Summary Sheet

Cardiac Risk Assessment

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Dr Simon Davies
YORK TEACHING HOSPITALS NHS FOUNDATION TRUST

Cardiac complications following major surgery are relatively common, for example in the POISE study examining outcomes after non cardiac surgery in patients with cardiac risk factors found a major adverse cardiac event rate of approximately 13% and a myocardial infarction rate of 5% (the majority of which were silent). This incidence of myocardial injury following major surgery is reiterated in the VISION study where 1 in 10 patients had some form of post-operative troponin elevation, whilst often minor and asymptomatic this did relate to an increase in 30 day mortality.

Specifically assessing an individual's cardiac risk prior to surgery is therefore important however it is complex and there is no perfect scoring system or test, however there are useful tools and tests that can help quantify risk.

Revised Cardiac Risk Indices

One of the most widely used risk indices in terms of cardiac outcomes is the Revised Cardiac Risk Index (RCRI) [1].

All risk factors within the RCRI carry an equal weighting, and the risk of perioperative cardiac complications increases with the number of risk factors present. Patients are deemed high risk if they have two or more factors; equating to a >7% chance of cardiac complications.

Risk Factors (1 point for each)

- *History of ischaemic heart disease*
- *History of congestive heart failure*
- *History of cerebrovascular disease*
- *Diabetes*
- *Chronic kidney disease*
- *High risk surgery (suprainguinal vascular, intra peritoneal, intrathoracic)*

Score	***Risk of MACE***
0	*0.4%*
1	*0.9%*
2	*6.6%*
3 or more	*11%*

The RCRI is widely utilised, and forms an integral part of the ACC/AHA guidelines for perioperative evaluation of cardiac disease[2], and a systematic review[3] of the RCRI has shown that it discriminates between low risk (≤ 1 risk factor), and high risk (≥ 2 risk factors) patients undergoing mixed non cardiac surgery.

In addition to predicting risk the RCRI may aid clinicians in deciding who will benefit from perioperative beta blockade[4], as well as those who may benefit from preoperative cardiac testing[5].

Echocardiography

An association has been documented between a reduced left ventricular ejection fraction and post-operative morbidity and mortality and an ejection fraction of less that 40% predicts adverse outcomes, however, compared to a simple clinical risk model, the addition of either wall motion scores or ejection fraction derived from echocardiographic measurements does not significantly increase the predictive ability.

A retrospective study has suggested that preoperative echocardiography is not associated with improved survival after major non cardiac surgery despite it being one of the most common preoperative investigations[6], and indeed it may be associated with worse outcomes in low and intermediate risk patients based on the RCRI score.

Although cheap, simple to perform and non-invasive, overall resting echocardiography has failed to show superiority over clinical models, and has a low positive predictive value for post-operative cardiac events in subjects undergoing major non vascular surgery.

Non invasive stress testing

There are two commonly used methods to assess the myocardial response to stress being dobutamine stress echocardiography which increases myocardial oxygen demand, and radionuclitide perfusion methods (thallium 201/ technetium 99m) which induce a hyperaemic response using either adenosine or diypyridamole.

Both tests have a high negative predictive value if 'normal' (>90%) however the positive predictive values are poor. They may be useful tools in high risk patients in determining who is at a lower risk of a cardiac event perioperatively.

Biomarkers

Brain natriuretic peptide (BNP) and its inactive precursor N-terminal pro BNP (NT-proBNP) are amino acid hormones secreted by cardiac ventricular myocytes in response to ventricular wall stress and ischaemia[7,8,] .

Elevated preoperative BNP or NT pro BNP confers increased risk in the perioperative period in both the vascular and non-vascular population. What remains unclear however is the optimal cut off for these assays, which if any is superior, and whether the cut off varies depending on the type and urgency of the surgery.

The results of a meta-analysis in 2009[9] show the strong signal that these biomarkers elude to and overall the high negative predictive value for normal values of BNP (<100 $pg.ml^{-1}$) and NT-proBNP (<300 $pg.ml^{-1}$) would provide a superior and simple test for identifying those patients who would not need further measurement.

References

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