

Nurse Practitioner-Administered Chloroprocaine in Children with Postoperative Pain

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■ ABSTRACT:

Pain is a complex physical and emotional experience. Therefore, assessment of acute pain requires self-report when possible, observations of emotional and behavioral responses and changes in vital signs. Peripheral nerve and epidural catheters often provide postoperative analgesia in children. Administration of chloroprocaine (a short acting local anesthetic) via a peripheral nerve or epidural catheter allows for a comparison of pain scores, observations of emotional and behavioral responses and changes in vital signs to determine catheter function. The aims of this study are to describe the use chloroprocaine injections for testing catheters; patient response; and how changes to pain management are guided by the patient response. This study describes the use of chloroprocaine injections to manage pain and assess the function of peripheral nerve or epidural catheters in a pediatric population. We examined 128 surgical patients, (0-25 years old), who received chloroprocaine injections for testing peripheral nerve or epidural catheters. Patient outcomes included: blood pressure, respiratory rate, heart rate and pain intensity scores. There were no significant adverse events. The injection guided intervention by determining the function of regional analgesia in the majority (98.5%) of patients. Chloroprocaine injections appear to be useful to evaluate functionality of peripheral nerve and epidural catheters after surgery in a pediatric population.

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Distinguishing between pain, agitation, and emotional upset is often challenging in hospitalized children. But this distinction is fundamental to achieving safe and compassionate postoperative care in children (Berde & Sethna, 2002). Both pain and agitation may indicate a serious postoperative complication requiring immediate intervention. Emotional upset after a surgical procedure may be affected by

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several common symptoms in the immediate postoperative period, including fear, nausea, and pruritus. Complicating this further, pain contributes to emotional upset; and emotional upset and agitation worsen pain (Park & Foster, 2015). Distinguishing between these subjective symptoms is even more challenging in children who are preverbal or nonverbal or have limited verbal abilities (Solodiuk et al., 2010).

Epidural and peripheral nerve catheters (PNCs) are often used to manage moderate to severe postoperative pain. An infusion of local anesthetics (for PNCs) or a combination (for epidurals) of local anesthetics, opioids (typically fentanyl and hydromorphone), and clonidine is administered to provide analgesia postoperatively (Berde & Sethna, 2002). The goal for an epidural or a PNC placement for post-operative pain is to cause analgesia and numbness at the site of surgical pain.

When a child with an epidural or PNC self-reports or exhibits pain behaviors, an assessment of catheter function is necessary. In this pediatric institution, the bedside nurses assess pain using developmentally appropriate pain scales: Face, Legs, Activity, Cry, Consolability (FLACC) scale (Merkel, Voepel-Lewis, Shayevitz, Malviya, 1997), Wong-Baker FACES scale (Wong et al., 1999), numeric rating scale (von Baeyer et al., 2009), and/or individualized numeric rating scale (Solodiuk et al., 2010). When pain is unexpected, intense, and not consistent with illness or surgery, nurses page the nurse practitioner on the Pain Treatment Service to evaluate the patient. Because pain is a subjective experience with variability between patients, there is not a standardized level of pain intensity (Vila et al., 2005) that necessitates a call for evaluation. Instead, nurses request a call for evaluation based on their clinical judgment and knowledge of the patient's pain behaviors.

Typically, when a catheter is positioned to cause numbness and analgesia at the site of surgical pain, a chloroprocaine injection will result in rapid and dense numbness, analgesia, and motor block (within 3-5 minutes) along the expected nerve (for PNCs) or dermatome (for epidural catheters). A chloroprocaine injection allows for comparison of the patient before and after injection of a short-acting local anesthetic. It has been our practice to use chloroprocaine injections to evaluate PNCs and epidural catheters for several years; however, little has been published about the practice of assessing the sensory or motor level of the catheters outside the operating room. In this retrospective review of cases, we describe both the use of chloroprocaine by nurse practitioners and how interventions for pain management are guided by the outcomes of these injections.

LITERATURE REVIEW

Epidurals and peripheral nerve catheters are often tested with local anesthetics by anesthesiologists and certified nurse anesthetists (CRNAs) to provide rapid surgical pain relief and to assess the function of the catheter. This article reviews the use of chloroprocaine by nurse practitioners. Chloroprocaine is an ester-type local anesthetic with a rapid onset (3-5 minutes) and short duration (<60 minutes) (Schechter, Berde, & Yaster, 2003). A chloroprocaine injection rapidly blocks nerve impulses and allows the provider to compare the child's level of sensation and motor block before and after the injection of chloroprocaine.

Chloroprocaine has the advantages of both lower toxicity profile and short duration of action in the event of toxicity (Eng, Ghosh & Chin, 2014) as compared with longer-acting local anesthetics such as ropivacaine, lidocaine, and bupivacaine. Signs of local anesthetic toxicity include changes in level of consciousness, seizures, cardiac arrhythmias, and cardiac arrest. Chloroprocaine is rapidly metabolized in the plasma, which is especially important in neonates. Neonates have a decreased plasma concentration of albumin and α_1 -acid glycoprotein, which is the primary binding protein for amide local anesthetics. This decreased level of α_1 -acid glycoprotein in neonates persists until 3-6 months of age (Berde & Sethna, 2002), increasing the probability of toxic effects of local anesthetics in neonates using per kilogram dosing considered safe for older children (Gunter, 2002). For this reason, amide local anesthetics such as ropivacaine and bupivacaine are not recommended in neonates. Continuous infusions of chloroprocaine have been administered via epidural catheters in neonates for up to 96 hours without adverse effects (Ross, Reiter, Murphy & Boesky, 2015). In addition, paravertebral nerve blocks infusing continuous chloroprocaine in infants (<1 year old) with esophageal atresia have been managed for up to 8 days without any adverse events reported (Bairdain et al., 2015). Although the overall incidence of systemic toxicity in response to local anesthetics has decreased significantly in the past 30 years, from 0.2% to 0.01% (Faccenda & Finucane, 2001), the risk is still present. Toxicity has been reported both with unintentional intravascular injection (Cladis & Litman, 2004) and with large per kilogram doses of 3% chloroprocaine (Hernandez & Boretsky, 2016).

METHODS

After institutional review board approval was obtained for waiver of consent for a retrospective review of the

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