▽ Editorials

Continuous Perineural Infusions at Home: Narrowing the Focus

It is well established that postoperative pain, nausea, and vomiting represent the most frequent complications associated with (1) delays in hospital discharge and (2) increased frequency of unplanned hospitalization for patients undergoing ambulatory surgery. Although peripheral nerve blocks have been shown to be very effective in optimizing patient recovery[1] after hospital discharge, orthopedic patients frequently experience moderate to severe pain at home that is frequently not controlled by conventional prescriptions of oral opioids.[2]

In the past few years, several groups have explored the use of at-home perineural infusions of local anesthetic for postoperative pain control after ambulatory surgery. This research has benefited from (1) the introduction of ambulatory infusion pumps; (2) reported beneficial outcome after wound infusion of local anesthetic; (3) research and individual practitioners' experiences in the use of continuous nerve block techniques for postoperative analgesia after major orthopedic surgery; and (4) the introduction of ropivacaine, a local anesthetic providing preferential sensory block as well as a safety profile better than bupivacaine.

Ilfeld et al.[3-6] have made important original contributions to the acute orthopedic pain literature and especially the use of continuous perineural infusions at home. Their methodology has allowed for the determination of continuous nerve infusion effectiveness using both direct (average pain, worst pain) and indirect indices (e.g., oral analgesic use and associated sleep disturbances). They have studied the properties of continuous nerve infusions in several indications using several approaches.[3-6] Finally, they have both reviewed and validated characteristics of ambulatory infusion pumps.[7,8]

In their article published in this issue of *Regional Anesthesia and Pain Medicine*, Ilfeld et al.[9] report the results of a well-designed study. They compared 2 infusion regimens providing for a maximum volume of 10 mL per hour of ropivacaine 0.2% (8-mL/h infusion with 2-mL bolus *v* 4-mL/h infusion with 6-mL bolus). This pilot study provides new insights with respect to the role played by the basal infusion rate and the bolus volume in the patient's overall response. Although the primary end point was defined as a 50% reduction in the worst pain score on postoperative day 1, the authors also reported that the use of the 8/2 regimen was associated with fewer sleep disturbances on postoperative days 0 and 1, reinforcing the importance of functional end points when considering the effectiveness of a given postoperative pain protocol.

The report by Ilfeld et al. also illustrates the evolution of their group's practice in seeking better solutions for perineural catheter placement and the attached infusion device. In this study, the placement of the perineural catheter was achieved using a stimulating catheter (Arrow Inc., Reading, PA). The authors' success rate with this technique was 100%. Recently, Borgeat et al.[10] reported a 97% success rate with the use of a nonstimulating catheter. There is no doubt that the stimulating catheter represents an interesting alternative, but additional research is required to define the role of the stimulating catheter in our practice.

The authors reported that all pumps were returned via self-addressed padded envelopes. However, it is uncertain whether the return rate would be similarly

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high for less compliant patients not participating in a study protocol. One must recognize the importance of the capital investment associated with such a choice. Assuming similar performance of ambulatory pumps, third-party payment may play a primary role in the type of pumps that will be used.

This research is still in its infancy. Despite the advances of this literature to date, there are still many unanswered questions: (1) What is the best local anesthetic solution? What is the optimal local anesthetic concentration? What is the optimal mode of administration, i.e., the balance between infusion rates and patient-controlled boluses? What are the optimum volumes and durations for infusion? Are adjuncts useful for infusions? (2) What is the overall safety and efficacy of these techniques? (3) When are perineural infusions indicated versus wound infusions or intra-articular infusions? and (4) What role will continuous nerve infusions at home play in a number of orthopedic surgeries being performed as outpatient procedures such as minimally invasive joint replacement and hip arthroscopy surgery?

The type of local anesthetic, its concentration, infusion rate, the volume of the bolus, the lock-out period, and the total infusion volume/duration are issues that need to be finalized by the prescribing anesthesiologist. Finding answers to these questions not only requires knowledge of the relationship between concentration and volume but also an understanding of the role they play in the intensity of the postoperative pain by the patient and the type of surgery.[11] In their current study, Ilfeld et al.[9] used 500 mL of local anesthetic solution and a 60-hour infusion. Klein et al.[12] reported on the use of a 250-mL/48-hour infusion. With respect to nerve block additives, recently Ilfeld et al.[6] showed that the addition of clonidine (1 μg/mL) to the local anesthetic infusion mixture was not beneficial.

Regarding safety and efficacy, we need to acknowledge that this and other studies to date have been based only on the enrollment of a limited number of patients. Additional studies that include a much larger cohort are required to determine the safety of perineural infusions of local anesthetics at home.

There are a number of orthopedic surgeons who use intra-articular infusions of local anesthetic at home. This technique has also been shown to provide significant postoperative pain control at home, especially after shoulder surgery.[13] Yet, the criteria for selection of intra-articular versus wound versus perineural infusions at home for orthopedic indications remain to be established.

Another consideration for continuous nerve block dosing is the plan for active versus passive physical therapy. This not only depends on (1) the type of surgery (anterior cruciate ligament [ACL] versus ankle fusion) and (2) the technique (ACL using a hamstring autograft versus a patellar tendon autograft) but also the preference of the orthopedic surgeon (e.g., continuous passive motion for rehabilitation after shoulder surgery).

The introduction of new surgical approaches has led to the possibility of performing hip replacement as an outpatient procedure. To facilitate the functional recovery that requires full weight bearing within 2 to 3 hours after surgery and early discharge of minimally invasive hip replacement patients, continuous lumbar plexus blocks are performed. This technique as a part of a multimodal approach to postoperative pain control provides excellent postoperative pain control and minimizes the use of opioids and their associated side effects. Preliminary results indicate that the majority of patients are discharged home either the same day or the next morning.

Anesthesiologists need to recognize the role played by the surgical technique, the approach, and the type of surgery in the intensity of the postoperative orthopedic pain. For example, reconstruction of the ACL with a patellar tendon autograft is more painful than when an allograft (i.e., graft from cadaver) is used. It is clear that as indicated by Ilfeld et al.,[1] continuous nerve block infusions at home should be indicated preferentially to control moderate to severe pain lasting more than 12 to 24 hours. Consequently, to optimize the patient's recovery and

minimize the risks associated with the use of peripheral nerve blocks, especially in the ambulatory setting (infection, nerve injury, and so on), it is important to understand the relationship between the type of surgery and the intensity of pain experienced postoperatively.[14]

In conclusion, Ilfeld et al.[9] define several variables in a multifactorial response to this relatively new (but labor intensive) system of analgesia. Continuous nerve block techniques in orthopedics offer anesthesiologists the opportunity to show that they can play a crucial role in optimizing pain management, functional recovery, and outcome after ambulatory major orthopedic procedures. In this respect, this report by Ilfeld et al. provides each of us with essential preliminary data to apply these techniques to our daily practice. It is important that further study designs also include the role played by these techniques on overall patient outcomes.

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