinical data. At baseline, data were collected on markers obtained through history, clinical examination, and electrocardiogram: signs of congestive heart failure (active pulmonary edema or recent history of pulmonary edema), history of myocardial infarction in the previous 6 months, unstable angina, age older than 70 years, rhythm, type of surgery, and urgent versus nonurgent surgery. Patients were categorized according to the Goldman index [1], the American Association of Anesthesiologists index [2], the modified Detsky index [3], and the preoperative Canadian Cardiovascular Society (CCS) index for angina level [4].

Main outcome measures. Major cardiac events, including myocardial infarction, unstable angina, acute pulmonary edema, and death. The cardiac risk indices were compared by examining the areas under their respective receiver-operating characteristic (ROC) curves; the bigger the area under the curve, the better the predictive accuracy of the index.

Main results. A total of 2035 patients were enrolled in the study (1465 at site 1 and 570 at site 2). Of these, 130 (6.4%) had major cardiac events. There was a significant statistical difference between events occurring at the 2 hospitals (5.5% of patients at site 1 versus 8.6% of patients at site 2; $P = 0.015$). This difference was accounted for by the fact that more pulmonary edema cases were seen at site 2 than at site 1 (5.3% versus 2.5%; $P = 0.002$). Overall, there were 36 myocardial infarctions (1.8%), 67 episodes of pulmonary edema (3.3%), 27 episodes of unstable angina (1.3%), and 48 deaths (2.4%). The causes of deaths were not provided.

All of the indices studied showed a statistically significant degree of stratification ($P < 0.001$ for all comparisons). The area under the ROC curves was 0.625 (95% confidence interval [CI], 0.575 to 0.676) for the ASA index, 0.642 (95% CI, 0.588 to 0.695) for the Goldman index, 0.601 (95% CI, 0.544 to 0.657) for the modified Detsky index, and 0.654 (95% CI, 0.601 to 0.708) for the CCS index. Differences among areas under the curve were not statistically significant ($P > 0.05$). All indices were better than chance at predicting the chances of myocardial infarctions and deaths. The CCS index was the only useful index at predicting the risk of unstable angina.

Conclusion

These cardiac risk indices can predict outcomes slightly better than chance. However, no one index is superior to the others.

Commentary

Perioperative cardiac events are responsible for significant mortality and morbidity. Over the years, indices have been developed to try to predict which patients are at risk for adverse effects and which may benefit from further cardiovascular testing. The performance of these indices has been examined in validation studies [5-8], but no studies compare them to each other. Guidelines for risk assessment have been developed that incorporate these indices [9,10].

This study by Gilbert et al is important in that it is the first to compare these indices in a large prospective trial. The strength of the study lies in its large sample size. Researchers included a broad spectrum of different types of surgeries (31% orthopedic, 30% minor, 21% thoracic and abdominal, and 9.4% vascular). Of study patients, 54% had at least 1 significant risk factor for cardiovascular complications. Selection bias could explain this large number: all patients had been referred to an internist, probably because of some of these risk factors. Another problem is that there was no systematic screening for cardiovascular events postoperatively. Some studies suggest that up to 50% of myocardial infarctions that occur during the preoperative period are silent. One can argue, however, that the study methodology reflects actual practice.

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The area under the curve was relatively small, which means that the indices did not predict who was at risk and who was not. In addition, no mention was made as to what type of therapy was provided by consultants. This information obviously could have affected outcomes: successful therapy could have reduced the number of poor outcomes thereby reducing the predictive accuracy of the indices. Further studies are needed that take into account new therapeutic interventions, such as the use of β blockers in high-risk patients.

Applications for Clinical Practice

This study emphasizes the limitations of indices. Until further studies are done, indices can be used as aids in determining patients' risk. Risk stratification is complex and should take into account history, physical examination (with a focus on functional status), and current developments in the management and prevention of cardiovascular disease.

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