

Risk Indices

What Is Their Value to the Clinician and Patient?

FOR much of the latter half of the 20th century, there has been a great deal of interest in establishing and using indices to assess perioperative risk. One of the first and best-known attempts was Dr. Dripps¹ use of the American Society of Anesthesiologists (ASA) Physical Status Classification of surgical mortality. Beginning in 1977, with the development of the Cardiac Risk Index by Dr. Goldman *et al.*, there have been a plethora of such indices related to cardiovascular disease in individuals undergoing noncardiac surgery.²⁻⁴ Subsequently, the development and use of risk indices has taken on increasing importance in the arena of cardiac surgery.⁵⁻⁷ These newer indices usually take the form of complex logistic regression analysis of factors predicting outcome, and subsequent assignment of weights to these factors. In this issue of the Journal, Dupuis *et al.*⁸ have attempted to simplify the approach to risk of cardiac surgical procedures in a manner similar to the original ASA Physical Status Classification. They developed an index that uses a simple continuous categorization with five classes plus an emergency status. The Cardiac Anesthesia Risk Evaluation (CARE) index showed similar or superior predictive characteristics than the more complex indices. Although investigators continue to develop and refine these indices, do the indices continue to provide value to the clinicians who use them and to the patients for whom they were developed?

The underlying assumption in the development of a risk index is that specific factors (disease history, physical findings, laboratory data, nature of surgery) are unmodifiable with respect to their influence on outcome, *i.e.*, the perioperative period is essentially a "black box." If a specific factor is left untreated, it could lead to major morbidity. For example, the type and urgency of the planned surgical procedure cannot be changed. However, some factors can be modified once they are identified. For example, a shorter time interval between a

planned surgical procedure and previous myocardial infarction was considered one of the most important factors with respect to perioperative cardiac morbidity.⁹ Although the evidence is not as well-established, it is now clear that the absolute risk related to a specific time interval less than 6 months between the infarct and noncardiac surgery can be modified by medical therapy and coronary interventions and more appropriately approximates the residual ischemic potential after the initial period of myocardial healing and remodeling.¹⁰ Therefore, current indices would not include a myocardial infarction within 6 months, but may include active coronary artery disease as shown by the factors included in the Modified Cardiac Risk Index recently published by Lee *et al.*⁴ Therefore, one of the core indications from a scientific perspective for the development of a risk index is the identification of risk factors that should be targeted for intervention. If the interventions are successful, the risk factor decreases in importance; however, ignoring the factor may lead to its becoming an important cause of mortality.

In developing a risk index, it is important to benchmark it against other known means of assessing risks. It is important to determine if the index predicts morbidity, mortality, or both. Dupuis *et al.*⁸ appropriately determined the predictive value of the CARE index against both fatal and nonfatal endpoints. Secondly, it is important to determine if it provides additional or similar information to other known indices. Similar to the ASA Physical Status Classification, the CARE index is simple and incorporates a subjective component of medical comorbidity. Although the subjective nature of the ASA classification can be promulgated as a weakness, its success suggests that anesthesiologists tend to be good at assessing risk and that objective factors alone cannot account for all of the known variation in risk.¹¹ In the case of the current study, it was also important to benchmark the scale against previously developed indices that were computationally much more complex. The authors used the appropriate techniques of assessing sensitivity and specificity on receiver-operating characteristic curves and comparing areas under the curve. Therefore, the value of the current index is its computational ease of use without loss of information compared with established methodologies.

The real question is, "What is the additive value of a risk index above simple clinical judgment for both the clinician and the patient?" This leads to the question of

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exactly how risk indices are used in clinical practice. As previously described, the identification of important risk factors, *via* an index or simple research protocol, is critical in defining targets for intervention. One of the best examples of this approach has been the Framingham health study, in which hypertension and other public health hazards, on which the public health sector and pharmaceutical industry have focused a great deal of attention, have been identified clearly.¹² A second use of a risk index is for comparison between groups. It is now extremely common to risk-adjust outcomes when comparing two different locations or provider characteristics of care. This is seen most commonly in the area of cardiac surgery, a focus of the risk index in the current issue of the Journal. Report cards of mortality and morbidity rates surrounding cardiac surgery by surgeon and hospital have been published by New York State and Pennsylvania and are available on the Internet.¹³⁻¹⁶ Before public dissemination of mortality rates for individual hospitals and providers, it is critical to risk-adjust outcomes to provide meaningful comparisons to determine appropriateness of care. These report cards frequently incorporate a risk adjustment scheme because much of the outcome differences may be accounted for by differences in patient characteristics. For the case of risk adjustment, a more sophisticated analysis may have greater value than simplistic approaches. Additionally, most risk adjustment models are implemented using claims data (discharge summaries) and International Classification of Disease (ICD-9CM) codes. Therefore, the factors that go into any model must be translated easily into these discharge codes.

The final question remains, "Do clinicians really use risk indices for patient management or education?" Internists and cardiologists may use these indices to determine if a patient's risk is above some threshold for action. For example, patients with a Cardiac Risk Index of III may be sent for preoperative testing. Despite the appropriateness of a such an approach, the American Heart Association-American College of Cardiology Guidelines for Perioperative Cardiovascular Evaluation for Noncardiac Surgery does not advocate the use of a risk index, but rather the presence of specific clinical factors in determining the need for testing.¹⁰

Because perioperative morbidity and mortality rates are frequently institution specific, the use of established indices to determine thresholds for action is becoming less common.¹⁷ When clinicians understand the elements of perioperative risks, they frequently will not use a specific index. In particular, anesthesiologists are extremely good at predicting risks using the simple ASA classification. A recent study showed similar predictive characteristics using the ASA Physical Status Classification and objective risk indices predicting mortality after

noncardiac surgery,¹¹ suggesting that a subjective score can do as well as an objective one. Therefore, institutional data and subjective assessment of the anesthesiologist are important in defining a specific numeric risk, which is required rarely by patients, as shown by the low public perception of surgical report cards.¹⁶

So where does this leave us in the year 2001? Clearly, anesthesiologists are good at using subjective scores to assess risk, and the currently proposed CARE index fits into this category and may be used in a manner similar to the ASA Physical Status Classification. Physicians from other specialties may continue to use this and other risk indices as means of determining baseline rates of complications in their decision if there is a threshold for action. Importantly, the ability to calculate a simple number (*e.g.*, risk category) may detract from the dissemination of important clinical information because the risk category does not provide the anesthesiologist with the information he or she needs to modify care. Therefore, we believe that risk indices are most useful as a means of risk-stratifying outcomes and comparing populations and as a resource tool to identify areas that warrant targeted interventions but have minimal impact on perioperative care or patient education.

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