



## EDITORIAL

### How to identify a high-risk surgical patient?



The number of surgical procedures continues to grow globally and there is a clear need to increase the availability of safe, timely, and affordable surgery, especially in constrained resources scenarios.<sup>1</sup> As overall life expectancy continues to increase, it is more common to offer complex procedures to patients displaying advanced age and serious comorbidities, with inevitable increases in morbidity and mortality after surgery despite the most recent technological advances in anesthetic care. Although both postoperative morbidity and mortality vary significantly among patients, it is particularly higher in a vulnerable group of high-risk patients. Therefore, accurate preoperative identification of high-risk patients is strongly recommended.

Risk stratification and early recognition of high-risk patients may improve outcomes since it facilitates surgical decision-making, preoperative optimization, and tailored intraoperative and postoperative management.<sup>2</sup> However, in order to enhance patient care, risk stratification tools should be validated to the target populations it will be applied, and should be easily applicable at the bedside. Ultimately, risk stratification needs to encompass the complex interaction between surgical and anesthetic procedures and patient specific features to be able to assess postoperative morbidity and mortality in different moments, including the preoperative, intra-operative, and postoperative periods.<sup>3,4</sup>

Plenty of surgical risk models have been developed and investigated. American Society of Anesthesiologists' Physical Status (ASA-PS) classification, Revised Cardiac Risk Index (RCRI), American College of Surgeons' National Surgical Quality Improvement Program Risk Calculators (ACS-NSQIP), and the Surgical Outcome Risk Tool (SORT) model are some of the most commonly used preoperative scoring systems. ASA-PS classification is the simplest scoring system and has been used since 1941.<sup>5</sup> Risk assignment is independent of the surgical procedure and is based solely on subjective assessment of a patients' overall health status, leading to significant inter-rater reliability. The RCRI was designed to focus on major cardiovascular mortality following noncardiac surgeries, consisting of six independent predictors: high-risk surgery, history of ischemic heart disease,

congestive heart failure, cerebrovascular disease, preoperative treatment with insulin, and preoperative serum creatinine above 2 mg.dL<sup>-1</sup>.<sup>6</sup> Unfortunately, it performs poorly when predicting cardiac events following vascular surgeries or all-cause mortality following noncardiac surgeries.<sup>6</sup> The ACS-NSQIP surgical risk calculator consists of 20 patient-specific variables including ASA-PS, patient-reported functional capacity, and the planned surgery with over 1500 current procedural terminology codes that allow procedure-specific estimation of postoperative risk.<sup>7</sup> However, the ACS-NSQIP also displays limitations, not capturing important cardiovascular complications, and it has not been extensively validated out of the United States, impairing its generalizability. Finally, the SORT model has been validated in a multicenter study in the United Kingdom that used a specific surgical severity classification, comprising six main variables: ASA-PS physical status, urgency of surgery (expedited, urgent, immediate), high-risk surgical specialty (gastrointestinal, thoracic, vascular), surgical severity (from minor to complex major), cancer, and aged 65 years or over.<sup>8</sup> The SORT model allows rapid and easy evaluation of mortality risk for individuals undergoing non-cardiac surgery. However, some recent studies have indicated that SORT performed poorly in other populations as compared to the original work<sup>9</sup> and may not be an accurate predictor of adverse outcomes in higher risk patients.<sup>10</sup>

Of note, prediction of postoperative complications is quite difficult. Predictors of perioperative outcomes are usually categorized into two groups: patient-related and surgery-related factors. Patient age, comorbidities such as cardiovascular and pulmonary diseases, functional status, frailty, and perioperative biomarkers may predict outcomes. Emergency or urgent surgeries significantly increase the risk of postoperative complications. Other surgery-related predictors include length of surgery, blood loss, and major surgery.<sup>11</sup> Nevertheless, so far, most complication prediction scores display moderate accuracy in predicting postoperative complications, especially in some surgical subpopulations.<sup>12</sup> It is important to emphasize that these tools predict outcomes in a "typical patient", but are limited in

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accurately predicting risk for an individual patient as specific factors related to the patient and the surgery must be considered. Alternatively, subspecialty prediction models may be more accurate for high-risk patients and new risk models addressing individual high-risk groups are in constant development and validation. At the end of the day, the ultimate goal of any prediction tool is providing adequate and clear information to patients and clinicians in order to preemptively discuss management options, rescue strategies, and, in a more extreme scenario, end-of-life decisions.

As demonstrated, several assessment tools have been implemented to identify high-risk surgical patients. However, most of these models have been developed and validated in high income countries. The feasibility of reliable risk assessment is particularly important when resources are limited, especially in low- and middle-income countries (LMICs) where primary care is insufficient and advanced conditions of diseases compound the surgical scenario. Therefore, prospective validation is warranted across different geopolitical sectors to test the external validity of those scores. Brazil, as well as most countries in Latin America, present huge disparities in terms of healthcare access and medical available resources to assist surgical patients, factors that may significantly impact in poorer outcomes for individual patients undergoing surgery.<sup>13</sup>

In this context, Gutierrez et al.,<sup>14</sup> using a large Brazilian surgical cohort, have developed and investigated a multivariable logistic regression model, which predicts in-hospital mortality (the Ex-Care risk model). In this risk model, patient and perioperative predictors were considered, and its performance was compared to well-known surgical risk tools, namely the Charlson comorbidity index (CCI), the RCRI, and the SORT risk model. The Ex-Care risk model was very efficient at identifying high-risk surgical patients, displaying superior accuracy than the RCRI and similar performance as compared to the CCI and SORT models. Although these findings are promising, the new surgical risk model needs to be further investigated in multicenter studies, requiring an assessment of its accuracy in other national and international institutions.

For all the reasons above, in this issue of the Brazilian Journal of Anesthesiology we invite readers to access several interesting studies providing new insights into the stratification and management of high-risk surgical patients. These studies have addressed a myriad of topics related to high-risk surgery, from measures to detect patients at higher risk for complications to strategies focused on providing enhanced perioperative care in high-risk surgical patients.<sup>15-22</sup>

Among these studies, it is tempting to highlight the multicenter study protocol described by Passos et al.,<sup>15</sup> proposing a large national investigation of the Ex-Care model as a new and valid risk tool for the Brazilian surgical population. This is a retrospective, multicenter, cohort study which aims to build a national preoperative risk model based on Ex-Care model of probability of death within 30 days after surgery. In-hospital mortality within 30 days after surgery will be the primary outcome. Importantly, to date, there is no surgical risk model developed for the Brazilian population. Therefore, the Ex-Care model may be a helpful tool to accurately stratify the risk of death after surgery in Brazil, supporting professionals involved in perioperative care to identify high-risk surgical patients and to better plan therapeutic strategies.

Morbidity and mortality for high-risk surgical patients are often high, especially in low-resource settings. The development of several risk calculators has enhanced our ability to comprehensively quantify the risk of adverse postoperative events, especially surgery-related mortality. The association of these tools with new perioperative biomarkers, frailty scores, and a more comprehensive assessment of functional status may further refine our ability to detect high-risk surgical patients. As knowledge continues to grow in this area, new research should focus on the implementation of mitigation strategies to reduce adverse events after surgery. For those patients who are identified as having increased surgical risk, perioperative strategies to mitigate risk may need a whole new surgical model associated with an enhanced perioperative care with the potential to reduce preventable deaths and the risk of postoperative major adverse cardiac events. These strategies might include timing of surgery after cardiac events or interventions, an improved perioperative management of ischemic or valvular heart disease, hypertension, arrhythmia, and heart failure.<sup>23</sup> Additionally, postoperative comprehensive monitoring should be performed at least in the first 48 hours after surgery in order to detect adverse events and implement early rescue strategies. This postoperative enhanced care pathway for high-risk surgical patients, or in other words, a “high-risk surgical bundle” with a patient-centered decision-making, may significantly improve the patient’s experience and outcomes through the surgical process for patients at higher risk of adverse events.<sup>24</sup> In this context, a recent before-and-after cohort study with a clinical pathway based on enhanced surveillance for high-risk surgical patients has demonstrated a significant reduction of in-hospital mortality.<sup>24</sup> Particularly in this study, the “high-risk surgical bundle” has included six main elements, such as risk identification and communication, adoption of a high-risk post anesthesia care unit discharge checklist, prompt nursing admission to ward, intensification of vital signs monitoring, perioperative troponin measurement, and prompt access to medical support if required.<sup>24</sup> New research is still warranted to further evaluate which strategies designed to enhance perioperative care can actually reduce morbidity and mortality in high-risk surgical subpopulations.

In summary, the high-risk surgical patient is a growing challenge to the modern anesthetic care. Perioperative risk stratification is currently a fundamental principle of an adequate care for surgical patients. The surgical risk should be predicted for every patient in the preoperative period, and risk models are valuable clinical tools for shared decision-making and the development of individualized care plans. Methods for stratifying individual risk include assessment tools, measures of functional capacity and biomarker assays. They have the potential to contribute to the delivery of a high quality and up-to-date anesthetic and perioperative care. Notably, the development and application of robust tools to properly identify high-risk patients is essential to ground future intervention studies toward improved outcomes for all surgical patients.

## Conflicts of interest

The authors declare no conflicts of interest.

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