

# Fear and Loathing in the ER: Managing Procedural Pain and Anxiety in the Pediatric Emergency Department

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## ABSTRACT

The pediatric emergency department can be frightening for children. Visits are unplanned, and frequently accompanied by significant emotional and physical distress. While treatment of pain and anxiety in children have been historically inadequate, the barriers to their treatment have largely been overcome through increased awareness, child- and family-focused care, standardized assessment, institutional safety protocols, and newer pharmacologic agents. The pediatric emergency physician is now a primary advocate for treatment of children's pain and anxiety and for the safe and appropriate use of procedural sedation. This article focuses on the treatment spectrum available for providing safe and effective procedural sedation, analgesia and anxiolytic therapy.

**KEYWORDS:** Procedural sedation, analgesia

## INTRODUCTION

The pediatric emergency department (PED) can be frightening for children. Unplanned visits, family anxiety, illness and injury lead to significant emotional and physical distress. Historically, treatment of pain and anxiety in children has been poorly delivered.<sup>1</sup> Infants and children were once thought to experience pain differently from adults, or not at all. Physicians may be hesitant to prescribe stigmatized medications, such as narcotics, to children. A long-discredited belief that analgesia may mask important diagnostic findings is still widely held. During different stages of development, anxiety and pain can be difficult to assess in infants and children and are often underestimated.<sup>2</sup>

Thankfully, myths and stigma surrounding the treatment of pain and fear have been largely minimized. Using standardized assessment tools, newer pharmacologic agents, improved monitoring, institutional safety protocols, the pediatric emergency physician (PEP) now advocates for and provides analgesia, anxiolysis and procedural sedation for PED patients.<sup>3</sup> This article focuses on the treatment spectrum available for providing procedural sedation, anxiolysis and analgesia (PSA).

## Assessment through the developmental lens

Pain is subjective, making self-report the preferred method of assessment. However, when combined with anxiety of an unfamiliar situation, pain is difficult to assess accurately in infants and children. Self-reported numeric pain scales, commonly used in adults, can be applied to older children and adolescents. Self-report pain scales such as the FACES or color analog pain scales may be used in pre-school and school-aged children.<sup>4</sup> For infants and toddlers, in whom self-report is not appropriate, a behavioral scale such as the Face, Legs, Activity, Cry, Consolability (FLACC) scale can be substituted.<sup>5</sup>

Developmentally disabled children, particularly those who are non-verbal, may display increased anxiety and maladaptive reactions to pain or anxiety. Observational pain scales are available to assess pain in these children, but frequently it is the caregivers who recognize subtle changes in state or behavior that indicate discomfort in their child. PEPs should actively enlist the partnership of the parents of non-communicative patients in the assessment and re-evaluation process in the PED.

## Non-pharmacologic anxiolysis

Anxiety and pain are intricately interrelated. The approach to pain must include an appreciation of anxiety, and vice versa. Beginning with a non-threatening, child-friendly environment, gearing the PED toward child and family comfort is a first step toward minimizing children's anxiety. Environmental approaches, including pictures on the walls and ceiling and the availability of books, toys, and age-appropriate videos in PSA areas, provide comfort and therapeutic distraction to anxious patients and their families.

**Table 1.** Commonly-used pain assessment scales in the PED

Scale	Ages
Neonatal Infant Pain Scale (NIPS)	Newborns
Face, Legs, Activity, Cry, Consolability (FLACC)	Newborns to Age 7
Faces Pain Scale*	3 years and up
Non-Communicating Children's Pain Checklist	5 years and up, non-verbal or with developmental disability
Numeric Rating Scales (0-10, e.g.)*	7 years and up
Visual Analog or Color Analog Scales*	7 years and up

\*Self-reported pain scales

Children fear the unknown, including the possibility of a painful procedure. While preschool and young school-age children are not likely to respond to reasoning or detailed explanation, emotional support at an age-appropriate level reduces pain and anxiety. Older children can be comforted by a reassuring explanation of anticipated procedures.

Child life specialists are a crucial part of the PED team, providing therapeutic methods of distraction, anticipation, coping and education.<sup>6</sup> These specialists use books, pictures, toys, music, video, guided imagery and other tools during preparation, procedure and recovery. In the absence of a dedicated specialist, ubiquitous smart phones and tablet computers allow PEPs to enlist parents or PED staff in providing child-centered distraction such as videos or music as an adjunct to PSA. Allowing family members to remain present during procedures reduces distress, especially if the family can be enlisted to guide the patient through the procedure.

**Pharmacologic anxiolytics**

Even painless procedures can lead to significant anxiety in children, sometimes precluding successful completion. Procedures for which analgesia will be necessary may also require treatment of anxiety. For instance, a child with a facial laceration will require local anesthesia, but may also benefit from anxiolytics during the delicate repair. In concert with non-pharmacologic techniques, medications specifically aimed at reducing anxiety can limit a child’s distress and ensure successful procedure completion.

Benzodiazepines are the most commonly used anxiolytics in the PED. Midazolam has the advantages of rapid onset and relatively brief duration, and may be given by oral, intravenous (IV) or intranasal (IN) routes. The IN route, using an atomizer and syringe, provides rapid transmucosal absorption, which bypasses hepatic first-pass metabolism, making the medication immediately bioavailable.<sup>7,8</sup>

**Table 2. Commonly-Used Anxiolytics in the Pediatric ED**

	Dose	Route
Midazolam	0.5 mg/kg	PO
	0.1 mg/kg	IV
	0.2-0.4 mg/kg	IN
Nitrous Oxide	40-70%	Inhaled

**Analgesia in the PED**

In addition to assessment for pain in all PED patients, protocols that call for the timely administration of pain medications, even for less severe pain, allow for earlier management.<sup>9</sup> Triage and nursing protocols can identify patients with pain early in their ED stays, and oral medications such as ibuprofen, acetaminophen, and even oral or IN narcotics can be administered.

In addition to systemic analgesics, topical analgesia can be applied in anticipation of IV cannulation, laceration

repair, lumbar puncture or other procedures. Early placement of topical anesthetics can shorten procedure time and improve results. Needle-free lidocaine powder or liquid and ethyl chloride vapocoolants can further reduce IV-associated pain, and a variety of products using vibration or cooling are reported to mitigate pain from IV insertion. Concentrated sucrose solution and non-nutritive sucking have been shown to decrease the pain response in neonates and young infants.

Topical anesthetics can also be applied in anticipation of wound closure. Lidocaine, epinephrine and tetracaine (LET) can be compounded in a liquid or gel and applied to lacerations, and offers effective anesthesia for many small wounds. Alternative repair techniques are considered for appropriate wounds; cyanoacrylate wound adhesive or adhesive “butterfly” bandages may be painless substitutes for sutures.

Local anesthesia is achieved using 1-2% lidocaine or 0.25-0.5% bupivacaine. Administration causes a brief but intense stinging sensation, which can be mitigated by buffering with

**Table 3. Commonly-Used Analgesics in the Pediatric ED**

	Dose	Route	Comments
<b>Topical preparations</b>			
LET (liquid or gel)	0.175 ml/kg max 3 ml	Topical	
EMLA or LMX <sub>4</sub>	“Small Amount”	Topical	
<b>Local anesthetics</b>			
1% lidocaine with epinephrine	Minimal necessary	Injected within a wound	Injection causes stinging pain. Use epinephrine with caution in areas of terminal circulation. Max: 5 mg/kg of lidocaine
<b>Non-narcotics</b>			
Acetaminophen	15 mg/kg	PO, PR	Max 3g/day or 75 mg/kg/day
Ibuprofen	10 mg/kg	PO	Caution in anticoagulated patients, asthmatics
Ketorolac	0.5-1 mg/kg	IV, IM	Similar to ibuprofen. Max 15-30 mg
Nitrous oxide	40-70%	Inhaled	Avoid in intracranial injury, pneumothorax, bowel obstruction
<b>Narcotics</b>			
Morphine	0.1-0.2 mg/kg	IV, IM, SQ	Frequent histamine release, observe for respiratory depression
Hydromorphone	0.015 mg/kg	IV, IM	
Hydrocodone	0.2 mg/kg	PO	Typically available in combination with acetaminophen
Fentanyl	1-2 mcg/kg	IV, IM, IN	Rigid chest is a rare but severe side effect. IV formulation (50 mcg/ml) can be given intranasally

SQ = subcutaneous, IM = intramuscular, IV = intravenous, IN = intranasal

sodium bicarbonate, warming to room temperature, and administering the smallest necessary dose as slowly as possible. For small lacerations, a 1 ml insulin syringe allows a slowly titrated injection through a tiny 29-gauge needle, causing less distress than a larger syringe and avoiding using more anesthetic than necessary. When possible, regional blocks may provide a broader area of anesthesia with fewer injections.<sup>10</sup>

Opiates, morphine being the archetypal example, are the workhorses of ED analgesia, with rapid and generally predictable absorption and onset. Monitoring for respiratory depression is recommended, though typical doses are generally safe. Morphine may cause histamine release, with flushing and pruritus, nausea and hypotension, which are less common with synthetics such as fentanyl. Fentanyl has been associated with sudden onset of chest wall rigidity, which requires aggressive treatment, including respiratory support and muscle relaxation. Naloxone may be used for reversal, given at a dose of 0.1 mg/kg IV and repeated every 2-5 minutes.

An alternative to IV opiates is IN fentanyl. Like midazolam, fentanyl becomes rapidly bioavailable when administered to the nasal mucosa using an atomizer and syringe. It has relatively rapid onset, and is less irritating to the mucosa than is midazolam. IN fentanyl can be used for brief painful procedures (e.g., I&D) or as a bridge to definitive analgesia prior to IV access.<sup>11,12</sup> Fentanyl may also be effective when nebulized, though there is less data using this administration.

**Sedation in the PED**

There are situations when analgesia alone is inadequate to safely care for PED patients, and prudence calls for the use of sedation. Sedation can be achieved using a pure sedative without analgesic properties (e.g., for a radiographic procedure), a sedative with some analgesic properties (e.g., for suturing a laceration) or one with strong analgesic properties (e.g., for fracture reduction). As with any medication, the PEP must weigh risks and benefits in the context of a patient’s history and needs.

PEPs have the training and skills, including emergency management of pediatric airways and resuscitation, necessary to safely manage the sedated child and any potential untoward effects of sedatives.<sup>13-16</sup> Although serious complications are rare, it is critical that sedation providers in the PED establish and adhere to institutional guidelines for training, credentialing and provision of PSA, and refresh this

training to maintain familiarity with the medications and their appropriate applications.<sup>14,16</sup>

Ketamine is a dissociative anesthetic with sympathomimetic effects, providing analgesia and sedation but preserving airway reflexes and cardiovascular function. This makes ketamine an attractive sedative for painful procedures.<sup>17</sup> While ketamine may cause some increase in oral secretions, this side effect is rarely clinically significant, though some PEPs co-administer antisialagogues.<sup>18</sup> Ketamine’s most serious adverse effect is laryngospasm, though this too is rare. Its most common side effect, however, is nausea, for which some practitioners provide empiric antiemetics. Occasionally ketamine is associated with a non-dose-dependent dysphoric emergence reaction, and is contraindicated in those with known psychosis.

Propofol is gaining traction in PEDs as a short-acting sedative-hypnotic whose rapid onset, short duration and antiemetic effect make it ideal for many procedures.<sup>19</sup> While it provides no analgesia in and of itself, it can be combined with ketamine or other analgesia to achieve excellent sedation for painful procedures. In fact, when mixed and co-administered with ketamine, the total doses of either medication can be reduced.<sup>20</sup> When provided as a constant infusion, propofol can provide prolonged post-intubation sedation for critically ill patients who can tolerate its modest lowering of blood pressure.

Like propofol, the barbiturates, including pentobarbital, provide sedation but little or no analgesia. Adverse reactions are rare, and primarily include symptoms related to hypoventilation.

Inhaled nitrous oxide is an effective sedative used alone or in combination with analgesics. It has a rapid onset, and

**Table 4. Commonly-Used Sedative Agents in the Pediatric ED**

	Dose	Route	Comments
Dissociative			
Ketamine	1-2 mg/kg	IV	IM dosing less predictable, may be associated with increased incidence of laryngospasm. Nausea is common. Emergence reactions may occur.
Sedative/Hypnotics			
Propofol	1-2 mg/kg, repeat doses of 0.5 mg/kg	IV	Little/no analgesia, hypotension common but not often clinically important
Pentobarbital	2-5 mg/kg	IV	No analgesia. Respiratory depression and hypotension possible
Inhaled agent			
Nitrous oxide	40-70% admixed with oxygen	Inhaled	Some analgesia. Nausea is common
Combined Medications			
“Ketofol” 1:1 mixture of ketamine/propofol	Starting dose of 0.5-1 mg/kg of each agent	IV	Unproven benefit over ketamine alone

once removed, its effects are reversed within seconds to minutes. It provides some analgesia, making it useful for brief painful procedures. Nausea and vomiting are common but tend to be brief. The drug requires a gas scavenging system, which may limit its use to specific locations within an ED.

There is evolving pediatric experience with newer sedatives such as dexmedetomidine, which appears promising, though it may require longer induction time than similarly effective agents such as propofol.<sup>21</sup>

## CONCLUSION

Pediatric emergency physicians are uniquely positioned to advocate for and manage pain, anxiety and distress in sick and injured children throughout the ED experience. Untreated pain and anxiety are not excusable given our understanding of pediatric pain and its lasting effects. PEPs possess a unique understanding of the modalities for pain management – including but not limited to pharmacologic choices. The PEP should understand the relative safety and efficacy of each of these modalities and should be prepared with a systematic approach to pediatric pain.

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## Disclosures

None

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