

Anaesthesia for joint replacement surgery

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Abstract

With the ageing population, there is increasing demand for joint replacement surgery. Common joint replacement surgeries include hip, knee, elbow and ankle replacement. Elderly patients with multiple comorbidities presenting for joint replacement surgery often pose challenges to our anaesthetic management. Careful preoperative assessment, perioperative anaesthetic plan and postoperative analgesic management can facilitate success of the surgery and avoid complications.

Keywords Arthroplasty; general anaesthesia; hip; joint replacement; knee; peripheral nerve block; regional anaesthesia

Royal College of Anaesthetists CPD matrix: 3A08

The main objectives for joint arthroplasty are for pain relief and improvement of joint stability and mobility. The most common indication for joint replacement is degenerative osteoarthritis, other indications include secondary arthritis to fracture, dislocation, avascular necrosis, Paget's disease, rheumatoid arthritis, infective arthritis and bone tumour. Most of the patients presenting for joint replacement surgery are elderly with multiple medical problems. The mortality after hip and knee arthroplasty ranges from 0.4% to 4.6%, depending on the type of surgery, whether primary or revision. Advanced age is one of the major risk factors for perioperative morbidity and mortality. These patients require a thorough preoperative medical evaluation, in order to identify risk factors, optimize their medical condition to avoid possible complications and to choose an appropriate anaesthetic technique for the surgery.

Preoperative considerations

Assessment of cardiopulmonary status is important as there may be haemodynamic changes during surgery that can impact on the patients' medical condition. However, assessment of functional status is difficult in these patients due to their limited mobility. ECG can identify ischaemia and arrhythmia. For more complex cardiac disease an echocardiogram can provide additional information on ventricular function and valvular abnormality. Chest X-ray and lung function tests will give an indication of respiratory status. Dynamic function tests such as cardiopulmonary exercise testing or pharmacological stress tests provide greater information but are not readily available. Patients with high risk of

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Learning objectives

After reading this article you should be able to:

- understand the importance of preoperative assessment for patients undergoing joint arthroplasty
- focus on the anaesthetic management, intraoperative considerations and avoidance of complications for joint replacement surgery
- discuss the various options for postoperative pain control

perioperative cardiac complications should have been monitored postoperatively in an intensive care area as early diagnosis and appropriate treatment can reduce morbidity and mortality.

Baseline renal and liver function tests should be done. Renal function may be impaired due to advanced age, hypertension, diabetes or chronic use of non-steroidal anti-inflammatory drugs (NSAIDs).

Chronic multiple drug intake is common in the elderly. Detailed drug history should be obtained. Studies showed that use of perioperative adrenergic β -blockers can reduce myocardial ischaemia and reduce the risk of postoperative myocardial infarction. Therefore, β -blockers should be continued perioperatively in patients taking long-term β -blockers.

Patients on antiplatelet or anticoagulant agents should be carefully assessed before neuraxial and regional technique.

Rheumatoid arthritis is a chronic inflammatory arthritis, which lead to progressive bone erosion and joint destruction and is therefore a common medical condition presenting for joint replacement surgery (Table 1).

Deep vein thrombosis (DVT) prophylaxis

Thromboembolic complications remain one of the leading causes of morbidity and mortality after joint replacement surgery. Venous thromboembolism can occur in 44–90% of patients undergoing total hip or knee replacement who do not receive anticoagulants.

Anaesthetic considerations for patients with rheumatoid arthritis

Airway	<ul style="list-style-type: none"> • Limited oral opening due to temporomandibular joint involvement • Arthritis of cervical spine with atlantoaxial instability
Respiratory	<ul style="list-style-type: none"> • Diffuse interstitial fibrosis • Pleural disease and intrapulmonary nodules
Cardiac	<ul style="list-style-type: none"> • Restrictive pericarditis • Pulmonary hypertension and right heart failure
Eyes	<ul style="list-style-type: none"> • Drying of eyes with corneal and conjunctival lesions in Sjogren's syndrome
Drugs	<ul style="list-style-type: none"> • Assess for gastrointestinal side effects and renal problems in patients taking NSAIDs • Glucocorticoids can have systemic side effects. Consider need for additional dose during surgery • Disease-modifying antirheumatoid drugs may cause increased risk of infection with prosthesis insertion

Table 1

Based on the guidelines established by the American College of Chest Physicians (ACCP),¹ patients undergoing elective total hip or knee replacement should receive one of the following standard prophylaxis treatments: (1) low-molecular-weight heparin (usual high-risk dose, started 12 hours before surgery or 12–24 hours after surgery); (2) warfarin (adjusted dose vitamin K antagonist started preoperatively or the evening of surgical day with target international normalized ratio 2.5, range 2.0–3.0); (3) fondaparinux. (2.5 mg started 6–24 hours after surgery). Use of intermittent pneumatic pump can be an alternative option. The optimal duration of therapy is unknown; from 10 days up to 35 days has been recommended.

Use of perioperative anticoagulants can have a significant impact on use of regional anaesthesia, especially neuraxial analgesia with potential risk of epidural haematoma. Therefore this must be administered at an appropriate interval before surgery, when neuraxial block or deep plexus peripheral block is used (Table 2).²

Anaesthetic technique

Various anaesthetic techniques with general anaesthesia, regional anaesthesia with neuraxial anaesthesia, peripheral nerve block or in combination, are used for hip or knee arthroplasty. There is no clear evidence documenting the superiority of one technique over another.

Regional anaesthesia is a common technique of choice for hip or knee replacement surgery. Recent reviews showed that some of the benefits of regional anaesthesia include reduced pain scores,³ less opioid related adverse events such as nausea, vomiting and respiratory depression, reduced blood loss and reduced incidence of DVT. However, patients may experience complications of neuraxial blockade, such as hypotension, headache, back pain, urinary retention, lower limb weakness, delayed mobilization and rare complications such as nerve injury and high block.

General anaesthesia is considered when neuraxial anaesthesia is contraindicated and for uncooperative patients who may not be suitable for regional anaesthesia. It can be combined with peripheral nerve block for intraoperative and postoperative pain control. Currently there is no consensus about the most appropriate anaesthetic and analgesic technique for each procedure.

PROSPECT recommended the use of femoral nerve block with either spinal anaesthesia or general anaesthesia for total knee replacement surgery.⁴ For total hip arthroplasty, spinal anaesthesia, epidural anaesthesia with or without general anaesthesia, general anaesthesia alone or in combination with lumbar plexus block technique can be used. The choice of anaesthetic technique should be based on the comorbid state of the patients and any contraindication of the proposed choice of anaesthesia.

Proper perioperative education of patients can help in guaranteeing a successful patient outcome. Informing the patient about our plan on anaesthesia and pain management provided would lead to better understanding and decrease anxiety of the patients.

Intraoperative considerations

Monitoring

Standard non-invasive monitoring including ECG, pulse oximeter, non-invasive blood pressure monitoring, are routinely used. Invasive monitoring including arterial line and central venous

Neuraxial anaesthesia in patients receiving anticoagulations

Timing of neuraxial anaesthesia

Warfarin	Normal international normalized ratio (INR) before neuraxial technique Removal catheter when INR <1.5
Unfractionated heparin	Give heparin 1 hour after neuraxial technique Remove catheter 2–4 hours after last heparin dose
LMWH	Preoperative: wait 10–12 hours after last dose For patient receiving treatment dose, delay for at least 24 hours Postoperatively: Single daily dose: administered 6–8 hours after operation Catheter removal 10–12 hours after last dose LMWH, restart after minimum 2 hours after catheter removal Twice daily dose: administered 24 hours postoperatively Catheter removal before start of LMWH, restart after minimum 2 hours after catheter removal
NSAIDs	No contraindication
Thienopyridine derivatives	Clopidogrel: discontinue for 7 days Ticlopidine: discontinue for 14 days
Fondaparinux	Actual risk is unknown, neuraxial techniques should be done in conditions proven safe in clinical trials (atraumatic tap, single needle pass, no indwelling catheter), otherwise consider other method of thromboprophylaxis if neuraxial technique is needed
Direct thrombin inhibitors	Insufficient information Suggest avoidance of neuraxial technique
Thrombolytics	Absolute contraindication
LMWH, low-molecular-weight heparin; NSAIDs, non-steroidal anti-inflammatory drugs.	

Table 2

pressure catheter is considered in patients with significant cardiac co-morbidities, or when significant blood loss is anticipated as in revision surgery.

Antibiotics prophylaxis

Antibiotics prophylaxis, usually a second- or third-generation cephalosporin, is prescribed at induction of anaesthesia.

Patient position

Careful positioning is important as these patients may have joint pain or limited joint movement. With lateral position for hip surgery, patient is at risk of pressure on the dependent limb and problem with neck positioning. The patient's head must be kept in a neutral position to prevent excessive lateral rotation of the

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