Pain in the Pediatric Population
Noor Daghistani, Pharm.D.

Definition

• “An unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage”
• “The inability to communicate verbally does not negate the possibility that an individual is experiencing pain”

Classification of Pain

<table>
<thead>
<tr>
<th>Pathophysiological Mechanism of Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of Pain</td>
</tr>
<tr>
<td>Etiology of Pain</td>
</tr>
<tr>
<td>Anatomic Location of Pain</td>
</tr>
</tbody>
</table>

Pathophysiological Classification

• Nociceptive Pain
  – Protective
  – Tissue injury activates nociceptors
  – Divided into Somatic vs Visceral pain
• Neuropathic
  – Harmful
  – Structural damage and nerve cell dysfunction
• Mixed Pain
  – Neuropathic pain with nociceptive pain

Objective

• Define and discuss types of pain
• Discuss barriers in the treatment of pain in the pediatric population
• Describe age appropriate strategies and assessment tools for measuring pain in the pediatric population
• Review non-pharmacological and pharmacological treatment modalities for pain in the pediatric population
• Describe specific pharmacokinetic characteristics of commonly used pain medications in pediatric patients

Pain Pathway

Duration of Pain

Pathway of Pain

Pathway of Pain

Pathway of Pain
Duration of Pain

- **Acute**
  - Sudden onset
  - Short-lasting
- **Chronic**
  - Continuous
  - Negatively affects all aspects of life
- **Episodic**
  - Intermittent
  - Intensity, quality, and frequency fluctuate
- **Breakthrough**
  - Temporary increase in pain severity
- **Incidental**
  - Pain due to simple movements
- **End of dose**
  - Pain due to medication blood levels falling below minimum effective analgesic level

Secondary Classifications

- **Etiology of Pain**
  - Little relevance to mechanism and treatment of pain
  - Based on underlying disease
    - Malignant
    - Non-malignant
- **Anatomic Location**
  - Body location or anatomic function of affected tissue
  - Does not offer bases for clinical management of pain

Barriers to Treatment

- Myth that children & infants do not feel pain the way adults do
- Lack of assessment & reassessment
  - Belief that addressing pain in children takes too much time and effort
- Difficulty with understanding & quantifying a subjective experience
- Fears of adverse effects of analgesic medications
- Lack of knowledge of pain treatment

General Pain Assessment Principles

- Gather information on the usual behavior of the child when not in pain
- Assess cognitive developmental level
  - Tools used depend on child’s age and cognitive level.
    - Can use self-report, behavioral observation, & physical measures
- Assess pain regularly
  - Inquire about the character, location, intensity, & duration of the pain

Pain Expression

- **Neonates & Infants**
  - Inability to verbally express pain or discomfort
  - Rely on behavioral features and vital signs
- **Toddlers (2-3 years)**
  - Ability to indicate presence of pain verbally
  - Gradually learn to distinguish levels of pain, and by 5 years can describe pain and pain intensity
- **Early Childhood (2-5 years)**
  - At 6 years: can clearly differentiate levels of pain intensity
  - 7-10 years: can explain why it hurts
- **Middle Childhood (6-11 years)**
  - Have the highest capacity to describe pain
- **Adolescents (12-18 years)**
  - Gradually learn to distinguish levels of pain, and by 5 years can describe pain and pain intensity

Behavioral/Physiologic Scales

- Recommended Age: premature to full-term infants
  - Neonatal Facial Coding System (NFCS)
  - Neonatal Infant Pain Scale (NIPS)
  - Premature Infant Pain Profile (PIPP)
Behavioral/Physiological Scales

Face Legs Activity Cry Consolability (FLACC)
- Recommended Age: 2 months – 7 years

<table>
<thead>
<tr>
<th>Categories</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Face</td>
<td>No particular expression or smile</td>
<td>Occasional grimace or frown, withdrawn, disinterested</td>
<td>Frequent to constant quivering, clenched jaw</td>
</tr>
<tr>
<td>Legs</td>
<td>Normal position or relaxed</td>
<td>Uneasy, restless, tense</td>
<td>Kicking, or legs drawn up</td>
</tr>
<tr>
<td>Activity</td>
<td>Lying quietly, normal position, moves easily</td>
<td>Squirming, shifting back and forth, tense</td>
<td>Arched, rigid or jerking</td>
</tr>
<tr>
<td>Cry</td>
<td>No cry, (awake or asleep)</td>
<td>Moans or whimpers, occasional complaint</td>
<td>Crying steadily, screams or sobs, frequent complaint</td>
</tr>
<tr>
<td>Consolability</td>
<td>Content, relaxed</td>
<td>Reassured by occasional toughing, hugging, or being talked to, distractible</td>
<td>Difficult to console or comfort</td>
</tr>
</tbody>
</table>

Self-Report Scales

- FACES Scales (3 years and older)
  - Wong-Baker
  - Faces Pain Scale- Revised (FSP-R)
  - Recommended

- Poker Chip tool/Pieces of Hurt tool (3-12 years)

Other Parameters to Assess

- The extent of the child's restriction in physical and social activities
- Emotional disturbances
  - Fear
  - Anxiety
  - Emotional stress
- Sleeping difficulties
- Coping skills

Nonpharmacologic Management

- Neonates & Infants:
  - Cognitive strategies are visual or auditory
  - Behavioral strategies: Swaddling, facilitated tucking, rocking, pacifier use, and positioning
- Toddlers & Preschoolers
  - Explain procedure using age appropriate vocabulary
  - Distraction:
    - Active: bubbles, therapeutic play, distracting conversations, deep breathing
    - Passive: television, read age appropriate books
### Nonpharmacologic Management

- **School-Aged Children**
  - Provide with age-appropriate information regarding procedure
  - Give children choices
  - Educate on passive and active distraction techniques
- **Adolescents**
  - Ensure a private setting for procedure
  - Give power to chose type of distraction and who can be present for procedure

### Special Considerations

- ↓ capacity to metabolize medications
- ↓ glomerular filtration and tubular secretion
- Thinner stratum corneum and greater hydration to the epidermis
  - Topical medications
- Higher % of body weight as water
- ↓ concentrations of albumin & alpha-1 acid glycoprotein
- Premature infants, have ↓ ventilatory responses

### Teething Pain

- **Non-pharmacologic treatment:**
  - Teething ring chilled in refrigerator
  - Gently rub or massage gums with finger
- **Pharmacologic treatment**
  - Acetaminophen or ibuprofen
- **FDA does NOT recommend:**
  - Benzocaine- methemoglobinemia
  - OTC: Anbesol, Hurricaine, Orajel
- Lidocaine 2%- seizures, brain injury, heart problems

### Principles of Pharmacologic Pain Management

- **Mild Pain**
  - **Acetaminophen**
  - **Ibuprofen**
- **Moderate to severe Pain**
  - **Consider Opioids**
  - "By the clock"
  - "By the mouth"
  - "By the individual"

### Special Considerations

- **Children < 50 kg and < 18 years:**
  - Use weight-based dosing
- **Children ≥ 50 kg**
  - Single-dose medications: use weight-based dosing unless patient’s dose or dose per day exceeds adult dose for indication
  - Continuous intravenous medication: avoid weight-based dosing strategies and use adult dosing strategies

### Procedural-Related Pain

- Key to management: anticipation
- Multimodal approach
- Use of local anesthetics and strategies to soothe, even in simple procedures, like venipuncture’s
  - Eutectic Mixture of Local Anesthetics (EMLA)
  - Iontophoresis
  - Liposomal lidocaine
  - Vapocoolant spray
- Use systemic agents for procedures which usually cause severe pain, such as bone marrow aspirations
  - Do not use sedatives or anxiolytics alone
**Acetaminophen**

- Most common due to safety profile
- Available in many formulations (eg: tabs, caps, oral liquids, sup, IV)
  - Beware of concentrated solutions
- General dosing principles
  - PO: 10-15mg/kg
  - Rec: 20mg/kg
  - Loading dose needed: 30-40mg/kg
  - IV: 15mg/kg
  - Not FDA approved for use in children < 2 years
  - MAX: 3G or 4G?
- Hepatically cleared

**Nonsteroidal Anti-inflammatory Drugs (NSAIDs)**

- Most common NSAIDs in hospital settings: ibuprofen, naproxen, ketorolac
- FDA indication: Ibuprofen & ketorolac
  - Exceptions:
    - Neoprofen: PDA
    - Caldaror only approved for ≥ 17 years
    - Ketorolac: only single dose in < 2 years
- WHO only recommends the use of ibuprofen

**NSAIDs**

- Adverse Events:
  - Increased incidence of bleeding
  - Gastrointestinal bleeding
  - Nephropathy
  - Edema
- Caution in children with:
  - Asthma
  - Orthopedic injuries

**Opioid Analgesics**

- Morphine
  - Most common opioid prescribed
  - Safety:
    - Hypotension
    - Histamine release
- Hydromorphone
  - 5 times more potent than morphine
  - Preferred for intermittent dosing in patients with renal failure

- Fentanyl
  - 70-100 times more potent than morphine
  - More lipophilic and quicker onset
  - Structurally similar to meperidine
  - Shorter half-life in children: ~2h
- Methadone
  - Long-acting opioid
  - Same potency as morphine
  - Safety:
    - Bradycardia, hypotension, cardiac arrhythmias
Opioid Analgesics

- Hydrocodone
  - Oral administration
  - Used for moderate pain
- Oxycodone
  - Oral administration
  - Used for moderate to severe pain
- Safety: Acetaminophen overdose in combination products

Opioid Analgesics

- Meperidine
  - No longer recommended for treatment of acute pain
- Codeine
  - Weak opioid
  - Should not be routinely recommended
  - 2013 BW: respiratory depression in children following tonsillectomy and/or adenoidectomy
- Tramadol
  - May have role in some types of pain in adolescents
  - Use is limited in children
  - Safety: seizures and drug-interaction with serotonin reuptake inhibitors

### Opioid Dosing

<table>
<thead>
<tr>
<th>Medication</th>
<th>Initial IV</th>
<th>PO</th>
<th>Initial IV</th>
<th>PO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>B: 0.5-2 mg/kg/dose q 2-4h</td>
<td>□</td>
<td>B: 0.1 mg/kg/dose q 6-8h</td>
<td>□</td>
</tr>
<tr>
<td>Hydrocodone</td>
<td>B: 0.01-0.2 mg/kg/dose q 4-6h</td>
<td>□</td>
<td>B: 0.01-0.1 mg/kg/dose q 6-8h</td>
<td>□</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>B: 0.2 mg/kg/dose q 4-6h</td>
<td>□</td>
<td>B: 0.03-0.06 mg/kg/dose q 6-8h</td>
<td>□</td>
</tr>
<tr>
<td>Meperidine</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

**B= bolus, CI= continuous infusion, h= hours, IV= intravenous, max= maximum, PO= oral, q= every

### Summary

- Pediatric patients feel pain, even neonates
- Comprehensive pain management is multidisciplinary
- Pain assessments should be done regularly, using self-report scales when possible
- Appropriate analgesic dosing is based on patient’s weight and/or age

### Assessment: True or False?

- Infants and children suffer less from pain than adults.
  - FALSE
- Self-Report Scales, when possible, are the preferred strategy for gathering information about pain levels in the pediatric population.
  - TRUE
- Preterm and term infants clear acetaminophen faster than older children and therefore require a higher dosing frequency.
  - TRUE

### References