Elective surgery in patients with complex conditions

Older patients can benefit greatly from elective surgery, but complications and adverse events must be considered. Variables that affect outcome include the differing risks of particular procedures and the functional capacity and comorbidities of the patient. Many people can undergo surgery successfully if their conditions are managed appropriately before, during, and after surgery.

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Increasing numbers of older patients with multiple comorbidities have benefited from surgery, but complication rates remain, justifiably, a major concern. The question of whether a person is fit for surgery is an oversimplification of the risk-benefit assessment and of the planning of preoperative, intraoperative, and postoperative care aimed at minimising complications.[1] In this article we review current practice regarding elective surgery; emergency surgery entails different risk-benefit assessments.

The risks surrounding surgery depend on: the complexity and nature of surgery (table 1); the patient's comorbidity and fitness (ie, cardiorespiratory reserve); medical care given before, during, and after surgery; and anaesthetic technique.

Basic science

The ageing process reduces functional reserve in all organ systems and elderly patients have surgical complications with greater frequency and severity than do younger patients.[2] Survival after major surgery requires increases in both delivery of oxygen and its use at the cellular level. Identification of patients with reduced cardiorespiratory reserve is therefore important in anticipating complications. Cardiopulmonary exercise testing can identify elderly patients at high risk of complications,[3] but such objective measures are not widely available—the ability to perform daily activities is an adequate surrogate marker.[4] The metabolic equivalent is a laboratory measure of the resting oxygen consumption of an average adult (3·5 ml/kg/min) and is used in cardiopulmonary exercise testing to record the peak oxygen consumption (VO_2 max). This formal measure can be equated with daily activities (table 2).

An exercise capacity of approximately four metabolic equivalents is considered to be the minimum fitness required to survive major physical stress (table 2). The American Society of Anesthesiologists' (ASA) grading of preoperative fitness (box 1) correlates with postoperative mortality[5,6] and a high proportion of older patients are ASA grades 3 or 4.

	Type of surgery
High (>5%)	Aortic and other major vascular surgery Peripheral vascular surgery
Intermediate (1–5%)	Intraperitoneal and thoracic surgery Carotid endarterectomy Head and neck surgery Orthopaedic surgery Prostate surgery
Low (<1%)	Endoscopic procedures Superficial procedures Cataract surgery Breast surgery Ambulatory surgery

Table 1: Estimated risk of cardiac complications of surgery
Risks are increased considerably by comorbid disease

Preoperative assessments

The Association of Anaesthetists of Great Britain and Ireland recommends early cross-specialty assessment for elderly patients and surgery may need to be delayed to improve preoperative fitness.[1] Good communication between medical, surgical, and anaesthetic teams allows for coordinated planning and avoids unnecessary or irrelevant tests. Extensive guidelines on preoperative testing exist,[7,8] but many departments have simplified versions. Table 3 shows an overview of the NICE guidance.[8] Patients of ASA grade 4 will probably need tests in addition to those required for ASA grade-3 patients.

Many hospitals hold anaesthetic assessment clinics to arrange further investigations and to ensure that comorbid diseases are stable and well treated. Such clinics may improve hospital efficiency and safety for some patients[9] because they allow discussion of anaesthetic techniques, risks, consent, intra-operative and postoperative care, and social care after discharge. Referral is usually made by the surgeon, but an informal phone call can be made to the anaesthetist for discussion of complex cases. Specialist investigations, such as pulmonary function, exercise ECG and coronary angiography provide detailed information, but should be requested only if the patient's history and examination raise further concerns and are likely to alter management.

The preoperative clinic also provides an opportunity for advice on smoking, weight loss, and nutrition, and thus can improve perioperative risk. Stopping smoking 6–8 weeks before surgery reduces complications and improves wound healing[10] and stopping even 24 hours preoperatively reduces both the effects of nicotine and the concentration of carboxyhaemoglobin.

Undernutrition, which is common in elderly patients, increases skin fragility and pressure sores, and impairs wound healing. Guidelines regarding obesity have been produced as this also increases anaesthetic and operative risks.[11]

Notable conditions

Ischaemic heart disease

Myocardial infarction is the leading cause of perioperative death in 80-year-olds and may have an atypical or silent presentation.[12] Recognised risk factors are shown in box 2.[7]

	Metabolic equivalent	Equivalent activity
Good	7–10	Bowls, golf, dancing, tennis
Moderate	4–7	Climb a flight of stairs or walk up a hill, heavy housework, brisk walking
Poor	2–3	Walking indoors or slowly on flat ground, light housework
Very poor	1	Eating, dressing

Table 2: Relationship between functional capacity and estimated metabolic equivalents

Box 1: ASA classification system for assessing preoperative physical status

1. Normal healthy patient
2. Patient with mild systemic disease
3. Patient with severe systemic disease
4. Patient with severe systemic disease that is a constant threat to life
5. Moribund patient who is not expected to survive without surgery

Diabetes mellitus and renal impairment are strongly associated with widespread and occult atherosclerosis. Patients treated with insulin may need to switch to an intravenous regimen perioperatively.

Non-invasive tests (eg myocardial perfusion scan, or stress echocardiography) may provide useful information, particularly for patients in the intermediate-risk category. High-risk patients need full anaesthetic and cardiological assessment.

β-blocking drugs are currently recommended for patients undergoing high-risk surgery who have evidence of cardiac ischaemia (recent mycardial infarction, unstable angina, or abnormalities on preoperative tests). Good quality trials regarding other indications for β-blockade are lacking and the optimum drug, dosage, and duration are unclear.[13] β-blockers should be continued in patients on long-term treatment for angina, arrhythmias, heart failure, or hypertension.

Anti-platelet drugs such as aspirin and clopidogrel are used in combination after myocardial infarction and coronary artery stenting, but may cause excessive perioperative bleeding. Current evidence suggests that aspirin should

be continued, but the risks and benefits of stopping clopidogrel (typically 7 days before surgery) should be discussed between the surgeon, cardiologist, and anaesthetist.[14]

Heart failure and hypertension

Left ventricular dysfunction confers an additional risk of complications which may be small if symptoms are well controlled. Echocardiography is suggested for patients with uncontrolled symptoms. New York Heart Association grades 3–4 should be fully assessed with an ECG and treated by an anaesthetist and cardiologist.[7] Hypertensive patients have exaggerated cardiovascular responses under anaesthesia, so pulse and blood pressure are difficult to control, increasing the risk of complications.[12] Severe hypertension (greater than 180/110 mmHg) should be treated effectively for 2 weeks before surgery.

Atrial fibrillation and other arrhythmias

If the ventricular rate is controlled to under 100 beats per minute, then atrial fibrillation alone is a minor risk factor, but it is still important to consider associated systemic vascular disease. Drugs such as β-blockers or digoxin, or both, may be needed for rate control, and patients taking anticoagulants need clear guidance about stopping these

	ASA grade 1	ASA grade 2	ASA grade 3
Minor surgery: Excision of skin lesion, drainage of abscess	ECG Full blood count Urea and electrolytes Urinalysis	ECG Full blood count Urea and electrolytes Urinalysis Chest X-ray	ECG Full blood count Urea and electrolytes Urinalysis Chest X-ray Coagulation Arterial blood gas
Intermediate surgery: Hernia repair, ligation of varicose veins, knee arthroscopy	ECG Full blood count Urea and electrolytes Urinalysis Random glucose	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Chest X-ray Arterial blood gas	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Chest X-ray Arterial blood gas Pulmonary function tests
Major surgery: Total abdominal hysterectomy, transurethral resection of the prostate, lumbar discectomy, thyroidectomy	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Chest X-ray	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Chest X-ray Pulmonary function tests	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Chest X-ray Pulmonary function tests Arterial blood gas
Very major surgery: Joint replacement, colonic resection, radical neck dissection	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Coagulation Chest X-ray	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Coagulation Chest X-ray Arterial blood gas Pulmonary function tests	ECG Full blood count Urea and electrolytes Urinalysis Random glucose Coagulation Chest X-ray Arterial blood gas Pulmonary function tests

Table 3: A summary of preoperative tests recommended by NICE for patients older than 60 years[8]

Recommended tests are not shaded; shaded tests can be considered depending on comorbidity and type of surgery. Types of surgery listed are typical examples.

drugs preoperatively. Any heart block other than asymptomatic first degree (isolated P–R interval lengthening) requires advice from a cardiologist to optimise medication and for consideration of pacing.

Stroke

Previous strokes or transient ischaemic attacks confer an increased risk of cardiovascular complications and further stroke. Stroke survivors are known to have poor fitness and low cardiorespiratory reserve,[15] and past neurological damage may cause poor posture, unsafe swallowing, and prolonged rehabilitation.

Respiratory disease

Postoperative respiratory complications affect 2–10% of elderly patients.[12] Risk factors include smoking, chronic obstructive pulmonary disease (COPD), asthma, hypersecretion of mucus, and chest deformities. Anaesthetic technique may be altered for patients with poor respiratory function (eg, regional versus general anaesthesia), but postoperative high-dependency care may still be necessary. Deformity of the chest wall (eg, from osteoporotic vertebral collapse) reduces rib excursion and lung function, thereby increasing postoperative chest infections. Such patients may benefit from preoperative physiotherapy and strength building exercises.[1]

Pulmonary function can usually be assessed with reference to daily activities.[4,12] Patients who report worse symptoms and functional capacity preoperatively are more likely to suffer respiratory complications postoperatively. Serial measurements of peak flow are helpful in asthmatic patients and spirometry may be useful for patients with COPD who plan to have upper abdominal or thoracic surgery. This test highlights those requiring physiotherapy and high-dependency care. Respiratory infections should be treated aggressively and inhaled bronchodilator therapies should be optimised.

Box 2: Guideline predictors for perioperative cardiovascular complications—myocardial infarction, heart failure, or death according to the American College of Cardiology and the American Heart Association[3]

Major risk

- Myocardial infarction or unstable coronary syndrome within 1 month of surgery
- Decompensated heart failure
- Significant arrhythmias (eg, high-grade atrioventricular block)
- Severe valvular disease

Intermediate risk

- Any previous myocardial infarction or angina
- Compensated or prior heart failure
- Diabetes mellitus
- Renal impairment

Minor risk

- Advanced age
- Left bundle branch block, ST segment changes, or left ventricular hypertrophy on ECG
- Rhythm other than sinus (eg, atrial fibrillation)
- Low functional capacity (less than four metabolic equivalents)
- Previous stroke or transient ischaemic attack
- Uncontrolled hypertension

Dementia and delirium

Pre-existing dementia and unrecognised cognitive impairment increase the risk of postoperative delirium, which in turn increases both length of stay and mortality. Patients who lack mental capacity to consent to an operation need special consideration. Changes in environment can exacerbate confusion, particularly at night, and day case procedures may minimise this problem.[12]

Chronic kidney disease

Significant renal impairment, typically an estimated glomerular filtration rate of less than 60 ml/min or creatinine greater than 180 µmol/l) is associated with cardiac complications,[5] systemic atherosclerosis, and delirium. Renovascular disease is the most common underlying cause in elderly patients. Persistent proteinuria, haematuria, a recent decline in glomerular filtration (eg, more than 15%) or a rise in creatinine (eg, more than 20%) should be discussed with a nephrologist. Drug doses, including for anaesthetic agents, may need to be modified.

Anaesthetic techniques

Anaesthesia can be either general or regional by anaesthetising a specific body area, (eg, spinal epidural, or peripheral nerve blockade). No technique is

preferred for elderly patients, as each patient requires a technique tailored to their individual needs. However, regional anaesthesia may reduce bleeding, thromboembolic and respiratory complications, and cognitive dysfunction.[12,16] Consequently these techniques are gaining popularity in all groups of patients, but may particularly benefit elderly patients.

Summary

Survival after major surgery requires adequate cardiorespiratory reserve. In practice, daily activities provide surrogate markers of fitness and risk of postoperative complications. Multidisciplinary preoperative assessment guides the use of specialised tests, care planning, and the optimum management of comorbid conditions. Extensive guidelines exist but still require tailoring to individual patients

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Example case

A 79-year-old woman wishes to be considered for total hip replacement. She is receiving treatment for stable angina, hypertension, and mild renal impairment. She also has chronic bronchitis controlled with inhalers and can walk 200 m on flat ground before stopping because of joint pain and dyspnoea.

- What are the risks of surgery?
- How can these risks be minimised?
- What preoperative assessments are needed?

Assessment

This patient is ASA grade 3 and plans major surgery. Preoperative assessment should highlight unstable angina, covert ischaemia, heart failure, and COPD. Exercise capacity should be referenced to daily tasks. Minimum investigations are ECG, urine dipstick, full blood count and serum electrolyte measurement. Chest X-ray, blood glucose and arterial-blood-gas tests may help depending on her symptoms and signs. Formal exercise testing is not practical but pharmacological stress testing could be used. Spirometry is probably not necessary given the peripheral nature of the surgery and stability of her symptoms. β-blockade should be considered, but is relatively contraindicated in COPD. The consent process should discuss cardiac and respiratory complications because she is at intermediate risk.