Adductor Canal Block for Total Knee Arthroplasty

The Perfect Recipe or Just One Ingredient?

Edward R. Mariano, M.D., M.A.S. (Clinical Research), Anahi Perlas, M.D., F.R.C.P.C.

In this issue of Anesthesiology, Kim et al.\(^1\) compare the motor and analgesic effects of adductor canal block (ACB) and femoral nerve block (FNB) for total knee arthroplasty (TKA) in the context of an established clinical pathway using multimodal analgesia. The management of postoperative pain after TKA remains challenging. Postoperative pain can be moderate to severe; yet, patients are expected to start physical therapy and ambulate as soon as possible after surgery because early rehabilitation may translate into longer-term functional achievements.\(^2\)

Recent interest in ACB as a regional analgesic technique for TKA\(^3\) coincides with the negative light cast on FNB due to previously reported claims that it increases fall risk.\(^4–6\) Another article published in this issue of Anesthesiology by Memtsoudis et al.\(^7\) (including E.R.M.) provides compelling evidence to refute these claims and identifies many other factors associated with increased fall risk other than anesthetic and analgesic selection.\(^8\) However, no one can argue against the need to reduce fall risk; in our study, TKA patients who fell were more likely to go on to suffer additional major cardiac, pulmonary, thromboembolic, or other organ-system complications with higher 30-day mortality compared with TKA patients who did not fall.\(^7\) Inpatient falls leading to injury are considered hospital-acquired conditions and “never events” by the Center for Medicare and Medicaid Services (http://www.cms.gov). In some practice settings, especially those that may not have comprehensive multicomponent fall prevention programs in place,\(^8\) FNB and continuous femoral perineural local anesthetic infusions in particular may not be considered viable options despite providing effective analgesia and decreasing the time to meet discharge criteria.\(^6\)

The search for the perfect regional analgesic regimen for TKA patients continues. Although we anxiously await the selective local anesthetic that can preferentially anesthetize sensory nerves while sparing motor nerves,\(^9\) we need to make the most of our imperfect nonselective local anesthetics in the perioperative management of pain. The innervation of the knee is complex, with contributions from both the lumbar and sacral plexuses. Thus, continuous neuraxial analgesia and femoral and sciatic nerve blocks, in single dose or continuous infusions, have all been used for postoperative pain management after TKA.\(^10,11\) Although enthusiasm for ACB with TKA is fairly recent, the technique itself is not. A similar approach has been used to anesthetize the saphenous nerve in the adductor canal to provide analgesia to the medial aspect of the ankle.\(^11–14\) For TKA, however, the real question in many anesthesiologists’ minds is: How can an injection of local anesthetic into the adductor canal by itself possibly provide enough analgesia for TKA? The short answer is: it does not have to. Integrated multimodal analgesic protocols, as defined by the American Society of Anesthesiologists’ practice guidelines on perioperative pain management, use two or more analgesic modalities with different mechanisms of action to provide superior analgesia and limit side effects and adverse events.\(^12\) Regional analgesic techniques are usually at the center of these multimodal

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\(^{1}\) Kim ET, et al. \(^{2}\) Postoperative pain after total knee arthroplasty remains challenging. \(^{3}\) Recent interest in ACB as a regional analgesic technique for TKA coincides with the negative light cast on FNB due to previously reported claims that it increases fall risk. \(^{4}\) Another article published in this issue of Anesthesiology by Memtsoudis et al. provides compelling evidence to refute these claims and identifies many other factors associated with increased fall risk other than anesthetic and analgesic selection. \(^{5}\) However, no one can argue against the need to reduce fall risk; in our study, TKA patients who fell were more likely to go on to suffer additional major cardiac, pulmonary, thromboembolic, or other organ-system complications with higher 30-day mortality compared with TKA patients who did not fall. \(^{6}\) Inpatient falls leading to injury are considered hospital-acquired conditions and “never events” by the Center for Medicare and Medicaid Services (http://www.cms.gov). In some practice settings, especially those that may not have comprehensive multicomponent fall prevention programs in place, FNB and continuous femoral perineural local anesthetic infusions in particular may not be considered viable options despite providing effective analgesia and decreasing the time to meet discharge criteria. \(^{7}\) The search for the perfect regional analgesic regimen for TKA patients continues. Although we anxiously await the selective local anesthetic that can preferentially anesthetize sensory nerves while sparing motor nerves, we need to make the most of our imperfect nonselective local anesthetics in the perioperative management of pain. The innervation of the knee is complex, with contributions from both the lumbar and sacral plexuses. Thus, continuous neuraxial analgesia and femoral and sciatic nerve blocks, in single dose or continuous infusions, have all been used for postoperative pain management after TKA. Although enthusiasm for ACB with TKA is fairly recent, the technique itself is not. A similar approach has been used to anesthetize the saphenous nerve in the adductor canal to provide analgesia to the medial aspect of the ankle. For TKA, however, the real question in many anesthesiologists’ minds is: How can an injection of local anesthetic into the adductor canal by itself possibly provide enough analgesia for TKA? The short answer is: it does not have to. Integrated multimodal analgesic protocols, as defined by the American Society of Anesthesiologists’ practice guidelines on perioperative pain management, use two or more analgesic modalities with different mechanisms of action to provide superior analgesia and limit side effects and adverse events. Regional analgesic techniques are usually at the center of these multimodal

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Corresponding articles on page 540 and page 551.

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protocols in a background of nonsteroidal anti-inflammatory drugs, acetaminophen, and low-dose opioids. There is a nascent but growing case being made in the contemporary literature to support ACB as the most appropriate regional analgesic technique to be the core of a multimodal analgesic protocol for TKA due to its decreased potential for quadriceps weakness.

The efficacy of ACB for TKA in the setting of oral multimodal analgesia has been previously demonstrated in a proof-of-concept study. Similarly, the addition of ACB to a multimodal protocol including local infiltration analgesia provides further improvement in pain scores and ambulation compared with placebo injection. Retrospective cohort studies further suggest that the combination of ACB and local infiltration analgesia is associated with enhanced early postoperative ambulation compared with femoral nerve perineural infusions.

The current study is one of the first randomized clinical trials to compare the effectiveness of ACBs to FNBs for TKA patients within a multimodal analgesic protocol. All subjects received preoperative and postoperative nonsteroidal anti-inflammatory drugs, acetaminophen, and systemic opioids; all but three subjects received low-dose epidural patient-controlled analgesia with bupivacaine and hydromorphone postoperatively. Subjects were randomly assigned to receive an ACB or FNB preoperatively followed by intraoperative neuraxial anesthesia with local anesthetic only. Quadriceps muscle strength was assessed at 6 to 8 h postoperatively, whereas pain and opioid consumption were monitored for the first 48 h. The ACB group demonstrated greater quadriceps muscle strength at 6 to 8 h (an advantage of 5.2 kgf over the FNB) and was found to be noninferior in terms of pain scores and opioid consumption up to 48 h. Although the difference in muscle strength is statistically significant, the clinical relevance of this outcome is still questionable; a recent study comparing ACB with FNB also demonstrated a quadriceps strength advantage postoperatively in TKA patients, but no benefits in mobilization ability. Furthermore, the epidural analgesia provided to both groups may have been a confounder in the noninferiority hypothesis testing. We can conclude that ACB does not provide inferior analgesia compared with FNB within this institution’s multimodal protocol, but we do not know whether or not a quadriceps strength advantage at 6 to 8 h postoperatively translates into actual rehabilitative benefits for TKA patients in the short or long term or whether these results can be reproduced in other practice models.

The study by Kim et al. does not report any in-hospital rehabilitation metrics such as ambulation distance, range of motion, ability to perform straight leg raise, time to meet functional independence and discharge eligibility, or short- or long-term functional outcomes. The effects of ACB on these parameters, if any, remain unknown. At the authors’ institution, patients are only “dangled” at the bedside on the day of surgery and begin ambulation on postoperative day 1. The physical therapy regimen (i.e., knee immobilizer for the operative extremity, use of a front-wheel walker, number of assistants during ambulation) is not specified. At institutions that brace the operative extremity with a knee immobilizer and provide sufficient assistance, a decrease in quadriceps strength from FNB may not necessarily be a hindrance to ambulation.

The issue of context is an important one as clinical pathways integrating pain management, physical therapy, nursing, and surgical care are often specific to individual institutions. Multimodal analgesia should be interpreted and applied differently based on the practice model, just as there can be many different recipes for the same dish. There is no question that the “recipe” for TKA multimodal analgesia should include regional anesthesia, opioids, and nonopioid analgesic medications, but there may be some latitude with regard to choosing the individual “ingredients.”

The change from FNB to ACB and the maintenance of quadriceps strength have the potential to affect physical therapy outcomes in a way that we have not previously seen. Although the study by Kim et al. provides us with important new information, there is a great deal of work to be done to quantify these potential benefits within the context of different practice models, and many prospective studies are currently underway to evaluate ACB in comparison with FNB. In a recent search of ClinicalTrials.gov using the search terms “adductor canal,” “femoral,” and “knee arthroplasty,” the output generated nine studies—two completed (the current study and the study by Jäger et al.), one terminated, four recruiting but not completed, and two that have not started recruiting. Although we do not yet have sufficient evidence to support a universal change from FNB to ACB for TKA patients within a multimodal analgesic protocol, perhaps the time is coming.

Competing Interests

Dr. Mariano has received an unrestricted educational funding (paid to his institution) for teaching programs from I-Flow Corporation/Kimberly-Clark (Lake Forest, California) and B Braun (Bethlehem, Pennsylvania). These companies had absolutely no input into any aspect of article preparation. Dr. Perlas declares no competing interests.

Correspondence

Address correspondence to Dr. Mariano: emariano@stanford.edu

References
