Perioperative cardiac risk assessment

The number of older people having surgery is increasing and geriatrician involvement is being increasingly sought. This article uses guidance from the European Society of Cardiology[1] and the American College of Cardiology[2] to provide a practical guide for geriatricians advising on preoperative cardiac optimisation in older people. Preoperative investigations should be justified according to risk. These include blood tests, electrocardiograms (ECGs), echocardiograms, stress tests and angiography. Optimising and initiating treatment for cardiac disease reduces adverse postoperative outcomes.

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In an ageing population, with improved surgical techniques and changes in patient expectations, the number of older people undergoing surgery is increasing. Older people often have multiple comorbidities, a lower physiological reserve and an impaired ability to respond to the stress of surgery. Unsurprisingly, older patients have more post operative complications than younger patients.[3]

Cardiac complications, in particular, are more common in older people. This is often in the context of preexisting cardiac disease or cardiac risk factors. The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) report[4] identified that 81% of older surgical patients (who died within 30 days of surgery) had known pre-existing cardiac disease. Older patients with pre-existing cardiac disease may have a cardiac morbidity as high as 25.8% and a 5.5% risk of cardiac death postoperatively.[5]

Geriatricians' advice is increasingly sought to optimise older people preoperatively. Some hospitals are beginning to develop models of care for older surgical patients, such as for fractured neck of femur and POPS[6] (Proactive care of older people undergoing surgery). The evidence base demonstrating benefit of geriatrician input in fractured neck of femur care is established and early data published in POPS[6] has been positive. Preoperative geriatrician input may be beneficial not only in improving outcomes but also in preventing surgery being cancelled unnecessarily due to the presence of comorbidities.

It is therefore important for geriatricians advising surgical teams to be familiar with the evidence base regarding cardiac preoperative assessment and management. This article uses guidance from the European Society of Cardiology[1] and the American College of Cardiology[2] to produce an evidence based practical guide for the geriatrician advising on preoperative optimisation in elective surgery for older people. The article will focus on cardiac assessment and risk reduction. Fully reviewing the evidence for comprehensive geriatric assessment in surgical patients is beyond the scope of this article.

Surgical context

Perioperative cardiac risk is influenced by many factors, including risk from the surgery, intraoperative conditions and the patient's premorbid condition. When considering cardiovascular optimisation, it is important to know the cardiac risk associated with a particular operation. Box 1 demonstrates which operations constitute low, intermediate and high risk with their associated 30 day risk of myocardial infarction (MI) or cardiac death.

History taking

Older patients with complex comorbidities or who are at

Box 1: 30 day risk of MI or cardiac death (modified from the European guidelines)[1]

Low Risk <1%	Intermediate Risk 1–5%	High Risk >5%
Breast	Abdominal	Aortic
Dental	Carotid	Major vascular
Endocrine	Peripheral angioplasty	Peripheral vascular surgery
Eye	Endovascular repair	
Gynaecological	Head and neck	
Reconstructive	Pulmonary	
Minor orthopaedic eg. knee	Major orthopaedic eg. hip	
Minor urological	Major urological	
	Spinal	
	Renal or liver transplant	

risk of complications should be targeted for a preoperative assessment by a geriatrician. Assessment of preexisting cardiac conditions should be detailed. History of associated diseases should also be identified including peripheral vascular disease, cerebrovascular disease, diabetes, renal impairment and chronic pulmonary disease.

Medications should be reviewed to identify those which will improve or worsen the perioperative risk, and those which are unnecessary. Cardiac medications which may alter perioperative outcomes will be discussed below in treatment strategies.

Assessing a patient's functional capacity is important in identifying cardiac risk as it allows us to estimate their physiological reserve. A common measure of functional capacity is metabolic equivalents (METS). Box 2 illustrates activities and their equivalent METS. Patients with less than 4 METS (equivalent to climbing two flights of stairs) have a poor functional capacity and have a higher risk of postoperative cardiac events, but not an increase in mortality. This does not mean that patients with less than this exercise tolerance should not be operated on; many older people will fall below this functional threshold. It does however make it even more relevant to make a full cardiovascular risk assessment, as addressing cardiac risk will alter outcomes more than their functional abilities.

Examination

A full examination is imperative to assess known comorbidities as well as to identify previously undetected diseases. In addition to the cardiovascular, respiratory and abdominal examination, the peripheral vascular system including carotid bruits should be examined, and a nutritional assessment made (obesity affecting cardiac risk, sarcopenia affecting functional reserve).

Investigations

Blood tests

Blood tests should be performed in all elderly patients having intermediate and high risk surgery and considered in low risk procedures. These include full blood count, renal function, liver function and bone profile. B-type natriuretic peptide (BNP) should be considered if there is the suspicion of heart failure.

ECGs

Box 3 illustrates when preoperative ECGs are indicated. If indicated, ECGs should be performed within 30 days of surgery. Patients with ECGs showing left ventricular hypertrophy (LVH) or ST depression are at higher risk for perioperative cardiac events.

Exercise tolerance tests and stress tests

If physically able then an exercise tolerance test may

Box 2: METS and equivalent activity

METS	Activity
1	Resting basal metabolic rate
2	Walking slow pace
3	House work
4	Climbing 2 flights of stairs
8	Jogging/swimming

Table 3. Indications for preoperative ECGs

Definitely required	Consider	Not routinely
High risk surgery	Intermediate risk surgery and no risk factors*	Low risk surgery with no risk factors
Intermediate risk surgery with risk factors for cardiac or peripheral vascular disease (PVD)	Low risk surgery with risk factors for cardiac or PVD	

*Risk factors: IHD, heart failure, cerebrovascular disease, diabetes, renal impairment

be considered. If unable to exercise or the resting ECG shows left bundle branch block (LBBB), LVH with strain or digitalis effect, then a pharmacological stress test is more appropriate. Both myocardial perfusion scans and dobutamine stress echoes have a high negative predictive value for postoperative MI or cardiac death although are weaker for positive predictive value. Patients with reversible defects are at higher risk of cardiac death or MI. Patients with fixed defects may have more events than normal scans but are not as high risk as with reversible defects. If a reversible defect is detected, then angiography should be considered prior to surgery.

Cardiopulmonary exercise testing (CPET)

CPET involves a multi-organ assessment of the cardiac, pulmonary and skeletal muscle and their combined response to stress. A high proportion of older people are unable to complete this test thus limiting its utility. Routine use of CPET is not recommended.

Echocardiogram

Pre-existing LV dysfunction is predictive of death in the critically ill and of postoperative heart failure. It is not predictive of postoperative MI. The need for preoperative echocardiogram remains controversial. From a geriatrician's point of view, we would advocate an echocardiogram only if it will alter clinical management. Often this will require discussion with the anaesthetist. It is unusual to need to delay surgery for preoperative echocardiograms.

Medical management

Optimisation of preexisting cardiac disease reduces adverse postoperative outcomes.[7] This section will review how common cardiac medications and interventions affect perioperative outcomes. It will also highlight when to and when not to withhold medications perioperatively.

Beta-blockers

There have been mixed reports on the initiation of beta-blockers preoperatively. Some randomised controlled trials including by Mangano et al[8] (atenolol), DECREASE[9] (bisoprolol) and POISE[10] (metoprolol) have shown a reduction in cardiac mortality and MI in patients with either known ischaemic heart disease (IHD) or with risk factors. DECREASE[9] showed that in fact the benefit was sustained up to three years. POISE was by far the largest trial with 8351 patients, using high dose metoprolol (200mg) commenced in the immediate preoperative period. It found a 17% reduction in composite endpoint, 30% reduction in non-fatal MI but a two fold increase risk of stroke and an increased all cause mortality. Other trials with metoprolol (POBBLE[11], MaVS[12] and DIPOM[13]) have shown no benefit. POBBLE[11] and MaVS[12] however were for low risk groups. There have been seven meta-analyses, five concluding that beta-blockers reduced perioperative MI and cardiac death, with benefits more marked in high risk groups. The differences may be explained by different patient selection, different surgeries, and different timings of initiation as well as different beta-blockers. They should be started at least 7-30 days prior to surgery with a target heart rate >60-70 bpm and systolic >100mmHg. Beta-blockers of choice are bisoprolol or metoprolol, and they should be continued postoperatively.

Statins

Perioperative statin use has been shown to be beneficial with a reduction in mortality and cardiac death, possibly due to coronary plaque stabilisation. A meta-analysis of 223,010 patients showed a 44% mortality reduction in non-cardiac surgical patients.[14]

Statins should be commenced 7-30 days preoperatively in high risk surgery and in intermediate risk surgery with at least one risk factor and should be continued perioperatively and in the long-term.

ACE inhibitors

Quinapril has been shown to reduce postoperative cardiac events in the QUO VADIS study.[15] If LV dysfunction is discovered during preoperative screening, ACE inhibitors should be considered and withholding ACE inhibitors perioperatively should be avoided. Hypotension perioperatively is common[3] and often due to an easily reversible causes eg. hypovolaemia and dehydration rather than due to medications. However, in this setting, it may be appropriate to withhold medications likely to exacerbate hypotension.

Calcium channel blockers

There is limited evidence regarding calcium channel blockers. A meta analysis of 1007 patients showed reduced mortality and MI but only on combining endpoints.[16] Calcium channel blockers may be considered for rate control if there are contraindications to beta-blockers but otherwise their routine use is not recommended as a strategy for cardiac risk reduction perioperatively.

Diuretics

Diuretics may induce hypokalaemia, which is associated with an increased risk of ventricular arrhythmias in cardiac disease. Potassium and magnesium levels should be measured preoperatively and supplemented if required. Alternative strategies to improve electrolytes are dose reduction or switching to potassium sparing alternatives.

Aspirin

Patients with pre-existing IHD or with risk factors, who have their aspirin withdrawn preoperatively, have a threefold higher risk for a major cardiac event. A meta analysis of 49590 patients[17] demonstrated patients who continue on aspirin have a 1.5 increased risk of bleeding but this is not classed as severe bleeding with no increase in mortality from bleeding. Ideally aspirin should only be discontinued if the bleeding risk is high. Despite this evidence base, most units in the UK stop aspirin seven days preoperatively.

Anticoagulants

Local guidelines may differ. At Guys and St Thomas' NHS Foundation Trust detailed guidelines have been developed (enquiries to authors are welcome).

Previous cardiac events and interventions

Recent MI

Surgery should usually be delayed for 4–6 weeks following an MI. It should not be delayed if there is a life threatening indication for surgery. In this situation, aggressive medical management and possible intervention should follow postoperatively.

Bypass surgery

This is not a contraindication to surgery. In fact, if patients had a CABG in previous five years and are stable, they have a reduced risk of cardiac complications following other surgery.

Balloon angioplasty

A 2–4 week delay to surgery following balloon angioplasty is indicated unless the surgical condition is life threatening.

Stents

Patients with coronary stents may be at higher risk of perioperative cardiac events. Patients with recent bare metal stents should wait at least six weeks (optimally >3 months) before surgery, and then proceed with aspirin cover. If a drug eluting stent has been inserted recently, a 12 month delay is advised for elective surgery. Discontinuing the associated anti-platelet treatment causes an increased risk of stent thrombosis therefore it should not routinely be discontinued. If anti-platelets must be stopped then this should be for the least possible time.

Hypertension

Blood pressure control is important in the perioperative period. Poor control is associated with a higher incidence of delirium[18] and acute kidney injury.[19] Pharmacological measures should follow standard guidelines, but in patients with IHD, beta-blockers are recommended. In most cases it is not beneficial to delay surgery to optimise control, but if the systolic >180mmHg or diastolic >110mmHg then it may be sensible to delay non-urgent surgery.

Valves

Patients with severe aortic stenosis or severe symptomatic mitral stenosis should be considered for valve surgery prior to their elective surgery. If the surgery is emergent, then a risk benefit assessment will be required. In aortic and mitral regurgitation, if the left ventricular function is preserved then surgery can proceed. If the left ventricular function is <30% then a careful consideration to the necessity of

surgery is required.

Patients with valve replacements do require endocarditis prophylaxis perioperatively. Bjork-Shirley valves and mechanical mitral valves are at particular high risk of thromboembolism therefore adequate anticoagulation is imperative.

Conclusion

Geriatrician involvement is being increasingly sought to optimise older people before surgery. Preoperative cardiac assessment and risk reduction reduces adverse outcomes in older people, and geriatricians should target high risk patients. We need to work closely with surgeons, anaesthetists and cardiologists, with the current evidence base, to provide older people with better quality perioperative care.

Conflict of interest: none declared

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