

Before Take-Off: Preparations for Non-Cardiac Procedures

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Lecture Outline

- Recognizing patients at risk of perioperative cardiac complications
- Perioperative cardiac risk stratification
- Managing cardiac patients' medications perioperatively
- Managing other specific cardiac issues
- Indications for antibiotic prophylaxis against bacterial endocarditis

Before take-off...

- Most people are able to undergo non-surgery without cardiac complications.
- However, no surgery is without risk and some individuals are at increased risk of major cardiac complications perioperatively.
- It is our responsibility to identify patients at increased risk, and to advise them accordingly about their risk.
- Once the risk is identified, the decision to proceed with or delay the surgery should be made conjointly by the surgeon, anaesthetist, cardiologist and other healthcare specialists, together with the patient and/or family.

Surgical factors that influence cardiac risk

- Every operation is a stressful event that may:
 - Increase myocardial oxygen demand
 - Predispose to atherosclerotic plaque rupture & coronary thrombogenicity
 - Predispose to arrhythmia
 - Precipitate heart failure
- Surgical factors that may influence cardiac risk:
 - Urgency, type, invasiveness, duration of the procedure
 - Blood loss, fluid shifts
 - Body position, temperature change
 - Drugs used
 - Inflammatory response

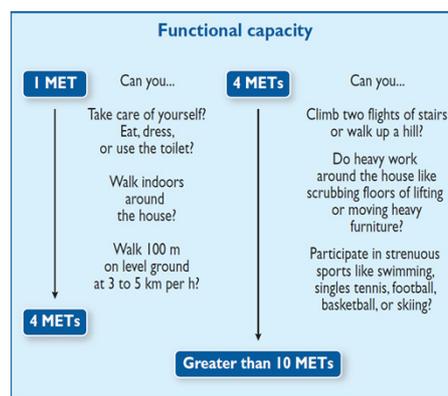
Surgical risk according to type of procedure

Low risk (<1%)	Intermediate risk (1-5%)	High risk (>5%)
<ul style="list-style-type: none"> • Superficial surgery • Breast • Dental • Thyroid • Eye • Reconstructive • Asymptomatic carotid (CEA or CAS) • Gynaecology: minor • Orthopaedic: minor (meniscectomy) • Urological: minor (TURP) 	<ul style="list-style-type: none"> • Intra-peritoneal: splenectomy, hiatal hernia repair, cholecystectomy • Symptomatic carotid (CEA or CAS) • Peripheral arterial angioplasty • Endovascular aneurysm repair • Head and neck surgery • Neurological or orthopaedic: major (hip and spine surgery) • Urological or gynaecological: major • Renal transplant • Intra-thoracic: non-major 	<ul style="list-style-type: none"> • Aortic and major vascular surgery • Open lower limb revascularization, amputation or thromboembolism • Duodeno-pancreatic surgery • Liver resection, bile duct surgery • Oesophagectomy • Repair of perforated bowel • Adrenal resection • Total cystectomy • Pneumonectomy • Pulmonary, liver transplant

Surgical risk estimate is a broad approximation of 30-day risk of CV death and MI

Recognizing patients at risk of perioperative cardiac complications

- Determine functional capacity
 - Estimated in metabolic equivalents (METs)
 - 1MET=basal metabolic rate
- Poor functional capacity (<4 METs) associated with increased risk of post-operative cardiac events.



Recognizing patients at risk of perioperative cardiac complications

- Clinical risk factors that predict risk of major perioperative cardiac events (perioperative myocardial infarction, death):
 - Ischaemic heart disease (angina pectoris and/or previous myocardial infarction)
 - Heart failure
 - Stroke or transient ischaemic attack
 - Renal dysfunction (serum creatinine >170 $\mu\text{mol/L}$ or creatinine clearance <60 mL/min/1.73 m^2)
 - Diabetes mellitus requiring insulin therapy

Recognizing patients at risk of perioperative cardiac complications

- Unstable cardiac conditions that should be diagnosed and treated before surgery:
 - Unstable angina pectoris
 - Acute heart failure
 - Symptomatic cardiac arrhythmias
 - Symptomatic valvular heart disease
 - Recent myocardial infarction within past 30 days and residual myocardial ischaemia
- These conditions greatly increase risk and non-cardiac surgery should be delayed whenever possible.

Pre-operative non-invasive testing of cardiac disease

- Pre-operative non-invasive testing aims to provide information on LV function, myocardial ischaemia, heart valve abnormalities, pulmonary artery pressures.
- Diagnostic algorithm should be similar for patients in non-surgical setting.
- Testing should be considered only if results may change management of the heart disease, useful for patient counselling, change of management of surgical/anaesthetic technique, and for long term prognosis.

Pre-operative non-invasive testing of cardiac disease

- Pre-operative ECG
 - To detect presence of underlying cardiac disease (eg. Q waves indicating previous MI).
 - Recommended for patients with risk factors scheduled for intermediate- or high-risk surgery.
 - Reasonable for patients with known CAD, significant arrhythmia, PAD, cerebrovascular disease, or other significant structural heart disease.
 - May be considered for patients with risk factors scheduled for low-risk surgery, or those >65 years of age with no risk factors & scheduled for intermediate-risk surgery.

Pre-operative non-invasive testing of cardiac disease

- Assessment of left ventricular function
 - LV ejection fraction is a predictor of CV risk.
 - Knowledge of LV function may help perioperative management, eg. Fluid management.
 - Recommended for patients with risk factors scheduled for intermediate- or high-risk surgery.
 - Reasonable for patients with known CAD, significant arrhythmia, PAD, cerebrovascular disease, or other significant structural heart disease.
 - May be considered for patients with risk factors scheduled for low-risk surgery, or those >65 years of age with no risk factors & scheduled for intermediate-risk surgery.

Pre-operative non-invasive testing of cardiac disease

- Non-invasive testing for ischaemic heart disease
 - Presence of myocardial ischaemia may increase risk for perioperative CV events.
 - Testing should only be performed if results might influence perioperative management.
 - Most data with nuclear imaging and stress echo.
 - Generally these tests have high negative predictive value and low positive predictive value.
 - Meta analysis of nuclear stress imaging indicate that reversible ischaemia in <20% of LV myocardium did not increase risk, whereas patients with more extensive reversible defects involving 20-50% LV myocardium were at increased risk.

Pre-operative non-invasive testing of cardiac disease

- Non-invasive stress imaging test for ischaemic heart disease before non-cardiac surgery:
 - Recommended before high-risk surgery in patients with >2 clinical risk factors and poor functional capacity (<4 METs).
 - May be considered before intermediate- or high-risk non-cardiac surgery in patients with 1 or 2 risk factors and poor functional capacity (<4 METS).
 - Not recommended before low risk surgery regardless of patient's clinical status.

Pre-operative coronary angiography

- Indications for coronary angiography similar to those in non-surgical settings.
- Lack of information from randomized controlled trials regarding its usefulness in patients scheduled for non-cardiac surgery.
- Recommended in patients with unstable coronary syndromes, persistent angina despite adequate medical therapy and those with proven myocardial ischaemia.

Pre-operative pharmacologic treatment to reduce CV risk

- Beta-blockers:
 - Cardioprotective effect is controversial and may be dependent on heart rate and BP effects.
 - Continuation of beta-blockers recommended in patients already receiving this medication.
 - Pre-operative initiation of beta-blockers (bisoprolol, atenolol) may be considered in patients scheduled for high-risk surgery who have ≥ 2 clinical risk factors or ASA status ≥ 3 .
 - May also be considered in patients with known IHD or myocardial ischaemia.

Pre-operative pharmacologic treatment to reduce CV risk

- Statins:
 - Continuation of statins recommended in patients already receiving this medication.
 - Pre-operative initiation of statin therapy should be considered in patients undergoing vascular surgery (ideally at least 2 weeks before surgery).
- Nitrates
 - No evidence that perioperative use of nitrates reduce incidence of MI or cardiac death.

Pre-operative pharmacologic treatment to reduce CV risk

- ACE inhibitors or angiotensin receptor blockers:
 - Increase risk of perioperative hypotension.
 - Initiation or continuation of these drugs in stable patients with heart failure and LV systolic dysfunction.
- Calcium channel blockers:
 - May reduce myocardial ischaemia and SVT.
 - Initiation or continuation of heart rate-reducing CCBs (verapamil, diltiazem) may be considered in patients who do not tolerate beta-blockers.

Pre-operative coronary revascularization in stable/asymptomatic patients

- Coronary revascularization is recommended according to usual indications for management of stable CAD in non-surgical setting.
- Prophylactic coronary revascularization may be considered before high-risk surgery depending on extent of inducible myocardial ischaemia.
- In asymptomatic patients or those with stable CAD, prophylactic coronary angiography—and, if needed, revascularization before non-cardiac surgery—does not confer any beneficial effects as compared with optimal medical management in terms of perioperative mortality, myocardial infarction, long-term mortality, and adverse cardiac events.

Perioperative management of patients on anti-platelet therapy

- In patients undergoing non-cardiac surgery after recent MI or stent implantation, benefits of early surgery must be balanced against risk of stent thrombosis.
- Consult interventional cardiologist for opinion.
- Aspirin and P2Y₁₂ inhibitor (clopidogrel, ticagrelor, prasugrel) treatment should be continued for 4 weeks after bare metal stent implantation and for 3-12 months after drug-eluting stent implantation, unless unacceptably high risk of bleeding.
- Decision to discontinue antiplatelet therapy depends on perioperative bleeding risk weighed against risk of thrombotic complications.
- For patients at very high risk of stent thrombosis, bridging with IV glycoprotein inhibitors (eptifibatide or tirofiban) may be considered.

Perioperative management of patients on anticoagulant therapy

- Risk of bleeding must be weighed against risk of thromboembolic complications.
- For patients on warfarin, surgery can be safely performed if INR ≤ 1.5 .
- Patients at high risk of thromboembolic complications will need perioperative bridging with heparin:
 - AF with previous stroke or CHA₂DS₂-VASc score 4
 - Mechanical prosthetic heart valve or newly inserted bioprosthetic heart valve
 - Within 3 months of mitral valve repair
 - Within 3 months of thromboembolism
 - Thrombophilia

Perioperative management of patients with valvular heart disease

- In patients with suspected valvular heart disease or heart murmur, echocardiogram is recommended before non-cardiac surgery.
- Valve disease that confers increased perioperative risk of cardiac complications:
 - Severe aortic stenosis
 - Asymptomatic patients with severe mitral stenosis and pulmonary artery systolic pressure >50 mmHg
 - Symptomatic patient with severe mitral stenosis, aortic or mitral regurgitation
 - Asymptomatic patient with severe mitral or aortic regurgitation and LVEF <30%
 - For these patients, valvular intervention/surgery should be considered if non-cardiac surgery can be safely delayed.
- In asymptomatic patients with severe aortic and mitral regurgitation, non-cardiac surgery can be safely performed without additional risk.

Antibiotic prophylaxis against bacterial endocarditis

- Antibiotic prophylaxis indicated for the following high-risk cardiac conditions:
 - Prosthetic heart valve
 - History of infective endocarditis
 - Congenital heart disease:
 - Unrepaired cyanotic CHD, including palliative shunts and conduits;
 - Completely repaired congenital heart defect with prosthetic material or device, whether placed by surgery or by catheter intervention, during the first 6 months after the procedure;
 - Repaired CHD with residual defects at the site or adjacent to the site of a prosthetic patch or prosthetic device (which inhibits endothelialization).
 - Cardiac transplantation recipients with valvular disease

Perioperative management of patients with chronic heart failure

- Patients with heart failure should be stabilized and compensated before surgery:
 - Ensure optimal fluid and perfusion status
 - Should ideally be on ACE inhibitor/ARB and beta-blocker therapy in case of HF with reduced LVEF
 - Diuretic therapy may be stopped just prior to surgery if fluid status optimal
 - Ensure renal function and electrolytes are stable
- For patients who have suffered decompensated HF, should wait at least 4-6 weeks before surgery if can be safely delayed.

Perioperative management of patients with implanted cardiac devices

- Consult electrophysiologist or cardiologist.
- Use of unipolar electrocautery may inhibit or reprogramme pacemakers & should be avoided.
- Use of bipolar electrocautery, proper position of grounding pad, keeping electrocautery away from device, giving short bursts and using lowest amplitude possible should prevent issues with device.
- Device should be checked, and if necessary, reprogrammed before and after surgery.
- ICD should be deactivated before surgery and switched on during recovery.
 - Patient will need continuous heart rhythm monitoring with external defibrillator on standby during surgery.

Take home messages

- Most patients with stable cardiac disease are able to undergo most non-cardiac surgery safely.
- However, some patients are at increased risk of perioperative cardiac complications and these need to be identified and treated before non-cardiac surgery.
- Using clinical risk prediction tools is the first step to identifying which patients require further cardiac testing to further refine risk and to guide management.
- Perioperative cardiac risk assessment, management and decision to proceed with non-cardiac surgery is best performed in a multidisciplinary setting involving the surgeon, anaesthetist, cardiologist and other relevant health care personnel, in conjunction with the patient/care-giver.

References

- 2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management. *European Heart Journal* (2014) 35, 2383–2431.
- 2014 ACC/AHA Guideline on Perioperative Cardiovascular Evaluation and Management of Patients Undergoing Noncardiac Surgery. *Circulation*. 2014;130:e278-e333.