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Analgesic Techniques for Total Knee Arthroplasty

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• Total knee arthroplasty • Analgesia • Femoral nerve block • Adductor canal block • Sciatic nerve block • Local infiltration analgesia • Liposomal bupivacaine

Key points

- Femoral nerve block (FNB) and continuous FNB (cFNB) provide superior analgesic and functional outcomes compared with intravenous patient-controlled anesthesia following total knee arthroplasty (TKA).
- Adductor canal block (ACB) is associated with superior quadriceps strength preservation compared with FNB; however, the evidence for improved postoperative mobilization with ACB remains conflicting. There is no adequately powered randomized controlled trial in the contemporary literature that shows equivalent postoperative analgesia between ACB and FNB.
- Sciatic nerve block (SNB) and continuous SNB (cSNB) reduce postoperative pain scores and opioid consumption during the first 24 and 48 hours respectively following TKA; however, the effect on functional outcomes remains inconclusive.
- Studies comparing local infiltration analgesia with FNB are difficult to interpret in the clinical setting because of methodological flaws and associated high risk of bias.
- There is currently an absence of evidence to support the use of liposomal bupivacaine for surgical site or perineural infiltration following TKA.

INTRODUCTION

Total knee arthroplasty (TKA) is associated with significant postoperative pain, which can contribute to impaired postoperative mobilization, functional recovery, and patient satisfaction [1]. Because of the increasing prevalence of

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obesity and an aging population, the number of patients requiring TKA is rapidly increasing [2]. This article discusses the common regional anesthetic techniques used for postoperative analgesia following TKA, including femoral nerve block (FNB), adductor canal block (ACB), sciatic nerve block (SNB), and local infiltration analgesia (LIA). For each technique the relevant anatomy is discussed, in addition to practical guidance on procedural performance and use of ultrasound guidance. In addition, a comprehensive overview of the currently available evidence for analgesic and functional outcomes of each technique is discussed, aiming to resolve current controversies such as the comparative performance of ACB and FNB, the role of routine SNB, the efficacy of LIA, and the role of liposomal bupivacaine in prolongation of postoperative analgesia.

FEMORAL NERVE BLOCK

Anatomy

The femoral nerve is a branch of the lumbar plexus formed from the anterior rami of the second, third, and fourth lumbar nerve roots [3]. It descends through the psoas muscle, emerging from the lateral border before passing beneath the inguinal ligament to enter the proximal thigh, lateral to the femoral artery. Immediately below the inguinal ligament it divides into an anterior and posterior division. The anterior division provides cutaneous sensation to the anteromedial thigh and knee, in addition to motor innervation to the sartorius and pectineus muscles. The posterior division provides motor innervation to vastus medialis, intermedius, and lateralis muscles, and the rectus femoris muscle, and supplies articular branches to the anterior knee joint. The saphenous nerve is also derived from the posterior division and provides cutaneous sensation to the medial aspect of the lower leg, in addition to an articular branch to the knee joint.

Technical description of ultrasound-guided femoral nerve block

With the patient lying supine, a high-frequency linear array ultrasound transducer is placed in an oblique transverse orientation just inferior to the inguinal ligament. The femoral artery is identified proximal to its bifurcation into the superficial and deep femoral arteries, lateral to the femoral vein. At this level the femoral nerve appears in the short axis as a distinct ellipsoid hyperechoic structure located lateral to the femoral artery, before it divides into multiple branches. The fascia lata and fascia iliaca are identified superficial to the iliacus muscle, and the femoral nerve is seen deep to the fascia iliaca (Fig. 1). Small adjustments of probe angle are required to optimize the view of the femoral nerve. Local anesthetic must be deposited deep to the fascia iliaca to achieve satisfactory block. A needle-in-plane approach allows visualization of the entire needle; however, the out-of-plane approach may also be used. A local anesthetic volume of 15 to 20 mL is adequate,