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Long and Short Cases in Anesthesiology



Editors
Puneet Khanna
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CHAPTER

4

Anesthesia for Total Hip and Knee Replacement

Mritunjay Kumar, Pooja Bihani

Q1. What is total hip and knee replacement (THR/TKR)? What are its indications?

Ans. The knee joint is a hinge joint, in which ends of the bones are covered by a hyaline (articular) cartilage for smooth movement of the joint. Damage to the cartilage can cause degenerative knee disease. The common indications of TKR are osteoarthritis (most common), rheumatoid arthritis, knee injury or knee deformity, hemophilia and gout causing severe and disabling painful joint.

The hip joint is a ball and socket synovial joint between femur head and acetabulum. Hip replacement surgery is commonly done for treatment for painful joint or inability to walk due to osteoarthritis or traumatic hip fracture.

In TKR, the damaged ends of the tibia and femur are cut away. Then the femoral end and tibia end are replaced by a curved steel alloy piece and a flat plate of steel alloy or titanium with plastic spacer, respectively. Cement or a special press-fit technique is used to connect both the prosthesis. Hemiarthroplasty or unicompartmental knee replacement can be performed for single compartment arthritic changes which is less painful postoperatively.

Q2. What is the nerve supply of hip and knee joint?

Ans. The complex neural innervation of knee joint follows Hilton's law which states that the nerve supplying the muscle not only supplies the muscle but also the joint moved by the muscle through articular branches and overlying skin. The knee joint is innervated by five nerves namely (1) femoral, (2) obturator, (3) tibial, (4) common peroneal, and (5) recurrent peroneal nerves. The femoral nerve, through the saphenous nerve supplies the anteromedial and anterolateral aspect of the joint capsule (articular branches), branches to the quadriceps muscle (vastus medialis, intermedius and lateralis) through fascicular branches and cutaneous innervation of the skin overlying anterior aspect of the knee. The tibial nerve supplies medial, lateral, and posterior aspects of the joint capsule, the infrapatellar fat pad, tibial periosteum, and the superior tibiofibular joint. Within the popliteal fossa, the common peroneal nerve innervates the anterolateral portion of the capsule and the infrapatellar fat pad, by sending an articular branch. While the tibial periosteum, tibial tuberosity and the superior tibiofibular joint are supplied by the recurrent peroneal nerve. The obturator nerve sends articular branches to the superior part of the posteromedial and anteromedial aspect of the knee joint capsule.

The innervations of hip joint are by three nerves namely:

1. Femoral nerve via nerve to rectus femoris (L2, L3, and L4)
2. Sciatic nerve via nerve to quadratus femoris (L4, L5, S1, S2, and S3)
3. Obturator nerve directly from its anterior division (L2, L3, and L4).

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The cutaneous innervation of the lateral aspect of the thigh is by the lateral cutaneous nerve of the thigh, with variable innervation proximally from the subcostal nerve (T12).

Q3. What are anesthetic considerations for patient undergoing hip and knee replacement?
Ans.

- Old age and associated comorbidities
- Perioperative optimization of concurrent diseases and medications
- Tourniquet application and its consequences
- Bone cement implantation syndrome (BCIS)
- Fat embolism and embolization syndrome
- Need for effective postoperative pain management for early rehabilitation
- Thromboprophylaxis.

Q4. What are the preanesthetic concerns for TKR and THR?
Ans. Patients are usually elderly subjects having multiple comorbidities such as hypertension, ischemic heart disease, chronic obstructive pulmonary disease (COPD), osteoarthritis, spinal stenosis, ankylosing spondylitis, morbid obesity, rheumatoid arthritis, and renal impairment. Underlying orthopedic conditions like rheumatoid arthritis, gout or hemophilia have their own anesthetic implications. A careful preoperative evaluation is mandatory to identify risk factors and to optimize them to make the patient as fit as possible for surgery. Preoperative evaluation should include a medical history and anesthesia-directed physical examination, including airway assessment and examination of site for regional anesthesia. Issues related to chronic pain including prior or ongoing analgesic use, plan for postoperative pain management, and the psychological aspects of chronic pain should be discussed preoperatively.

Investigations: All patients should have: full blood count, kidney function test (blood urea, serum creatinine, and electrolytes), an electrocardiogram (ECG), and a chest X-ray. Other investigations like echocardiography, dobutamine stress echocardiography, coagulation profile, etc., can be done as per patient's comorbidities and preoperative status.

Q5. What are the anesthetic options for hip and knee replacement?
Ans.

- Spinal anesthesia alone
- Epidural analgesia combined with spinal or general anesthesia (GA)
- General anesthesia alone
- Femoral nerve block combined with spinal or GA.

Q6. What are advantages of regional anesthesia over general anesthesia?
Ans. Risks and benefits of regional and GA in TKR surgery are being studied over last few years and results are more compelling in favor of regional anesthesia in view of reduction in the incidences of deep venous thrombosis, pulmonary complications such as embolism, pneumonia and respiratory depression, postoperative cognitive dysfunction and subsequently length of stay at hospital.

Choice of regional anesthesia may vary according to institute's practice, patient factors, and surgical duration. Combined spinal-epidural anesthesia may be used for prolonged procedures (e.g., bilateral or revision TKA) in which the duration of surgery is expected to outlast spinal anesthesia or when postoperative epidural analgesia is desired. Adjuvants

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are usually coadministered with local anesthetics to improve the quality of neural blockade simultaneously increasing the risk of additional side effects. Commonly used agents are opioids such as morphine, or fentanyl, alpha-2 receptor agonists like clonidine or dexmedetomidine and epinephrine. Urinary retention, pruritus, nausea, vomiting, and respiratory depression are common problems after opioids administered through neuraxial route.

Commonly used local anesthetic adjuvants

Name	*Dosage*	*Adverse effects*
Morphine	Intrathecal: 5–10 µg/kg Epidural: 30–50 µg/kg	Pruritus, postoperative nausea and vomiting (PONV), respiratory depression, urinary retention
Fentanyl	Intrathecal: 10–25 µg Epidural: 2–4 µg/mL	Pruritus, PONV, respiratory depression
Clonidine	Intrathecal: 15–40 µg Epidural: 2–4 µg/mL	Hypotension, bradycardia
Dexmedetomidine	Intrathecal: 5–10 µg Epidural: 1 µg/kg	Hypotension, bradycardia (less pronounced than clonidine)

Q7. What is bone cement implantation syndrome and cement reaction? What are its risk factors? What will be your management strategy?

Ans. Bone cement is often used to secure the TKR prosthesis to bone. It is composed of 90% prepolymerized polymethyl methacrylate (PMMA); 10% radiocontrast material (zirconium dioxide or barium sulfate); liquid monomer, dibenzoyl peroxide as initiator; *N,N*-dimethyl-*p*-toluidine as activator and antibiotics (gentamicin, tobramycin, clindamycin) at times. Although very rare, use of bone cement during insertion of prosthesis can cause BCIS, which is characterized by hypoxia, hypotension, and features of pulmonary hypertension, which can at times have catastrophic outcome like cardiac arrest. The primary pathophysiologic mechanism for BCIS is debated, and probably involves pulmonary microembolism of cement or fat, with resultant increased pulmonary vascular resistance and right heart compromise or failure. Other proposed mechanisms are hypersensitivity reaction and complement activation. Patient-related risk factors are body mass index (BMI) > 30 kg/m^2, poor physical or cardiopulmonary reserve, preexisting pulmonary hypertension, and osteoporosis. Surgery-related risk factors are previously instrumented femoral canal, pathologic fracture, intertrochanteric fracture, long-stem femoral component, and high intramedullary pressure.

Classification of BCIS

Grade	*Hypoxia*	*Hypotension*
1	Moderate (SpO_2 < 94%)	Fall in systolic blood pressure > 20%
2	Severe (SpO_2 < 88%)	Fall in SBP > 40% + Unexpected loss of consciousness
3	Cardiopulmonary collapse requiring cardiopulmonary resuscitation	

(SBP: systolic blood pressure; SpO_2: oxygen saturation)

In high-risk patients, additional hemodynamic monitoring including invasive arterial pressure and central venous pressure (CVP) should be done for early recognition of hemodynamic

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instability in BCIS. Under neuraxial block, dyspnea, altered sensorium and cardiovascular collapse may be the presenting symptoms for BCIS while in anesthetized patient fall in end-tidal carbon dioxide may be the first presenting symptom of BCIS. Close communication between anesthetist and surgeon is important. In high-risk patients and on clinical suspicion of BCIS, 100% oxygen should be given and supplemental oxygen is continued in the recovery period. Hemodynamic instability should be treated aggressively with intravascular fluid and vasopressors (phenylephrine, dobutamine, milrinone). Choice of vasopressor depends on degree of right ventricular dysfunction and systemic vascular resistance. Surgical measures for prevention of BCIS include use of noncemented prosthesis, minimizing the length of the stem, medullary lavage and venting before implantation.

Q8. What are the considerations related to tourniquet application?

Ans. A thigh tourniquet is typically used during TKR to create a bloodless surgical field. Tourniquet time > 100 minutes may be associated with postoperative complications, and efforts should be made to minimize tourniquet time. Exsanguination using elastic wraps, Esmarch bandage before tourniquet inflation helps in reducing blood loss and tourniquet associated pain. Release of the tourniquet and reperfusion of the ischemic extremity typically cause mild and brief hemodynamic (hypotension, decrease cerebral blood flow) and metabolic derangements (hyperkalemia, metabolic acidosis, hypercarbia, myoglobinuria), which can be significant for vulnerable patients (e.g., patients with limited cardiac reserve). Increased platelets aggregation and fibrinolysis have also been observed.

The 2009 Perioperative Standards and Recommended Practices guidelines recommend the use of soft padding underneath, widest cuff (cuff size should be more than half of the limb's circumference) possible of tourniquet, depending on tourniquet length with an overlap of 3–6 inches. The ideal tourniquet inflation pressure is determined by adding a safety margin of 100 mm Hg to systolic blood pressure for upper limbs and 100–150 mm Hg for lower limbs or 40–80 mm Hg to the limb occlusion pressure. The recommended inflation time limit is 1 hour. Surgeries requiring prolonged tourniquet time, a 10- to 15-minute tourniquet-free period for reperfusion of extremity, are recommended before tourniquet reinsufflation. Simultaneous application of bilateral tourniquet should be avoided and inflation of tourniquet in other limb should be done only after an interval of 30–45 minutes. After deflation of the tourniquet, the patient should be ideally monitored for at least 15 minutes. Tourniquet-associated pain; nerve, vascular, muscle and skin injuries; deep vein thrombosis (DVT) and pulmonary embolism are some other complications associated with tourniquet use. Prolonged use of tourniquet may lead to "post-tourniquet syndrome" characterized by edema, pallor and weakness lasting up to 1–6 weeks. Tourniquet use in limbs should be avoided or used with caution in patients with sickle cell disease, peripheral neuropathies, severe crush injury, infection or peripheral vascular disease and in those with history of DVT.

Q9. What are postoperative pain management options for TKR and THR patients?

Ans. Higher preoperative pain scores, depression, and younger age are independent predictors of pain in the postoperative period. These predictors may help in selection of an appropriate pain management strategy.

Postoperative pain management should include multimodal analgesic regimen to facilitate rehabilitation after knee and hip arthroplasty.

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Postoperative pain modalities after TKR

- Preemptive analgesia with paracetamol, nonsteroidal anti-inflammatory drugs (NSAIDs), gabapentin, pregabalin, nerve blocks
- Continuous epidural analgesia
- Spinal anesthesia with intrathecal opioids
- Intravenous (IV) patient-controlled analgesia
- IV paracetamol and NSAIDs
- Local infiltration analgesia (LIA)—local anesthetics, steroids, morphine, clonidine, ketorolac
- Peripheral nerve blocks like
  - Femoral nerve block—most commonly done and easy to perform
  - Femoral nerve block plus sciatic nerve block
  - Fascia iliaca plane or compartment (FIC) block
  - Adductor canal block (ACB)
  - Sciatic and selective tibial nerve block
  - Subsartorial compartment block—ultrasonography (USG)-guided local anesthetic deposition below the sartorius muscle distal to the adductor hiatus—saphenous nerve block; sensory block
  - Periarticular injection (PAI)/LIA
  - Infiltration of the interspace between the popliteal artery and the capsule of the posterior knee (IPACK) block
  - Multimodal analgesia—ideal.

Postoperative pain modalities after THR

- Preemptive analgesia
- Continuous epidural analgesia
- Spinal anesthesia with intrathecal opioids
- IV patient-controlled analgesia
- IV paracetamol and NSAIDs
- Low-dose glucocorticoids
- Peripheral nerve blocks like
  - Lumbar plexus block (posterior approach)
  - Femoral nerve block
  - FIC block
  - Sciatic nerve block
  - Adductor canal block or the femoral triangle block
  - IPACK block
  - Continuous femoral perineural catheter placement
  - Multimodal analgesia
- Intra-articular injection of local anesthetic.

Q10. What is adductor canal block and what are its advantages over femoral nerve block?

Ans. The adductor canal is an intermuscular, musculoaponeurotic tunnel that begins as the seamless transition from the apex of the femoral triangle and ends at the adductor hiatus. The boundaries are formed by vastus medialis muscle anterolaterally and the adductor longus and adductor magnus muscles posteromedially. The roof adductor canal is made by sartorius muscle. Within the adductor canal lies the neurovascular bundle consisting of superficial artery

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and vein, saphenous nerve, the nerve to vastus medialis (originate from saphenous nerve just before entering into adductor canal), the posterior branch of the obturator nerve, and in some cases, the medial cutaneous nerve and the anterior branch of the obturator nerve. ACB preserves quadriceps muscle strength so helps in early mobilization.

In 1993, the ACB was first described as a landmark-based technique dependent on palpation of the sartorius muscle and loss of resistance as the block needle pierced the vastoadductor membrane overlying the adductor canal. Ultrasound guidance has improved the success rate of ACB.

Q11. What is IPACK block?

Ans. The infiltration between the popliteal artery and capsule of the knee block provides analgesia to the posterior knee capsule mainly through blockade of terminal branches innervating it, while sparing the tibial and peroneal nerves. The risk of neurovascular injury during the IPACK block is more due to the presence of the popliteal vessels and tibial and peroneal nerves near the posterior capsule. While further studies are being conducted to establish its efficacy and safety profile, IPACK blocks may represent a significant advance in providing analgesia to the posterior aspect of the knee after TKR.

Q12. What are the possible postoperative complications after TKR/THR?

Ans.

Postoperative delirium: The relationship between the choice of anesthetic technique for TKR and long-term cognitive dysfunction is an area of active research. There may be an increase in delirium and cognitive decline in the first postoperative week after GA. The use of opioid-sparing analgesic techniques, depth of periprocedural sedation, and sedative selection (e.g., propofol and dexmedetomidine rather than benzodiazepines) may be more important for decreasing early postoperative decline.

Tourniquet pain: Unmyelinated C fibers play a major role in tourniquet pain, which are relatively resistant to local anesthetics. It is generally prevented by spinal anesthesia, adjuvants like clonidine and opioids, IV ketamine, dexmedetomidine, magnesium sulfate and deeper plane of anesthesia. Eutectic mixture of local anesthetics (EMLA) and topical local anesthetics have also been used. Tourniquet pain can happen in presence of spinal anesthesia too as these fibers recover earlier than larger myelinated A fibers as the local anesthetic concentration in cerebrospinal fluid (CSF) decreases after 60–75 minutes of tourniquet time.

Nerve injury: It may be due to surgical procedure or use of a tourniquet. Nerve injury after orthopedic procedures is a significant malpractice concern for anesthesia clinicians claiming injury due to nerve block. The most common neurologic complication after TKR is peroneal nerve palsy, particularly in patients with severe valgus alignment in combination with a flexion deformity. Application of tourniquet over bony prominences like ulna, fibula and malleoli; and use of tourniquet for >3 hours are also risk factors for neuropraxia.

Blood loss: Perioperative blood loss for TKR varies widely, from approximately 650 to 1,400 mL. Significant patient risk factors for transfusion include: age, preoperative anemia, female sex, BMI < 30 kg/m^2, and the American Society of Anesthesiologist (ASA) class > 2. Intraoperative blood loss is generally low, particularly if the tourniquet is left inflated till wound closure and application of compressive dressing.

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Tranexamic acid (TXA): TXA acts on the lysine-binding site on plasminogen and reversibly inhibits it thus preventing degradation of fibrin. In many recently conducted trials, it has been proven to be safe and effective in reducing bleeding and hematoma formation after TKR. TXA can be administered both topically and through IV route. It is given as 10–20 mg/kg bolus followed by 1–2 kg/hour infusion for 24 hours.

Postoperative urinary retention: Around 10–80% subjects experience postoperative urinary retention after arthroplasty. Routine postoperative catheterization is not recommended until unless patient is having high-risk factors (history of urinary retention).

Popliteal vascular injury: It is a rare complication of TKR, incidence ranging from 0.03 to 0.17%. Risk factors for popliteal vessels injury are presence of arteriosclerotic disease; redo arthroplasty and correction of extensive flexion contractures. Other vascular complications commonly seen are thrombosis, atherosclerotic occlusion, or direct sharp trauma. Color Doppler may help in confirming the diagnosis.

Deep vein thrombosis: TKR and THR surgeries are considered to be high-risk surgeries for venous thromboembolism (VTE). As reported by the American College of Cardiology Foundation/American Heart Association (AHA), the incidence of proximal and distal (calf) DVT can be up to 10–20% and 40–80%, respectively, if prophylaxis is not given after knee and hip arthroplasties. The incidence of pulmonary embolism in such patient varies from 4 to 10% with mortality rate of 0.2–5% after TKR and THR.

Q13. How do we give thromboprophylaxis after TKR and THR?

Ans. Postoperative ambulation should be started as early as possible. Thromboprophylaxis may be mechanical or pharmacological. Mechanical prophylactic measures include intermittent pneumatic compression (IPC) and compression stockings. In patients at high risk for bleeding, aggressive mechanical prophylaxis may be the only suitable option. Early ambulation combined with mechanical prophylactic measures results in more rapid resolution of pain and swelling.

Pharmacological prophylaxis

Aspirin: It is used in the dosage ranging from 75 to 150 mg but its efficacy is low compared to low-molecular-weight heparin (LMWH) when used alone. LMWHs are preferred over unfractionated heparin (UFH) due to their improved efficacy and comparable risk of bleeding complications and less risk of complications.

Vitamin K antagonist like warfarin is more effective than IPC, but is less effective than LMWH in preventing DVT. Fondaparinux is recently is avoided in the presence of indwelling epidural catheter. Oral rivaroxaban, a direct inhibitor of factor Xa is now available in India.

Timing of prophylaxis in surgical patients: Thromboembolic complications occur early after TKR, with a median time of diagnosis of VTE at postoperative day 7 versus 17 days after THR. This suggests that to reduce thromboembolic events, prolonged prophylaxis is required after THR (10 days for TKR and 35 days for THR). Initiation of LMWH should be delayed for 24 hours postoperatively in the presence of traumatic needle/catheter placement.

Neuraxial anesthesia and thromboprophylaxis: Neuraxial anesthesia when used concomitantly with anticoagulation increases the risk of epidural hematomas and subsequent spinal cord injury. American Society of Regional Anesthesia and Pain Medicine 2018 recommends waiting 24 hours after a full dose and 12 hours after a prophylactic dose of LMWH before central neuraxial blocks (CNB). LMWH should be withheld for at least 2 hours after removal of epidural catheter.

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Q14. What are the special case scenarios, we can encounter in such patients?

Ans.

- *Patients with diabetes*: During preanesthesia checkup such patients must be assessed for blood sugar control [fasting, postprandial, hemoglobin A1c (HbA1c) values], and any diabetes-associated macro- and microvascular complications namely cardiovascular and cerebrovascular disease, peripheral and autonomic neuropathy, nephropathy, stiff joint syndrome and difficult airway must be looked for. Perioperative optimization of blood sugar levels, oral hypoglycemic agents, change of anesthesia plan as per presence of sequelae of diabetes and high degree of suspicion of dreaded complications like hyperosmolar coma and diabetes ketoacidosis should be kept in mind.
- *Patients with hypertension*: Preoperative evaluation of these patients will include etiology and severity of hypertension, current antihypertensive therapy patient is on, evaluation of the organ damage like renal, cerebral, cardiac involvement. Most of the antihypertensives should be continued except may be angiotensin receptor blockers. Perioperative ischemia monitoring, intra-arterial monitoring, suppression of intubation response, adequate analgesia and anesthetic depth, use of parenteral hypotensive agents are some of the steps that can be undertaken in such patients.
- *Patients on pacemaker or artificial implanted cardioverter-defibrillator (AICD)*: In preanesthesia checkup, indication of the pacemaker implantation, details of current settings and battery life of the device, pacemaker dependency and present cardiac status of the patient should be assessed. A chest X-ray can tell us whether it is a pacemaker or AICD (two thick coils near right ventricle), its position and presence of any disconnection or fracture. If the interrogation of the device by the manufacturer's engineers is not done within 12 months for pacemaker, 6 months for AICD or 3–6 months for cardiac resynchronization therapy device, it should be done. Reprogramming to asynchronous mode (e.g., VOO) for pacemaker or disabling antitachyarrhythmia function of AICD before surgery to prevent inappropriate shock delivery caused by electrical interference. Backup external or transvenous pacing, magnet and cardiologist or electrophysiologist should be available inside the operation theater. Other measures to be taken intraoperatively—changing the ECG setting to diagnostic mode to detect pacemaker spikes; keeping the grounding plate close to operative site and as far as possible from the implant (at least 15 cm) preferably on thigh; use of bipolar cautery; short burst (1–2 seconds) with long pauses (10 seconds) of electrocautery; maintenance of normothermia to prevent interference by shivering. In case of emergency cardioversion, the paddles of defibrillator should be placed as far from the implanted device as possible and should be oriented perpendicular to the device.
- *Patients with ischemic heart disease*: According to the American College of Cardiology (ACC)/AHA, patient with history of recent myocardial infarction (within 6 weeks—high; up to 3 months—intermediate), unstable or severe angina, decompensated heart failure, severe valvular disease (e.g., severe aortic stenosis), or significant arrhythmias (e.g., ventricular tachycardia or atrial fibrillation with a rapid rate) are high-risk patients and their cardiac condition needs to be optimized before elective surgeries. Risk factors identified by the American College of Physicians for perioperative major adverse cardiac events (MACEs) are age > 75 years, ongoing angina, previous myocardial infarction, congestive heart failure (CHF), history of stroke, diabetes mellitus on insulin, renal insufficiency and poor functional status (metabolic equivalent) due to heart disease. Orthopedic surgeries are considered to

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be elevated risk (>1%) surgery for MACE. Coagulation function, renal function, noninvasive (12-lead ECG, Echo, stress echo, etc.) or invasive (coronary angiography) may be required. After percutaneous coronary intervention, arthroplasties should be delayed for a period of 14 days for balloon angioplasty, 4–6 weeks for bare-metal stent and 6 months to 1 year for drug-eluting stent. Statins and beta-blockers are to be continued till the morning of surgery. Clopidogrel, ticlopidine, glycoprotein (GP) IIb/IIIa inhibitors should be discontinued 7 days, 14 days and 8–48 hours, respectively before surgery. Patient should be assessed for the risk of stent thrombosis before stopping dual antiplatelet (DAP) therapy. Bridging therapy with UHH or LMWH may be considered in patients with high risk of stent thrombosis. Oral antiplatelet drugs can be resumed 24 hours after the surgery.

- *Patient on oral anticoagulants*: Patients on oral anticoagulation may require bridging therapy perioperatively especially in patients with high risk for thromboembolism such as thrombophilia, recurrent (two or more)/recent (within 3 months) thromboembolic events, atrial fibrillation with risk factor for embolism, recently placed mechanical valve (<3 months). Elective surgery should be postponed for a minimum of 1 month from the VTE event. Bridging therapy—warfarin should be stopped 5 days before the surgery if international normalized ratio (INR) is 2–3. LMWH should be started 36 hours after last warfarin dose. Choice of LMWH may include enoxaparin 1 mg/kg twice daily or 1.5 mg/kg once daily. Last dose of LMWH should be given 24 hours before the planned surgery. Preoperative INR should be <1.5. Postoperatively, warfarin can be started 6–12 hours after surgery and LMWH after 24 hours. LMWH is discontinued when INR is therapeutic for 2 consecutive days. Bridging is generally not used for the shorter-acting direct oral thrombin inhibitors (dabigatran) or factor Xa inhibitors (rivaroxaban, apixaban, edoxaban)
- *Patients with acute or chronic kidney disease (CKD)*: Patients with obesity, elevated preoperative serum creatinine, preoperative liver dysfunction, CHF, hypertension, and underlying heart disease are high risk for developing perioperative renal dysfunctions. Patients with CKD may have normochromic normocytic anemia and impaired platelet function and preoperative anemia. Blood pressure cuff and IV lines should not be placed in the limb with arteriovenous (AV) fistula. Optimal fluid therapy can be guided by CVP monitoring. Patients on renal replacement therapy should have their dialysis scheduled 24 hours before surgery and postdialysis electrolytes should be repeated.
- *Patients with COPD*: Patients with COPD have a two- to fourfold increased risk of postoperative pulmonary complications. Optimization of lung function should be done by smoking cessation for at least 4–6 weeks, bronchodilation, clearing of secretions, antibiotics, incentive spirometry and hydration arterial blood gas monitoring can be done perioperatively for patients with moderate-to-severe COPD. Bronchodilators, inhaled or oral steroids, and antibiotics need to be continued on the day of surgery. Beta-agonists are the most useful prophylactic intervention to lower the risk for bronchospasm on induction. Early mobilization, deep breathing, incentive spirometry, and effective analgesia are recommended postoperatively.
- *Patients with rheumatoid arthritis*: These patients may have difficult airway because of limited mouth opening due to temporomandibular joint involvement, narrow glottic opening (cricoarytenoiditis) and instability of atlantoaxial joint. During preanesthesia checkup patients should be evaluated for extra-articular manifestations like pericardial or pleural effusion, conduction abnormalities, pulmonary and hepatic fibrosis, renal

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insufficiency, "stiffness" of the arteries, anemia, and thrombocytopenia. These patients are generally on steroids and disease-modifying drugs like methotrexate (interstitial lung disease, liver toxicity), hydroxychloroquine (ocular toxicity), ciclosporin (hypertension, nephrotoxicity), leflunomide (liver toxicity, extensive hepatoenteric recirculation), anakinra [interleukin (IL)-1 receptor antagonist; pneumonia], sulfasalazine (Stevens-Johnson syndrome), so, concerns related with these drugs should be kept in mind.

- *Patients with ankylosing spondylitis*: These patients usually have reduced movement of the cervical spine and reduced mouth opening and may present with difficult intubation so awake fiberoptic endotracheal intubation is preferred in most cases. Ossification of interspinous ligament and formation of syndesmophytes result in classic "bamboo spine" appearance making neuraxial block difficult. Central neuraxial blockade by paramedian approach or using ultrasound and peripheral nerve blocks can be useful in these patients. Strict attention to intraoperative positioning and padding of pressure points is important to avoid fracture of the fused spine with concomitant spinal cord trauma. Patients have narrowed epidural spaces and hence there can be unpredictable drug spread during epidural infusion and recovery of sensory or motor blockade may be delayed. Extra-articular manifestations of the disease include aortic insufficiency, apical lung fibrosis and restrictive lung disease.
- *Patients with spine pathologies*: Neuraxial blocks can be difficult in these patients due to abnormal vertebral anatomy, obliteration of tactile landmarks and can lead to unpredictable local anesthetic spread and inadvertent dural puncture. USG can come handy here to provide information about the depth and route and can be used real time too.

Q15. What are implications of redo or revision arthroplasty?

Ans. Loosening, shearing and breakage, infections, staged procedure or shift of the age profile to younger population are some of the reasons for revision arthroplasty. Increased blood loss and complications of massive blood transfusion, long duration of surgeries, increased risk of infection, nerve or vessel injuries and internal viscera damage are some of concerns related with redo hip surgeries. Other than good venous access, invasive blood pressure monitoring; use of TXA, cell salvage, blood gas and coagulation monitoring are some of the measures that can be taken.

Q16. What are the relative contraindications for bilateral THR/TKR?

Ans. Although there is no absolute contraindications, some of the relative contraindications include pulmonary hypertension, active ischemic heart disease (e.g., symptomatic or positive dobutamine stress test) with or without left ventricular dysfunction [left ventricular ejection fraction (LVEF) < 40%], presence of patent ductus arteriosus or septal defects, severe pulmonary disease requiring oxygen, steroid-dependent COPD or asthma, active cerebrovascular disease, hepatic or renal impairment, age ≥ 75 years, and morbid obesity (BMI > 40), etc.

FURTHER READING

1. Cement curfew.
2. Limb occlusion pressure.
3. Post tourniquet bleed.

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Long and Short Cases in Anesthesiology

Salient Features

- The book fulfils the need of the students in anesthesiology for in-depth knowledge of physiology of the human body as well as pharmacokinetics and pharmacodynamics of drugs in order to give safe anesthesia to the patient
- The art of giving anesthesia is in turn dependent on technology of advanced monitoring gadgets as well as in-depth understanding of various subjects
- The book discusses long cases and short cases which are major part of the practical examination focuses on evaluating the examinee's knowledge of clinical case management
- The whole gamut of clinical cases may not be covered in every institute, however, the postgraduates are expected to be familiar with the management of all possible clinical situations they may encounter
- In creating this book, the authors have approached knowledgeable and enthusiastic faculty and trainers in their subject fields to discuss an illustrative or interesting exam case
- The aim of this book is to create a number of small chapters that could be used as basis for individual reading or group tutorials for further exploration around a topic
- The book is not intended to be a definitive text but contains mixture of core knowledge and detailed background information.

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