Pediatric Procedural Sedation, Analgesia, and Anxiolysis

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Pediatric patients presenting for evaluation of both traumatic injuries and nontraumatic illness often require analgesia and/or sedation to facilitate workup and treatment, as well as anxiolytics to ameliorate fears and anxiety.

For many years, pediatric patients undergoing procedures in the ED have received inadequate pain management and sedation. Children's (and parents') anxieties and distress leading up to and during a potentially painful or anxiety-inducing procedure are now more easily mitigated by the appropriate use of a variety of pediatric-appropriate analgesics, sedatives, and anxiolytics. The ability to provide adequate, minimally invasive sedation and analgesia is critically important to performing successful procedures in children, and is a hallmark of excellent pediatric emergency care.

The following case vignettes, based on actual cases, illustrate the range and routes of medications available to provide appropriate analgesia, sedation, and anxiolysis.

Cases

Case 1

A 4-year-old boy presented to the ED for evaluation of a fractured wrist sustained after he fell off his bed during a temper tantrum. At presentation, the patient's vital signs were: blood pressure (BP), 110/70 mm Hg; heart rate (HR), 100 beats/min; respiratory rate (RR), 28 breaths/min; and temperature (T), 99.5°F. Oxygen saturation on room air was within normal limits. The patient's weight was within normal range for his age and height at 15 kg (33 lb).

Upon examination, the child appeared agitated and in significant distress; his anxiety increased after an initial attempt at placing an intravenous (IV) line in his uninjured arm failed.

The emergency physician (EP) considered several options to ameliorate the child's anxiety and facilitate evaluation and treatment.

Case 2

After accidentally running into a pole, a 6-year-old girl presented to the ED for evaluation and suturing of a large laceration to her forehead. At presentation, the patient's vital signs were: BP, 115/70 mm Hg; HR, 95 beats/min; RR, 24 breaths/min; and T,

98.6°F. Oxygen saturation on room air was within normal limits. The patient's body weight was normal for her age and height at 20 kg (44 lb).

On examination, the patient was awake, alert, and in no acute distress. However, she immediately became tearful and visibly upset when she learned that an IV line was about to be placed in her arm.

The physician instead decided to employ an IV/needle-free strategy for this wound repair, as well as anxiolysis.

Case 3
A 5-year-old girl was brought to a community hospital ED by emergency medical services after falling from a balance beam and landing headfirst on the ground during a gymnastics class. Prior to presentation, emergency medical technicians had placed the patient in a cervical collar. At presentation, the patient's vital signs were: BP, 105/75 mm Hg; HR, 115 beats/min; RR, 28 breaths/min; and T, 99.1°F. Oxygen saturation on room air was within normal limits. The patient's body weight was normal for her age and height at 18 kg (39.6 lb).

Although the neurological examination was normal, the patient had persistent midline cervical tenderness as well as hemotympanum. The EP ordered a head and neck computed tomography (CT) scan, but shortly after the patient arrived at radiology, the CT technician informed the EP that she was unable to perform the scan because the patient kept moving and would not stay still.

The EP considered several sedatives to facilitate the CT study.

Case 4
A febrile, but nontoxic-appearing 3-week-old girl was referred to the ED by her pediatrician for a lumbar puncture (LP) to diagnose or exclude meningitis. However, the mother's own recent negative experience with an epidural analgesia during the patient's delivery, made the neonate's mother extremely anxious that the procedure might be too painful for her daughter.

The EP considered the best choice of medication to provide analgesia and allay the mother's concerns prior to performing the LP in this neonatal patient.

Overview and Definitions
Analgesia describes the alleviation of pain without intentional sedation. However, pediatric patients typically receive sedative hypnotics (anxiolytics) both for analgesia and for anxiolysis to modify behavior (eg, enhance immobility) and to allow for the safe completion of a procedure.[1] The ultimate goal of procedural sedation and analgesia is to provide a depressed level of consciousness and pain relief while the patient maintains a patent airway and spontaneous ventilation.[2]

Sedation Continuum
The American Society of Anesthesiologists (ASA) classifies procedural sedation and analgesia based on a sedation continuum that affects overall responsiveness, airway, ventilation, and cardiovascular (CV) function.[3] Procedural sedation is subcategorized into minimal, moderate, and deep sedation.

Minimal Sedation. Formally referred to as anxiolysis, minimal sedation is a state in which the patient is responsive but somewhat cognitively impaired, while maintaining all other functions rated in the sedation continuum.

Moderate Sedation. Previously referred to as "conscious sedation," moderate sedation is a state of drug-induced depression of consciousness that still enables the patient to maintain purposeful responses to age-appropriate verbal commands and tactile stimulation, spontaneous ventilation, and CV integrity.

Deep Sedation. Deep sedation causes a drug-induced depression of consciousness that may potentially impair spontaneous ventilation and independent airway patency, while maintaining CV function. A

deeply sedated patient is usually arousable with repeated painful stimulation.

Dissociative Sedation. This level of sedation induces a unique, trance-like cataleptic state characterized by profound analgesia and amnesia, with retention of protective airway reflexes, spontaneous respirations, and cardiopulmonary stability. The dissociative state can facilitate the performance of moderate-to-severe painful procedures, as well as procedures requiring immobilization in uncooperative patients.[4]

Contraindications to Procedural Sedation

Though there are no absolute contraindications to procedural sedation in children, its use is generally determined based on ASA's patient physical status classification system. In this grading system, procedural sedation is appropriate for pediatric patients with a physical status of Class I (normally healthy patient) or Class II (a patient with mild systemic disease—eg, mild asthma).[5] The EP should consult with a pediatric anesthesiologist prior to sedating a patient with an ASA status of Class II or higher, or a patient with a known laryngotracheal pathology.[1]

Pre- and Postsedation Considerations

History and Physical Examination

Prior to patient sedation, the EP should perform a focused history, including a determination of the patient's last meal and/or drink, and a physical examination. The history should also include known allergies and past or current medication use—specifically any history of adverse events associated with prior sedation. Pregnancy status should be determined in every postpubertal female patient.

The physical examination should focus on the cardiac and respiratory systems, with particular attention to any airway abnormalities or possible sources of obstruction.[1,3]

Fasting

A need for fasting prior to procedural sedation remains controversial: Current ASA guidelines for fasting call for fasting times of 2 hours for clear liquids, 4 hours after breastfeeding, 6 hours for nonhuman milk or formula feeding, and 8 hours for solids.[6]

Fasting prior to general anesthesia has become a common requirement because of the risk of adverse respiratory events, including apnea, stridor, bronchospasm, emesis, and pulmonary aspiration of gastric contents. However, these events rarely occur during pediatric procedural sedation in the ED, and it is important to note that the American College of Emergency Physicians' standards do not require delaying procedural sedation based on fasting times. There is no strong evidence that the duration of preprocedural sedation-fasting reduces or prevents emesis or aspiration.[7]

Equipment

In 2016, the American Academy of Pediatrics (AAP) updated its "Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures,"[1] including the essential equipment required for the safe administration of sedation, which can be remembered using the following "SOAPME" mnemonic:

Size: appropriate suction catheters and a functioning suction apparatus (eg, Yankauer-type suction);

Oxygen: An adequate oxygen supply and functioning flow meters or other devices to allow its delivery;

Airway: Size-appropriate equipment (eg, bag-valve-mask or equivalent device [functioning]), nasopharyngeal and oropharyngeal airways, laryngeal mask airway, laryngoscope blades (checked and functioning), endotracheal tubes, stylets, face mask;

Pharmacy: All the basic drugs needed to support life during an emergency, including antagonists as indicated;

Monitors: Functioning pulse oximeter with size-appropriate oximeter probes, end-tidal carbon dioxide monitor, and other monitors as appropriate for the pro-

...the American College of Emergency Physicians' standards do not require delaying procedural sedation based on fasting times.

cedure (eg, noninvasive blood pressure, electrocardiogram, stethoscope); and **E**quipment: Special equipment or drugs for a particular case (eg, defibrillator).[1]

Personnel

The 2016 AAP guidelines[1] also indicate the number and type of personnel needed for sedation—in addition to the physician performing the procedure—which is primarily determined by the intended level of sedation as follows:

Minimal Sedation. Though there are no set guidelines for minimal sedation, all providers must be capable of caring for a child who progresses to moderate sedation.

Moderate Sedation. Intentional moderate sedation necessitates two practitioners: one practitioner to oversee the sedation and monitor the patient's vital signs, who is capable of rescuing the patient from deep sedation if it occurs; and a second provider proficient at least in basic life support to monitor vital signs and assist in a resuscitation as needed.

Deep Sedation. For patients requiring deep sedation, the practitioner administering or supervising sedative drug administration should have no other responsibilities other than observing the patient. Moreover, there must be at least one other individual present who is certified in advanced life support and airway management.[1]

Discharge Criteria

Prior to discharge, pediatric patients must meet predetermined criteria that include easy arousability, a return to baseline mental status, stable age-appropriate vital signs, and the ability to remain hydrated.[1,3] In addition, while late postsedation complications are rare, caregivers should be provided with specific symptoms that would warrant immediate return to the ED.

Available Options for Analgesia and Sedation

Several different methods of providing analgesia and pediatric procedural sedation are available, ranging from nonpharmacological methods to topical and parenteral medication administration.

Nonpharmacological Options: Child-Life Specialists

Child-life specialists can be particularly helpful with pediatric emergency patients. With a background in normal child development, child-life specialists utilize myriad distraction techniques and coping strategies to help patients within the stressful environment of an ED. Studies have shown that the presence of a child-life specialist may reduce the depth of sedation needed for certain procedures.[1]

Sucrose

Several studies have identified the benefits of sucrose as a pain reliever in neonates. Available as a 12% to 25% solution, sucrose decreases noxious stimuli and is a useful analgesic for such common neonatal procedures as venipuncture, circumcision, heel sticks, Foley catheter insertion, and LP. Efficacy of sucrose for these procedures is greatest in newborns, and decreases gradually after 6 months of age. The effectiveness of sucrose is enhanced when it is given in conjunction with nonnutritive sucking or maternal "skin-to-skin" techniques. There are no contraindications to the use of sucrose.[8]

Nonopioid Systemic Analgesia

Nonopioid oral analgesics (NOAs), such as acetaminophen and the nonsteroidal anti-inflammatory drug (NSAID) ibuprofen, are appropriate for mild-to-moderate procedural pain. The NOAs can be given alone or in conjunction with an opioid to enhance the analgesic effect for patients with severe pain.

Acetaminophen. Acetaminophen, which also has antipyretic properties, can be administered orally, rectally, or IV. Since acetaminophen is not an NSAID and does not affect platelet function, it is a good choice for treating patients with gastrointestinal (GI) pain.

Adverse effects of acetaminophen, which is metabolized by the liver, include hepatotoxicity in toxic doses. The suggested oral dose for infants and children weighing less than 60 kg (132 lb) is 10 to 15 mg/kg per dose every 4 to 6 hours as needed, with a maximum dose of 75 mg/kg/d for infants and 100 mg/kg/d for children. Rectal dosing for infants and children weighing less than 60 kg (132 lb) is 10 to 20 mg/kg every 6 hours as needed, with a maximum daily dose of 75 mg/kg/d in infants, and 100 mg/kg/d in children.

Ibuprofen. Ibuprofen, an NSAID with both antipyretic and anti-inflammatory properties, acts as a prostaglandin inhibitor and is indicated for use in patients over 6 months of age. Since ibuprofen inhibits platelet function, it can cause GI bleeding with chronic use. The suggested pediatric dose for ibuprofen is 5 to 10 mg/kg per dose every 6 to 8 hours orally, with a maximum dose of 40 mg/kg/d.[9]

Local Anesthesia

Local anesthetics administered via the topical or subcutaneous (SC) route provide anesthesia by temporarily blocking peripheral or central nerve conduction at the sodium channel.

LET Gel. This topical anesthetic combination composed of 4% lidocaine, 0.1% epinephrine, and 0.5% tetracaine (LET gel) is commonly used on patients prior to repair of a skin laceration. Its peak onset of action occurs in 30 minutes, with an anesthetic duration of 45 minutes. The epinephrine component of LET reduces blood flow to the anesthetized area, which increases duration of action but also creates a small risk of vasoconstriction in the areas supplied by end arteries, such as in the penis, nose, digits, and pinna.[9]

EMLA and LMX4. Topical lidocaine anesthetics are extremely useful in the ED because their application can help reduce the pain of minor procedures, when they are applied in adequate time prior to initiating the procedure to reach peak effect. Eutectic mixture of 2.5% lidocaine and 2.5% prilocaine (EMLA) and liposomal 4% lidocaine (LMX4) are the most commonly used topical lidocaine anesthetics. The peak analgesic effect of EMLA occurs within 60 minutes, with a duration of 90 minutes; LMX4 reaches its analgesic peak after 30 minutes with duration of up to 60 minutes.

Because of the slight delay of the time-to-peak effect, these topical anesthetics are not useful for emergent procedures. Further, neither EMLA nor LMX4 is approved for nonintact skin injuries such as lacerations.[9] Both LMX4 and EMLA are approved for use in intact skin, providing effective analgesia for procedures such as venipuncture, circumcision, LP, and abscess drainage.

Subcutaneous Lidocaine. When SC injection of lidocaine is preferred, a useful technique to reduce the pain of administration is to warm the lidocaine, alkalinize the solution with 1 mL (1 mEq) sodium bicarbonate to 9 mL lidocaine,[6] prior to injecting it slowly with a small-gauge needle.[8]

Vapocoolant Lidocaine. Vapocoolant sprays produce an immediate cold sensation that is effective in reducing localized pain in adults. Studies looking at its efficacy in children are not as convincing, with some studies suggesting the cold sensation is quite distressing for many children.[8]

Opioids

Opioids are commonly chosen for pediatric procedural sedation because of their short onset of action and ability to produce significant analgesia with varying amounts of sedation. Fentanyl and morphine are the most widely used opioid analgesics to manage moderate-to-severe procedural pain in children.

Morphine. Morphine remains the gold standard for pediatric opioid analgesia, partly because it can be administered SC, IV, intramuscularly (IM), and orally. Its properties are more quickly achieved via the IV route, as the onset of action is 4 to 6 minutes. The standard IV dose of mor-

phine is 0.1 mg/kg per dose, and can provide analgesia for up to 4 hours.

Adverse effects of morphine include dependence (though not an issue with a single emergency dose), respiratory depression, nausea, vomiting, constipation, urinary retention, hypotension, and bradycardia. Naloxone can rapidly reverse these adverse effects.

Fentanyl. Fentanyl, which is 100 times more potent than morphine, can be administered IV, transdermally, or transmucosally. When given IV, the onset of action of fentanyl is 2 to 3 minutes, and duration of action of 30 to 60 minutes. For sedation and analgesia, the suggested IV dose of fentanyl in neonates and young infants is 1 to 4 mcg/kg every 2 to 4 hours as needed, and for older infants and children, 1 to 2 mcg/kg every 30 to 60 minutes as needed.

Adverse effects of fentanyl are respiratory depression and chest wall rigidity,[9] which can be rapidly reversed with naloxone (the dose of naloxone by patient weight is the same as that given to reverse adverse effects of morphine and fentanyl).

Codeine. A weaker opioid analgesic, codeine is not recommended for routine pediatric use because of its significant potential to hypermetabolize to morphine in some children, leading to overdose.[6]

Benzodiazepines: Midazolam

Benzodiazepines, which act on the type A gamma-aminobutyric acid receptor, causing muscle relaxation, anxiolysis, and anterograde amnesia, are useful for pediatric procedural sedation. Due to its short half-life, midazolam is the most common benzodiazepine used in pediatric patients. Midazolam can be delivered via different routes of administration, including orally, IM, IV, and transmucosally.

Intramuscular Route. Intramuscular midazolam has been shown to cause deep sedation at doses of 0.3 mg/kg, with maximum sedation occurring at 45 minutes, recovery beginning by 60 minutes, and the most common side effect being euphoria.[10]

Intravenous Route. Intravenous midazolam is used extensively in pediatric procedural sedation and is usually given at a dose of 0.05 to 0.1 mg/kg, with a maximum dose of 2 mg.

Even among small children, midazolam is usually quite safe when given alone, but because it does not provide effective analgesia, it often requires combination with an opioid for effective procedural sedation. Flumazenil may be given for rapid reversal of known benzodiazepine-induced respiratory depression, but it should be avoided in children with seizure disorders.

Propofol

Propofol is now frequently employed for pediatric sedation outside of the operating room. Propofol has excellent sedation properties but, like midazolam, does not provide analgesia and necessitates a second agent such as ketamine or an opioid for successful completion of more painful procedures. However, for children in whom sedation is required to facilitate simple neuroimaging of the head or spine, propofol is a very useful agent given the child's quick return to his/her baseline mental status following the procedure.

Regarding contraindications, since propofol contains egg lecithin and soybean oil, it was once considered inappropriate for use in patients with an egg or soy allergy. Recent data, however, have refuted this belief, and while the package insert for propofol still lists patient allergy to egg, egg products, soy, or soybeans as a contraindication to use,[11] the American Academy of Allergy, Asthma and Immunology recently concluded that patients with soy allergy or egg allergy can receive propofol without any special precautions.[12]

Since propofol is a powerful sedative and can cause a greater depth of sedation than that intended, providers must be comfortable with both monitoring and managing the pediatric airway. The induction dose of propofol is 1 mg/kg with repeated doses of 0.5 mg/kg to achieve the

desired level of sedation. One emergency medicine-specific study by Jasiak et al[13] found a mean cumulative propofol dose of 2.1 mg/kg for pediatric procedures given in a median of three boluses, with younger children requiring an overall higher mg/kg induction dose. Another study by Young et al[14] showed an induction dose of 2 mg/kg to be well tolerated and without increased adverse events for pediatric procedural sedation.

When used properly, propofol has been shown to be safe and effective in pediatric patients. A recent review by Mallory et al[15] looking at 25,433 cases of EP administration of propofol to pediatric patients noted serious complications in only 2% of patients, including one unplanned intubation, one cardiac arrest, and two aspirations.

Ketamine

Dissociative procedural sedation is frequently utilized in pediatric patients, for which ketamine is usually the agent of choice given its fast onset of action, multiple modes of administration, and robust pediatric safety data. Ketamine is a unique agent because of its sedative, analgesic, and paralytic-like properties. A phencyclidine derivative, ketamine exerts its effect by binding to the N-methyl-D-aspartate receptor, and may be given IM or IV, with usual dosing of 1 to 1.5 mg/kg IV, or 2 to 4 mg/kg IM. Unlike other sedatives, there is a "dissociation threshold" for ketamine, and further dosing does not increase its effects.[16]

Because of multiple observations and reported cases of airway complications in infants younger than 3 months of age, it is not recommended for routine use in this age group. While ketamine-associated infant airway events are thought by some experts to not be specific to ketamine (and more representative of infant differences in airway anatomy and laryngeal excitability), risks seem to outweigh benefits for routine use in this cohort.[16]

Ketamine is known to exaggerate protective airway reflexes and can cause la-ryngospasm, so it is best avoided during procedures that cause a large amount of pharyngeal stimulation. The overall rate of ketamine-induced pediatric laryngospasm is low in the general population (0.3%), and when it does occur, can usually be treated easily with assisted ventilation and oxygenation.[17]

Prior concerns of ketamine increasing intracranial pressure (ICP) have been shown not to be the case by recent data, which in fact demonstrate that ketamine may instead actually lower ICP.[18]

For many pediatric centers, including the authors', ketamine is a first-line agent to facilitate head and/or neck CT in otherwise uncooperative children. Emesis is the most common side effect of ketamine, but the incidence can be significantly reduced by pretreating the patient with ondansetron.[19] Though ketamine may also be combined with propofol, there is no robust pediatric-specific evidence showing any benefits of this practice.

Nitrous Oxide

Nitrous oxide (N_2O), the most commonly used inhaled anesthetic agent used in the pediatric ED, provides analgesia, sedation, anterograde amnesia, and anxiolysis. It can be given in mixtures of 30% to 70% N_2O with oxygen, has a rapid onset of action (<1 minute), and there is rapid recovery after cessation. In patients older than 5 years of age, N_2O is usually given via a demand valve system, which will fall off the patient's face if he or she becomes overly sedated.

Nitrous oxide is usually very well tolerated with few serious events, the most common being emesis.[20] Absolute contraindications to its use are few and include pneumothorax, pulmonary blebs, bowel obstruction, air embolus, and a recent history of intracranial or middle ear surgery.

Intranasal Analgesia

Intranasal (IN) analgesics are becoming increasingly popular for pediatric proce-

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dures because of their rapid onset of action compared with oral medications, without the need for IV or "needle" access prior to administration.

Intranasal Fentanyl. The EP should use a mucosal atomizer when administering midazolam or fentanyl via the IN route. The atomizer transforms these liquid drugs into a fine spray, which increases surface area, improving mucosal absorption and central nervous system concentrations when compared with IN administration via dropper.[21]

In a study by Klein et al,[22] IN midazolam effectively provided sedation, with more effective diminution of activity and better overall patient satisfaction than with either oral or buccal midazolam. Intranasal midazolam causes a slight burning sensation, and some patients report initial discomfort after administration. The half-lives of IN and IV midazolam are very similar (2.2 vs 2.4 hours).[23]

Intranasal Fentanyl. IN fentanyl is an excellent alternative to IV pain medications for patients in whom there is no IV access. When given at a dose of 1.7 mcg/kg, IN fentanyl produces analgesic effects similar to that of morphine 0.1 mg/kg.

The only reported adverse effect associated with IN fentanyl has been a bad taste in the mouth.[24] Another study of children aged 1 to 3 years showed a significant decrease in pain in 93% of children at 10 minutes, and 98% of children at 30 minutes, with no significant side effects.[25]

Intranasal fentanyl is a great choice for initial and immediate pain control in children with suspected long bone fractures, and is especially useful in facilitating their comfort during radiographic imaging.

Managing a Child for Radiographic Imaging

To facilitate a relatively rapid procedure such as obtaining plain films or a CT scan, anxiolysis, rather than analgesia, is required. Given its quick and predictable onset of action, IN midazolam is an excellent choice for pediatric patients requiring imaging studies. If, however, a mucosal atomizer is not available for IN drug delivery and the patient is already in radiology and requires emergent imaging studies, oral midazolam should *not* be given as an alternative because of its delayed onset of action. In such cases, placing an IV line and administering IV propofol offers the best chance of achieving quick and effective anxiolysis to obtain the images required to exclude clinically important injuries.

In hospitals that restrict the use of propofol in young children outside of the operating room—and when there are no findings suggestive of impending cerebral herniation—a safe and effective alternative is IV ketamine at a dose of 1.5 mg/kg.

Cases Continued

Case 1

[The 4-year-old boy with the fractured wrist.]

Recognizing that repeated attempts at IV placement in a child with a contralateral extremity fracture often leads to escalating distress and anxiety, the EP decided against further attempts to place an IV line. Instead, he gave the child fentanyl via the IN route, which immediately relieved the patient's pain and facilitated radiographic evaluation. After administrating the fentanyl IN, the EP instructed a member of the ED staff to apply LMX4 cream to several potential IV sites and then cover each site with occlusive dressings. Afterward, the patient was taken to radiology, and X-ray images of the fracture were easily obtained. When the patient returned from imaging, the ED nurse was able to place an IV line at one of the sites that had been previously anesthetized with LMX4 cream.

The EP consulted with the orthopedist, who determined that the child's distal radius fracture necessitated closed reduction. To facilitate the procedure, the patient was given 1.5 mg/kg of ketamine. After a successful closed reduction, the orthopedic chief resident recommended the EP dis-

charge the 15-kg (33-lb) patient home in the care of his parents, with a prescription for 5 mL oral acetaminophen and codeine suspension four times a day as needed for pain (5 mL = acetaminophen 120 mg/codeine 12 mg, and codeine dosed at 0.5-1 mg/kg per dose). Prior to discharge, the EP counseled the patient's parents on the risks of codeine hypermetabolism in children. However, based on the parents' expressed concerns, the EP instead discharged the patient home with a prescription for 4 cc oral acetaminophen-hydrocodone elixir every 4 to 6 hours as needed for pain instead (dosing is 0.27 mL/kg; elixir is hydrocodone bitartrate 7.5 mg/acetaminophen 325 mg/15 mL).

Case 2
[The 6-year-old girl with a large laceration to her forehead.]
The type of laceration sustained by this patient was appropriate for treatment with a local anesthetic combined with an agent for non-IV anxiolysis. Thirty minutes prior to suturing, LET gel was applied over the open wound site, and 5 minutes prior to initiating closure of the wound, the patient received IN midazolam. Since the LET cream was placed on the wound 30 minutes prior to the procedure, the site was well anesthetized for both irrigation and closure. The anxiolytic effects of the IN midazolam resulted in a calm patient, who was happy and playful throughout the procedure.

After successfully closing the wound, the physician discharged the patient home in the care of her parents, with instructions to apply bacitracin ointment to the wound site three times a day for the next 3 days, and give the patient over-the-counter acetaminophen elixir for any mild discomfort.

Case 3
[The 5-year-old boy who suffered cervical spine injuries after falling head-first off of a balance beam during gymnastics.]
Since no mucosal atomizer was available for IN drug delivery, and hospital policy restricted the use of propofol in young children outside of the operating room, the patient was given 1.5 mg/kg of IV ketamine. Within 45 seconds of ketamine administration, the child had adequate dissociative sedation, which allowed for high-quality CT scans of both the head and neck without incident.

Case 4
[The febrile 3-week-old female neonate referred by her pediatrician for evaluation and LP.]
Since this neonate did not appear toxic, the EP delayed the LP by 30 minutes to allow time for application of a topical anesthetic to minimize associated procedural pain. Thirty minutes prior to the LP, LMX4 cream was applied to the patient's L4 spinal interspace, and just prior to the procedure, the patient was given a pacifier that had been dipped in a solution of 4% sucrose. The neonate was then positioned appropriately for the LP and barely squirmed when the spinal needle was introduced, allowing the EP to obtain a nontraumatic cerebrospinal fluid sample on the first attempt.

Conclusion
Addressing pediatric pain and anxiety, especially preceding and during procedures and radiographic imaging, is a serious challenge in the ED. Several means are now available to provide safe and effective sedation, analgesia, and anxiolysis in the ED, with or without IV access. Many of the medications utilized, however, can cause significant respiratory and CV depression, making proper patient selection and monitoring, and training of involved personnel imperative to ensure safe use in the ED. Appropriate use of the agents and strategies discussed above will allow EPs to reduce both procedural pain and anxiety for our youngest patients—and their parents.

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