Use of Catheters in the Postoperative Patient

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abstract

Continuous peripheral nerve block has been shown to be superior to traditional opioid-based analgesia in terms of improved analgesia with reduced sedation, nausea, pruritis, and hospital stay. Because of its safety and efficacy, continuous peripheral nerve block has broad application in ambulatory and pediatric patients. Techniques for continuous peripheral nerve block have advanced significantly in the past decade, particularly as a result of affordable, high-resolution ultrasound equipment that permits rapid and successful administration and results in reduced procedure-related pain, lower dose requirements, and fewer vascular punctures. Continuous peripheral nerve block is associated with some limitations, including infection, neurologic injury, local anesthetic toxicity, and patient falls. The benefits of continuous peripheral nerve block are becoming increasingly relevant in the ambulatory surgery setting where more complex procedures are being performed on an outpatient basis.

Although single injection nerve block also can provide excellent analgesia, the duration of pain relief using this technique is limited. In addition, it requires high concentrations of local anesthetic that are associated with dense motor and sensory effect.

By contrast, with continuous peripheral nerve block, the duration and intensity of local anesthetic effect can be tailored to the needs of the patient. Thus, common problems associated with intense local anesthetic effect such as limb neglect, falls, or complaints of the extremity being too numb can be avoided. For example, after shoulder surgery, interscalene blocks using dilute bupivacaine (0.125% versus 0.25%) provide comparable analgesia but with reduced compromise of motor function at the diaphragm. Improved diaphragm function is associated with higher oxygen saturation during postoperative recovery.16

ADVANCES

Historically, nerve stimulation has been used to guide catheter placement. However, in recent years, techniques for continuous peripheral nerve block have advanced significantly. The introduction of affordable, high-resolution equipment has made ultrasound the major, if not the dominant, technique for catheter placement. Studies comparing nerve stimulation to ultrasound confirm that ultrasound-guided blocks are performed more quickly with higher success rates, reduced procedure-related pain, lower dose requirements, and fewer vascular punctures than those performed using nerve stimulation.17-22

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A significant advantage of ultrasound-guided continuous peripheral nerve block placement is the ability to visually confirm accurate position by injecting local anesthetic through the catheter while imaging the nerve (Figure 1). This technique, originally described anecdotally, is now commonly reported as a method to verify catheter position.23,24

**COMPlications**

Complications most commonly associated with continuous peripheral nerve block include infection, neurologic injury, local anesthetic toxicity, and falls. For inpatients, the incidence of catheter infection ranges from 0.0% to 3.2%, whereas outpatient rates are <1%.1,13,25-26 Specific risk factors associated with infection have been identified and include catheter use >48 hours, lack of antibiotic prophylaxis, and axillary or femoral location.26 To date, there is no consensus on antibiotic prophylaxis in addition to that used for the surgical procedure.

Neurologic injury associated with continuous peripheral nerve block is usually transient and occurs in 0.3% to 2% of patients.11,25 Injury may occur during performance of the block as well as during the postoperative period where positioning injury has been implicated as a likely cause.11 Current outcome data reflect almost entirely nerve stimulation techniques. Unlike nerve stimulation techniques, when using ultrasound guidance, a safe distance can be maintained between the injecting needle and the nerve. More recent data with ultrasound-only techniques have been favorable with respect to the avoidance of serious nerve injury.27

The loss of sensory and motor function in a lower extremity is a risk for patient falls. In a recent report, 4 of 233 patients (1.7%) treated with continuous femoral nerve block after knee surgery fell as outpatients.28 These falls occurred despite patients receiving instruction not to bear weight on the affected extremity. This complication, although uncommon, is an additional example of the potential benefit in providing low concentration blocks that preserve more motor function and proprioception.

**MUltimodal Analgesia**

Currently, there is an increasing trend toward the use of multimodal analgesia. This practice involves the use of low concentration, motor-sparing blocks in conjunction with other analgesics such as opioids, nonsteroidal anti-inflammatory agents, and acetaminophen. It is hoped that this technique will facilitate early ambulation by providing excellent analgesia without accompanying motor weakness.

A significant advantage of continuous peripheral nerve block over single injection nerve block is the ability to provide prolonged analgesia with relatively low doses of local anesthetic (Figure 2). Unlike single injection nerve block, in which up to 150 mg of bupivacaine may be used as a single injection, analgesia can be initiated with as little as 25 mg through an indwelling catheter. Most authors report subsequent basal hourly infusion rates of 5 mL to 10 mL/hour using dilute solutions of either ropivacaine or bupivacaine.11,29-31 With these low rates of infusion, it is not surprising that local anesthetic toxicity is not listed as a complication in any large published series of continuous peripheral nerve block to date.

To date, no particular combination of drug, rate, regimen, or pump has been established as a “best practice” for continuous peripheral nerve block infusion. In most reports, accurately positioned catheters at a reasonable range of basal infusions (5 to 10 mL/hour) will provide analgesia that is superior to opioid-based techniques.

When considering the cost of catheter programs, the measurable differences between various pumps and local anesthetics should be considered carefully. Fixed-rate elastomeric pumps are an attractive option with respect to cost and ease of use for patients.

**Conclusion**

The use of continuous peripheral nerve block provides improved analgesia with fewer side effects than traditional opioid-based techniques. These benefits are increasingly relevant in the ambulatory surgery setting where more complex procedures are being performed on an outpatient basis. The safe and effective use of these catheters at home has been demonstrated in large trials in which patients manage and remove their own catheters.11,13

Although variations exist between institutions with respect to placement and management strategies, a number of trends are becoming apparent. First, ultrasound has emerged as the dominant technique...
for placing continuous peripheral nerve block. The ability to visualize nerves, blood vessels, and other relevant structures should provide additional safety with these procedures. Second, the low doses of local anesthetic that can be used successfully to provide analgesia with continuous peripheral nerve block are an attractive alternative to the dense motor and sensory effect associated with single injection nerve block. Finally, by reducing the need for hospitalization, the elusive goal of improved care at lower cost may be achieved.

REFERENCES


