Hip fractures are a common condition and the incidence is increasing. Most hip fractures in the elderly are caused by a simple fall, 1% of which result in fracture of the hip. Recent Department of Health figures have shown that, in the financial year 1998/99, a diagnosis of isolated hip fracture was made in 49,020 patients in England, 79% of these occurred in females. The mean age at diagnosis was 80 years with 79% of hip fractures occurring over the age of 75 years. During this period, the mean length of hospital stay for hip fracture was 21 days, which occupied 849,620 inpatient bed days in total. The East Anglian Hip Fracture audit identified a hospital mortality of 5–24% for eight hospitals.

Most of these fractures are treated surgically, either by internal fixation of the fracture or by replacement of the femoral head with an arthroplasty. Intercurrent disease, especially cardiorespiratory conditions, is common in this population. These problems result in a relatively high morbidity and mortality for the treatment of hip fractures. Anaesthesia for hip fracture involves either general or regional anaesthesia and the anaesthetist should co-operate closely with surgical colleagues and be involved in pre-, peri- and postoperative management.

### Pre-operative considerations

Physiological reserve is reduced and co-morbidity becomes more common with increasing age. Cardiovascular disease, renal disease, compromised respiratory function, neurological pathology and metabolic disease are more likely in the elderly; the incidence of diabetes is up to 25% in those aged over 80 years. The anaesthetist and any other physician involved must be familiar with the pathophysiology of this

### Table 1 Pathophysiology of the elderly patient

<table>
<thead>
<tr>
<th>Pathophysiology</th>
<th>Common diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular system</td>
<td>Hypertension</td>
</tr>
<tr>
<td>Reduced cardiac output</td>
<td>Ischaemic heart disease</td>
</tr>
<tr>
<td>Reduced stroke volume</td>
<td>Peripheral vascular disease</td>
</tr>
<tr>
<td>Decreased ventricular compliance</td>
<td>Valvular heart disease</td>
</tr>
<tr>
<td>Cardiac conduction defects</td>
<td>Heart failure</td>
</tr>
<tr>
<td>Decreased cardiac conduction time</td>
<td>Rigid vascular tree (raised SVR)</td>
</tr>
<tr>
<td>Decreased baroreceptor sensitivity</td>
<td>Ability to increase heart rate reduced</td>
</tr>
<tr>
<td>FRC reduced</td>
<td>Chronic obstructive pulmonary disease</td>
</tr>
<tr>
<td>Closing volume greater than FRC</td>
<td>Reduced response to hypoxia and hypercarbia</td>
</tr>
<tr>
<td>Cardiovascular system</td>
<td>Reduced RBF</td>
</tr>
<tr>
<td>Reduced GFR</td>
<td>Reduced renal clearance of drugs</td>
</tr>
<tr>
<td>Renal</td>
<td>Reduced hepatic blood flow</td>
</tr>
<tr>
<td>Reduced hepatic excretion of drugs</td>
<td>Metabolic</td>
</tr>
<tr>
<td>Reduced basal metabolic rate</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Reduced response to hypothermia</td>
<td>Thyroid disease</td>
</tr>
<tr>
<td>Central nervous system</td>
<td>Decreased cerebral blood flow</td>
</tr>
<tr>
<td>Decreased CMRO2</td>
<td>Peripheral neuropathy</td>
</tr>
<tr>
<td>Decreased neuronal density</td>
<td>Autonomic neuropathy</td>
</tr>
<tr>
<td>Reduced peripheral nerve function</td>
<td>Stroke</td>
</tr>
<tr>
<td>Dementia/confusion</td>
<td>Parkinson’s disease</td>
</tr>
</tbody>
</table>

SVR, systemic vascular resistance; FRC, functional residual capacity; V/Q, ventilation/perfusion; RBF, renal blood flow; GFR, glomerular filtration rate; CMRO2, cerebral metabolic rate of oxygen consumption.

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**Key points**

- Resuscitation should commence as soon as the patient arrives in hospital
- Patients with hip fracture require careful pre-operative assessment
- Surgery should take place on the earliest available trauma list during daytime hours
- Senior surgeons and anaesthetists should supervise these cases
- A dedicated unit with a multidisciplinary team approach is recommended.
elderly population (Table 1). Polypharmacy occurs frequently in the elderly population and drug interactions are more common. Careful pre-operative assessment is required. Patients with hip fracture should be considered ‘high risk’ and managed accordingly. Resuscitation must start as soon as the patient is admitted to hospital and contact made with the anaesthetic team so that surgery can be planned for the earliest available trauma or emergency list during day time hours. Analgesia should be administered as soon as the patient arrives in hospital. Intramuscular opi- mates are still the most commonly used form of analgesia combined with paracetamol and other non-steroidal anti-inflammatory analgesics (NSAIDs). There are few studies examining the role of local nerve blocks in the management of pain from fractured neck of femurs. Ensuring that the patient receives early resuscitation and an operation on the earliest trauma list best reduces the total dose of analgesics given. Senior surgeons and anaesthetists should supervise these cases and they should not be performed by inexperienced anaesthetists or surgeons or during the night. These patients deserve a high quality service provided by a dedicated multidisciplinary team.

**Conduct of anaesthesia**

**Pre-operative resuscitation**

Fracture of the hip is associated with a variable blood loss. For those fractures that are confined within the hip joint (intracapsular or cervical), blood loss is minimal due to the poor vascularity of the bone in this area and the restrictive effects of the hip joint capsule. For fractures that are outside the hip joint capsule (extracapsular or trochanteric), comminution of the fracture is more common and extensive blood loss can occur from the vascular cancellous bone. For such fractures, a blood loss of 0.5–1 l is common. In some cases, e.g. multifragmented displaced subtrochanteric fracture, a blood loss of more than one litre is to be expected (20% of blood volume). This hypovolaemic state can be exacerbated further by poor pre-operative hydration because of negligible oral fluid intake. Fluid balance in this situation is often documented poorly and, even when recorded, effective action is often not taken.

Resuscitation must start as soon as the patient arrives in hospital. Intravenous access must be obtained and careful volume replacement commenced, taking into account the degree of dehydration, expected blood loss at the fracture site and the patient’s oral intake. Generally, crystalloids are used pre-operatively. However, in cases of larger volume loss, colloid administration, guided by monitoring of basic haemodynamic variables and urine output, may be more appropriate. If there is any doubt about the patient’s fluid balance, urinary catheterisation is indicated. Biochemical results may necessitate further adjustments.

Pre-operative optimisation of patients may improve postoperative outcome. Most of the available data pertain to general surgical patients, but there is some limited evidence from studies of patients with fractures. In one study, invasive physiological monitoring reduced mortality from 29% to 2.9%. All patients must have a comprehensive pre-operative assessment with detection and treatment of pre-existing pathology. The emphasis is on restoration of intravascular volume and early operation to avoid extensive periods of pre-operative fasting. Outcome is improved if surgery takes place between 24–36 h after admission. Delaying surgery can result in an overall increase in hospital stay. A delay of more than 48 h is associated with significantly increased morbidity due to the problems associated with recumbency in the elderly, i.e. thrombo-embolic disease, pressure sores, pneumonia and urinary tract infection. Liaison between surgeons and anaesthetists is essential to reduce the possibility of prolonged periods of preoperative starvation.

**Prophylactic anticoagulation**

The use of thrombo-embolic prophylaxis remains controversial. Despite recommendations from the Thromboembolic Risk Factors Consensus Group and considerable evidence of their efficacy, treatment with anticoagulant drugs is often not implemented routinely. In the East Anglian audit of hip fractures, which followed 580 patients in 8 hospitals, the overall use of prophylactic anticoagulants was only 45%, with a range between hospitals of 10–91%. Patients with a fractured hip are at high risk from thrombo-embolism. If prophylactic measures are not taken, 40–80% will develop deep vein thrombosis, 10–30% proximal vein thrombosis and 1–5% fatal pulmonary embolism. The benefits of reduced rates of deep vein thrombosis and death due to pulmonary embolism are often ignored due to the potential risk of wound haematoma and infection which is associated with increased hospital stay, morbidity and mortality.

The use of prophylactic anticoagulants, especially low molecular weight heparins, also carries an additional risk if regional anaesthesia is performed. The risk of spinal haematoma formation, although small, carries with it catastrophic consequences. Currently, it is recommended that spinal (or epidural) analgesia should take place more than 12 h after the administration of a low molecular weight heparin. Liaison between surgeons, nursing staff and anaesthetists is essential to ensure optimum timing of prophylactic anticoagulation. Theoretically, this group of patients is more likely to develop epidural haematomas, as low molecular weight heparins are not administered on a weight basis. The
The anaesthetic management of patients with hip fractures

majority of hip fracture patients are slight, female and may also be taking NSAIDs, which have an antiplatelet effect. There is clear evidence that prophylaxis with heparin or low molecular weight heparin does reduce the incidence of deep vein thrombosis, but, as yet, insufficient evidence that it reduces the incidence of fatal pulmonary embolism.

As well as prophylactic anticoagulants, other methods of preventing deep vein thrombosis should be considered. These include methods which can be implemented pre-, intra-, and post-operatively, e.g. avoiding delays to surgery, the use of calf compression devices, early mobilisation and the avoidance of over transfusion. Aspirin has also been used to reduce the incidence of thrombo-embolic complications. When compared with placebo, aspirin reduces the number of thrombotic complications but at the expense of increased haemorrhagic complications, with no significant difference in mortality.

Type of anaesthesia

Regional anaesthesia, local nerve blocks, general anaesthesia and a combination of these are employed. Advocates of regional anaesthesia (the vast majority being spinal anaesthesia) argue that the benefits include simplicity of technique, lower incidence of systemic complications, intra-operative anaesthesia combined with intra- and postoperative analgesia and less postoperative nausea and sedation. Those who prefer general anaesthesia claim the benefits include more peri-operative control over duration and depth of anaesthesia, greater haemodynamic control and complete control over the airway.

When one considers the evidence for regional or general anaesthesia for hip fracture then there is very little difference in terms of morbidity and mortality. A meta-analysis based on 15 randomised controlled trials involving a total of 2162 patients receiving general anaesthesia or regional anaesthesia (mainly spinal) for hip fracture, has been published recently. When compared with general anaesthesia, regional anaesthesia is associated with a reduced mortality at 1 month, but this advantage does not appear to extend to 3 months or beyond. Regional anaesthesia is associated with a reduced incidence of deep vein thrombosis and fatal pulmonary embolism. This is thought to be due to a reduction in sympathetic tone to the lower limbs resulting in increased venous blood flow and reduced venous stagnation. It has also been shown that regional anaesthesia is associated with alterations in the viscosity and coagulability of blood.

General anaesthesia is associated with a small, but significantly shorter overall, operative time. The meta-analysis suggested that general anaesthesia had a non-significant tendency to reduced levels of peri-operative hypotension and a tendency towards increased peri-operative blood loss, although transfusion requirements remained the same. General anaesthesia may also be associated with a tendency towards lower oxygen tension immediately postoperatively, although some studies have shown no difference. General anaesthesia may also be associated with a tendency towards increased rates of myocardial infarction and postoperative confusion, but again these differences are not statistically significant. Regional anaesthesia is associated with a non-significant tendency for increased rates of postoperative stroke.

Particular care must be taken when positioning these patients both under regional and general anaesthesia. All hip fracture patients should be considered at high risk of developing pressure sores, the formation of which can dramatically complicate their postoperative course.

Nerve blocks of the lower limb can be used in conjunction with general anaesthesia with the aim of reducing general anaesthetic requirements and producing postoperative analgesia. Their use is becoming increasingly popular. Techniques include lateral cutaneous nerve block, femoral nerve block, psoas compartment block and the three-in-one or triple nerve block. The latter, attempts to block the femoral, lateral cutaneous and obturator nerve with one injection. Location of the nerve and chances of successful block are enhanced by the use of a peripheral nerve stimulator.

A recent Cochrane review has examined the effectiveness of nerve blocks as part of the peri-operative treatment of hip fracture. The review was limited by the number of studies which were of sufficient quality that were eligible for inclusion, the small numbers involved and by the different number of nerve blocks being performed. A triple nerve block or a lateral cutaneous nerve block combined with general anaesthesia was shown to decrease the time to administration of the first dose of intramuscular opiate analgesic (from a mean of 1.75 h to 24.3 h for triple nerve block and 10.8 h for lateral cutaneous nerve block). The total number of intramuscular opiate injections and the mean dose of opiate in the first 24 h were also reduced. There was a significant reduction in pain scores at 15 min and 2 h postoperatively for those who had received local nerve blocks. In one study, psoas nerve block increased significantly the total operative time for hip fracture surgery, although another study found no difference in duration of surgery but quicker postoperative recovery times. It has not been possible to show any overall clinical benefit in terms of postoperative complications, length of hospital stay and hospital mortality when comparing lower limb nerve blocks with general anaesthesia and general anaesthesia alone. The conclusion from this evidence is that data are limited and more studies are needed.
Intra-operative optimisation

Recently, some improvement in postoperative outcome has been demonstrated in a study evaluating the optimisation of intravascular volume with repeated colloidal fluid challenges in association with oesophageal Doppler ultrasonography. Sinclair and colleagues used minimally invasive oesophageal Doppler to aid assessment of cardiac output and as a guide to intra-operative fluid management with the aim of preventing peri-operative tissue oxygen debt. They found that oesophageal Doppler-guided fluid management was associated with improved cardiac output and stroke volume, even though heart rate and blood pressure remained unchanged. Also, there was a significantly faster postoperative recovery leading to earlier mobilisation and a shorter hospital stay. Unfortunately, the use of oesophageal Doppler is limited to those patients undergoing general anaesthesia only and the number of subjects involved in this study was small.

Postoperative care

The early postoperative course can often involve input and care from the anaesthetist. Patients should receive supplementary oxygen in the early postoperative period, ideally for at least 12 h and the following 3 nights. Although there is no clear evidence of improved survival, postoperative hypoxaemia is common in patients who have undergone surgery for hip fracture, irrespective of type of anaesthesia. As many as 30% of patients still have episodes of hypoxaemia on the third postoperative day. Meticulous attention must be paid also to postoperative fluid balance. Excessive use of colloids and crystalloids can precipitate pulmonary oedema and dilutional anaemia. Both are tolerated poorly in this age group.

Regional anaesthesia and local nerve blocks provide effective analgesia postoperatively, but for a limited duration only. The vast majority of patients will require some further postoperative analgesia, although some do not. Patients should not be denied appropriate postoperative opioid analgesics, although the dose may have to be adjusted when the individual’s age and physiological status are taken into account. Postoperative NSAIDs should be given with great care because of increased risks of renal insufficiency and gastrointestinal complications.

Rehabilitation using a multidisciplinary team is recommended strongly. Early mobilisation, which involves weight bearing on the injured leg, has been shown to reduce hospital stay significantly. Mobilisation on day 1 occurs in up to 50% of patients in some centres.

On admission, most patients with hip fracture have nutritional deficiencies and, despite being offered adequate quantities, nutritional requirements are often not met during their hospital stay. Compared with a control group, patients with fracture neck of femur whose food is supplemented have a shorter length of hospital stay and a significantly lower rate of postoperative complications and reduced mortality. These benefits are still apparent at 6 month follow-up.

Intensive rehabilitation has been shown to improve survival significantly and reduce hospital stay in patients with mild-to-moderate dementia (as assessed by the mini-mental state examination score). There was no difference in normal or severely demented patients.

Conclusions

Fracture of the hip in the elderly patient is a common condition and its incidence is likely to increase. The overall morbidity and mortality rates are high but can be reduced if care is optimised. Several interventions have been shown to improve outcome significantly while others have shown marginal benefit only.

All these patients should receive a high quality service. Resuscitation should commence as soon as the patient arrives into hospital. Meticulous pre-operative assessment must take place. Surgery should be scheduled for the earliest possible daytime session and should involve a senior anaesthetist and surgeon. This high quality service should continue postoperatively until discharge. Ideally, this entire process should take place in a dedicated unit, where a multidisciplinary team approach and maximum use of resources can take place.

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Key references


See multiple choice questions 30–32.