Risk assessment in anaesthesia

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Abstract

National audit indicates that formal and documented assessment of perioperative risk is performed infrequently and inadequately by clinicians in the preoperative period. Many tools exist to assist the anaesthetist with this role and should be used in conjunction with clinical judgement. The presence of frailty has been found to increase the risk of adverse outcome following surgery and guidance recommends frailty screening as part of a preoperative assessment for older adults. Functional capacity strongly correlates with risk of postoperative major adverse cardiac events and should be assessed preoperatively. The role of cardiopulmonary exercise testing for the purpose of functional capacity assessment and prognostication of outcome is continually evolving. Once a patient's risk has been assessed, it should be used to plan an appropriate perioperative care pathway and to inform the process of shared decision-making.

Keywords Frailty; functional capacity; postoperative complications; postoperative mortality; risk assessment

Royal College of Anaesthetists CPD Matrix: 2A03

Learning objectives

After reading this article, you should be able to:

- summarize the role of risk assessment in anaesthesia
- describe commonly used risk prediction models
- identify patients at high risk of common postoperative complications
- define frailty and explain its significance in the preoperative setting

The need for risk assessment

Postoperative mortality rates in the UK have been variably reported, ranging between 1% and 3.6%. Prolonged morbidity following surgery is thought to occur in 15% of patients in the UK and is associated with an increased risk of death for up to 3 years postoperatively. A complicated postoperative course can have a devastating impact on patient quality of life and presents a significant financial burden to hospital trusts.

A National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report published in 2011, entitled 'Knowing the risk', found that patients who died in the perioperative period often received care that was substandard.[1] Risk was poorly identified and acted upon by clinicians and a lack of consensus emerged regarding what constitutes risk for an individual undergoing surgery. This led to one of the main recommendations of the report being the development and adoption of a national preoperative risk scoring system.

Anaesthetists are becoming increasing familiar with the use of risk assessment tools to complement clinical judgement when performing a preoperative assessment. This review will discuss formal methods of quantifying risk for individuals undergoing surgery.

Tools for estimating mortality and morbidity

Since the introduction of the American Society of Anaesthesiologists Physical Status (ASA-PS) score in 1941, an increasing number of tools for estimating perioperative risk have emerged from the literature. Multivariate analysis techniques are used to identify risk factors for a specific outcome (predominantly surgical mortality). Traditional risk scores add weight to each risk factor to calculate a score for the patient (eg ASA-PS, surgical risk scale). The patient's score can then be placed on a scale by which they are compared to other patients, but the individual's probability of an outcome occurring cannot be provided. Newer tools, referred to as risk prediction models (e.g. P-POSSUM), can provide this. Commonly used examples along with recently published tools are briefly discussed below.

ASA-PS

This remains the most commonly used tool for quantifying risk, with patients placed in one of five physical status categories depending on their co-morbidities and perceived functional status. It is familiar, easy to use and has been found in systematic review to have reasonable discrimination for predicting 30-day postoperative mortality[2]; however it has important limitations. The tool relies on subjective assessment and inter-rater reliability has been found to be moderate to poor in some evaluations. Perhaps more importantly, its very simplicity means that it is unlikely to be helpful as a predictor of individual patient risk. Population risk for ASA level 3 patients is around 3% and for ASA level 4 patients, around 16%. This implies that a wide range of individual risk exists within these populations, with individual patient risk determined by the type of comorbidity, and the magnitude and urgency of the proposed surgery, neither of which is evaluated by the ASA score.

P-POSSUM

The Physiological and Operative Severity Score for the enUmeration of Mortality and Morbidity (POSSUM score) was developed to estimate the risk of morbidity and mortality for the purposes of

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risk adjustment in comparative audit. It uses 12 physiological and six operative variables (Table 1). A group from Portsmouth, using the same variables, modified the mathematical model to achieve greater predictive accuracy. This is known as the P-POSSUM score and is familiar to most. Systematic review[2] found it to be widely validated and it has been found to have a moderate to high discriminant accuracy for predicting postoperative mortality.

Limitations include the need for intraoperative data to generate risk, rendering it less useful in the preoperative setting, it requires the input of 18 variables, reducing its capacity for user-friendliness and lastly, it still has the tendency to overestimate risk in lower risk patients; though the effect is smaller than that seen in the original model.

NSQIP

Data from over 1 million patient episodes were used by the American College of Surgeons to create the National Surgical Quality Improvement Programme (ACS-NSQIP) surgical risk calculator. The type of surgery, plus 21 patient variables are fed into the model, allowing the calculator to produce percentage risk estimates of specific postoperative complications and overall postoperative mortality, occurring within 30 days of surgery. The authors report good predictive value, with an area under receiver operating characteristic curves (AUROCs) for mortality and morbidity of 0.94 and 0.82 respectively.

While clearly a promising tool of high potential value to the perioperative physician, at time writing it has yet to be validated outside of NSQIP hospitals in the USA (accounting for 10% of all US hospitals). This is particularly relevant if wanting to use it for the prediction of complications, as their definitions of particular complications may be different to those used in the UK. Other limitations include the inclusion of ASA-PS category, leaving it open to inter-rater variability; the requirement for the input of 21 patient specific variables, rendering it relatively time-consuming to complete and finally, the inclusion of a 'surgeon adjustment score'. This function allows the user to adjust particular risk scores (within confidence limits) according to their clinical acumen. Whilst clinical judgement is an integral part of any patient assessment, this leaves the NSQIP tool open to potential inaccuracy from further inter-rater variability.

SORT

The Surgical Outcome Risk Tool (SORT) was developed and internally validated in the UK using NCEPOD data from over 16,000 patients. It requires the input of six preoperative variables and as such may be considered a relatively user-friendly tool for use in the preoperative setting (Table 2). It was found to exhibit a good level of discrimination for the purpose of predicting 30-day postoperative mortality. Limitations include again, the inclusion of ASA scoring, introducing inter-rater variability. Importantly, its accuracy is yet to be tested outside of the original NCEPOD cohort.

Biomarkers

There has been a recent surge in observational research examining serum biomarkers as a means of predicting surgical outcome. Areas of promise include the measurement of high-sensitivity C-reactive protein (hsCRP), N-terminal pro-b-type natriuretic peptide (NT-proBNP) and troponin T. NT-proBNP has been found to predict postoperative cardiac events and mortality and also add incremental predictive ability to the Revised Cardiac Risk Index (RCRI). HsCRP, an established marker of inflammation, has been shown to predict postoperative cardiac events.

The VISION trial looked at fourth-generation troponin T measurements in the 3 days immediately after surgery and found peak levels to be strongly predictive of 30-day postoperative mortality.[3] Whilst this was an observational study, such postoperative risk scoring could offer valuable information to clinicians about ongoing risk in the immediate postoperative period. It remains unclear however, how (or indeed if) the knowledge of a troponin rise should be used to guide patient management as no interventions based on postoperative troponin levels (e.g. critical care admission or altered pharmacological therapy) have yet been tested.

Frailty

In the face of an ageing population and with advances in surgical and anaesthetic technique, we are likely to continue to see an increase in the number of elderly patients having surgery. Frailty is a multidimensional disorder seen commonly in elderly patients

Data required for calculation of P-POSSUM score

Preoperative P-POSSUM variables	Intraoperative P-POSSUM variables
• Age	• Surgical severity
• Cardiac failure	• Number of procedures
• Respiratory disease	• Operative blood loss
• ECG rhythm abnormality	• Peritoneal contamination
• Systolic blood pressure	• Malignancy status
• Pulse rate	• Surgical urgency
• Haemoglobin	
• White cell count	
• Sodium	
• Potassium	
• Glasgow Coma Scale score	
• Urea	

Table 1

Data required for calculation of SORT score

Preoperative SORT score variables

- Surgical severity (minor/intermediate/major/complex major)
- ASA-PS (I–V)
- Urgency of surgery (elective/expedited/urgent/immediate)
- High risk speciality (thoracic, gastrointestinal or vascular surgery)
- Active cancer (within 5 years)
- Age (<65/65–80/>80)

ASA PS, American Society of Anesthesiologists Physical Status score; SORT, Surgical Outcome Risk Tool.

Table 2

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