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Management of Acute Pain in Childen: An Overview

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Abstract

BACKGROUND: Contrary to some beliefs, all children do experience pain, with its adverse emotional and social consequences. Pain may be of diagnostic and therapeutic origin such as lumbar puncture, bone marrow aspiration, or venipuncture. The aim of this review is to sensitise all health care providers to appreciate, prevent and control pain in children. Relevant literature from selected references on the current concepts of paediatric pain management was reviewed. Various pain assessment modalities indicate that pain is a common accompaniment and complication of paediatric surgery. Pain in children is under diagnosed and under treated in our environment. The popular dogma that “children do not feel pain” and “powerful analgesics may lead to drug addiction” is erroneous and misleading.

CONCLUSION: Concerted efforts are required to enhance our understanding of the mechanisms of pain in children and its diagnosis and treatment. Fears of the side effects of analgesics and anaesthetics such as addiction in children are often exaggerated. Clinicians should be familiar with current pain management modalities in children.

Introduction

Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage1. An important responsibility of physicians who care for children is to eliminate pain and suffering whenever possible. The most common type of pain experienced by children is acute pain resulting from injury, illness, and medical procedures2. It is the obligation of primary care physicians, general practitioners, paediatric surgeons, and all paediatric sub-specialists to recognize and address all types of pain, including acute pain, chronic pain, recurring pain and, procedure-related pain. Barriers to the treatment of pain in children include

1. The myth that children, especially infants, do not feel pain the way adults do, and that if they do, there is no untoward consequence.
2. Lack of assessment and reassessment of pain.
3. Misunderstanding of how to conceptualize and quantify a subjective experience.
4. Lack of knowledge of pain treatment.
5. The notion that addressing pain in children takes too much time and effort.
6. Fears of adverse effects of analgesic medications, including respiratory depression and addiction.

Effective pain management involves an interdisciplinary approach with a combination of pharmacologic, cognitive-behavioural, psychological, and physical treatments.

Pathophysiology

Much of our understanding of pain in children has been extrapolated from adult studies. The mechanisms and pathways for pain perception are intact during late foetal and neonatal life. As early as the 7th week of gestation cutaneous sensory perception appears in the peri - oral area. In the newborn infant pain perception can be traced from sensory receptors in the skin to the cerebral cortex3. An "Established Pain Response" has been described to occur in neonates who have undergone procedures such as circumcision and heel lancing without anaesthesia or analgesia3. The gate control theory of pain is the most widely accepted model of pain4. It is, however, a physiological theory of pain transmission and does not explain psychosocial aspects of pain. Following a painful stimulus (e.g. surgical incision) peripheral nociceptors are sensitised (primary hyperalgesia). This then results in central sensitisation of dorsal horn cells. Thus altered central processing of nociceptive input can prolong post–operative pain. Blocking the noxious input prior to surgery as opposed to after their surgery prevents central sensitisation. This is the rationale for pre– emptive analgesia.

Pain Assessment in children (Table 1)

To treat pain adequately, ongoing assessment of the presence and severity of pain, and the child's response to treatment is essential. Reliable, valid, and clinically sensitive assessment tools are available for neonates through adolescents. In a hospital setting, pain and response to treatment, including adverse effects, should be monitored routinely and documented clearly and in a visible place, such as on the vital sign sheet, to facilitate treatment and communication among healthcare professionals. When communication is difficult, and behavioural observation is utilized as a means of assessment, healthcare professionals’ assumptions about the

meaning of the behaviour should be examined carefully. Careful and thorough assessments are necessary when communication with the patient is problematic, as may be the case with children who are cognitively impaired or severely emotionally disturbed. Cultural and language differences between the child and healthcare professional also require additional care in assessment. Paediatric pain measurement has progressed substantially over the last decade, and, in response to doubts that pain can be reliably measured in children, the intensity of pain measures have been thoroughly validated in paediatric patients5. The objectives of pain assessment are to a. Detect the presence of pain.

b. Estimate the potential impact of pain on the individual.

c. Quantify the success of intervention.

Several means are used to assess pain in infants and younger children, such as

a. Behavioural assessment facial expression. body movement, behavioural state, crying],

b. Physiological assessment [cardiorespiratory parameters, hormonal and neurochemical responses-increase in cortisol, glucagon, corticosteroids, catecholamines, increase rennin level]. In older children and adolescents, the assessment of pain involves self- reporting pain6. Self-report measures can be followed objectively for a prolonged period of time.

Procedure-related Pain

The key to managing procedure-related pain and distress is anticipation. The approach to procedural pain varies according to the anticipated intensity and duration of expected pain, the context and meaning as seen by the child and family, the coping style and temperament of the child, the type of procedure, the child's history of pain, and the family support system. Procedures should be performed by persons with sufficient technical expertise, or by persons whom individuals with technical expertise directly supervise, so that pain is minimized to the greatest extent possible. Children and parents should receive appropriate information about what to expect, and appropriate preparation about how to minimize distress. It is advisable in appropriate situations to have parents present and prepared with specific ways of comforting their children. The treatment approach should be multi-modal and meet the child's needs. Depending on the nature of the procedure and characteristics of the child, optimal pain control may be obtained with interventions ranging from deep sedation and anaesthesia to strategies aimed at facilitating competent coping with the procedure in ways that enhance self-esteem with little or no pharmacologic support. Cognitive behavioural strategies that involve the use of imagery, relaxation, and self-regulation can provide pain relief independently or in conjunction with other pain management modalities. Other complementary approaches, such as massage or use of heat compresses, may be beneficial. For each of these approaches, a quiet environment, calm adults, and clear, confident instructions increase the likelihood that the specific pain management strategy selected will be effective. Local anaesthetics and strategies to soothe and minimize distress such as EMLA cream and Ametop gel® should be considered even for simple procedures, such as venipuncture. EMLA means euthetic mixture of local anaesthetic and it contains Lidocaine and Prilocaine. Ametop gel® is another percutaneous local anaesthetic agent containing 4% Amethocaine base. Some common painful minor procedures, such as circumcision, do not always receive the warranted attention to comfort issues. Available research indicates that newborn circumcisions are a significant source of pain during the procedure and are associated with irritability and feeding disturbances during the days afterward. Opportunities for alleviating pain exist before, during, and after the procedure, and many interventions are effective7. For procedural pain that is predictably severe and for which local measures give inadequate relief, such as for bone marrow aspirations, the use of systemic agents like pethidine is required to bring pain to acceptable levels. The use of anxiolytics or sedatives alone for painful procedures does not provide analgesia but makes a child less able to communicate distress. The child still experiences pain during the procedure, and there are no data on the short- or long-term sequelae of this strategy. When it is necessary to use sedation and analgesia for painful procedures, there are guidelines to be adopted2. These guidelines recommend that sedation be conducted in a monitored setting with resuscitative drugs and equipment available, and that a competent person administer agents. The guidelines stipulate that one person is assigned to monitor the child's condition and another qualified person is present to respond to medical emergencies.

Operative Pain and Trauma-associated Pain

Plans for postoperative pain management should be

discussed and generated with the family before surgery. Basic elements of pharmacologic treatment include type of analgesic, dose, timing, and routes of delivery. Postoperative pain management encompasses the use of different classes of drugs, including opioids and non-opioid analgesics. The use of other analgesics, such as acetaminophen and non-steroidal anti-inflammatory agents, in combination with opioids, can reduce the amount of opioid required. Analgesic treatment should include proper dosing according to body weight, physiologic development, and the medical situation. The goal is to control the pain as rapidly as possible, and thus, the starting dose should be optimal and further doses should be titrated depending on patient response. Administration of multiple, small, ineffective doses of analgesic may result in the prolongation of pain, exacerbation of anxiety, and even severe adverse effects of the analgesic, such as respiratory depression. As part of the comprehensive assessment and management of trauma necessitating emergency treatment, pain should be addressed in the emergency department with provisions made for pain management at home. Severe trauma may lead to hospitalisation in an intensive care unit, and the management of pain may be compromised because of the primary emphasis on life-supporting critical care interventions. In severe trauma, the psychological effect of the injury and the intensive care unit experience necessitate the optimal treatment of pain to reduce the total burden of suffering. Pain may be attributable to a variety of causes, including the trauma, surgical procedures, restricted movement, underlying disease, and the presence of lines, tubes, and drains. Because of the diversity and complexity of the clinical issues present, pain treatment, including choice of drug, dosage, route, and mode (continuous versus intermittent) of administration, must be tailored to the individual patient, and analgesics given in the overall context of what is best for the patient. Communication among caregivers and an interdisciplinary approach are helpful. Attention should be paid to optimising sleep-wake cycles, because sufficient sleep will enable the child to cope better when awake. Prolonged pain may require use of opioids for an extended duration. Dosages should be adjusted to compensate for the development of physical tolerance, and weaning strategies should be used to minimize or obviate withdrawal symptoms.

Methods of Pain Assessment In Children

Some methods of pain assessment in children are shown in Table 1

Modalities Of Acute and Post-Operative Pain Management

Some methods of post-operative pain management are shown in Table 2

Patient Controlled Analgesia (PCA):

Following appropriate pre–operative teaching, children as young as seven years of age, can learn to use a PCA pump. Occasionally there is a particularly bright 5 or 6 year old that also makes a good candidate. Parent Controlled analgesia should be discouraged since it circumvents the internal safeguard of PCA. Some centres, however, encourage a parent-controlled analgesia in children with chronic pain from Cancer or Acquired Immunodeficiency Syndrome3. Parent Assisted Analgesia is a compromise where by both parent and child decides on appropriateness of using the PCA Device. Opioids like Fentanyl are used commonly. Use of a background infusion is controversial; addition of a NSAID (e.g. Ketorolac) can preclude use of a basal infusion3. Many oncology patients, with prior opioid use, appear to benefit from a basal rate of 15 mcg/kg/hr. Side effects include nausea, vomiting and urinary retention appear to be no more frequent with PCA than with IM narcotics. Respiratory depression is rare except when combined with other sedating drugs.

Epidural Analgesia:

It is possible in infants (not premature neonates) to successfully thread a lumbar a caudal catheter rostrally to a thoracic level, and instil an analgesic (e.g Morphine 30–50 mcg/kg q 6–12 h). The recommended dosing for post–op epidural infusion is, Bupivacaine 0.1%, with Fentanyl 2 mcg/ml, to run at 0.3 ml/kg/hr [dosing (upper limit) is: Bolus: 2–2.5 mg/kg; Infusion: 0.4mg/kg/hr Infants <2 months of age: .25 – .3 mg/kg/hr]. Side Effects (which are rare) include, seizures, cardiac arrest, pruritus. nausea, respiratory depression: there is an increased likelihood of developing respiratory depression in patients with:

i. Additional systemic narcotics.
ii. High catheters.
iii. Age less than 6 months.
iv. Preterm babies less than 60weeks gestational age.

Single injection Regional techniques may be used and

these include:
Caudal block, Penile block, Ilio-inguinal Ilio-hypo gastric block, Fascia iliaca block.

Other approaches include:
1. Subcutaneous administration of opioids
2. Transdermal fentanyl
3. EMLA Cream, Ametop gel®.
4. Other routes of administration of opioids such as: nasal, per rectum, per oral, or intravenous.

Multiple opportunities exist along the pain pathways to modulate and attenuate the pain response intra–operatively and post–operatively. Morphine can exert its affects, peripherally, spinally and supraspinally. NSAIDs, antihistamines, and serotonin antagonists can be important in attenuating hyperalgesia. Regional anaesthesia with local anaesthetic can ameliorate the surgical stress response. Epidural analgesia may decrease the incidence of post-surgical morbidity and mortality. Thoracic level epidural anaesthesia/analgesia may be the ideal way to effectively treat post–thoracotomy and post abdominal surgery pain. Epidural opioids probably provide superior analgesia and therefore probably decreased post–op pulmonary and cardiac complications, but further studies are needed to confirm this. Epidural analgesia with local anaesthetics can improve post–operative gastrointestinal (GI) function and decrease paralytic ileus time. Epidural opioids however decrease GI propulsion motility and can cause nausea, and vomiting. The secret is to use combined therapy in a pre–emptive way to decrease post–op pain and prevent the occurrence of chronic pain.

TABLE 2: MODALITIES OF ACUTE AND POST-OPERATIVE PAIN MANAGEMENT

Conclusion

In conclusion, ample knowledge about paediatric pain exists to treat children humanely and effectively, but it is not universally applied. Multiple sources of information are available, and it is important that paediatric health care practitioners expand their knowledge base and advocate for the appropriate treatment of pain in children. This may include the institution of and adherence to educational requirements and quality improvement guidelines for the treatment of paediatric pain. When paediatric pain is severe, most management techniques include potent analgesics or the use of narcotics. There is considerable resistance to the use of narcotics in children for fear of addiction or concern about respiratory depression. This may also pose an ethical dilemma to the nursing staff8. Pain can be devastating to a child's morale and should be treated the same way any other disease symptom is addressed. The key to excellent continuing care for these children is a multidisciplinary approach with a psychologist, physical therapist and a pain management specialist.

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Illustrations

Illustration 1

Table 1

TABLE 1: PAIN ASSESSMENT IN CHILDREN

Method of pain assessment	Remark
The Visual Analogue Scale (VAS) [is useful in children older than 6–7 years of age]	The patient is presented with a 10 cm line, labelled as above, and asked to mark an `X' on the line indicating the intensity of their pain. The result is then measured with a metric ruler and scored between 0 (No pain) – 10 (Worst possible pain).
The Numerical Rating Score (NRS) [Approximately ages 5–6]	This is similar to the VAS with the addition of the numbers 0 through 10 spaced along the line. This can be used with children who understand the concept of numbers.
The Oucher Scale (AKA Faces Rating Scale or Smiley Analogue Scale) [as young as ages 3–5]	This involves a range of numbered faces that the child can relate to. This scale can be used in all verbal children.
The Poker Chip Scale	This scale quantifies the child's pain by the number of chips (0–4) he/she/ selects, "pieces of hurt".
Analogue Chromatic Continuous Scale (ACCS)	This system potentially is useful for children as young as 3 years old. Children tend to associate red & black with increased pain sensation. (The back is ruled for easy scoring).

Illustration 2

Table 1 Continues

Table 1: Continues

Body Outlines	Useful tool that allows children to colour the area that hurts. Colouring is a favourite pastime for children. They tend to associate blue with cold and red with hot. In children who are unable to verbally report their pain intensity behavioural scales can be used.
The Children's Hospital of Eastern Ontario Pain Scale (CHEOPS)	This is based on observation of child behaviour by physicians or nurse. The scale assigns a point score to 6 categories of behaviour and the total score is supposed to correlate with pain. It is not too reliable. Note: crying can be caused by pain, hunger, frustration, restraints or anxiety.
The objective pain scale	This combines physiologic and behavioural parameters. The ability to calm the child is important when using this scale.

Illustration 3

Table-2

TABLE 2: Modalities Of Acute And Post-Operative Pain Management

Modality	Means	Remarks
A. Behavioural Considerations	Guided Imagery Distraction Being held or rocked.	
B. Pharmacological management:	1) Non –opioid Analgesics a) Paracetamol (acetaminophen)	Immaturity of the newborn hepatic enzymes serves to be protective.
	b) Acetylsalicylic Acid (ASA)	Useful in children with mild to moderate pain of inflammatory origin. *Concerns*: Reyes Syndrome, GI side effects, platelet dysfunction.
	c) Ibuprofen is available in liquid form. (Pediaprofen. 100 mg/5ml)	Renal compromise and bleeding diathesis are contraindications.
	d) Indomethacin – I.V.	used to promote closure of Patent Ductus Arteriosus

Illustration 4

Table 2 Continues

	e) Choline Mg Trisalicylate (Trilisate)	A long acting non–acetylated salicylate with less GI upset and platelet dysfunction.
	f) Ketorolac p.o. IM/ I.V.	Side effects include nausea, gastro-intestinal bleeding, platelets dysfunction, and interstitial nephritis.
	2) Opioid Analgesics:	Because hepatic enzymes take time to mature (3–6months) theT½ of morphine is twice as long in the neonate as in the adult. Morphine is metabolised into morphine –3–glucuronide (inactive) and morphine–6–glucuronide (active)
	a)Patient Controlled Analgesia (PCA) –IV/IM	Intermittent bolus of narcotic on demand is probably the best course to take. Allowed if the child is older than 7 years of age. Children in pain may prefer pain to the "shot" (and they'll under report their pain).

Illustration 5

Table-2 Continues

	i. Intravenous morphine @ 30–100 mcg/kg q 1–2h	A useful alternative would be to use IV methadone since its longer elimination T½ allows less frequent dosing. Start with a loading dose. of 50mcg/kg every 10 minutes in the recovery room then use a "reverse prn" sliding scale to maintain comfort.
	b. Continuous opioid IV infusions	In the ventilated patient, the very young, or in patients with cognitive or physical handicaps that preclude use of a PCA.
	Morphine:	Bolus or Loading dose: 50–100 mcg/kg (25–50mcg/kg q 10 min.)Maintenance infusion: 10–15 mcg/kg/hr < 3–6 months If > 6 months of age: 25–30mcg/kg/hr
	Fentanyl:	Bolus or Loading dose: 0.5–1 mcg/kg Maintenance infusion: 0.5–1 mcg/kg/hr

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