Perioperative care of the elderly

David Murray
Chris Dodds

In the Western population, 15% are >65 yr old, and half will undergo surgery within the remainder of their lifetime. There are few anaesthetic techniques that are used in younger adults that cannot be used to anaesthetise the elderly patient. However, even in the absence of a specific organ-based disease process, anaesthesia for the elderly may require an alteration in technique to take account of age-related changes to normal physiology. It is vital to consider the effects that the ageing process, the active disease process and any residual effects of previous illness have had on the elderly patient and tailor the anaesthetic technique accordingly. The following comments relate to elective elderly patients, or emergency patients who have been appropriately resuscitated after admission. There are very little data to support the attempt to achieve optimal resuscitation using assessment of cardiac output and oxygen delivery. Several studies with small numbers of patients have been quoted, but the very heterogeneous nature of the elderly makes extrapolation from these difficult.

Careful preoperative assessment is essential in the elderly and this has been described in a previous article published in this journal (see key references).

Pharmacological implications

Virtually all opioids, i.v. agents and benzodiazepines, exhibit an age-related increase of their $t_{1/2B}$ elimination half-life, resulting in a prolonged duration of action. This is attributable to an increased volume of distribution for lipophilic drugs because of the increase in body lipid content in the elderly, and a reduction in organ-based elimination. The clinical effect of this is that, for instance, premedication with benzodiazepines may lead to prolonged sedation in the postoperative period, whilst the dosing interval of fentanyl, if used for sedation in the postoperative period, whilst the dosing interval of fentanyl, if used for perioperative analgesia, is increased.

Induction agents

The dose requirement for induction agents is also reduced in the elderly. A contracted blood volume coupled with reduced protein binding leads to a higher free-drug concentration. Prolongation of arm–brain circulation time dictates that induction agents should be administered more slowly than in the younger patient. Failure to do this leads to inadvertent overdose often with marked cardiorespiratory side-effects. Reduced hepatic clearance leads to an increased recovery time even when given at the correct dose.

Inhalational agents

The MAC value of all inhalational anaesthetic agents is reduced by 20–40% from young adult values. The use of an inhalational agent for both induction and maintenance of anaesthesia appears an attractive option. As the new more insoluble inhalational agents are largely excreted (unmetabolized) via the lungs rather than relying on organ-based elimination, recovery after such an anaesthetic is likely to be more predictable. Of the newer agents, sevoflurane, being relatively non-irritant, has been used more extensively compared with desflurane but there are few direct comparisons in the elderly. The more easily lost airway in the edentulous elderly patient can cause problems. Another problem with very insoluble agents is their slower uptake in patients with increased V/Q mismatching and shunts. The elderly supine patient has their closing capacity in tidal breathing exacerbating this effect.

Neuromuscular blockade

Although ageing is associated with a reduction in muscle mass, the development of extrajunctional cholinergic receptors offsets the reduction in the expected dosage of neuromuscular blocking agents required to produce acceptable intubating conditions. However, the time of onset and the duration of action are both prolonged because of a reduction in cardiac output and reduced metabolism, respectively. In effect, a reduced dose is given to provide the usual duration of block seen with younger patients, albeit at the cost of waiting longer...
for onset of blockade. Antagonism of neuromuscular blockade with anticholinesterase drugs tends to be similar to younger adults. Drugs that do not rely on hepatic metabolism and clearance have a greater safety profile in the elderly patient.

**Cardiovascular implications**

Arterial hypotension is the most common haemodynamic complication of general and regional anaesthesia. It should be anticipated that hypotension will occur with greater frequency and severity on induction of anaesthesia in the elderly. This is largely the result of impaired autonomic homeostasis. Ageing is associated with a reduction in the carotid baroreceptor response to a fall in blood pressure. Both i.v. and inhalational anaesthetic agents further impair this response, and also depress cardiac and vascular smooth muscle contractility. Etomidate is an exception in that it spares myocardial contractility.

Regional anaesthesia produces a drug-induced sympatho-amy that produces a drop in blood pressure of >25% in 25–50% of elderly patients. The choice of vasopressor used to correct hypotension lies between a mixed α- and β-adrenoceptor agonist such as ephedrine, or a pure α-agonist such as metaraminol or phenylephrine. α-Agonists increase blood pressure via peripheral arterial and venous vasoconstriction, whilst the addition of β-agonist activity increases cardiac output by increasing heart rate and contractility. Ageing is associated with reduced β-receptor sensitivity, which results in a reduction in response to exogenous β-agonists. However, the response to α-agonists is comparable to that seen in younger patients. This relatively poor response to β-stimulation also results in the reduced heart rate response to atropine.

**Hypotension during spinal anaesthesia**

Spinal anaesthesia causes a reduction in blood pressure attributable to a drug-induced sympathoamy resulting in a decrease in systemic vascular resistance (SVR), and a reduction in cardiac output (CO). Loss of SVR usually produces a compensatory increase in stroke volume and heart rate. However, venodilation will decrease venous return and hence stroke volume, and the ability to increase heart rate and contractility will depend on the degree that the block height has encroached on the cardioacceleratory nerves (T1–T4). In the elderly, reduced physiological reserve further compounds these changes. The traditional response to these haemodynamic changes is to administer fluids and a vasopressor. There have been several studies to determine the optimum management of hypotension during spinal anaesthesia in the elderly patient. Attempts to maintain preload by administering fluid should be limited to 8 ml kg⁻¹ of crystalloid or colloid, given whilst the block is evolving. Additional volumes of fluid serve no purpose and place the patient at risk of fluid overload. Should the blood pressure decrease by >25% or to <90 mm Hg, a vasopressor such as metaraminol or phenylephrine should be administered.

**Respiratory implications**

In the elderly, reduced respiratory reserve leads to a lower baseline PaO₂, and an increased risk of peri- and postoperative hypoxaemia. There are reduced central ventilatory responses to both hypoxaemia and hypercapnia. The elderly are more likely to suffer apnoeas, periodic breathing patterns and respiratory depression after administration of opioids and benzodiazepines. The use of regional anaesthesia may seem attractive in an attempt to avoid the respiratory effects of general anaesthesia. However, the effects of ageing by themselves on the respiratory system do not dictate a change in anaesthetic technique. A high regional blockade may still impair respiratory muscle function enough for the patient to decompensate. No benefit in terms of respiratory mechanics or gas exchange, either peri- or postoperatively has been attributed to regional as opposed to general anaesthesia.

The edentulous state of the elderly patient may make airway maintenance during mask ventilation more difficult than in younger adults. Simply leaving false teeth in situ prevents these problems. Newer flexible face masks are available, such as the ‘Everseal’ mask, which allows the anaesthetist to obtain an improved seal around the face. Limited neck movement caused by arthritic changes may also present difficulties in securing an airway. These factors need to be considered when planning the anaesthetic technique. Reduction of upper airway tone in the elderly increases the likelihood of airway obstruction during sleep, and therefore the anaesthetist needs to be vigilant of this during regional anaesthesia, especially if sedation is administered.

**Fluid management**

The elderly patient’s ability to deal with fluid depletion or excess is severely impaired, even though laboratory indices of renal function may be normal. The NCEPOD report *Extremes of Age* has highlighted the necessity of careful management of fluid balance. Hypovolaemia was considered a major factor in morbidity resulting from hypotension during anaesthesia. Hypovolaemia may occur preoperatively because of factors such as self-imposed fluid restriction, and occult blood loss in the case of extracapsular hip fractures, in which 500–1000 ml blood can be lost into the fracture site. Overhydration may also occur and has greater impact because of reduced cardiorespiratory reserve. A urinary catheter is essential in the monitoring of fluid status but is only useful if accompanied by accurate charting of fluid balance. If there is any doubt as to the patient’s fluid status, invasive monitoring should be given early consideration.

**Temperature**

Maintenance of body temperature is essential during the perioperative period, and should start when the patient enters the theatre environment. Although the oxygen demand created by shivering is less in the elderly than younger patients because of reduced muscle bulk, it may still impose a requirement that
exceeds respiratory and cardiac reserve. The elderly may also lack the metabolic and muscular reserve to bring their body temperature back to normal levels. Passive measures such as reflective drapes and warmed i.v. fluids prevent heat loss but will not return a hypothermic patient to normothermia. Warm air systems and warming mattresses are more useful in this respect. There is a small group of elderly patients who do not have a normal response to hypothermia and who will not mount an appropriate response even after anaesthesia. The core temperature should be within normal limits before the patient leaves the recovery area.

**Practical issues**

Care of pressure areas is essential, as development of pressure sores will unnecessarily delay discharge and can lead to sepsis that may be fatal. Arthritis is almost universal in the elderly. Restriction of joint movement may lead to difficulty in obtaining a satisfactory position for surgery or regional anaesthesia and excessive joint manipulation may lead to severe pain postoperatively.

The monitoring of elderly patients must be tailored to their physical status and not to the procedure being undertaken. They may need invasive monitoring for minor surgical procedures for instance. Temperature should be recorded from entry into the holding area, and maintained at normal values throughout the perioperative period.

Venous access may be easy to achieve, yet rapidly lost because of the thin fragile vessel walls. Pressure over the tip of the cannula may easily tear the vessel wall. Poor fixation will also prejudice the useful life of the i.v. system.

Airway management using either an endotracheal tube or laryngeal mask airway depends on the balance between protecting the airway from the aspiration that is much more common in the elderly patient (because of autonomic dysfunction) and the stress response and laryngeal trauma from the process of intubation. If in doubt, the evidence at present favours an endotracheal tube. Ventilation should maintain normal awake values for carbon dioxide tension and oxygenation, and be achieved at low inflationary pressures.

Adhesive tapes will damage the fragile skin just as much as they do in neonates, and in the very elderly specialized dressings may be needed.

**Choice of anaesthetic technique**

The choice of anaesthetic technique lies between local, regional, or general anaesthesia. Local anaesthesia should be considered wherever possible, and is an attractive option in the elderly patient. NCEPOD has highlighted the use of local anaesthesia for short diagnostic urological procedures in an attempt to reduce the number of general anaesthetics administered to the elderly. Day-case surgery has advantages for the elderly because it allows the patient to return home as soon as possible and can help reduce the anxiety and disorientation that may occur in an unfamiliar environment. However, it requires careful planning to ensure that proper preoperative evaluation is feasible.

Impairment of cognitive function attributable to deafness or confusion in the elderly precludes the use of a regional technique in many cases. Performing regional blockade may be challenging because of difficulty in patient positioning, calcification of spinous ligaments and vertebral collapse caused by osteoporosis. The use of larger gauge spinal needles is acceptable because the incidence of post-dural puncture headache is reduced in the elderly patient.

When making the choice between regional and general anaesthesia, there is little evidence to suggest that one technique is better than the other. Two recent meta-analyses have considered this question, examining both mortality and morbidity in all types of surgery and also in patients undergoing hip fracture surgery. In the former study, regional anaesthesia was associated with a reduction in overall mortality, deep venous thrombosis (DVT), pulmonary emboli, transfusion requirements and pneumonia at 30 days after surgery. However, these differences were not maintained at 6 months. For hip surgery, there was a reduction in mortality, DVT and fatal pulmonary embolism at 30 days, but again, advantages were not seen at 3 months and beyond. The Scottish Intercollegiate Guidelines Network (SIGN) produced updated guidance on hip fracture patients in January 2002 and recommended regional anaesthesia whilst cautioning that the data to support this was both old and based on very small data sets.

**Common operations in the elderly**

**Cataract surgery**

This is the commonest operation in the elderly and is usually performed as a day-case procedure. It is also becoming more frequent as the general population ages. The patients are pre-assessed up to 2 weeks before the day of operation and arrive (often in a staggered manner) for surgery. Most units use orbital regional anaesthesia and only about 10% of cases require general anaesthesia. The regional techniques are either needle-based blocks such as peribulbar or retrobulbar, or cannula-based such as the sub-Tenon’s block. Indications for general anaesthesia include cognitive dysfunction, movement disorders, communication problems and teaching. The procedures are often very short and have minimal postoperative pain or nausea and vomiting. The eye is technically closed and scrupulous attention to preventing movement or coughing has become less imperative.

**Trans-urethral resection of the prostate**

One of the main challenges for the anaesthetist during trans-urethral resection of the prostate (TURP) is accurate fluid balance. Blood loss, which increases with the mass of prostate resected, is diluted by irrigation fluid and prevents direct measurement. The fact that the patient is in a lithotomy position may also mask the haemodynamic effects of blood loss owing to the additional volume provided by drainage of blood from the
legs. Hypotension may result when the patient’s legs are returned to the normal position, and the anaesthetist needs to be alert to this phenomenon.

Absorption of irrigation fluid may present two problems during TURP. Profound hypothermia may be caused unless warmed irrigation fluids are used. TUR syndrome is caused when irrigation fluid is absorbed into the prostatic venous plexus. Ensuring that episodes of hypotension are kept to a minimum by use of vaso-pressors, and reducing hydrostatic pressure by minimizing the height of the irrigation fluid above the patient can reduce absorption of irrigation fluid. Short surgical procedures, experienced surgeons and limiting the volume of prostatic tissue resected are the other key factors.

TUR syndrome may cause a range of symptoms. Absorption of 1000–2000 ml produces a slight increase in blood pressure, lethargy and nausea. Volumes >2000 ml produce more severe circulatory disturbances, with greater rises in blood pressure, dyspnoea, and visual disturbances by the end of the procedure. Central nervous symptoms tend to be caused when volumes >3000 ml are absorbed. Traditionally, spinal anaesthesia is advocated as it allows continuous monitoring of the patients mental function as a warning sign for development of TUR syndrome. Treatment can be difficult and hypertonic saline, whilst effective, may cause further neurological damage.

There is little to choose between regional and general anaesthesia for TURP. Regional anaesthesia is associated with improved postoperative cognitive function, but this is negated if sedation is given peri-operatively.

Hip fracture surgery

This is one of the most common operations in the elderly, with a mean patient age of 80 yr. There is often concurrent medical disease, which may have precipitated the fall, and this necessitates a multidisciplinary approach to management. Hypovolaemia may exist preoperatively because of blood loss into the fracture site, and poor oral intake including during the time the patient may have spent lying on the floor after the fall. Careful fluid replacement is necessary, which should continue from the time of admission into the postoperative period. Ideally, surgery should take place within 24 h of admission. Delay beyond 48 h is associated with significant increases in morbidity. The use of thromboprophylaxis is recommended, but has implications if a regional technique is intended. The choice of technique, as mentioned previously, appears to make little impact on long-term outcome in these patients, although the incidence of DVT and pulmonary embolism is reduced with regional anaesthesia. A triple nerve block or lateral cutaneous nerve block may be combined with general anaesthesia, and reduces postoperative morphine requirements. Regional anaesthesia provides analgesia for a limited time, after which the majority of patients will require further postoperative analgesia.

Paracetamol should be prescribed, whilst non-steroidal anti-inflammatory drugs (NSAIDs) may be used with due regard to renal function. Postoperative hypoaemia is common regardless of the type of anaesthesia administered, and supplementary oxygen should be provided for at least 12 h and the following three nights if indicated by pulse oximetry.

Key references

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See multiple choice questions 144–148.