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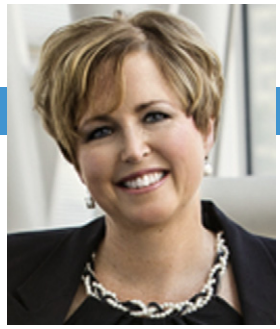

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New Techniques in Pediatric Pain Management: Continuous Peripheral Nerve Block

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OPTIMUM PERI-OPERATIVE pain management in children requires significant communication and coordination among the patient, the family, and the health care team. A plan that permits adequate pain control after major orthopedic surgery permits pediatric patients to recover sooner and provides for a shorter length of hospitalization. Advances in pain management through the use of a continuous peripheral nerve block (CPNB), provides children with regional anesthesia that creates sensory numbness in the extremity while at the same allowing for motor control (Moos, 2011). This column will review indications for CPNB in the pediatric population and the nursing implications for caring for children in the post-operative period.

A CPNB with continuous or intermittent analgesia and a local anesthetic, such as Ropivacaine, provides exceptional localized pain control and minimizes the need for systemic opioids (Polomano, Rathmell, Krenzischek, & Dunwood, 2008). Compared to a single injection of local anesthetic that provides for only 12–16 hours of pain control, infusions through a CPNB catheter extends the length of post-operative analgesia with minimal side effects (Gurnaney et al., 2014; Polomano et al., 2008).

CPNB catheters, inserted through the guidance of ultrasound, can be used for numerous types of surgery with the majority placed for orthopedic procedures (Dadure & Capdevila, 2012). CPNB is one component of a pain management plan; post-operatively, children will still require an intake of oral opioids and acetaminophen to maintain adequate pain control. There are several benefits of CPNB use in children. CPNB improves post-operative ambulation and reduces the use of analgesia, recovery time, length of stay, and costs per patient day (Dadure & Capdevila, 2012; Polomano et al., 2008).

Indications

The use of CPNB is contingent upon the type of surgery and the risk/benefit ratio for each patient. Determining the anatomical position of the CPNB is dependent upon the surgical site (Ilfeld, 2011). CPNB is useful in children requiring major orthopedic surgery associated with intense post-operative pain. CPNB is being used in pediatric surgeries such as congenital foot or hand malformation; traction of a femoral shaft fracture; anterior cruciate ligament (ACL) repair; osteotomies of the humeral, femoral, or tibial bone; femoral elongation; and osteosynthesis/exostosis (Dadure & Capdevila, 2012). In addition, CPNB has been beneficial in a multimodal methodology to treat various medical problems, such as inducing vasodilation to escalate blood flow and sympathectomy post vascular accident, or digit transfer/implantation (Dadure & Capdevila, 2012; Ilfeld, 2011). CPNB has also been used to "treat chronic

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pain, such as complex regional pain syndrome, intractable phantom limb pain, as well as pain from terminal cancer, and trigeminal neuralgia" (Ilfeld, 2011, p. 904). Originally CPNB was used during prolonged intra-operative surgical anesthesia and in treating intractable hiccups (Ilfeld, 2011).

Applications of CPNB

Peripheral Nerve Blocks: Upper Extremity

Michael is a healthy 15-year-old adolescent who is a member of his high school's football team. During a recent game, Michael tackled an opposing player, and his left arm was forcibly extended behind his opponent. He heard a popping sound followed by the feeling that he described as a "dead arm". Michael presented to the local emergency department and was diagnosed with a left shoulder traumatic dislocation. Because there was concern that there was a superior labrum anterior–posterior (SLAP) tear, Michael followed up with an orthopedic surgeon. An MRI showed damage to the shoulder ligaments, a Bankart tear. The surgeon suggested arthroscopic-assisted anterior superior capsule labral repair to correct the instability of Michael's left shoulder. During the surgery, the labrum was pulled back up, shifted, and then anchored into the socket portion of the scapula.

To aid in the management of acute post-operative pain, the anesthesia team inserted an interscalene nerve block with a continuous local anesthetic. The anesthesia team placed the peripheral interscalene nerve catheter intra-operatively between the anterior and middle scalene muscles in the neck; this enabled the instillation of local anesthetic toward the network of nerves that supply the arm and shoulder, the brachial plexus. The roots of the brachial plexus lie at the level of C5-C6 [Figure 1] (Gurnaney, Muhly, Kraemer, Cucchiaro, & Ganesh, 2015).

The interscalene method for a CPNB is specified for surgical procedures like Michaels which involve the upper extremity because the anesthetic is distributed primarily at C5 to C7 with minimal distribution at C8 to T1 (Moos, 2011). This surgical approach is often done with paresthesia, nerve stimulation, or ultrasound technique to prevent complications (Moos, 2011). A hollow stimulating needle is inserted to the desirable location, and the catheter is advanced through the needle into the interscalene space. Dextrose in sterile water is injected and observed on ultrasound, confirming good catheter placement and predicting adequate spread of the local anesthetic into the desirable location. An X-ray with dye injection is done to ensure that the catheter tip is in the interscalene groove. The catheter is secured in place with topical adhesive, and an occlusive dressing; then a bolus dose of 0.2% Ropivacaine is delivered through the catheter. Michael's vital signs remained stable throughout the procedure, suggesting a good response to the local anesthetic sensory block.

Intrascalene method is contradicted if the surgery involves the ulnar nerve and for children with pulmonary disease. The

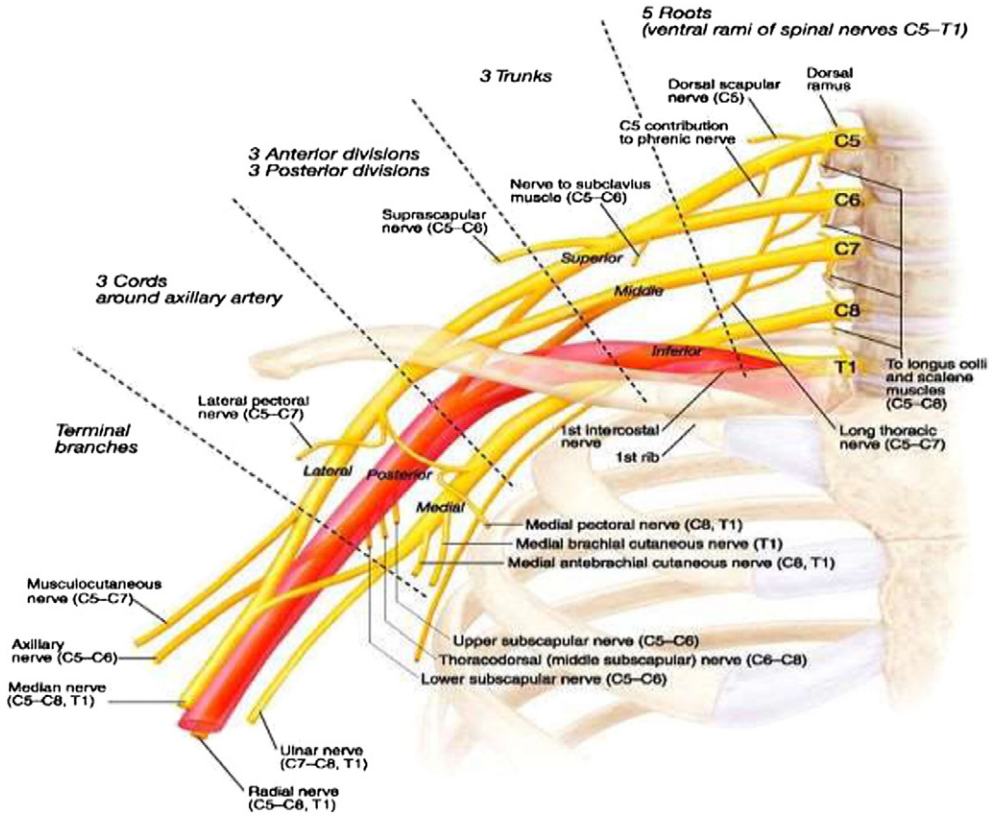

Figure 1 Brachial plexus anatomy. Reprinted from Tank and Gest (2009). The upper limb. In B. Sun & K. Scogna, (Ed.), *Lippincott Williams & Wilkins Atlas of Anatomy*. Philadelphia: Lippincott Williams & Wilkins. Reprinted with permission.