Chapter 3

Perioperative Management of Hip Fracture Patients Undergoing Total Hip Replacement

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Abstract

Patients with hip fractures have high morbidity and mortality, which has not changed significantly since last two decades. There are various national guidelines in UK, which give guidance to help improve outcomes in these patients such as National Institute for Health and Clinical Excellence's guidelines (NICE), Guidelines from Anaesthetists of Great Britain and Ireland (AAGBI) and Scottish intercollegiate guideline network (SIGN). NICE guidelines recommend total hip replacement (THR) rather than hemiarthroplasty in patients with a displaced intracapsular hip fracture in selected patients. AAGBI has produced guidelines for *Management of Proximal Femoral Fractures 2011*.

Keywords: total hip replacement, hip fracture, AAGBI, spinal anaesthesia, nerve block

1. Introduction

Patients with osteoporotic hip fracture have poor outcomes, which have not changed significantly in the last 20 years. Rates of morbidity and mortality are high in these patients and also there is decline in function and loss of independence. NICE, AAGBI, and SIGN have provided guidelines to help improve outcomes in these patients [1–3]. New approaches to treatment aim to improve outcomes. In older adults, hemiarthroplasty (or 'partial' hip replacement) has largely replaced internal fixation for displaced intracapsular hip fractures and this is associated with lower rates of revision surgery and better overall outcomes. Lately, in this population, there has been a thrust to enhance the use of total hip replacement (THR) because there are better chances of returning to functional mobility and, therefore, independence. THR is used more commonly for arthritis of the hip.

NICE guidelines [1] recommend total hip replacement (THR) rather than hemiarthroplasty to patients with a displaced intracapsular hip fracture if they were:

- able to walk independently out of doors with no more than the use of a stick;
- are not cognitively impaired; and
- are medically fit for anaesthesia and the procedure.

Outcomes after THR for displaced fractures of hip are similar to those after THR for elective surgery. Careful selection of patients is essential to achieve this success.

Perioperative care of patients with proximal femoral fractures can be challenging, as it involves care of large numbers of older patients with significant comorbidities. Risk of significant morbidity and mortality in these patients can be reduced by early surgical fixation of the fracture and early, effective rehabilitation.

The Department of Health has suggested the following targets for patients with hip fracture [4]:

i. All patients should be admitted within 4 h of arrival in the emergency department; and

ii. Patients should be operated on by an experienced clinical team within 24 h of a decision that the patient is fit for surgery.

Multidisciplinary care improves the quality and efficiency of hip fracture care. The multidisciplinary team includes trauma co-ordinators, general practitioners, nurses, emergency staff, bed managers, orthopaedic nursing staff and surgeons, anaesthetists, orthogeriatricians, physio- and occupational therapists, social workers and rehabilitation services.

2. Preoperative management

2.1. Initial management

'Fast-track' triage systems should be in place as most of these patients are admitted via the emergency department. These will enable early clinical recognition of hip fracture with early radiography and diagnosis, allowing rapid ward admission. The use of a care pathway pro forma ensures basic quality standards are met and helps in patient care.

Patients who have a clinical suspicion or confirmation of a hip fracture should have the 'Big Six' interventions/treatments before leaving the Emergency Department [5].

1. *Provision of pain relief.* All patients should be offered analgesia. The use of a nerve block helps to reduce pain, opioid requirement and delirium. Painkillers such as paracetamol should be prescribed on regular basis. Opioids should be prescribed with caution. Non-steroidal anti-inflammatory drugs and codeine to be avoided due to its side effects

2. *Screening for delirium.*

3. *Early warning score (EWS) system*.

4. *Full blood investigation and electrocardiogram*

5. *Intravenous fluids therapy*: Many hip fracture patients are fluid deplete at presentation. Assessment of hydration is difficult in elderly patients as they may not exhibit typical physiological responses such as tachycardia or hypotension. These patients tolerate hypovolemia poorly, risking cardiovascular instability and organ hypoperfusion. All patients should have a documented assessment of fluid status and resuscitation with IV fluids where appropriate. Preoperative administration of colloid solution intravenously before hip fracture surgery does not improve outcome, compared with a conventional IV fluid regime with a crystalloid solution.

   A literature review to identify relevant evidence supporting the use of blood resuscitation in adult patients aged 65 years and over who have presented within 24 h of sustaining a fracture of the proximal femur when compared with crystalloid or colloid resuscitation did not yield any articles [6].

6. *Pressure area care*.

2.2. Preoperative assessment

The assessment by anaesthetist allows pre-optimisation, planning of anaesthetic techniques and communication of perioperative risks to the patient and relatives.

Early involvement of orthogeriatrician has been shown to be useful in many ways such as medical pre-optimisation of patients, early rehabilitation and discharge planning.

One-fourth of these patients have moderate cognitive impairment and therefore tools such as abbreviated mental test score (AMTS) should be used to assess for cognitive impairment. Capacity assessment is vital for informed consent. Treatment may be provided according to the Mental Capacity Act 2005, if the patient lacks capacity and should be undertaken in the best interests of patients.

2.3. Nottingham hip fracture score

Nottingham hip fracture score (NHFS),a risk prediction tool [7], has been developed to predict postoperative mortality. It is summative score of seven variables—comorbidities and other factors (age, male sex, malignancy, preoperative cognitive function, place of residence and anaemia). NHFS is used to predict mortality at 30 days and it provides the information about outcome which may be discussed with the patient or their relatives (**Tables 1** and **2**).

2.4. Investigations

Full blood count, urea, electrolytes and ECG should be done in all patients. Anaemia is common in these patients due to various reasons and a lower threshold for blood transfusion should be considered in this group of patients.

Variable	Points
Age 66–85 years	3
Age 86 ≥ older	4
Male	1
Haemoglobin concentration ≤ 10 $g.dl^{-1}$ on admission to hospital	1
Abbreviated mental test score ≤ 6/10 on admission to hospital	1
Living in an institution	1
More than one co-morbidity	1
Active malignancy within last 20 years	1

Table 1. Derivation of Nottingham hip fracture score (NHFS). Reproduced with kind permission of AAGBI [2]. Copyright ©2000-2018 by John Wiley & sons.

Score	Predicted 30-day postoperative mortality
0	0
1	1%
2	2%
3	4%
4	6%
5	10%
6	15%
7	23%
8	22%
9	45%
10	57%

Table 2. Predicted 30-day mortality as per NHFS. Reproduced with kind permission of AAGB [2]. Copyright ©2000-2018 by John Wiley & sons.

2.5. Special cases

2.5.1. Atrial fibrillation

All patients in AF should have ventricular rate less than 100 per min. Reversible causes such as electrolyte imbalance and hypovolemia should be corrected if rate is faster. Pharmacological treatment will be required if still remains high [8].

2.5.2. Anticoagulation

INR should be less than 2 for surgery and less than 1.5 for neuroaxial anaesthesia. Patients having warfarin should have vitamin K to reverse the effect.

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If a patient is on clopidogrel, surgery should be done with expectation of higher blood loss.

Platelets should not be given prophylactically. The haematologist's opinion should be taken if required.

2.5.3. Chest infection

Patients with chest infection should have their surgery done under regional anaesthesia which will give the benefit of analgesia and help in early mobilisation and chest physiotherapy.

2.5.4. Heart murmur

The management of patients with hip fracture in whom a systolic murmur (indicating aortic stenosis) is heard remains debatable. If aortic stenosis is suspected and echo has not been done preoperatively, then the patient should be managed as having aortic stenosis.

2.5.5. Implantable pacemakers

Preoperative evaluation by cardiologist is necessary to know the type of device.

2.5.6. DNA-CPR (do not attempt cardio pulmonary resuscitation)

Resuscitation may not be in the best interests of the patient or not desired by the patients. DNA-CPR should be discussed with the patients where appropriate. Patients with pre-existing DNA-CPR orders must have perioperative modifications to that process prior to coming to theatre for having surgery [9] (As per recommendations from Resuscitation Council UK and Association of Anaesthetist of Great Britain & Ireland).

3. Intraoperative management

3.1. Surgical management

They can be broadly classified into extracapsular and intracapsular fractures.

Intracapsular fractures are further classified as subcapital, transcervical and basicervical fractures depending on the site of fracture. These may be displaced or undisplaced (**Table 3**).

Intracapsular	Extracapsular
Undisplaced fracture - internal fixation with multiple screws or a sliding hip screw.	Intertrochanteric fractures - a sliding hip screw
Displaced fractures - hemiarthroplasty or total hip replacement	Subtrochanteric fractures - proximal femoral intramedullary nail

Table 3. Surgical management of proximal hip fractures.

Cemented arthroplasty as compared to uncemented arthroplasty improves hip function and is associated with lower residual pain postoperatively.

3.2. Anaesthetic considerations

Both audit and meta-analysis of anaesthetic practice have not shown any great difference in outcome between general and regional (spinal) anaesthesia.

Parker and colleagues [10] in Cochrane review of 2004 analysed 22 trials (all of which were found to be methodologically flawed and many do not reflect current anaesthetic practice), involving 2567 patients, and concluded that regional anaesthesia may reduce the prevalence of acute postoperative confusion (9% *vs.* 19%); however, no difference in 30-day mortality after regional anaesthesia compared with general anaesthesia. Based on these findings, the Scottish Intercollegiate Guidelines Network (SIGN) has produced recommendation concerning choice of anaesthetic technique, namely that 'Spinal/epidural anaesthesia should be considered for all patients undergoing hip fracture repair, unless contraindicated'.

A meta-analysis [11] of 34 randomised controlled trials, 14 observational studies, and 8 meta-analyses, involving 18,715 patients, concluded that spinal anaesthesia is associated with significantly reduced early mortality, fewer incidents of deep vein thrombosis, less acute postoperative confusion, a tendency to fewer myocardial infarctions and fewer cases of pneumonia, fatal pulmonary embolism and postoperative hypoxia.

A further recent meta-analysis [12] of 47 clinical trials and 35 reviews/meta-analyses in geriatric patients undergoing non-cardiac surgery concluded that regional anaesthesia is associated with reduced early mortality and morbidity, for example, fewer incidents of deep vein thrombosis and less acute postoperative confusion, as well as a tendency towards fewer myocardial infarctions and fatal pulmonary embolisms.

Large observational studies in UK [13, 14] and US [15–17] show there is no difference in 30-day mortality between general and spinal anaesthesia.

NICE support the use of either spinal or general anaesthesia, + nerve block.

There are various problems attempting to perform the definitive outcome comparison study between general and regional anaesthesia, including, but not restricted to, definition of the primary endpoint.

For the time being, the AAGBI recommends that either method of anaesthesia (but not both together) may be used, but most importantly that they are administered with care to any patient, using reduced doses of anaesthetic agent combined with multimodal analgesia with an aim to minimise rapid fluctuations in arterial pressure and resultant changes in cerebral and coronary perfusion pressures. This is supported by a recent retrospective study of 1131 patients which showed that a reduced volume of intrathecal 0.5% hyperbaric bupivacaine was associated with a reduction in intraoperative hypotension, and therefore less reactive fluid administration avoiding consequent haemodilution [18].

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3.2.1. General anaesthesia

Small doses of intravenous induction agents should be used. Alternatively, inhalational induction can be done. The advantages of inhalational induction are that it is well tolerated by the elderly patients and also allows for maintenance of spontaneous ventilation. The choice of using mechanical ventilation versus spontaneous ventilation remains controversial. The benefit of using mechanical ventilation is that there is reduced risk of aspiration and better control of carbon dioxide levels. On the other hand, there is greater physiological derangement with paralysis and tracheal intubation as compared to spontaneous ventilation.

3.2.2. Regional anaesthesia

Spinal anaesthesia: Lower doses of intrathecal bupivacaine (<10 mg) and unilateral subarachnoid anaesthesia may help to decrease hypotension. Use of intrathecal opioids helps for postoperative analgesia. As morphine or diamorphine is associated with greater respiratory and cognitive depression, it is preferable to use fentanyl.

Sedation should be used cautiously in elderly patients with spinal anaesthesia. If necessary for patient comfort, sedation should be restricted to propofol. Ketamine can cause postop confusion and delirium.

Epidural: It provides good postoperative analgesia, but may limit early mobilisation after surgery.

Nerve block: NICE recommends to consider intraoperative nerve blocks for all patients undergoing surgery.

The rational being, co-administration of a nerve block, reduces age-adjusted maintenance doses of general anaesthesia, helps in positioning of patient for spinal anaesthesia, enables the use of low-dose spinal anaesthesia as it provides analgesia during skin closure even if spinal starts wearing off and it helps in providing opioid sparing analgesia in early postoperative period.

Blockade of the three nerves—femoral, obturator and lateral cutaneous nerve of the thigh—can provide adequate analgesia. The most reliable method of blocking all three nerves is the psoas compartment block. The fascia iliaca block/femoral nerve blocks do not reliably block all three nerves but do provide some pain relief. Ultrasound guidance can be used for performing these nerve blocks.

3.3. Monitoring

As recommended by AAGBI, minimum standards for monitoring as for any other surgery include the continual presence of the anaesthetist, pulse oximetry, capnography, ECG and non-invasive blood pressure monitoring.

As elderly patients are prone to hypothermia, core temperature monitoring should be used routinely.

Further monitoring should be considered depending on the risk. This may include invasive blood pressure monitoring, central venous pressure (CVP) monitoring and cardiac output

monitoring. Transoesophageal Doppler, Transthoracic Doppler or LIDCO can be used for cardiac output monitoring.

Bispectral index (BIS) monitors may be used to monitor the depth of anaesthesia as it will allow for dose reduction and hence avoid potential hypotension. Initial BIS levels may be abnormally low in alcoholic patients and patients with dementia.

Cerebral oxygen saturation: Postoperative cognitive dysfunction is associated with reduced cerebral oxygen saturation.

AAGBI emphasises the finding in the NCEPOD reports '*Extremes of Age* (1999)' and '*An Age Old Problem* (2010)' that, in spite of being among the sickest patients with the worst outcomes in hospitals, elderly hip fracture patients were not intensively monitored during surgery, and recommend a greater consideration be given to invasive arterial pressure monitoring and use of cardiac output (e.g. Doppler, LiDCO) and cerebral function (e.g., bispectral index, cerebral oxygen saturation) monitors.

3.4. Infection control

Antibiotic prophylaxis significantly reduces overall wound infections. Antibiotics should be administered within 1 h of skin incision according to AAGBI recommendations. Hospital antibiotic protocols should be followed.

3.5. Fluid management

Perioperative optimisation of fluid management helps to reduce morbidity. Cardiac output-guided fluid administration in this group of patients could reduce hospital stay and improve outcome [19].

3.6. Thromboprophylaxis

The following strategies will help reduce the risk of deep vein thrombosis-thromboprophylactic stockings or intraop usage of intermittent calf compressors, regional anaesthesia, early surgery and early mobilisation.

3.7. Prevention of hypothermia

Active warming techniques like body warmers and warm IV fluids should be used as elderly patients are prone to intraoperative hypothermia.

3.8. Tranexamic acid

Patients with hip fractures can have significant blood loss. The rate of blood transfusion in the perioperative period for hip fracture patients is reported between 20 and 60%.These patients have multiple comorbidities making them more susceptible to adverse events from blood loss.

Antifibrinolytics, such as tranexamic acid (TXA), have been used to limit bleeding in orthopaedic surgery and prevent the need for blood transfusion.

It acts as a competitive inhibitor in the activation of plasminogen to plasmin, therefore preventing the degradation of fibrin. Despite its proven efficacy in patients undergoing elective orthopaedic surgery, including total joint replacement and spine surgery, there is clinical uncertainty and a lack of high-quality evidence regarding the use of TXA in hip fracture patients.

Four of five studies [20–24] identified a significant decrease in rate of transfusion in patients who received TXA compared to those that did not. Some of these studies were underpowered for detecting significant differences in thromboembolic events. Also, patients were only followed perioperatively, and differences in 6-month and 1-year mortality rates and late-onset complications were not assessed.

A systematic review of tranexamic acid in hip fracture surgery showed moderate quality evidence that TXA reduces blood transfusion in hip fracture surgery and low-quality evidence suggesting no increased risk of thrombotic events. A randomised controlled trial on the efficacy of tranexamic acid in reducing blood loss in hip fracture patients is being done. The immediate goal of this trial is to provide high-quality evidence that can be used to develop clinical guidelines for use of TXA in patients with hip fractures [25].

3.9. Bone cement implantation syndrome (BCIS)

This is characterised by hypoxia, hypotension, or both, and/or unexpected loss of consciousness [26]. This occurs at the time of cementation, prosthesis insertion and reduction of the joint or, occasionally, limb tourniquet deflation in a patient undergoing cemented bone surgery. Several mechanisms may contribute to a multimodal aetiology, including fat/platelet/fibrin/marrow emboli and stimulated release of vasoactive mediators. The treatment of BCIS includes delivery of 100% oxygen, fluid resuscitation (guided by CVP measurement) and vasoactive/inotropic support. AAGBI [27] has made several recommendations to reduce the risk of developing BCIS from cemented arthroplasty. They advocate a three-step check process to ensure we are prepared for such events and we are able to manage them in a proactive manner.

4. Postoperative care

AAGBI recommends use of point-of-care Hb analysers (e.g., Hemocue or similar) routinely at the end of surgery to assess the degree of anaemia and guide blood transfusion. Haemoglobin and electrolytes need to be monitored postoperatively. An analysis of postoperative haemoglobin levels in patients with a fractured neck of femur demonstrated that a haemoglobin value taken on D2 postoperatively represents the largest drop in a patient's circulating haemoglobin with statistical and also clinical significance [28]. Certain groups will require close daily monitoring of haemoglobin levels such as patients with chronic renal, cardiac disease and patients taking any form of anticoagulation.

Good nursing care with regular input from orthogeriatricians, adequate analgesia, hydration and nutrition are all important for good postoperative outcomes.

Early rehabilitation helps return the patient to their pre-morbid level of activity.

4.1. Postoperative cognitive dysfunction

This is common in this group of patients. Management includes adequate analgesia, nutrition and hydration, electrolyte balance, appropriate medication, optimising bowel habit, mobilisation and also identifying and treating any infection or silent myocardial ischaemia. Drugs such as haloperidol or lorazepam should only be used for short-term control of symptoms.

5. Conclusions

1. Patients with a hip fracture have a relatively high risk of perioperative morbidity and mortality.
2. High-quality care of these patients requires multidisciplinary care and protocol-driven care pathways
3. Early surgery aids in providing analgesia and allows early mobilisation, and is associated with reduced morbidity and mortality.
4. The mode of anaesthesia provided is less important than the manner with which it is delivered with regard to the age and pathophysiological status of the individual patient.
5. Surgery and anaesthesia must be undertaken by appropriately experienced surgeons and anaesthetists.

Conflict of interest

None declared.

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