Selecting the Right Regional Analgesic Technique for Knee Surgery

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A great deal of research is currently underway to determine the optimal analgesic regimens for all types of surgery. Since the pain experience is specific to the individual, not all patients will neatly fit into predefined postoperative pain categories. Beware the patient who says, “I have a high pain threshold.” To further complicate the issue, not all surgeons or surgical approaches are created equally. However, various knee surgeries can be expected to generate differing levels of pain, and therefore, I base my recommendations on the best available evidence presented below with the caveat that every analgesic regimen should be personalized to the individual patient’s needs.

Total Knee Arthroplasty (TKA)

Very few knee surgeries will produce as much postoperative pain as tricompartment TKA. In addition to the surgical insult and associated stress response, expectations of early and rapid rehabilitation contribute significantly to the pain experience.

There is compelling evidence to support the use of continuous femoral nerve blocks (cFNB) for postoperative analgesia following TKA.1-3 Compared to subjects who receive a one-day infusion of ropivacaine (representing single-injection blocks) followed by systemic analgesia alone, subjects receiving a 4-day cFNB achieve predetermined criteria for hospital discharge faster.3 How do cFNB compare to alternative regional anesthesia techniques for TKA?

Since the femoral nerve is a terminal branch of the lumbar plexus, a lumbar plexus catheter, or psoas compartment catheter, may provide effective analgesia following TKA. A study comparing these two continuous nerve block techniques for TKA did not demonstrate a difference in analgesia although this was not the primary outcome.4 Potential complications from lumbar plexus blocks include epidural spread, hypotension, intrathecal or intravascular injection, and hematomas of the psoas compartment, retroperitoneum, and renal capsule.5 Arguably, continuous epidural analgesia can be considered the gold standard for pain management following lower extremity joint replacement. However, recent studies have demonstrated comparable analgesia produced by cFNB.6,7 More importantly, subjects who received cFNB suffered fewer side effects such as nausea/vomiting, pruritus, and hypotension compared to subjects who received epidurals.6,7 In addition, the selectivity of cFNB preserves function in the non-operative limb, which may aid in early rehabilitation. In our experience, patients also report satisfaction from early removal of urinary catheters when placed intraoperatively since they are not indicated for cFNB. A major complication that can be avoided when cFNB are used instead of epidural catheters for TKA is the dreaded epidural hematoma. Due to the serious potential consequences, the American Society of Regional Anesthesia recommends removal of epidural catheters prior to commencing twice-daily dosing of low molecular weight heparin thromboprophylaxis.8 Given the effective analgesia provided by cFNB and relative safety profile, cFNB are the ideal choice for TKA.
Are sciatic nerve blocks necessary for TKA in addition to cFNB?
I have heard many practitioners comment that the time required to place a sciatic nerve block in addition to cFNB preoperatively may not be feasible in a busy surgery center. Patients who receive cFNB alone will experience pain and require intravenous opioids, particularly on the day of surgery through postoperative day 1.3,9-11 In contrast, sciatic nerve blocks added to cFNB provide near-complete analgesia for tricompartment TKA.9,11 However, the decision to add sciatic nerve blocks should be institution-specific and take into account the physical therapy goals for the individual patient and surgical factors (tricompartment vs. unicompartment or minimally-invasive TKA). For example, a patient on a minimally-invasive TKA clinical pathway may be expected to ambulate on the day of surgery, and anesthesia in the sciatic nerve distribution (foot and ankle) may actually be a hindrance. Multimodal analgesia with long-acting opioids (sustained-release oxycodone, methadone, or sustained-release oral morphine), short-acting opioids (oxycodone or hydrocodone) and nonopioid analgesics (nonsteroidal anti-inflammatory agents such as celecoxib, acetaminophen, and/or gabapentin) in addition to cFNB may decrease the need for sciatic nerve blocks following less-invasive TKA. Depending on the clinical pathway and regional anesthesia practice model, it may be prudent to place cFNB preoperatively and assess the need for a “rescue” sciatic nerve block postoperatively in the case of significant breakthrough pain in postanesthesia recovery.

Anterior Cruciate Ligament Reconstruction (ACLR)
For complex outpatient knee surgeries such as ACLR, peripheral nerve blocks (femoral nerve blocks with or without sciatic nerve blocks) are associated with less pain and lower odds of unplanned hospital admission compared to systemic analgesia.12 The decision regarding continuous vs. single-injection and whether or not to add a sciatic nerve block depends on the expected surgical trauma and patient factors. When a cadaveric allograft is used for ACLR, a single-injection femoral nerve block provides superior pain control compared to placebo, and cFNB may not offer significant advantages.13 However, patients who undergo autograft ACLR with cFNB report lower pain scores for the first 4 days after surgery compared to single-injection femoral nerve block and placebo groups.13 Patients with opioid intolerance and/or increased pain sensitivity may benefit from cFNB for ACLR regardless of graft type. In order to ensure patient safety at home, patients with continuous lower extremity blocks should be non-weightbearing, and outpatients with cFNB should be discharged home with a knee immobilizer. A single-injection sciatic nerve block added to femoral blockade provides complete analgesia following ACLR14 and should be considered, especially when an autograft harvest of hamstring or Achilles tendon is planned. Intraarticular local anesthetics do not offer advantages over peripheral nerve blockade for ACLR.14,15

Knee Arthroscopy
For knee arthroscopy not involving ligamentous reconstruction, patient disposition and weightbearing status are important considerations. Despite the seemingly complex list of procedures associated with knee arthroscopy (e.g. chondroplasty, meniscectomy, loose body removal), patients are routinely discharged home with no weightbearing restriction. In these situations, peripheral nerve blocks for analgesia may not be indicated, and intraarticular injections offer an alternative for minimally-invasive surgeries expected to generate only mild
pain. The mixture of 0.25% bupivacaine 30 ml with morphine 3 mg and clonidine 1 mcg/kg injected into the knee joint provides better pain relief than local anesthetic alone.\textsuperscript{16} Other adjuvant medications that may be added to local anesthetics for intraarticular injection include neostigmine,\textsuperscript{17} ketorolac,\textsuperscript{18} steroids,\textsuperscript{19,20} and tramadol.\textsuperscript{21}

In summary, optimal regional analgesia for knee surgery depends on many factors including type of surgery, postoperative management goals, and patient preferences. Peripheral nerve blockade should not be the only analgesic, and multi-modal pain control has proven advantages. Although there are many recommended strategies (Table 1), the ideal plan will always be tailored to the individual patient.

<table>
<thead>
<tr>
<th>Surgical Procedure</th>
<th>Femoral Nerve Block</th>
<th>Sciatic Nerve Block</th>
</tr>
</thead>
<tbody>
<tr>
<td>TKA (tricompartment)</td>
<td>Continuous</td>
<td>Single or Continuous</td>
</tr>
<tr>
<td>TKA (uncompartment)</td>
<td>Continuous</td>
<td>+/- Single</td>
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<td>ACLR with autograft</td>
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<td>Single</td>
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<tr>
<td>ACLR with allograft</td>
<td>Single or Continuous</td>
<td>+/- Single</td>
</tr>
<tr>
<td>Knee arthroscopy</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
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\textit{TKA – total knee arthroplasty; ACLR – anterior cruciate ligament reconstruction}

References:


