

# The underuse of analgesia and sedation in pediatric emergency medicine

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Although pain is one of the commonest complaints among children presenting to the emergency department, it unfortunately remains inadequately and poorly managed,<sup>1-3</sup> leading to unnecessary suffering in the pediatric population. Some studies have shown an increase in administration of opiates to children with fractures,<sup>3-5</sup> but analgesia administration varies by age and lags behind adults, with the youngest children at highest risk of receiving inadequate analgesia.<sup>3-12</sup> There seems to be a wide variation in pain management practices by different emergency departments and health care professionals throughout the world, and in some settings analgesics are underused in children with pain.<sup>4,13</sup> There are many examples of the widespread and inappropriate attitude of medical staff to pain management in children.<sup>14-16</sup>

Having spent a number of years working in different hospitals in the Gulf region, the author's experience suggests that children here are also similarly undertreated for pain and a change in approach to this issue is needed just as in other parts of the world. Some of the possible key factors responsible for this widespread inadequacy in pediatric pain management need to be further elaborated so that areas needing improvement can be identified and measures taken to change this sad state of affairs.

In the not so distant past it was thought that children do not experience pain to the same degree as adults because their nervous system is immature and incompletely myelinated.<sup>17,18</sup> Even as recently as just over a decade ago they were felt to have less capacity than adults to feel and remember pain and therefore to require less analgesia.<sup>19-23</sup> However, in light of more recent findings these concepts have been found to be untrue and unjustified. There is now clear evidence that the neurotransmitters, cortical senses, neural pathways and cutaneous receptors needed for pain perception are actually present by mid-gestation and are fully organized in infancy;<sup>24-26</sup> also it would seem that complete myelination is actually not necessary for pain perception with the implication that newborn babies who have partial myelination are therefore capable of experiencing pain.<sup>26</sup> It has been shown that even premature neonates respond to painful stimuli, and the use of anaesthetic agents blunts this response as it does in adults.<sup>27</sup> Other studies have shown that infants undergoing surgery with little or no analgesia mounted a significant stress response with alterations in physiological parameters,<sup>28,29</sup> while infants who received potent analgesia demonstrated significantly fewer postoperative complications.<sup>30</sup> Studies have also shown that neonates undergoing procedures without adequate analgesia have long-standing alterations in their response to and perceptions of painful experiences,<sup>31-35</sup> and that post-traumatic stress disorder can occur in children after painful or stressful medical experiences that are not accompanied by adequate analgesia or sedation.<sup>36,37</sup> Despite comprehensive evidence

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that children and infants can and do feel pain, and that they mount physiological and psychological responses to it, the myth still exists that children do not feel pain the same as adults and that it has no negative consequences in children.<sup>38</sup>

Other major factors relate to education of staff and staff inexperience with regard to analgesic and sedative use and the recognition and assessment of pain in children. Until recently, education in pain management was not really emphasized for clinical staff.<sup>39,40</sup> The subject received little emphasis in undergraduate and graduate medical education curricula.<sup>20,41-46</sup> Prehospital health care providers also typically receive insufficient pain management education.<sup>47,48</sup> Optimal and effective pain management requires a thorough understanding of pain assessment and management strategies,<sup>49,50</sup> and therefore, education of healthcare providers is a key area in need of improvement. Some doctors may feel that introducing opiates at an early age can lead to addiction.<sup>51</sup> Studies in adults, however, suggest that addiction developing after hospital use of opioids for acute pain is rare.<sup>52</sup> Withdrawal phenomena have been shown to occur in children in the setting of the intensive care unit, but these generally follow prolonged and higher doses of medications;<sup>53,54</sup> for the acute setting in the emergency department there is no reason to believe that children fare any worse than adults with regard to the risk of developing an addictive state. The fear of masking physical and clinical signs may lead some clinicians to denying patients analgesia; however, there is no evidence that appropriate pain management masks symptoms or clouds diagnostic skills. In patients with abdominal pain, several studies have shown that pain medications can be used without affecting diagnostic accuracy<sup>55-57</sup> and a pediatric study showed similar findings.<sup>58</sup> Even in children who have suffered multi-system trauma, small titrated doses of opiates can be used for pain relief without affecting the clinical examination or the ability to perform adequate neurological assessments.<sup>59,60</sup>

One important factor in improving pain management in children is an improvement in the initial recognition and assessment of pain in the emergency department.<sup>40,50</sup> The standards of the Joint Commission on Accreditation of Healthcare Organisations include a mandatory assessment of pain for all hospital patients, including children.<sup>40</sup> Assessment of pain should begin at the triage desk in the emergency department, allowing the triage point to become a focus for improvement in pain

management.<sup>49,50</sup> Protocols should be in place to allow the initiation of analgesia at triage as needed. Children should be assessed for pain and appropriate pain management begun as soon as possible according to the degree of pain; subsequent reassessments can then dictate the requirement for ongoing management. With regard to the assessment of pain, there are several standard clinical scales that can be used to objectively measure pain in children. Two that are well-validated are the Wong-Baker Faces scale and the 10-cm Visual Analog Scale, which have been used successfully in many emergency departments in caring for children;<sup>61-63</sup> these are self report scales that can be used in children as young as three years of age. For children unable to use the self report scales, pain can be assessed in younger children using behavioral scales combined with an evaluation of the physical findings and history;<sup>64-66</sup> one such scale is the CHEOPS (Childrens Hospital of Eastern Ontario Pain Scale).

## Pharmacological Agents for Analgesia and Sedation

### *Local Anaesthetic Techniques*

All staff using local anaesthetic techniques should be familiar with the maximum safe dosages and complications of agents used.

*Topical anaesthesia.* Local anaesthetic cream preparations can be used to decrease the pain of procedures such as venepuncture and cannulation if the child's condition permits time for this. They can also be utilized to advantage prior to lumbar puncture, abscess drainage and joint aspiration. Examples include *EMLA* (Astra) and *Ametop* (S&N Health). *EMLA* contains 2.5% lidocaine with 2.5% prilocaine, while *Ametop* contains 4% amethocaine. Both are applied thickly over skin and covered with an occlusive dressing for 30 to 60 minutes; *EMLA* takes about 45 to 60 minutes to act and *Ametop* about 30 to 40 minutes. *EMLA* is contraindicated in infants younger than 1 year, and *Ametop* is not recommended in infants younger than 1 month. Neither should be used on open wounds or mucous membranes as absorption can lead to systemic toxicity.

There are other preparations that can be applied on open wounds for cleaning and suturing and these are anaesthetic/vasoconstrictor combinations such as LET (lidocaine, epinephrine and tetracaine) and TAC (tetracaine, epinephrine [adrenaline] and cocaine). These agents should not be used on mucous membranes or anatomical areas prone to distal isch-

aemia due to the vasoconstrictor actions of epinephrine.

Vapocoolant sprays that have an immediate onset of action can be used successfully for injection pain in children, but are not effective for intravenous line placement.<sup>67,68</sup>

*Local infiltration.* This is the commonest anaesthetic technique used in the emergency department for suturing wounds in adults and children. The pain of injecting the agent (commonly lidocaine) can be minimized by using a narrow gauge needle, and warmed, buffered lidocaine.<sup>69-73</sup> Injecting slowly will help to reduce the discomfort further. If the characteristics of the wound allow, then suturing may be avoided altogether and the wound closed with tissue adhesive or paper strips such as *SteriStrips* whenever possible as long as the cosmetic result will not be inferior.<sup>74</sup> However, if a child is unable to tolerate any planned procedure using local anesthetic techniques, then general anaesthesia may be an appropriate option.

*Field blocks.* A field block may be useful to drain a small abscess or clean a small, infected wound because the effectiveness of local infiltration directly into inflamed and infected areas is reduced.<sup>75</sup> Also infiltration into infected and inflamed areas is very painful. Since in field blocks the anaesthetic is injected slightly distant to the infected area, the likelihood of these problems is reduced.

*Peripheral nerve blocks.* A peripheral nerve block utilizes the injection of local anaesthetic in the region of a peripheral nerve, producing anaesthesia in the area supplied by that nerve. Examples of such blocks are femoral and digital nerve blocks. Femoral nerve block gives excellent analgesia for a fractured shaft of the femur in a child and can be used before the application of a traction splint. Digital nerve blocks are useful for procedures on the fingers and toes such as draining a paronychia; however, epinephrine should not be used in digital blocks or indeed near any end artery to avoid the risk of ischaemic complications.

## Pharmacological agents

The route of administration of pharmacological agents will depend on several factors, including the severity of pain, whether the child is vomiting, and the likelihood of the child needing to be kept fasting.

Oral analgesics are painless and these agents are easily given and accepted, but there will be a delay in onset of action. The rectal route is also painless, and there is usually rapid and reliable absorption. The in-

travenous route provides the most reliable method for controlled analgesia in severe pain, and can be titrated to effect. The intramuscular route is generally not appropriate for pediatric emergency analgesia as injection is painful, absorption unpredictable and onset of action is slow. Several agents can be given by the intranasal route for analgesia and/or adjuvant sedation and these include diamorphine, fentanyl and midazolam; the intranasal route is particularly useful when intravenous access is difficult or inappropriate.

*Sucrose solutions.* Sucrose solutions given orally have been found to decrease the response to painful stimuli such as heel pricks and injections in neonates,<sup>76-79</sup> an effect which is strongest in the newborn and wears off over the first 6 months of life. The infant is given 2 mL of 25% sucrose solution orally either by syringe or allowed to suck it from a pacifier, not more than 2 minutes before the painful procedure.

*Paracetamol (acetaminophen).* For mild pain this is an excellent analgesic, which can be given to children orally or rectally. The dose is 10-15 mg/kg every 4-6 hours with a maximum of 4 doses in 24 hours.

*Aspirin.* Aspirin is also an effective mild to moderate analgesic, but should not be given to children less than 12 years old because of the association with Reye's syndrome.

*Ibuprofen and diclofenac.* These agents are useful in children for mild to moderate pain, especially musculoskeletal trauma. The dose for ibuprofen is 5 mg/kg orally given every 6-8 hours as needed. The dose of diclofenac is 1-3 mg/kg daily in 2-3 divided doses orally or rectally; the rectal route is useful in a child who is vomiting. Ibuprofen is not recommended in children younger than 1 year of age, and both should be avoided with a history of asthma, gastrointestinal bleeding or renal impairment.

*Nitrous oxide.* This is inhaled as a 50/50 mixture with oxygen, and provides good analgesia for moderate pain within 3-4 minutes; children as young as 3 years old can control nitrous oxide administration by themselves, and those who are afraid of using the facemask can be encouraged to use a mouthpiece. It is useful in the prehospital setting, and for short procedures such as dressings, splints and cannula insertion. It should not be used for children with suspected pneumothorax, bowel obstruction or head injuries.<sup>80</sup>

*Codeine.* Codeine is a milder opiate that can be used for mild to moderate pain in children at an oral dose of 1 mg/kg every 4-6 hours. It is not recom-

mended intravenously in children as it can cause severe hypotension.

*Morphine.* Morphine is a potent opiate that is appropriate for the treatment of severe pain, for example burns and fractures. It can be titrated to effect intravenously at a dose of 0.1-0.2 mg/kg given over 2-3 minutes. The oral dose is 0.2-0.4 mg/kg but absorption is unreliable with a slow onset of action.

*Diamorphine.* Diamorphine can be used as an alternative to morphine, at a dose of 0.04-0.08 mg/kg intravenously. Trials using 0.1 mg/kg intranasally have shown this method to be safe and effective for the pain of isolated long bone fractures.<sup>81</sup>

*Pethidine.* Pethidine at a dose of 0.5-1 mg/kg intravenously can be used for severe pain, but side effects, including convulsions under some settings make morphine a better choice in children.

*Fentanyl.* This is a more recent synthetic opiate compound, given at a dose of between 1-5 µgrams/kg given slowly intravenously over 3-5 minutes and incremental doses of 1 µgram/kg can be given as needed. Fentanyl can also be given intranasally. With high doses or rapid infusions, a rare adverse reaction is abdominal and thoracic muscle rigidity, which may require naloxone and/or a paralyzing agent for reversal.

*Ketamine.* This is a phencyclidine derivative that acts via opiate receptors, and produces analgesia, anaesthesia and a dissociative state, but does have several side effects. An intravenous dose of 0.5-1 mg/kg will produce a state of mild sedation for about 10 minutes in a child, and can be given orally at 5-10 mg/kg for a similar but longer-lasting effect. A higher dose of 1-2 mg/kg intravenously will produce a deeper level of sedation. Emergent phenomena, which are seen more often in adults than children, can be reduced by the concurrent use of a benzodiazepine.<sup>82</sup>

*Midazolam.* This is a benzodiazepine class of drugs that is commonly used for procedural sedation and anxiolysis in children; it has no analgesic actions. The standard intravenous dose is 0.1-0.2 mg/kg. It can be given orally at 0.5 mg/kg, but then there will be a delay of about 15 minutes to onset of sedation. In children in whom oral delivery is inappropriate or intravenous access is not possible, midazolam can be given intranasally at 0.2 mg/kg.<sup>83</sup>

## Non-Pharmacological Adjuncts to Analgesia and Anxiolysis

### *Emergency department environment*

It is essential to create an environment that is conducive to minimizing pain and distress associated with a child's visit to the emergency department. Children should ideally be placed in a separate room where there are colorful walls with pictures on the ceilings and a range of toys, thus providing a calming and friendly atmosphere.<sup>49,84</sup> A dedicated play therapist or child life specialist can be very useful in the emergency department to decrease anxiety and pain perception, teach the child and staff simple distraction techniques and support family involvement in the child's care.<sup>85,86</sup> It has been recommended that any emergency department treating more than 18 000 children annually should employ the services of such specialists.<sup>87</sup>

### *Distraction techniques*

There are several ways to provide distraction for the child to alleviate distress and anxiety. These include the use of toys, books, bubble blowers, bubble-columns, light wands and the playing of music and/or video in areas where children are cared for or undergo procedures.<sup>88-92</sup> Staff should also be trained in these techniques as this will increase the use of these methods.

Staff can use other psychological methods to ease anxiety and pain. Behavioral therapy where the child's attention is focused on something other than the procedure, or guided imagery where the child for instance imagines the pain flowing out of the body, are examples of such techniques.<sup>93,94</sup> The distraction used needs to be age-appropriate to be effective. An important determinant of success with these techniques is the experience and attitude of the staff that use them.

Hypnosis is useful in managing patients with chronic and acute pain,<sup>95</sup> and the technique may have been used for pain control in children as early as 1840.<sup>96</sup> The benefits of using hypnosis for painful procedures in the emergency setting were shown in 1956 for both children and adults.<sup>97</sup> Also, the susceptibility to hypnosis has been shown to be increased in children attending the emergency department due to their vivid imagination, and the stress of the situation.<sup>98</sup> Hypnosis can therefore be a valuable pain and stress control maneuver for staff able to employ the technique.

***Cutaneous stimulation***

These methods include transcutaneous electrical nerve stimulation (TENS), application of hot or cold, massage and acupuncture. Acupuncture, which possibly works by releasing natural endorphins is limited in the emergency setting for children as they are often afraid of needles. TENS utilizes electrodes to deliver low voltage current and is useful for localized pain; it causes a tingling sensation, acting as a counter-irritant, and is thought to increase endorphin levels;<sup>99</sup> It has been used successfully in managing chronic pain in children, but may have a role in the emergency setting.

***Physical methods***

These include the application of bandages, dressings and splints as soon as possible, preferably in the pre-hospital phase. Splintage of injured limbs provides immobilization and reduces pain.<sup>100</sup>

**Sedation Issues in the Emergency Department**

Sedation is used as an adjunct in many procedures in the emergency department, and is also a side effect of many of the potent analgesics used for pain management. Also, there is a wide spectrum of the level of sedation used ranging from "light sedation" to "deep sedation". Deep sedation is associated with the potential risks of cardiorespiratory complications and compromise. Sedation should therefore be carried out by and under the supervision of trained staff.

Although excellent reviews have been published that describe the safe and effective use of sedation in the emergency department,<sup>101,102</sup> the issue should not be taken lightly and should be guided by protocols that ensure the safety of children. Guidelines from the American Academy of Paediatrics, American Society of Anaesthesiologists and American College of Emergency Physicians<sup>103-106</sup> recommend a structured evaluation of children that allows risk stratification before beginning sedation. Among other things this evaluation should particularly address issues such as pre-existing medical conditions, a focused airway examination and consideration of nil per os (NPO) status. Recent data have confirmed that adherence to such a structure-based sedation model can significantly decrease the incidence of complications in the pediatric age group.<sup>107</sup> Other factors to be considered in the implementation of a safe sedation protocol are:

- The protocol should require a trained observer to

be solely responsible for monitoring the patient while the procedure is performed.

- Physicians who administer analgesics and sedatives should have proven training and skills in pediatric airway and resuscitation as well as knowledge and management of the complications and adverse effects of medications used.
- Setting out the indications and contraindications to sedation, fasting requirements and consent policy.
- Setting out the criteria for safe discharge of children from the emergency department after the use of sedatives and analgesics with sedative properties.
- Auditing of the system to test the safety of the protocol and ongoing improvements/alterations as necessary in the light of new developments and knowledge.

**Conclusion and Summary of Key Issues**

It is clear that pain management remains inadequate in the pediatric emergency population, despite a wide variety of pharmacological and adjuvant non-pharmacological measures being available to treat children in pain. This situation can be improved by addressing the many key factors responsible for this state of affairs, and some of the actions that can be taken may be summarized as follows:

- Improved pain management education for all personnel involved in the care of children in the emergency system
- Enhanced coverage of pain management in graduate and postgraduate medical education curricula
- Protocols for the early recognition, assessment and treatment of pain in children in the emergency system
- Protocols for the safe use of sedation techniques in the emergency department

It is essential that pain management in children be improved so that the unnecessary suffering of a significant portion of our emergency department customers can be reduced to the best extent possible. The author would like to stress the importance of a change in attitude towards pain management in children in all those across the Gulf region involved in the care of children, particularly pediatricians, emergency physicians and surgeons.

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