

An Overview on Postoperative Pain in Pediatrics

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Abstract:

Pain is a stressful condition considered to be a global health problem, and children are the most vulnerable and under-served population. Moderate to severe postoperative pain in pediatric population is associated with physiological, psychological and emotional adverse effects.

Keywords: Pain, Postoperative, Pediatrics.

Introduction:

The International Association for the Study of Pain (IASP) defines pain as “an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage”. The mechanism of pain perception in the pediatric patients is complex, diverse and poorly understood. Children are not miniatures of adults. In addition, the belief that babies do not feel pain, do not remember pain or turn into an experience is also wrong. Different phases of their cognitive and physical development will affect how pediatric patients respond to and interpret pain (1).

In children, focusing on the symptom rather than the cause often results in inadequate treatment, and postoperative acute pain becomes chronic in 20% of cases. Untreated postoperative pain increases morbidity, decreases quality of life, prolongs recovery time, and extends the duration of opioid treatment associated with the use of analgesic drugs. Regular and frequent monitoring of pain, providing the appropriate intervention without delay, and ensuring the participation of the child's family in the treatment process increase the success of pain treatment (2).

Surgery is a common medical procedure that subjects children to pain, with over 85% of children experiencing pain postoperatively and 63% experiencing clinically significant pain upon transition to home. Furthermore, the implications of postoperative pain are not limited to immediate consequences. Poorly managed postoperative pain could lead to unanticipated hospitalization, development of chronic pain, increased sensitivity to pain and increased pain and anxiety during medical events that take place later in life (3).

Evaluation of Postoperative Pain in Children

In the treatment of pediatric postoperative pain, it is essential to evaluate the child's response to treatment at frequent and regular intervals. Difficulties in defining and grading pain in pediatric patients also complicate treatment. Pain is often difficult to assess in young children because the most widespread symptom of pain is crying, which occurs in many painless situations (4).

Increased heart rate and blood pressure, tachypnea, and decreased oxygen saturation can be considered as physiological indicators of pain. However, it should be kept in mind that these findings may also be seen due

to fever, dehydration and some drugs, and even the child's anxiety and fear may cause similar symptoms. Therefore, physiological parameters should always be used in conjunction with other assessment methods. Depending on the child's ability to communicate, pain is assessed by self-report, physiological parameters, or by observing the child's behavior (5).

Evaluation of postoperative pain in infants and young children

Self-rating scales cannot be used because infants and young children cannot communicate verbally. Symptoms of pain in this age group include body stiffness, excessive facial expression (frown and exaggerated eye closure), sleep disturbances, loud crying, and the child's attempt to get away when touching the painful area of the body (6). Toddlers show aggression, crying, or trying to protect the painful part of the body. The most commonly used pain scales for infants and young children are: Children's Hospital of Eastern Ontario Pain Scale (CHEOPS), Children and Infants Postoperative Pain Scale (CHIPPS), Revized Face, Legs, Activity, Cry, Consolability scale (FLAAC)'dir. On the other hand, the comfort scale evaluates both behavioral parameters and physiological (blood pressure, heart rate and muscle tone) parameters (7).

Table (1) : Modified-Comfort scale (8)

	1	2	3	4	5
Alertness	Deeply asleep	Lightly asleep	Drowsy	Fully awake and alert	Hyperalert
Calmness	Calm	Slightly anxious	Anxious	Very anxious	Panicky
Physical movement	Occasional	Slight	Frequent	Vigorous movement	Vigorous movement torso and head
Facial tension	Totally relaxed	No facial tension	Some muscles	Throughout the facial muscle	Contorted/grimace
Heart rate	Below baseline	At baseline	>15% above baseline Infrequent	>15% above baseline Frequent	>15% above baseline consistent
Blood pressure	Below baseline	At baseline	>15% above baseline Infrequent	>15% above baseline Frequent	>15% above baseline consistent

Evaluation of postoperative pain in preschool children

Children aged 3-7 can describe the severity of their pain and indicate its location. They can understand pain as punishment, complain and show aggression. At this age, scales based on both the clinician's observation and the child's self-expression are used. The most commonly used scales: Wong-Baker Faces Pain Rating Scale, OUCHER pain scale and The Faces Pain Scale – Revised (FPS-R) (Figure 1) (9).



Figure 1. The Faces Pain Scale – Revised (FPS-R) (9)

Evaluation of postoperative pain in school-age children

School-age children's reactions to pain and the words they use are influenced by the society they live in, and they often exhibit behaviors they learn from their families. School-age children can describe what they feel and show the location of pain in their body. The most commonly used scales are the Visual Analog Scale (VAS) (Figure 2), the Revised Facial Pain Scale (FPS-R), and the Numerical Rating Scale (NRS) (Figure 3) (10).



Figure 2. Visual Analog Scale (VAS) (AKKEMİK, 2022)

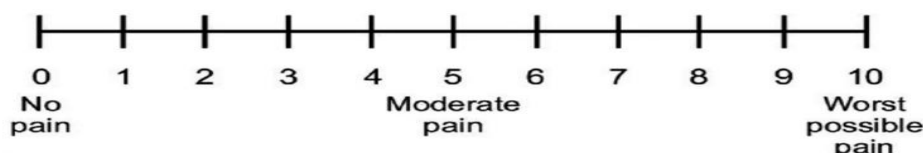


Figure 3. Numerical Rating Scale (NRS) (9)

Postoperative Pain Management in Children

The severity of post-surgical pain and response to analgesic therapy are difficult to predict because there are many variables that differ depending on the child and surgical procedure. In order to provide optimal analgesic treatment and to evaluate the response to treatment, pain should be questioned frequently in the postoperative period. Analgesic therapy should be planned according to the expected intensity and duration of pain and titrated according to clinical response. Treatment should be flexible to accommodate patient differences and contingencies or events (9).

The severity and duration of postoperative pain is variable. Solitary lymph node excision, hydrocele surgery, skull-brain surgery are surgeries which relatively less severe postoperative pain is after expected, while incisional hernia repair, open cholecystectomy, tonsillectomy, spinal reconstruction, and kidney transplantation are surgeries which severe postoperative pain is expected (2). After pain is severe in almost every case in the early perioperative period and is expected to decrease in severity and resolve spontaneously in the days or weeks following the operation. In practical terms, this means that at the beginning, analgesic therapy should be given regularly (hourly-every 4 hours) until requirements begin to decrease. Later, when pain is detected or when pain is expected (for example, before mobilization), analgesic treatment can be planned “as needed” (5)

Pharmacological Approaches

Non-Opioid Analgesics

Paracetamol (acetaminophen), ibuprofen, and ketorolac are the most commonly used non-opioid analgesics in the treatment of postoperative pain in children (11).

The pharmacokinetic and pharmacodynamic effects of paracetamol in children are relatively well understood and can be administered safely provided dosage guidelines are followed. Existent for oral use in tablet, syrup and soluble forms, it can also be administered rectally, but the bioavailability of rectal paracetamol is variable. Due to differences in the clearance, volume of distribution and half-life of the drug in newborns, the dose amount and dose frequency of paracetamol are different (5).

The recommended dose of oral paracetamol is 15-20 mg/kg every 4 hours. The maximum daily dose is 75 mg/kg in children, 60 mg/kg in term newborns and 45 mg/kg in premature babies. If the oral route is not preferred, a single rectal dose of 30-45 mg/kg can be given. Intravenous formulations are available and are useful in the postoperative period when oral medications are not preferred. The maximum daily dose of paracetamol is limited by the potential for hepatotoxicity after overdose (single or repeated doses exceeding 150 mg/kg in total). The toxicity is due to an oxidized metabolite of acetaminophen, which binds to glutathione and excess of which can lead to severe hepatotoxicity. Term neonates and children produce large amounts of glutathione and are thus relatively more resistant to toxicity (12).

Ibuprofen is the most commonly used non-steroidal anti-inflammatory (NSAID) drug in the form of syrup for the treatment of pain. Oral ibuprofen can be given as a single dose of 15m/kg or every 4-6 hours in children aged 3 months to 12 years. The maximum daily dose is 40mg/kg (11).

Ketorolac is another potent NSAID commonly used for postoperative pain and has been shown to reduce the need for opioid analgesic medication postoperatively. Ketorolac dose is 0.25- 0.5 mg/kg intravenously every 6 hours (4).

The mechanism of action of NSAIDs is through inhibition of cyclooxygenase activity, thereby blocking the synthesis of prostaglandins and thromboxane. Its side effects are gastritis, gastrointestinal bleeding, platelet and kidney dysfunction. Most of the toxicities associated with NSAIDs seen in adults are less common in infants (6 months and older) and children, owing to the absence of other comorbid diseases. Acetylsalicylic acid is not recommended in pediatric patients due to its association with Reye's syndrome (13).

Opioid Analgesics

Many physicians are reluctant to prescribe opioid analgesic drugs in adults and children because of fears about their side effects and potential for addiction. Studies have reported that respiratory depression due to opioid analgesics is not common. However, neonates have higher body water content, immature liver and kidneys, large volumes of extracellular fluid, slower gastric emptying, and less fat and muscle content as a percentage of body weight than older children and adults. In this way, the excretion of many drugs, including opioid analgesics, may be delayed (14).

Codeine is a weak-acting opioid analgesic that is usually administered in combination with paracetamol at a ratio of 20:1 (paracetamol 10-15mg/kg-0.5mg/ kg codeine) for moderate pain in children older than 3 years of age. Codeine has become the most widely used agent among opioid analgesics in pediatric populations due to its good safety profile. However, codeine is a prodrug and the production of the active metabolite morphine is significantly affected by genetic polymorphism (5)).

Morphine is the prototype opioid; Diamorphine, hydromorphone, oxycodone and tramadol are frequently used alternatives to morphine in the postoperative period. The synthetic opioid family (fentanyl, sufentanil, alfentanil, and remifentanil) can be used after major surgery and perioperatively to reduce the stress response in intensive care or before surgery. Morphine has a slow onset of action and a long duration of action due to its low fat-soluble property. However, it may cause hypotension by causing histamine release, and its use in asthma patients is not recommended (15).

Fentanyl citrate is among the ideal opioid agents due to its lipophilic nature, rapid onset of action and short half-life. Its side effects on the cardiovascular and respiratory systems are limited. Fentanyl has an analgesic feature 100 times stronger than morphine and it is advantageous as it has alternative routes of use such as nasal, transmucosal and intravenous (16).

Following appropriate training, patient-controlled analgesia (PCA) can be used in pediatric patients aged 6 years and older. Nursing controlled analgesia NCA is used when the child is too young. Although intermittent bolus is mostly preferred, continuous infusion is recommended to keep the plasma concentration of the drug stable and to prevent fluctuations. However, there is a risk of sedation and respiratory depression during the administration of opioid analgesics with this method (17). Morphine in PCA; 0.01-0.003 mg/kg bolus dose (max. 0.15 mg/ kg/hour), 0.01-0.03 mg/kg/hour continuous infusion, 5-10 min lock time, fentanyl; 0.5-1 µg/kg bolus dose (maximum 4 µg/kg/hour), 0.5-1 µg/kg/hour continuous infusion, 5-10 min lock time, hydromorphone 0.003- 0.005 mg/kg bolus dose (maximum 0.02 mg/kg/hour), 0.003-0.005 mg/kg/hour continuous infusion, 5-10 min lock time is recommended (11).

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