

## ANAESTHESIA FOR THE ELDERLY PATIENT

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- Introduction
- Age-related physiological changes
- Alterations in organ function
- Preoperative preparation
- Intraoperative management
- General or regional anaesthesia?
- Postoperative care
- Further reading

### Introduction

Increasing numbers of elderly patients are presenting for surgery due to longer life expectancy. The incidence of peri-operative complications is much higher in these patients due to reduced functional reserve and a high incidence of co-morbidity, but these complications can be minimised by careful preoperative assessment, a meticulous anaesthetic technique and good postoperative care.

### Age-Related Physiological Changes

Ageing is a process where progressive cell loss occurs, at a variable rate, in individual patients and their organ systems.

The concept of “functional reserve” is derived from the difference between the basal level of organ function at rest and the maximum level of organ function that can be achieved in response to increased demand, for example during exercise or in response to surgical stress. Functional reserve is often reduced in elderly patients, and is thought to be a major factor in the increased morbidity and mortality of the elderly population. However, decreased functional reserve may be difficult to detect. Some patients are limited by lack of mobility and as a result do not exert themselves as much. These patients rarely admit to breathlessness or angina, yet they may have significant underlying and undetected ischaemic cardiac disease.

### Alterations In Organ Function

Almost all age-related changes in organ systems are relevant to the anaesthetist. However, reduction in cardiovascular, pulmonary, renal and central nervous system function may be the most important determinants of outcome from surgical procedures under general or regional anaesthesia.

### Cardiovascular system

Ischaemic heart disease is common in affluent societies. Smoking, hypercholesterolaemia, hypertension, type 2 diabetes mellitus and obesity all contribute to the development of atherosclerosis. The result is a less compliant arterial tree, increased systemic vascular resistance and systemic hypertension. The net effects on the heart are concentric left ventricular hypertrophy, reduced ventricular compliance and contractility, and eventually reduced cardiac output.

In contrast, valvular heart disease secondary to rheumatic fever is more commonly seen in developing countries. Over 50% of patients will have mitral valve disease. Aortic lesions are less common.

The reduced cardiac output in heart disease compromises blood flow to the kidneys and brain. Autoregulation of blood flow to these organs is impaired in the elderly, and therefore both the kidneys and brain are prone to peri-operative ischaemia.

The physiological response to cardiovascular stressors (such as hypovolaemia) may be blunted due to reduced baroreceptor sensitivity and autonomic function. This lack of compensation may be significant if the patient is taking medication such as beta-blockers or ACE inhibitors. A normal response to exercise in young patients is an increased heart rate and ejection fraction. This response is blunted in elderly patients, due to decreased reactivity of  $\beta$ receptors, and as a result the ejection fraction may even fall. Maximum cardiac output and hence functional cardiac reserve decreases as age increases.

Atrial fibrillation (AF) in the elderly population is common, probably due to a progressive loss of atrial pacemaker cells with ageing. A 70 year old adult has only 10% of the atrial pacemaker cells that an adolescent has. The fast ventricular rate in AF leads to poor diastolic filling and reduced cardiac output: both are poorly tolerated in an elderly patient. Preoperatively, a patient in AF should ideally be cardioverted, but failing this the ventricular rate should be controlled to <100/minute.

### Respiratory system

Pulmonary elasticity, lung and chest wall compliance, total lung capacity (TLC), forced vital capacity (FVC), forced expiratory volume in one second ( $FEV_1$ ), vital capacity (VC) and inspiratory reserve volume (IRV) are all reduced, with an increase in the residual volume. Although functional residual capacity (FRC) is unchanged, closing capacity rises progressively with age, and may become greater than the FRC - this occurs in the supine position at 44 years of age and in the upright position at 66 years. The end result of these changes is airways collapse, VQ mismatch and hypoxaemia, even during tidal volume breaths. The small airways and alveoli therefore have to be reopened at each inspiration, leading to increased work of breathing and possible difficulties weaning from ventilation. The efficiency of gas exchange is reduced, and as a result  $PaO_2$  decreases with age ( $PaO_2 = 13.3 - \text{age}/30$  kPa, or  $PaO_2 = 100 - \text{age}/4$  mmHg) although  $PaCO_2$  remains constant.

Atelectasis, pulmonary embolism and chest infections are all more common in elderly patients, particularly following abdominal or thoracic surgery. Ineffective mucociliary activity exacerbated by smoking increases the risk of complications. Early mobilisation and good analgesia following abdominal surgery help reduce lung atelectasis and collapse.

## Renal system

Glomerular filtration is reduced. Muscle bulk decreases with age resulting in reduced creatinine production, hence even a modest rise in serum creatinine may represent significant renal impairment.

Tubular function is also impaired, with reduced renal concentrating ability and reduced free water clearance. Clearance of renally excreted drugs is reduced, and fluid balance is more critical as responses to both fluid loading and dehydration are impaired. Renal function may deteriorate rapidly in hypovolaemic patients, particularly those taking NSAIDs (non steroidal anti-inflammatory drugs) or ACE inhibitors such as captopril. Close monitoring of hourly urine output after major surgery should be routine.

## Nervous system

An age-related decline in central nervous system (CNS) function is common, the causes of which include cerebrovascular disease, changes in hormone levels, neuronal damage induced by oxidative stress as well as a generalised progressive loss of cells. As a result, confusion is more common, both pre and post-operatively.

Cognitive impairment increases with ageing, and dementia may affect up to 20% of patients over 80 years of age. However, it is important that dementia is only diagnosed after formal testing, ideally by specialists in geriatric psychology.

Blindness affects nearly 30% of the elderly, largely due to cataracts and glaucoma, and may make understanding written material such as consent forms and visual analogue pain scales very difficult. Deafness is more common, and may be severe in about 35% of elderly patients.

Autonomic dysfunction is also more prevalent in the elderly population, and may result in labile blood pressure and arrhythmias perioperatively. The baroreceptor reflex may be attenuated, leading to postural hypotension and a drop in blood pressure during anaesthesia, particularly during induction in a relatively hypovolaemic patient. Impaired temperature regulation and delayed gastric emptying may also occur, the latter predisposing the patient to aspiration. A rapid sequence induction should therefore be performed in such cases.

## Endocrine

The incidence of diabetes is increased in the elderly, and may be seen in up to 25% of patients aged over 80 years. Diabetics frequently have cardiovascular, renal, neurological and visual impairment, and require control of blood glucose levels during the perioperative period. (See *Update in Anaesthesia issue 10*)

## Pharmacology

Pharmacokinetics may be altered, with reduced hepatic and renal blood flow and a reduction in total body water. Plasma proteins are often reduced, resulting in reduced protein binding of drugs and metabolites, thereby increasing free drug levels and possible toxic effects.

Pharmacodynamics may also be altered, with increased sensitivity to many agents, especially CNS depressants. Minimum alveolar concentration (MAC) decreases steadily with age by 4-5% per

decade after 40 years - for example the MAC of isoflurane is approximately 0.92 at 80 years of age.

It may be difficult to ascertain exactly which medications are being taken, especially when patients are admitted as an emergency. Patients may be confused as to what drug/drugs they are taking, compliance may be poor, or medication may have been inadvertently stopped. It may be necessary to confirm exact details of current medication with a patient's relatives or family doctor. Long-term medication should usually be continued throughout the hospital stay.

## Nutrition

Malnutrition is common in the elderly, and is associated with increased morbidity and mortality. Trials of nutritional supplementation reduce the length of hospital stay and postoperative complications. Consider oral protein supplementation in those with significant malnutrition.

## Musculoskeletal

Degenerative diseases of all types affect the elderly, and arthritis is almost universal. This may limit exercise tolerance and makes it difficult to assess fitness. Osteoporosis and ligament laxity makes epidurals and spinals technically difficult; in addition, the patient is prone to fractures or dislocation of joints (including the cervical spine) while anaesthetised. Care should be taken with patient movement and intra-operative positioning. Vulnerable pressure points should be well padded.

## PREOPERATIVE PREPARATION

### Assessment

- A full history and thorough clinical assessment is required - significant cardiac, respiratory and renal disease may not have been previously detected. An ECG is required for all patients. A chest X-ray should be arranged for patients with known malignancy or possible tuberculosis, and for anyone with symptomatic cardiovascular or respiratory disease who has not had a recent chest X-ray. Note the level of cognitive function and the patient's social circumstances: these may determine both the perioperative prognosis and plans for the patient's rehabilitation postoperatively.
- In patients who have sustained a fracture, actively look for an underlying medical cause for a fall, such as arrhythmias, myocardial infarction, transient ischaemic attack (TIA), cerebral vascular event (CVE), pulmonary embolus, gastrointestinal bleed.
- Assessment of exercise tolerance and functional ability is important. The baseline functioning of the patient should be well documented. If a decreased functional reserve is detected, a high-care or intensive care facility may be appropriate post-operatively.
- A full explanation of the perioperative period should be given (details such as catheters, nasogastric tubes, CVP lines are important so the patient is expecting these when awakening). The patient should be consented for anaesthesia. If the patient will be on a different ward postoperatively, a preoperative visit may reduce confusion after the operation.
- The American Society of Anaesthesiologists (ASA) score should be recorded - it remains a good predictor of outcome in the elderly.

### Resuscitation/optimisation pre-operatively

Dehydration is common (note large fluid losses are associated with routine bowel preparation, and it is common to lose 50-1000mls of blood with a femoral neck fracture, especially with an extracapsular or trochanteric fracture.). Consider prescribing preoperative fluids if not already done.

One issue that is currently being debated in the anaesthetic press is whether patients, and especially elderly patients with ischaemic heart disease, may benefit from preoptimisation. This describes the enhancement of oxygen delivery to the tissues during the perioperative period, by using fluid therapy, oxygen and possibly inotropic agents. One high profile study in the BMJ showed a significant reduction in mortality following major surgery by using fluid and inotropic therapy along with invasive haemodynamic monitoring, but as yet this has not become routine practice in the UK.

### Consider day case surgery

The advantages of this include less confusion, earlier mobilisation and less nosocomial infections. However, day case surgery does need meticulous planning and preoperative assessment, including a detailed social appraisal as to the level of home support and care available.

### Decision to operate.

Extensive surgery may be futile in certain patients. Sometimes the best decision is not to operate and this should be made at consultant level, ideally in consultation with the patient and other members of the family.

### PERIOPERATIVE CARE

In general the full range of anaesthetic drugs and techniques used for young, fit adults may be used in elderly patients, within the limitations of their physiology. Modification of the techniques, and particularly drug doses, may be required.

### Induction of anaesthesia

Arm-brain circulation time is increased, and induction agent dose requirements are drastically reduced. Titrate drugs slowly against effect, and inject into a running intravenous infusion. Thiopentone or propofol are both useful but should be given slowly to avoid overdose. An induction dose of propofol may result in hypotension and require a vasopressor. Avoid ketamine in the presence of cardiac disease as the tachycardia and hypertension that may result can increase myocardial oxygen consumption and precipitate ischaemia. However, bear in mind that ketamine's hallucinogenic effects are not as marked in the elderly, and that it remains a very safe and effective analgesic, anaesthetic and sedative.

### Maintenance of anaesthesia

Maintenance of anaesthesia with inhalational agents is a suitable technique for elderly patients, as the depth of anaesthesia can be rapidly changed and inhalational agents are minimally metabolised. Isoflurane is maybe the most suitable, as it is relatively cardiovascularly stable, has a short onset and offset

time and only 0.2% of an administered dose is metabolised. Halothane has the advantage of being non-irritant to the upper airway and respiratory tract, although it sensitises the myocardium to catecholamines and so may predispose to tachyarrhythmias. Ether has been used successfully for many years, and in elderly patients is best given in low concentrations with supported ventilation. This allows the patient to wake up more quickly than prolonged deep ether anaesthesia.

### Temperature

Maintenance of body temperature pre-, intra- and postoperatively is essential. Elderly patients have a reduced basal metabolic rate (BMR) and are susceptible to heat loss as a result of impaired thermoregulation. Shivering may increase oxygen demand significantly and so should be avoided whenever possible. Conservation of heat by wrapping a patient up (including the head if possible), using fluid warmers and active warm air systems if available, and by operating in a warm ambient environment all help maintain body temperature and aid recovery.

### Fluid management

Careful peri-operative fluid balance is mandatory in the elderly. Always consider measuring the CVP with large fluid shifts. Patients are more often underfilled than overloaded, although care should be taken to avoid fluid overload: excess fluids in an elderly patient, especially in the presence of renal failure, can cause pulmonary oedema. Conversely, dehydration, which can be difficult to assess in the elderly, can precipitate renal failure. Regular review of fluid therapy is essential after major surgery.

### Pressure areas

Most pressure sores develop within the first 24 hours after surgery, and are more common in patients who have undergone long procedures, and those who have been exposed to periods of hypotension and poor tissue perfusion. Pressure sores should be avoided as they prolong hospital stay, delay rehabilitation and may cause sepsis. Suitable measures to prevent sores should be taken in both the operating theatre and recovery areas.

### General or regional anaesthesia?

Regional anaesthesia may have some advantages over general anaesthesia, including less thromboembolic events, confusion and respiratory problems post-operatively. Limb and plexus anaesthesia are ideal for peripheral surgery. Hernias and cataracts are widely performed under local anaesthesia.

Hypotension is more commonly seen in elderly patients undergoing spinal/epidural anaesthesia due to impaired autonomic function and reduced compliance of the arterial tree. In patients with severe cardiovascular disease who require tight control of their blood pressure, general anaesthesia may be better. The Cochrane Review of anaesthesia for hip fracture surgery looked at 17 trials (involving a total of over 2800 patients) comparing regional and general anaesthesia. It concluded that regional anaesthesia may reduce mortality at one month, but that regional and general anaesthesia appear to produce comparable results for longer term mortality.

## POSTOPERATIVE CARE

### Oxygen therapy

It is good practice to prescribe post-operative oxygen therapy for all elderly patients, and especially following abdominal or thoracic surgery, in the presence of cardiovascular or respiratory disease, in situations where there has been significant blood loss, or when opioid analgesia has been prescribed. Nasal cannulae are often better tolerated than facemasks.

### High dependency care

If high dependency care or intensive care facilities are available, these may improve the long-term outcome of elderly patients, especially those undergoing urgent or emergency surgery.

### Analgesia

Consider prescribing a regular simple analgesic such as paracetamol, and use NSAID's with caution; the complications of NSAIDs, including renal impairment and peptic ulceration, are more prevalent in older patients.

Intramuscular and subcutaneous opioids may be unreliably absorbed due to variable tissue perfusion, and an elderly confused patient may have difficulty using a PCA. Regional techniques or an iv opioid infusion (with appropriate close supervision) may be the most appropriate method of pain relief.

Involve an acute pain team whenever possible and consider using pain assessment charts: these should include regular pain and sedation scoring, using recognised non-verbal scoring systems if possible. The use of such pain assessment charts has been shown to improve pain management and to reduce the complications related to post-operative analgesia.

### Fluid management

Meticulous fluid management continues to be extremely important during the post-operative phase. Fluid balance charts should be utilised and carefully interpreted: failure to do so has been shown to be a major contributing factor in post-operative morbidity and mortality.

### Other considerations

- Frequent and regular review of the patient should be routine.

- Early and frequent physiotherapy and mobilisation facilitate post-operative recovery and have been shown to reduce hospital stay significantly.

- Consider deep vein thrombosis (DVT) prophylaxis: elderly patients are a high-risk group, especially those with a fractured neck of femur or those who have been bed bound for some days.

- Regular review looking for postoperative complications. Common complications include infection (especially wound, chest, urine), DVT and pulmonary embolus. Confusion may also be seen, and may be due to sepsis, dehydration, overhydration, abnormal urea and electrolyte levels, hypoxia, alcohol/drug withdrawal or pre-existing cognitive impairment/dementia.

- Parenteral or enteral nutrition should be continued from the pre-operative period, or instigated early after surgery to facilitate healing and aid recovery.

- Rehabilitation using a multidisciplinary team is strongly recommended.

### Further Reading

1. Rodgers A, Walker N, Schug S, et al. Reduction of postoperative mortality and morbidity with epidural or spinal anaesthesia: results from overview of randomised trials. *British Medical Journal* 2000;**16**:1493-99.
  2. Parker MJ, Handoll HHG, Griffiths R. Anaesthesia for hip fracture surgery in adults. (Cochrane review.) The Cochrane Library, Issue 3, 2000. May be accessed via [www.doctors.org.uk](http://www.doctors.org.uk).
  3. Sielenkammer A, Booke Michael. Anaesthesia and the Elderly. *Current Opinion in Anaesthesiology* 2001;**14**:679-684.
  4. Anaesthesia and Peri-operative Care of the Elderly. The Association of Anaesthetists of Great Britain and Ireland. December 2001. May be accessed via [www.aagbi.org](http://www.aagbi.org).
  5. Dodds C, Murray D. Pre-operative assessment of the elderly. *British Journal of Anaesthesia CEPD Reviews* 2001;**1**(6), 181-184.
  6. Jandziol A, Griffiths R. The anaesthetic management of patients with hip fractures. *British Journal of Anaesthesia CEPD Reviews* 2001;**1**(2), 52-55.
  7. Wilson J, Woods I, Fawcett J et al. Reducing the risk of major surgery: randomised controlled trial of preoperative optimisation of oxygen delivery. *British Medical Journal* 1999;**318**:1099-1103.
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