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Non-Cardiac Surgery and Cardiac Evaluation: Where Do We Stand Today?

Commentary

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Abstract

In present-day practice we frequently come across patients who need to undergo non-cardiac surgery and are either suffering from cardiac disorders or are suspected to have one. Detailed cardiac work of each and every patient is neither fruitful clinically nor it is cost-effective for the community. This has led to formulation of various approaches and guidelines towards evaluation of such patients. However, there are discrepancies among the various studies and trials, which form the basis of these guidelines. Moreover, there are areas where guidelines from various governing bodies are in conflict with each other. Guidelines themselves leave a lot to speculate in a number of gray areas. The present commentary intends to bring out the areas of agreement as well as areas of conflict in current approach to these patients. It also highlights the discrepancies in the data, which form the basis of current guidelines.

Keywords: Perioperative cardiac events; Perioperative cardiac risk; Cardiac assessment; Cardiac evaluation; Non-cardiac surgery

Abbreviations

ACE inhibitors: Angiotensin converting enzyme inhibitors; ECG: Electrocardiogram; ECHO: Echocardiogram; METs: Metabolic equivalents; RCRI: Revised cardiac risk index

Commentary

Case 1- A 79 years old male who underwent coronary artery bypass surgery about 8 months back wants to undergo cataract extraction.

Case 2- A 55 years old woman with no history of hypertension, diabetes and coronary artery disease has T wave inversion in leads V1-4. She wants to undergo laparoscopic cholecystectomy.

Case 3- A 45 years old labourer who has broken his left leg bones needs an orthopaedic surgery. There is no significant medical history.

Case 4- A 29 years old woman with severe mitral stenosis with ruptured ectopic pregnancy.

In present day practice of anaesthesia as well as cardiology, we frequently come across such patients who are suffering from cardiac disorder or suspected to have one and want to undergo non-cardiac surgery. Practitioners from both the fields are perplexed by similar kind of questions like how far should we investigate? How much risk is actually there? How to reduce that risk? etc. Despite recent publication of guidelines by American as well as English cardiac authorities, the percolation of exact practical information to the practicing physician is woefully little.

What is the approach suggested by guidelines? How meaningful it is?

The first thing that should be evaluated at the onset is the urgency of surgery. Emergency surgeries for conditions, which threaten life

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or limb like exploratory laprotomy for hemoperitonium, caesarean section for foetal distress, ruptured ectopic pregnancy, crush injuries of limbs, vascular injuries etc. should be taken up without any delay. In such cases, assessment of perioperative risk of cardiac event should be done after the surgery and appropriate measures should be taken.

If patient is known to have a cardiac disorder, the severity of the disease should be evaluated. Any patient with symptomatic severe valvular stenosis or regurgitation, symptomatic heart failure, acute coronary syndrome and uncontrolled rhythm disorder (active cardiac condition) should ordinarily be not taken up for surgery. Such patients require detailed assessment of their cardiac condition by a cardiologist and decision for surgery should be taken accordingly [1,2].

In a rare case, when a patient with active cardiac condition comes for an emergency surgery, decision for surgery should be taken on individual basis weighing risk of surgery against the conservative management [1,2].

Next step in evaluation is to ascertain if there is pre-existing coronary artery disease or any other cardiac disorder. One must take history and perform physical examination diligently for this purpose. This is the key area where we usually underperform and later on face multiple problems. Check, all the records that are available, howsoever, irrelevant they appear to the patient. Examine carefully for any signs of heart failure, presence of cardiac murmurs and additional sounds. This will prevent many surprises in operation theatre.

Patients with proven cardiovascular disease should be referred to a cardiologist for assessment of current status. They should be managed as per the existing guidelines for particular cardiac condition. The perioperative management should be guided as per the detailed guidelines on the subject, a brief summary of which will follow in this document.

If there is no documentary or historical evidence of cardiac disease, ascertain the risk of surgery. Traditionally it is divided into three categories (low, intermediate and high), details of which can also be found in detailed guidelines [1,2]. Patients undergoing low risk surgery need no further evaluation, once an active cardiac condition is ruled out. However, their future risk of cardiovascular events may be evaluated separately by the physician and advised accordingly.

Thereafter exercise capacity of the patients, who are undergoing intermediate to high risk surgery, should be determined. There is a set of questions, which can be used to determine the exercise capacity of the patient and can be individualised as per the social circumstances. Following list provides such a set of activities where exercise capacity of individual can be ascertained [1-3].

Ability to dress without stop 2-2.3 METs

Ability to clean windows- 3.7METs

Ability to mop floor- 4.2 METs

Hang Washed clothes- 4.4 METs

Have shower without stop – 3.6-4.2 METs

To climb two flight of stairs without stop at normal pace- More than 4 METs

Can have Sexual intercourse without stop- 5-5.5 METs

Carry objects that are at least 80 pounds- 8 METs

Jog or walk 5 miles an hour- 9 METs

Carry at least 24 pounds up 8 steps- 10 METs

If a patient can perform at least 10 METs of exercise without any symptoms and there is no obvious cardiovascular abnormality as per history and examination, he/she may be subjected to almost all non-cardiac surgeries [1,4].

Patients with more than 4 METs of exercise capacity but less than 10 METs may require more objective evaluation depending upon the risk of surgery and clinical probability of cardiac disease. The literature does not provide any definite approach towards these patients. In fact, the European and American guidelines also differ on this issue. As per the American guidelines, further testing for patients with exercise capacity between 4 to 10 METs may be foregone but it is a class IIb indication, which means insufficient evidence with doubtful benefit [1]. On the other hand, European guidelines suggest proceeding with surgery in all those with exercise capacity of more than 4 METs despite some reservations [2].

There are more angles to this tricky situation. The optimal exercise capacity is different for different age groups and gender. For example, good exercise capacity for a 40 years old male will be ~ 10.0 METs while it will be ~ 7.0 METs for a 60 years old female. Hence criteria of 10 METs is not applicable to all patients. Every effort should be made to decipher the cause, if a subject has lower than the expected exercise capacity. One of the practical nomograms which can be used to calculate good exercise capacity is -

For males- 14.7 - (Age x 0.11) METs

For Females- 14.7 - (Age x 0.13) METs

85% of the value derived in METs is considered just acceptable [5].

It is practically good to make a patient climb two flights of stairs without stop, at normal pace, in the health facility itself, if there is a doubt about their exercise capacity.

In view of uncertainties on this issue, we should evaluate exercise capacity of each patient carefully. Patients who have exercise capacity more than 4 METs and have no symptoms or clinical findings suggestive of cardiovascular disease should ordinarily be subjected to surgery without further testing [1,2].

Patients with exercise capacity less than 4 METs

The patient who has exercise capacity less than 4 METs and require intermediate to high risk surgery may be subjected to stress testing. We do not have clear guidelines regarding who should be subjected to stress test and who should not be.

One of the approaches is to estimate the risk factors for peri-operative acute cardiac event. There are five clinical predictors as per revised cardiac risk index (RCRI) [6]. These are

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1. Angina pectoris or history of myocardial infarction
2. Kidney disease with GFR < 60 ml/ minute
3. Diabetes mellitus requiring insulin therapy
4. History of ischemic stroke or transient ischemic attack
5. History of heart failure in the past.

As per European guidelines, presence of three or more risk factors warrant stress testing. It also states that stress testing may be used in any patient where it is likely to change perioperative management. However, these predictors were proposed about two decades back and can be considered as mere rough guides for clinicians today [2]. In the current era, it will be difficult to clear a patient for surgery, both by cardiologist and anaesthetist, who is giving typical or classical history of exertional angina with exercise capacity less than 4 METs without subjecting him to further testing, even if it is the only risk factor present, Hence, applicability of revised cardiac risk index is debatable in current era.

This notion gets further support from American guidelines that have dropped the recommendation of doing stress testing based on number of clinical predictors in their latest edition. Rather, it recommends stress testing only if it is likely to change perioperative management, which may include changes in cardiac drug therapy, decision regarding revascularization and anaesthetic management [1].

There is more confusing data regarding the occurrence of perioperative cardiac events in these patients with exercise capacity less than 4 METs. Wiklund et al. reported absence of any correlation between functional capacity as assessed in METs and perioperative adverse cardiac events [7]. Another study on the issue claimed that inability to climb two flight of stairs (attaining a height of at least 12 meters in 15 seconds) confers worse prognosis for patient undergoing thoracic surgery but has no negative implications for non-thoracic surgeries [8]. Goswami et al. found partially or totally dependent functional status as a powerful predictor of intraoperative cardiac arrest and subsequent 30 days mortality [9].

Will subjecting all these patients to stress testing be beneficial? Coronary artery revascularization prophylaxis (CARP) study found that RCRI score accurately predicts occurrence of perioperative cardiac event, however revascularization prior to surgery was not able to reduce events in such patients except for patients with left main disease [10,11]. On the other hand, one of the studies involving patients undergoing vascular surgery demonstrated long-term benefit of routine preoperative angiography as compared to those undergoing angiography only after positive stress test. All patients in this study had RCRI >2 [12]. However, current American guidelines forbid use of routine coronary angiogram preoperatively [1].

What we can do in this subgroup?

We do not have clear, evidence-based recommendations for dealing with such patients where exercise capacity is less than 4 METs. Subjecting all these patients to stress testing will neither be cost effective nor it will result into definite reduction in cardiac events and long-term survival as per current evidence. A logical proposal is to treat each patient on individual basis. We must try to ascertain the reason for low exercise capacity. All those patients where angina or equivalent symptoms appear to be the cause of limitation may be subjected to stress testing. This should preferably be imaging based exercise rather than pharamacological stress testing. All patients who have breathlessness as the limiting cause of reduced exercise capacity may be subjected to echocardiography (ECHO) and pulmonary function testing. Those patients who may have structural heart disease based on clinical examination, electrocardiogram (ECG) or X-ray chest should also be subjected to ECHO. Rest of the group which will include various causes of limited exercise capacity like obesity, anaemia, orthopaedic limitations, renal diseases etc may be subjected to stress testing after calculating number of clinical risk factors (3 or more risk factors) [2]. However, we must inform the patient as well as the surgeon that these patients fall into a high risk group, whatever be the result of stress testing.

The decision to revascularize patients from this subgroup should not only be influenced by the current guidelines of coronary artery disease but also by the fact that stenting with drug eluting stents will render them ineligible for elective surgeries for a long duration; may be one year and revascularization may not reduce the rate of perioperative and long term cardiac events and death. In fact guidelines clearly state that routine coronary revascularization before non-cardiac surgery should not be performed exclusively to reduce the risk of perioperative cardiac events [1,2].

How can we reduce the perioperative cardiac event rate ?

Can we really assess and prevent all cardiac events? The studies investigating the perioperative acute myocardial infarction tell us that prolonged ischemia with demand-supply mismatch and plaque disruption with thrombus formation are two important mechanisms. Infarction without ST elevation with underlying prolonged ischemia is commoner than ST elevation infraction with plaque disruption [13-15]. We do not have a non-invasive test, which can predict plaque disruption with subsequent thrombosis accurately. Hence, we cannot predict a proportion of acute cardiac events in peri-operative period by any means. Non-invasive testing, at best, can only provide information about existing significant flow-limiting lesions.

We can prevent prolonged ischemia mainly by keeping the myocardial demand in check. Mechanistically, it can be done well by beta-blockers. However, role of beta-blockers in perioperative management have become controversial in recent years [1,16].

Current guidelines recommend continuation of beta-blockers in patients who are already taking it for a long time. It also recommends starting beta-blockers in patients with three or more risk factors from RCRI or in those patients with long term indication of beta-blockers preoperatively. This should not be done on day of surgery but at least one day prior to surgery. Preoperative initiation of beta-blockers is a class IIb indication, indicating insufficient evidence and doubtful benefit. As per European guidelines, the agent of choice is either bisoprolol or atenolol [1,2,16].

Statins is another group of drugs that are found to be useful in reducing cardiac events associated with non-cardiac surgery. However, currently they are indicated only in patients undergoing

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vascular surgery. They should be started at least 2 weeks prior to the surgery. They are not recommended in other non-cardiac surgeries if there is no other indication for their use [1,2].

Summary of key recommendations concerning the patients with proven cardiac disease before a non-cardiac surgery [1,2]

Electrocardiogram (ECG) should be done for those with known cardiac disease. It may also be done as a baseline for those with cardiac risk factors and need to undergo high-risk surgery. There is no consensus regarding the prognostic value of various ECG changes at the baseline. As a general rule, implication of these changes increase with increasing age and number of coronary risk factors.

Role of stress testing has been discussed above. However, one must keep in mind that image based stress testing has a far better negative predictive value than positive predictive value in preoperative scenario.

Patients with suspected or proven heart failure should undergo echocardiographic evaluation before non-cardiac surgery. In addition to ECHO, natriuretic peptides may also be measured. Drug therapy should be optimized and patient should be stabilised before surgery with beta-blockers, angiotensin converting enzyme (ACE) inhibitors, diuretics and mineralocorticoid antagonists. In case of newly diagnosed heart failure surgery should be deferred by at least 3 months.

If patient is receiving angiotensin receptor blockers or angiotensin converting enzyme (ACE) inhibitors, consider stopping them 24 hours prior to surgery and should be restarted at the earliest possible.

Patients with newly diagnosed hypertension should be evaluated for end-organ damage and other cardiovascular risk factors. However, surgery should ordinarily be not deferred for hypertensives with blood pressure below 180/110 mmHg.

Major cardiac events after non-cardiac surgery are more common in patients with prior cardiac events. Risk of perioperative stroke and mortality is high even up to 6 months after acute myocardial infarction.

Asymptomatic patients who have undergone a cardiac by-pass surgery in last six years can be taken up for intermediate risk surgery without stress testing. However, baseline low ejection fraction remains a risk factor.

Elective non-cardiac surgery should not be performed in patients with balloon angioplasty, bare-metal stents and drug-eluting stents for a period of 14 days, 30 days and 365 days respectively.

The decision to stop antiplatelet drugs in patients having a stent should be discussed between surgeon, cardiologist and the patient. If surgery requires P2Y12 inhibitors to be discontinued, aspirin should be continued in peri-operative period and P2Y12 inhibitors restarted as soon as possible.

Aspirin may be continued (not started) in patients without a coronary stent only when risk of increased cardiac event is more than risk of bleeding.

Key points

- Patients who require emergency non-cardiac surgery should be taken up for surgery at the earliest. Diligent bed-side clinical assessment regarding any cardiac disorder should be made.
- Every patient should undergo thorough and detailed history and bed-side clinical examination.
- Patient with active or acute cardiac conditions like symptomatic severe valvular stenosis or regurgitation, acute coronary syndrome, uncontrolled heart failure or uncontrolled rhythm disorder should be referred for detailed cardiac evaluation prior to non-cardiac surgery.
- Patient requiring low risk surgeries should go for surgery in absence of active cardiac conditions without any further work-up.
- Exercise capacity should be ascertained in every individual before intermediate and high-risk surgery. Optimal exercise capacity differs with age and gender. Cause for suboptimal capacity should be searched for.
- Patients with good exercise capacity can be taken up for surgery without further evaluation.
- Patient with suboptimal exercise capacity but with ability to perform more than four METs of exercise needs careful consideration. However, majority of them may also be taken up for surgery.
- Patients with less than 4 METs of exercise capacity constitute a high risk group for perioperative cardiac events irrespective of results of further evaluation. However further testing needs to be done for optimization.
- There is no consensus regarding the prognostic value of various ECG changes at the baseline.
- Image based stress testing has a far better negative predictive value than positive predictive value in preoperative scenario.
- Use of routine coronary angiogram preoperatively is forbidden.
- Routine coronary revascularization before non-cardiac surgery should not be performed exclusively to reduce the risk of perioperative cardiac events.
- We cannot predict all the acute cardiac events in peri-operative period by any means.
- Preventive role of beta-blockers in perioperative setting is controversial. However, patients should be continued on beta-blockers if they are already receiving them.
- Elective non-cardiac surgery should be avoided for 6 months after acute myocardial infarction. It should also be avoided for 12 months in those with drug-eluting stents.
- Low baseline ejection fraction remains a risk factor despite the protective effect of CABG.

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