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Guidance for the Clinician in Rendering Pediatric Care

CLINICAL REPORT

Relief of Pain and Anxiety in Pediatric Patients in Emergency Medical Systems

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KEY WORDS
pain, stress, anxiety, analgesia, opiates, topical anesthesia

ABBREVIATIONS
ED—emergency department
EMS—emergency medical services
IV—intravenous
NPO—nil per os

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abstract

FREE

Control of pain and stress for children is a vital component of emergency medical care. Timely administration of analgesia affects the entire emergency medical experience and can have a lasting effect on a child's and family's reaction to current and future medical care. A systematic approach to pain management and anxiolysis, including staff education and protocol development, can provide comfort to children in the emergency setting and improve staff and family satisfaction. *Pediatrics* 2012;130:e1391–e1405

BACKGROUND

A systematic approach to pain management is required to ensure relief of pain and anxiety for children who enter into the emergency medical system, which includes all emergency medical services (EMS) agencies, interfacility critical care transport teams, and the emergency department (ED).[1] The administration of appropriate analgesia in children varies by age as well as by training of the ED team (which includes physicians, nurses, physician assistants, and nurse practitioners), however, and still lags behind analgesia provided for adults in similar situations.[2] Furthermore, neonates are at highest risk of receiving inadequate analgesia.[3,4]

Encouragingly, improvements in the recognition and treatment of pain in children have led to changes in the approach to pain management for acutely ill and injured pediatric patients.[5] Studies have shown an increase in opiate use in children with fractures.[6–8] Recent advances in the approach and support for pediatric analgesia and sedation, as well as new products and devices, have improved the overall climate of the ED for patients and families in search of the "ouchless" ED.[5,9] Increased parental education regarding pain and sedation, physician comfort and desire to enhance patient satisfaction, and a quest to satisfy accreditation regulations have appropriately driven this effort. System-wide approaches for pain management awareness and strategies work best if they are woven into the fabric of the emergency medical system through education and protocol development. The purpose of this report was to provide information to optimize the comfort and minimize the distress of children and families as they are cared for in the emergency setting.

STATEMENT OF THE PROBLEM

Barriers to adequate pain control for children in the ED and in out-of-hospital emergency care settings include difficulty in assessing pain in

young patients, unfamiliarity with new products and techniques, fear of medication adverse effects, staffing limitations, and time constraints.[10–15] Children's pain is underestimated because of the underuse of appropriate assessment tools and the failure to account for the wide range of children's developmental stages. Analgesic agents typically used for pain in other settings might not be used in the ED because of concerns regarding masking of symptoms and prevention of appropriate diagnoses as well as misconceptions or personal biases by physicians or parents against using stigmatized medications like opiates. Topical anesthetics may be underused because of concerns regarding delay in definitive treatment, cost, or lack of availability. In addition to the child's developmental level, culture, ethnicity, and race affect pain management from both a patient and physician perspective. It is clear that cultural differences can contribute to how an individual or family manifests behavioral distress and anxiety[16–19]; however, no predictable patterns have emerged with regard to a consistent pain experience within ethnic groups.[20] Studies have noted that Hispanic and black individuals with long-bone fractures were less likely to receive analgesics than were non-Hispanic white individuals.[21–23] A review of the National Hospital Ambulatory Medical Care Survey from 1992 to 1997 demonstrated that among patients with fractures, black children covered by Medicaid were least likely to receive parenteral sedation and analgesia.[24] Opioid prescribing for painful conditions has increased for all patients, but white patients continue to be more likely to receive an opioid prescription than black, Hispanic, or Asian patients.[25]

Although few physicians still believe that children do not feel pain the same way adults do and that pain has no untoward consequences,[15] there is a growing recognition of how even minor painful procedures, such as needle sticks, can affect a child's longer-term emotional well-being.[26] Inadequate sedation and pain control can worsen a child's reaction to subsequent, possibly even nonpainful procedures. Neonates who undergo procedures with inadequate analgesia have long-standing alterations in their response to and perceptions of painful experiences.[27–32] Inadequate pain control as well as invalidation of the child's pain during oncology procedures leads to significantly increased pain scores for subsequent painful procedures.[33,34] Posttraumatic stress symptoms can occur after procedures or stressful medical experiences that are not accompanied by appropriate pain control or sedation, and this can lead to adverse reactions to subsequent procedures.[35–37]

In the ED, children often present with a constellation of symptoms but no final diagnosis; they are usually unknown to the treating physician, have a wide range of medical or surgical problems, and are unlikely to be fasting on arrival.[11] These factors make their assessment and the selection of appropriate analgesic intervention more complicated. As well, the emergency setting can be a busy, fast-paced environment in which heightened patient and parental anxiety increases the perception of pain and makes its treatment more difficult.[12]

Optimal pain management requires a thorough understanding of pain assessment and management strategies.[12,13] Education in pain management is a recent emphasis for hospitals as well as regulatory agencies, such as The Joint Commission: "Each and every patient has a right to the assessment and management of pain."[38,39]

NEW INFORMATION

Setting the Stage for Relief of Pain and Anxiety

Physicians can begin to address pain and anxiety as soon as a child comes in contact with the EMS system. Prehospital EMS providers typically receive relatively little pain management instruction.[40,41] The development of pain assessment and management protocols specifically for prehospital EMS providers, along with educational initiatives, can improve pain management in the field.[40,42–44] Several adult studies and 1 pediatric trial show that analgesics, such as opiates and tramadol hydrochloride, can be used in prehospital protocols to decrease pain scores without causing respiratory depression.[45–48] Alternative delivery systems, such as transmucosal medications or inhaled nitrous oxide, could offer pain control without requiring intravenous (IV) access, providing advantages in the field as well as in the hospital setting.[49–53] Some EMS systems have implemented a "toolbox" of distraction equipment on units as an adjunct to providing pain relief in the anxious, uncomfortable child.

Assessment and Management of Pain, Stress, and Anxiety in the ED

The Environment

It is clear that there is a relationship between anxiety and perceived pain in children and adults.[54] The creation of an appropriate environment is essential to minimize the pain and distress of a child's ED visit.[12] Ideally, each child should be placed in a private room. Even in a general ED, there can be a dedicated pediatric area that provides a child-friendly, calming environment.[11] Colorful walls, pictures on the ceiling, and a collection of toys and games will minimize fear induced by this strange setting.[12]

Stress management and emotional support are essential to providing a comfortable environment for the child and have been shown to reduce anxiety in older children as well as parental perception of pain in younger children.[55] Adequate preparation has been shown to decrease anxiety and increase a child's coping before a minor procedure or surgery.[56–58] Distraction can range from simple techniques, such as a bubble blower or pinwheel used by the child during a painful injection, to techniques that require more time and training, such as hypnosis.[59–61] Structural changes, such as outfitting each procedure room with equipment that can provide videos and music, and distraction stations equipped with bubble columns, light wands, and imagery projectors, can be helpful in engendering a feeling of safety and comfort in young children.[62–67] A child life specialist based in the ED has the ability to (1) decrease anxiety and pain perception using developmentally appropriate education and preparation to patients and families; (2) teach the child and staff simple distraction techniques, deep breathing, progressive relaxation, or guided imagery; (3) help the child to develop and execute coping plans during difficult events in the ED; (4) educate the child about the ED environment and his or her diagnosis; and (5) support family involvement in the child's care.[68–70] The child life specialist has an important role. He or she is one of a few professionals in the emergency setting who is not in a position to cause emotional or physical pain to the child[71,72]; however, nurses, physicians, and ancillary staff also share in this responsibility and can learn from and teach each other these techniques. Optimally, the treatment plan for each child should be communicated to the entire medical care team with specific regard to the environmental and behavioral management of anxiety in the emergency medical setting. This includes teaching children what to expect during a procedure or during their visit, showing them specific medical supplies they will be using, offering them choices when appropriate, giving them a role or a job during a procedure or hospital visit, and using distractions. Creating a relaxing environment can help a child to feel more comfortable and less stressed.

Allowing (but not requiring) family presence during painful procedures also may be of benefit. Although there is no evidence that family presence decreases pain, their presence for procedures can decrease child distress.[73–76] Family presence does not usually increase anxiety of the child or decrease the procedure success rate of experienced physicians; however, it is important to monitor parental responses to limit the adverse effects on all parties.[73,74,77] In addition, involving the parent as a coach for the child during the procedure is useful in reducing anxiety and distress.[78–82]

Pain Assessment in the ED

The Joint Commission standards include mandatory pain assessments for all hospital patients.[39] Pain is, by nature, a subjective experience and is influenced by social, psychological, and experiential factors. For example, patients who experience chronic pain may not report the same pain level or exhibit the same facial cues and vocalizations as those who are new to the pain experience. Pain assessment, which is obviously the first step toward appropriate treatment, can, therefore, be more complex than just obtaining a single pain score; it is also essential to pay attention to changes in pain scores in response to treatment. The current clinical standard for pain assessment is a self-report scale. Simple numerical scales, such as verbally grading pain from 0 to 10, are often used in adults; although there is evidence that this technique may be accurate in older children with moderate to severe pain, it may be less accurate for those with abdominal pain.[83,84] Several well-validated scales exist for children as young as 3 years to report their own pain level.[85–88] The revised FACES pain scale, the Wong-Baker Faces scale, and the 10-cm Visual Analog Scale have been used successfully in many EDs caring for children.[86,88–92] Other dimensions can be added to the visual analog scale, such as height, width, and color, and are valid methods for assessment of acute pain in children.[93] For those who are unable to use self-report scales, behavioral scales can be combined with an evaluation of the patient's history and physical findings to assess the level of a child's pain.[94–96] Pain in a neonate can be evaluated using the Neonatal Infant Pain Scale,[97] and pain in infants, young children, and those with cognitive impairment can be assessed using the FLACC (face, legs, activity, crying and consolability) scale.[98–104] It must be noted that few, if any, scales have been validated in the prehospital setting.

Pain Management in the ED

Pain assessment should occur routinely at the triage desk along with vital signs; however, reassessment during the ED stay is imperative to determine treatment effect.[12,13,105] In addition, physicians should take into account the possibility that combining multiple minor procedures may produce as much stress and discomfort as a single major procedure.[106]

Controlling Pain Related to Needle Sticks and Other Minor Procedures

Patients with less acute conditions also may require analgesia.[107] Protocols should be developed to facilitate the delivery of appropriate medications, such as acetaminophen, ibuprofen, or oral opiates, to these patients (Table 1).

TABLE 1 Triage Oral Analgesic Administration Guidelines

Purpose
To provide analgesic therapy to patients presenting to triage with a complaint of pain
Procedure
1. Assess pain score using a validated tool
2. Immediately triage to a treatment room all patients with severe pain as assessed by triage nurse and consideration of pain score
3. For those not requiring immediate evaluation with pain score >3 (0–10 scale) or chief complaint consistent with pain, consider administration of oral analgesic
4. Assess recent analgesic use
Contraindications
1. Allergy to analgesic (consider alternative)
Medications
1. Ibuprofen (avoid if the patient has aspirin allergy, anticipated surgery, bleeding disorder, hemorrhage, or renal disease)
2. Acetaminophen (avoid if the patient has hepatic disease or dysfunction)
3. Oral oxycodone

TABLE 2 Guidelines for Use of Topical Lidocaine in the ED

Topical anesthetics should be considered in any patient who has a high likelihood of undergoing a non-emergent invasive procedure on intact skin in the ED. These include the following:
• Intravenous line placement or venipuncture
• Lumbar puncture
• Abscess drainage
• Joint aspiration
Discussion with parents should bring up the following issues:
• Topical lidocaine does not provide complete pain relief
• Some patients may require a procedure before topical lidocaine reaches its full effectiveness (see below)
• Discuss with the parents how they feel the patient will tolerate the topical lidocaine application, in terms of anticipation of the procedure as well as sensory integration disorders
Contraindications:
• Emergent need for IV access
• Allergy to amide anesthetics
• Nonintact skin
• EMLA only: Recent sulfonamide antibiotic use (trimethoprim-sulfamethoxazole, erythromycin-sulfisoxazole); congenital or idiopathic methemoglobinemia
The topical anesthetic dose should be lower for patients <12 mo old or weighing <10 kg
Placement of topical lidocaine:
• Intravenous line placement
Topical lidocaine should be placed in at least 2 sites over veins amenable to placement of an IV line, preferably judged by the nurse placing the IV line.
Care should be taken to avoid mucous membrane contact or ingestion
• Lumbar puncture
Placement of topical lidocaine for lumbar puncture should be considered as soon as the decision is made to perform a lumbar puncture; accurate placement may require consultation with the clinician performing the procedure
Liposomal topical lidocaine reaches full effectiveness in 30 min, heated topical lidocaine in 20 min, EMLA reaches full effectiveness in 60 min.

Topical anesthetics can be placed proactively to control the pain associated with placement of IV catheters and other minor procedures. For example, in 1 inner-city pediatric ED, 90% of patients requiring IV access did not undergo this procedure until at least 60 minutes after triage.[108] A prediction model was developed whereby the patient's chief complaint and medical history, combined with an experienced triage nurse assessment, determined with some accuracy which patients had a high probability of requiring IV access.[109] These findings could be adapted to develop topical anesthetic protocols for painful procedures in other EDs, taking into account their patient volume, acuity, and flow characteristics (Table 2). Some topical anesthetics have been developed that produce anesthesia more rapidly than eutectic mixture of local anesthetics (EMLA; AstraZeneca, Wilmington, DE). A topical liposomal 4% lidocaine cream (LMX_4; Ferndale Laboratories, Ferndale, MI) provides anesthesia in approximately 30 minutes.[110,111] Heat-activated systems have shortened the time required to as low as 10 to 20 minutes for IV insertion pain relief.[112] Topical anesthetics also have been reported to improve procedural success rates, likely because of decreased movement leading to better accuracy.[113,114] When the procedure cannot be delayed or needs to take place in the prehospital setting, other techniques can be used; intradermal lidocaine injection as well as intradermal saline with benzyl alcohol preservative decreases the pain of venous cannulation without affecting procedural success rate.[115–119] Needle-free injection systems using either powder or liquid jet injection reduce the onset time even more.[106,120–123] Vapocoolant sprays that have immediate onset of action have been found to be effective in reducing venipuncture pain in adults; however, they are less effective in children, likely because of their intolerance of the unpleasant cold feeling resulting from the required administration time.[124,125] Recent innovations include a vibrating device that, when applied to the proximal extremity over a cold pack, may decrease the pain of venipuncture and immunizations by taking advantage of the "gate" theory of pain. However, further study is required to determine the comparative efficacy of this technique.

Similar protocols should be developed for topical anesthetic placement for laceration repair at triage (Table 3). Laceration repair should be completed with an emphasis on minimizing pain and anxiety. Several topical anesthetic/vasoconstrictor combinations, such as lidocaine, epinephrine, and tetracaine, which can be made by the in-hospital pharmacy as a liquid or gel preparation, provide excellent wound anesthesia in 20 to 30 minutes.[126,127] EMLA cream also provides topical anesthesia for laceration repair, although it is not approved by the US Food and Drug Administration for this purpose.[128,129] Tissue adhesives, such as octyl cyanoacrylate, provide essentially painless closure for low-tension wounds.[130,131] Steri-Strips (3M, St Paul, MN) provide similar painless closure and are less expensive than currently available tissue adhesives.[132] Absorbable sutures should be considered for facial wounds that must be sutured to avoid the pain and anxiety produced by suture removal.[133,134]

TABLE 3 Guidelines for Use of LET (a Topical Anesthetic for Open Wounds)

Eligibility
• LET can be applied to simple lacerations and may be applied to complex or deeper lacerations that may require supplemental subcutaneous anesthetic administration.
Contraindications
• Allergy to amide anesthetics
• Gross contamination of wound
Procedure
• LET should be placed according to standard ED procedure; time of placement should be documented on triage sheet
• Dose: 3 mL for children >17 kg; 0.175 mL/kg in children <17 kg[a]
(1) Place LET on open wound and cover with occlusive dressing or place cotton ball soaked with LET solution into wound
(2) Allow LET to soak into wound for 10–20 min or until wound edges appear blanched.

LET, lidocaine, epinephrine, and tetracaine.
[a] Based on maximum dose of 5 mg/kg of lidocaine.

Lidocaine can be used alone in urgent situations or after topical anesthetics have been applied. Lidocaine can be injected in an almost painless manner.[115] This technique includes buffering the anesthetic with bicarbonate, warming the lidocaine before injection, and injecting slowly with a small-gauge needle.[135–139] Lidocaine buffered with bicarbonate made in advance can be stocked in the ED and will remain stable for up to 30 days.[140,141]

The pain of intramuscular injection can be reduced using the shortest needle length possible to reach the intramuscular tissue, and applying concurrent manual pressure to the injection site.[142–145]

Neonatal Pain Management in the ED

Simple changes in practice can minimize painful stimuli for infants. Protocols for topical anesthetic placement should include neonates. Topical anesthetics for procedures ranging from circumcision to venipuncture are safe in newborn infants and even preterm infants, with appropriate dosing and short administration times.[146–148]

Recent studies have suggested methods by which neonatal distress during painful procedures can be minimized. Sucrose has been found to decrease the response to noxious stimuli, such as heel sticks and injections, in neonates and has even been demonstrated to reduce subsequent crying episodes during routine care, such as diaper changes.[149–161] This effect seems to be strongest in the newborn infant and decreases gradually over the first 6 months of life. Nursing protocols that allow for the use of sucrose before painful procedures are in place at many hospitals (Table 4). A 12% to 25% sucrose solution that is made by the pharmacy or is available commercially can be used (Sweet-Ease, Children's Medical Ventures, Norwell, MA). The use of a pacifier alone or in conjunction with sucrose also has been shown to have analgesic effects in neonates undergoing routine venipuncture.[162] Skin-to-skin contact of an infant with his or her mother and breastfeeding during a procedure decrease pain behaviors associated with painful stimuli.[163,164]

Available evidence supports the use of local and topical anesthetic for lumbar puncture in neonates.[165,166] Protocols can allow for the timely placement of topical anesthetic, or injected buffered lidocaine can be used at the site of needle insertion before the procedure. Concerns over the increased difficulty of lumbar puncture after local anesthetic use have proved to be unfounded, and one study even demonstrated improved success with the use of topical anesthetic.[113,165,167]

Pain can be decreased in neonates by the elimination of heel sticks and intramuscular injections. Venipuncture seems to be less painful than heel lancing for obtaining blood for diagnostic testing.[168] When the intramuscular route is necessary, topical anesthetic should be used.[169] Use of distraction techniques discussed previously, ice, and less painful injection techniques can also be efficacious.[170–173] The use of lidocaine as the diluent for ceftriaxone can decrease the pain of intramuscular injection.[174]

TABLE 4 Guidelines for Use of Sucrose in the ED

Indications
• Use as an adjunct for limiting the pain associated with procedures such as heel sticks, venipuncture, IV line insertion, arterial puncture, insertion of a Foley catheter, and lumbar puncture in neonates and infants younger than 6 mo
Procedure
1. Administer 2 mL of 25% sucrose solution by syringe into the infant's mouth (1 mL in each cheek) or allow infant to suck solution from a nipple (pacifier) no more than 2 min before the start of the painful procedure
2. Sucrose seems to be more effective when given in combination with a pacifier; nonnutritive suck also contributes to calming the infant and decreasing pain-elicited distress
Contraindications: None

Does the Appropriate Use of Analgesics Make Evaluation More Difficult?

There is no evidence that pain management masks symptoms or clouds mental status, preventing adequate assessment and diagnosis. For patients with abdominal pain, several adult studies have shown that pain medications such as morphine can be used without affecting diagnostic accuracy.[175–179] Pediatric studies have demonstrated similar findings.[179,180] Clinical experience suggests that the use of pain medication makes children more comfortable and makes the examination of the patient's abdomen and diagnostic testing (such as ultrasonography) easier, thus aiding in diagnosis. In the child who has suffered multisystem trauma, small titrated doses of opiates can be used to provide pain relief without affecting the clinical examination or the ability to perform neurologic assessments.[181,182] The development of pain protocols can improve the management of children

who suffer major trauma.[183] Regional anesthesia should also be considered for patients who have injuries that are amenable to these techniques.[184,185] Additional studies evaluating these practices in pediatric patients are necessary but should not delay the development of protocols for the use of analgesics in patients with acute abdominal pain and multisystem trauma in the ED and even the prehospital setting.

Analgesia in the ED and EMS Setting

Optimal pain management requires expeditious pain assessment and rapid administration of systemic opioid pain medication to patients in severe pain. This may occur through various routes of administration, including transmucosal or IV routes. The IV route allows for rapid relief of pain and drug titration; the intramuscular route is less preferred, because it does not allow for medication titration and is painful at the time of delivery and for days afterward. Adjunctive pain medications, such as nonsteroidal antiinflammatory drugs, can be used judiciously in children with pain; antiplatelet activity and gastrointestinal tract and renal toxicity are rare but recognized adverse effects. Oral opiates and nonsteroidal antiinflammatory drugs are appropriate for mild to moderate pain if the patient has no contraindications to receiving oral medications. Alternative routes of medication administration, including oral, intranasal, transdermal, and inhaled routes, should be used when appropriate and may offer rapid relief of pain.[186] Studies of transmucosal, aerosolized, and inhaled fentanyl show analgesic action commensurate with IV opioids.[187–189] Transmucosal administration may be appropriate and useful in the prehospital setting as well.[190] Intranasal delivery, despite demonstrating more rapid onset of action, also may be less tolerated because of burning of the nasal mucosa during administration.[54,191] Drug delivery into the central nervous system is greatly enhanced with the use of an atomizer that distributes the medication more evenly to the mucous membranes.[192–194] Because adverse events are still possible when this mode of opiate administration is used, care should be taken when using adjunctive medications, such as benzodiazepines. In addition, if there is no IV access, it is prudent to prepare for alternative methods of administration for reversal agents. Pain medication should be provided in the ED as well as on discharge, even for those with mild to moderate pain. Patients and families should get specific instructions regarding dose and duration of use. Clear, written instructions should be provided for families regarding the after care of children who have received procedural sedation. Pain medication should be recommended on an around-the-clock basis for anyone in whom moderate pain is anticipated.

The use of sedative hypnotic medication may be required to reduce pain and distress for children undergoing procedures in the ED. Unfortunately, pain and anxiety are often difficult to differentiate in infants and toddlers and even in school-aged children. Although many procedures can be performed relatively painlessly with the use of a topical or local anesthetic, this does not obviate the use of pharmacologic agents to decrease the anxiety and stress in children undergoing procedures in the ED, especially when the child needs to remain still to ensure the success of the procedure. When the procedure is expected to be painful, the agents used should have analgesic properties as well. Emergency physicians are increasingly using short-acting medications such as propofol, alone or in combination with ketamine, for procedural sedation in children.[195,196] Published reports involving adult patients and recently published experiences with children demonstrate that, when applied using careful protocols and in a setting of experienced sedation teams, propofol, either alone or in combination with ketamine, can be used safely and effectively for sedation in children.[195,197–205] Benzodiazepines, particularly rapidly effective but relatively short-acting ones, such as midazolam, are also helpful in the prehospital and ED settings. Nitrous oxide is a potent analgesic that does not require venous access and is available in some EDs.[49–53] Nitrous oxide should be used in conjunction with appropriate sedation guidelines and avoided in patients with pneumothorax, bowel obstruction, intracranial injury, and cardiovascular compromise.[52,53] Nitrous oxide has many potential applications, including anxiolysis for procedures such as IV catheter insertion and laceration repair, pain control for burn débridement, and fracture and dislocation reduction; care should be taken if opiates are used concurrently so as not to reduce respiratory drive.[206] The most important part of providing safe sedation for children is the establishment of appropriate sedation systems and sedation training programs with credentialing guidelines for sedation providers that specifically address the core competencies required for the care of pediatric patients.[207,208]

Pain Considerations for Children With Developmental Disabilities

Children with developmental disabilities, particularly those with severe neurologic involvement, provide additional challenges to parents and EMS and ED personnel in management of acute pain and its associated anxiety. For many children, previous painful experiences in similar settings add to stress of the acute incident. Learning about the child's anticipated response

and previous experiences from parents, primary care physicians, and specialists informs the emergency physician and staff of useful supportive technique.[209–211] Parental understanding and awareness of subtle indirect behaviors or emotional shifts are often critical adjuncts in the assessment process of the child's sense of comfort and well-being. Child life specialists, as previously mentioned, are knowledgeable of distinct coping strategies to assist children with developmental disabilities and children who are more sensitive to sights and sounds. Myths of pain insensitivity or indifference must be actively avoided.[212–214] Pain modulation can vary widely, related to neurotransmitter function differences within the brain or along the injured spinal cord, thereby altering the perception and response to pain in children with previous injuries.[213–215] Cognitive impairments can affect both understanding and coping mechanisms, making self-report particularly challenging in young people with motor and/or cognitive differences. Maladaptive behaviors, heightened anxiety, and uncommon coping styles can add further complexity to the assessment process. The Non-communicating Children's Pain Checklist–Revised offers a validated visual method for staff members to assess and reassess children 3 to 18 years of age.[216–218] In addition, the Individual Numeric Rating Scale has been shown to be effective in children with developmental disabilities. In general, the approaches to medication use for pain and anxiety should hold true for children with developmental disabilities; some children, however, show altered sensitivity to medications and may be taking medications that interact with common pain medications.[219]

Sedation Policies and Protocols in the ED

Physicians, physician assistants, and nurse practitioners who administer sedation and analgesia should have proven training and skills and ongoing education in the management of pediatric airways and resuscitation, especially in the use of face mask ventilation and laryngeal mask airways. Emergency physicians and other nonanesthesiologist physicians with appropriate training have demonstrated the ability to safely and effectively provide moderate and deep sedation and dissociative anesthesia, allowing for the timely performance of procedures and rapid relief of pain and anxiety.[202,207,208,220,221] A recent large prospective study of 131 751 elective pediatric sedation encounters demonstrated no differences in serious adverse outcomes (ie, death, ICU admissions, aspiration events) between those performed by anesthesiologists and those performed by other pediatric medical subspecialists practicing in highly organized sedation systems.[222] Although the reported incidence of serious complications is low, it is imperative to develop ongoing policies that establish informed consent and close monitoring of these patients. A critical component of any sedation protocol is to require a trained observer to be solely responsible for monitoring the patient while the procedure is being performed.[223,224] Techniques such as noninvasive end-tidal carbon dioxide monitoring allow for more consistent detection of bradypnea, hypopnea, and apnea in sedated children and are being recognized increasingly as an essential part of the sedation armamentarium[225,226]; however, this is not a replacement for direct visualization of respiratory effort. Current guidelines from the American Academy of Pediatrics, American Society of Anesthesiologists, and American College of Emergency Physicians recommend a structured evaluation of children that allows risk stratification before beginning sedation, thereby reducing the risk of complications in the pediatric age group.[223,227–235] This evaluation should include issues such as preexisting medical conditions, focused airway examination, and consideration of nil per os (NPO) status. NPO guidelines for children receiving sedation in the ED are controversial. Many children who have received procedural sedation for emergencies have not fasted in accordance with published guidelines for elective procedures, and this variation was not associated with adverse outcomes.[236–239] Current data are insufficient to determine the length of time that constitutes safety with regard to NPO status.[237–243] Recently published guidelines recommend that the physician consider the urgency of the procedure, targeted depth of sedation, risk level of the patient, and timing of most recent solid food intake to determine the safety profile for each patient.[244]

Discharge criteria also are critically important for children undergoing sedation in the ED. Patients who receive sedatives with long half-lives, such as chloral hydrate or pentobarbital, are at particular risk of adverse events after discharge, either during transportation or in their homes after the procedure.[224] Strict adherence to criteria that require a child to be "back to baseline" in terms of consciousness, or adaptation of newer "maintenance of wakefulness" criteria, are critical to optimize safety surrounding the sedation process.[245]

Quality Improvement Programs

Any ED that provides treatment of children should have a quality improvement program that reviews, at regular intervals, sedation and pain management practices in pediatric patients. Transport team and prehospital EMS providers are essential partners in this ongoing review and should consider establishing internal review policies as well. Many hospitals use a multidisciplinary committee to

help interpret the data emanating from these reviews and then suggest system-wide protocol and educational initiatives. Indicators that should be evaluated include the use of validated pain scores; appropriate analgesics for specific disease states (whether severe or mild to moderate pain); topical anesthetics and other non-noxious routes of analgesia and sedation; monitoring for adverse outcomes; and the use of discharge instructions that outline the indications, dose, and duration of analgesic to be used.[246–248] Discharge instruction also should include any possible adverse effects of sedative/analgesic medications used in the ED. Adverse events that lead to respiratory depression or other life-threatening conditions should be fully reviewed by a committee charged with understanding if systemic care issues or provider-specific issues were root causes of these outcomes.

Implementation

A systematic approach to pain management in the EMS requires an implementation strategy, promoted and advocated by leadership, that includes the following: (1) a comprehensive evaluation of current pain and distress management practices; (2) an educational and credentialing program regarding pain assessment and management techniques for all clinical staff, preferably overseen by a hospital-wide sedation committee[249]; (3) development of protocols to allow the universal and efficient application of pain management strategies and medications; and (4) a quality improvement process to evaluate the ongoing success of the program.[11,13] EMS agencies should establish policies and protocols that make available pertinent provider education and ensure quality improvement processes are in place for pediatric pain management protocols appropriate for their practice setting.

CONCLUSIONS

Management of a child's distress during illness or after an injury is an important yet complex aspect of emergency medical care for children. Physicians and prehospital EMS providers should be aware of all the available analgesic and sedative options. Adequate pain assessment is essential for pain relief and should begin on entry into the EMS and continue through discharge of the child from the ED. Multiple modalities are now available that allow pain and anxiety control for all age groups. Future research should concentrate on pharmacologic, nonpharmacologic, and device-related technology that can assist in reducing the pain and distress associated with medical procedures.

SUMMARY OF KEY POINTS

1. Training and education in pediatric pain assessment and management should be provided to all participants in the EMS for children; EMS medical directors should formally include pediatric pain management measures within the protocols provided to EMS providers.
2. Incorporation of child life specialists and others trained in nonpharmacologic stress reduction can alleviate the anxiety and perceived pain related to pediatric procedures.
3. Family presence during painful procedures can be a viable and useful practice in the acute care setting.
4. Pain assessment for children should begin at admission to EMS, including prehospital management, and continue until discharge from the ED. When discharged, patients should receive detailed instructions regarding analgesic administration.
5. Administration of analgesics and anesthetics should be painless or as pain free as possible.
6. Neonates and young infants should receive adequate pain prophylaxis for procedures and pain relief as appropriate.
7. Administration of pain medication has been demonstrated to preserve the ability to assess patients with abdominal pain and should not be withheld.
8. Sedation or dissociative anesthesia should be provided appropriately for patients undergoing painful or stressful procedures in the ED.
9. Pain management and sedation, including deep sedation and dissociative anesthesia, are fully within the monitoring and management capabilities of appropriately trained emergency medicine and pediatric emergency medicine physicians. Each emergency department that provides sedation and analgesia to children should include sedation competencies in recredentialing procedures and develop protocols, policies, and quality improvement programs as part of the systematic approach to pain management in the EMS.

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