

Pediatric Perioperative Pain Management

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KEYWORDS

- Pediatric anesthesia • Pediatric acute pain • Analgesia • Pediatric orthopedic surgery
- Multimodal pain management • Regional anesthesia

KEY POINTS

- Effective pediatric perioperative pain control in patients undergoing orthopedic surgery is crucial for better outcomes, patient comfort, and satisfaction.
- Inadequate management of postoperative pediatric pain may stem from apprehension about serious complications from analgesic medications.
- Initial perioperative pain planning begins with a multidisciplinary meeting between the patient, patient's family, surgeon, and anesthesiologist.
- Acute pain control regimens are customized based on type of surgery, surgical site, age of the patient, anticipated severity of postoperative pain, and patient or family expectations.
- Multimodal strategies and regional anesthesia are useful adjuncts to perioperative analgesia.

INTRODUCTION

Effective perioperative pain management for the pediatric orthopedic patient continues to be challenging. Avoiding the undertreatment of pediatric pain is critical, because inadequate analgesia may lead to longer hospital stays, patient dissatisfaction and an increased risk of morbidity and mortality.¹ Rabbits and colleagues² studied children who underwent inpatient surgery and found a significant deterioration in health-related quality of life at 1-month follow-up in children who suffered severe postoperative pain. Yet, evidence suggests that postoperative pediatric pain may not be adequately treated. For optimal outcomes, perioperative pain management should begin with a surgeon-led multidisciplinary discussion with the patient, their parents, and anesthesiologist regarding expectations before surgery.

Perioperative pain management comprises numerous pharmacologic and nonpharmacologic treatment modalities. Treatment modalities include regional and local anesthesia,

dissociative anesthesia, and intravenous sedation (deep and conscious). Nonpharmacologic methods include cognitive behavioral interventions and distraction. Acute postoperative pain management regimens are based on the patient, type of orthopedic surgery performed, and current and anticipated postoperative pain. There is a wide diversity of orthopedic surgeries ranging from traumatic fracture care to elective orthopedic surgeries that require different considerations regarding pain management. This article provides an evidence-based overview of preoperative, intraoperative, and postoperative pain management, as well as their possible complications in pediatric orthopedic surgery.

PREOPERATIVE CONSIDERATIONS

Effective pain management begins preoperatively with a thorough assessment of the expectations of both the patient and the patient's family, and the expected level and duration of

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postoperative pain. The child and parents need to have information regarding the specific surgical procedure, expected severity of pain, and the available nonpharmacological and pharmacologic treatments available provided to them in a clear and simple manner. This discussion ideally takes into account the patient's and family's level of education and is undertaken in their native language.

Premedication

Preoperative premedication reduces patient anxiety, lessens the stress of separation from parents before surgery, and aids in the induction of general anesthesia. Midazolam is the most frequently used drug for pediatric premedication. Midazolam is a short-acting benzodiazepine with a fast onset administered via multiple routes but preferred in its oral form.³ Oral midazolam (0.5–0.7 mg/kg) provides effective preoperative premedication without a significant risk of respiratory adverse effects.⁴ Midazolam is commonly administered 15 to 20 minutes before planned induction. Although midazolam has several beneficial effects, it also has several possible adverse effects, such as excessive sedation, amnesia, restlessness, and cognitive impairment.⁵

Nonpharmacologic Interventions

Nonpharmacologic interventions, which include distractions and relaxation techniques, may help ease the patient's preoperative anxiety regarding the impending surgery and pain. Child life specialists are available at many institutions to provide support through play therapy, music therapy, and other methods. Use of these interventions in the holding area or in the operating room just before induction has been noted to decrease anxiety and improve pain control and patient cooperation.⁶ The presence of the parents at induction is another potential strategy but is variably permitted based on institutional preferences. According to Kain and colleagues,⁷ children older than 4 years old, those with parents with low anxiety levels, or children with a low baseline level of activity benefit from parental presence during induction.

INTRAOPERATIVE CONSIDERATIONS

Intraoperative pain considerations are an integral aspect of the intraoperative management plan for the pediatric patient. There are numerous opportunities to positively affect the postoperative course: from anesthetic medication options to regional blocks. The ultimate

goal is to provide adequate analgesia for treatment, and minimize physical discomfort and negative psychological impact while ensuring the safety and welfare of the child.

General Anesthetics

The new Food and Drug Administration (FDA) warning from December 4, 2016 regarding general anesthetics will certainly cause some parental concerns and questions. The warning states general anesthesia and sedation drugs used in children younger than 3 years of age undergoing anesthesia for more than 3 hours or repeated use of anesthetics "may affect the development of children's brains." The FDA has also issued a labeling change for 11 common general anesthetic and sedative agents that bind to gamma-aminobutyric acid (GABA) or N-methyl-D-aspartate acid (NMDA) receptors, including all anesthetic gases, such as sevoflurane, and intravenous agents, such as propofol, ketamine, barbiturates, and benzodiazepines.⁸ Despite this warning, the current literature remains difficult to interpret due to confounding factors. Children who require multiple procedures at this young age often have other sources of anoxic or inflammatory insult to the developing brain that may have caused injury before receiving anesthesia. Recent study has sought to fill the voids in the literature. Davidson and colleagues⁹ recently demonstrated that less than an hour of exposure to sevoflurane was not associated with poorer neurodevelopmental outcomes in a randomized controlled trial of infants younger than 60 weeks. Sun and colleagues¹⁰ had similar conclusions in the Pediatric Anesthesia and Neurodevelopment Assessment (PANDA) study, a sibling-matched cohort study of children younger than 36 months. The anesthetic group was exposed to various combinations of inhaled and intravenous anesthetics, including propofol, thiopental, ketamine, and midazolam. There was no difference in IQ scores between siblings when assessed at ages 8 to 15 years. Given this new FDA warning, Andropoulos and Greene¹¹ recommend an extensive preoperative discussion between parents, surgeons, other physicians, and anesthesiologists about duration of anesthesia, any plans for multiple general anesthetic exposures for multiple procedures, and the risks and benefits of possibly delaying the procedure until after 3 years of age.

Although rare, in the late postoperative period pediatric patients may display maladaptive behavioral changes days, weeks, or even months after surgery. These behaviors include

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