

# Basic Approaches to Pediatric Pain Management

An introduction to assessment, pharmacology, and management.  
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## Disclosure

- No relevant financial or other relationships exist between the speaker (me) and any pharmaceutical or medical equipment companies...

## Objectives

- Understand means and goals of pediatric pain assessment
  - Observer or self-report tools
- Reinforce prior knowledge of analgesic ladder and application to children
  - Analgesics and adjuvants
  - PCA and invasive management options

## What is Pain?

- Pain is “*an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage.*”

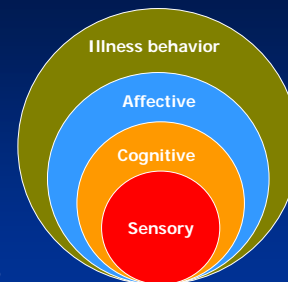
• International Association for the Study of Pain, 1979

## Pediatric Pain Management

- Basic ideas
  - Pediatric management is **different** than for adults.
  - Pain is experienced along a spectrum (**not different**).



## Pain has layers



(Turk 1992)

## Pain Assessment

- The goal of assessment
  - establish pain presence and a level
  - fit level to appropriate treatment plan
  - evaluate treatment



## Pain Assessment

- Scales are age and developmental specific.
- When possible, use patient's expressed response.
- Parents are not always reliable surrogates.
- Environmental, social, psychological, and physiologic factors impact the response.

## Pain Assessment

- Observational scales for use in preverbal children
  - Developmental issues between neonates, infants, toddlers, and non-verbal older children
  - Behavioral clues used to determine discomfort, anxiety, and pain
    - May not be able to determine difference between anger, frustration, fear

## Pain Assessment: Observational scales for neonates/infants

- CRIES
  - Crying, Requires O<sub>2</sub>, Increased vital signs, Expression, Sleeplessness
  - Neonatal postoperative pain measurement
    - Limited patient population validation
    - Primarily published as a research tool

## Pain Assessment: Observational scales for infants/toddlers

- CHEOPS
  - Face
  - Leg position and motion
  - Activity
  - Cry
  - Consolability

## Pain Assessment: Observational scales for neonates/infants

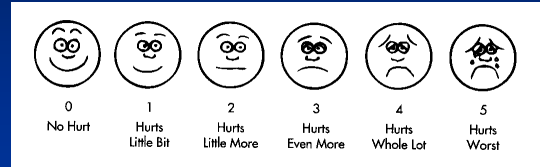
- Other validated pain scales for neonates and infants
  - Neonatal Infant Pain Scale
  - Modified Behavioural Pain Score
  - OPAS (SHC in burns)
  - Premature Infant Pain Profile
  - Neonatal facial coding system
  - Distress scale for ventilated newborn infants

## Pain Assessment: Self-report

- Believed to be best measure
- Developmental issues
  - Previous painful experiences?
  - Ability to conceptualize magnitude
  - Verbal or manual expression
    - Willingness to express to strangers
  - Memory issues of scale

## Pain Assessment: Self-report scales for pain, age 4+

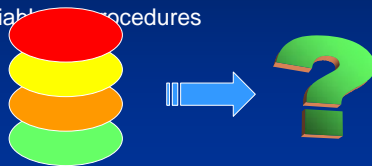
- Faces Scale
  - Familiar, easy, validated



(Bieri, 1990)

## Pain Assessment: Self-report scales for pain, age 4+

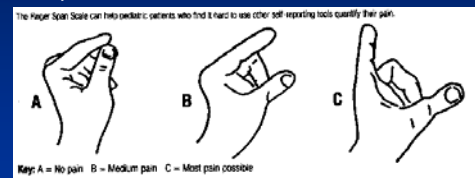
- Poker Chip Tool
  - Easy, baseline assessment
  - Less reliable procedures



(Hester 1990)

## Pain Assessment: Self-report scales for pain, age 4+

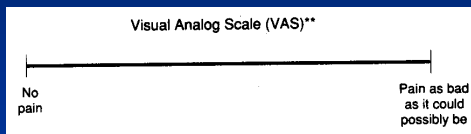
- Finger span scale
  - Simple



(Franzen 1989)

## Pain Assessment: Self-report scales for pain, age 6+

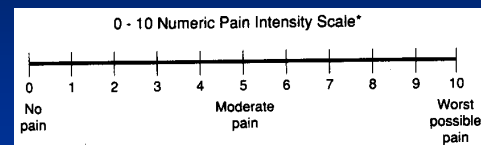
- Visual Analog Scale
  - 100mm line
  - measure point placed by patient



(AHCP 1992)

## Pain Assessment: Self-report scales for pain, age 6+

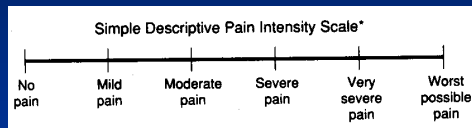
- Numeric scale
  - 0-10 scale



(AHCP 1992)

## Pain Assessment: Self-report scales for pain, adolescent

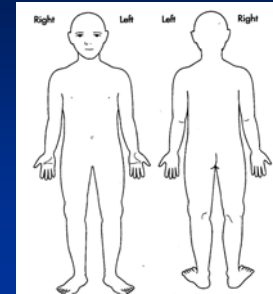
- Word graphic scales



(AHCPR 1992)

## Pain Assessment: Self-report scales for pain, adolescent

- Adolescent pediatric pain tool
  - Map of pain and descriptor



(Wong 2000)

## Pain Assessment: Self-report scales for pain, adolescent

- Pain diary
  - Requires higher level functioning
  - Allows association to events, people, moods
  - Allows association with functional basis
  - Allows association with treatments
  - Provides longer term reference

## Pain/Anxiety Assessment

- Anxiety contributes to pain and vice versa
- Manifestations of anxiety and pain
  - fear
  - avoidance
  - distress

## Pain/Anxiety Assessment

- **Anxiety is part of pain**
- Pain is not necessarily part of anxiety
  - Anxiety is difficult for younger children to understand
- Anxiety may only be recognized as general distress in children

## Pain/Anxiety Assessment

- Anxiety and acute pain management
  - management programs assessing pain and anxiety (or fear)
    - demonstrate improved cooperation
    - fewer acute management events
    - reduced overall medication requirements

(Sheridan 1997, 2001, Kadliak 2003)

## Pain Assessment

- This is not golf!
  - The score itself is not all important
  - Reducing the score is only one measure available to reduce overall pain and suffering
  - Anxiety management and coping mechanisms are key

## Pain/Function Assessment

- Function
  - Activities of daily living
    - Eating, play, interaction with family and friends
  - Specific physical therapy measures
    - Ambulation, grasp/strength
  - Specific medical procedures
    - Cooperation with dressings/splints

## Pain/Function Assessment

- The goal is improve the objective component (function) and manage the subjective component (pain)

## Pain Assessment and Management

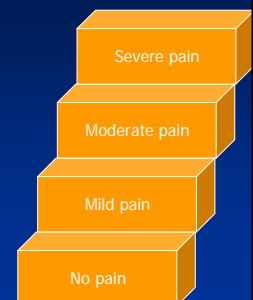
- Pain level is really a composite of all levels.
  - No pain = No
  - Mild pain = No + Mild
  - Moderate pain = No + Mild + Moderate
  - Severe pain = No + Mild + Moderate + Severe
- Treatment should mirror this model.

## Basic pain management

- Principles
  - Therapeutic regimens can be applied along the spectrum.
  - No reliable recipes (but you need to start somewhere).
  - Treatment must be individualized and frequently evaluated.

## Basic pain management

- Add ATC opioid, PCA, blocks, adjuvants
- Add opioid, adjuvants
- Add NSAID, APAP, adjuvants
- Supportive care



## Basic pain management/Multi-modal treatment

- Therapeutic options, the puzzle pieces
  - Supportive measures (we *always* perform these)
  - Medications (we *always* think of these)
  - Adjuvants (we *usually* think of these)
  - Invasive modalities (we *hardly ever* think of these)
- Pain management is multi-modal!

## No pain:

- A basic principle: **No pain = no drugs**
  - Reassurance and comforting
  - **Supportive care**
  - Quick return to normal routines

## No pain: supportive measures

- What are they?
  - Cuddling
  - Play
  - Music and song
  - Suckling or bottle
  - Massage and hugging

## No pain: supportive measures

- Supportive measures are not just “feel good” activities
  - Relieve edema, tension, stress
  - Activate endogenous endorphins
  - Encourage pain inhibition pathway function
  - Provide psychological benefit

## Mild pain: Acetaminophen

- Very effective for all age groups
- Cumulative doses required are route dependent, and controversial
  - Term neonate <60mg/kg/day
  - Infant/toddler <75mg/kg/day
  - children <100mg/kg/day
- “Around the clock” offer/dose
- Combinations with other adjuvants

## Mild pain: Acetaminophen

- Short onset, long duration
- Multiple routes
- Analgesia similar to NSAIDs
- Mechanism of action
  - inhibition of cyclo-oxygenase (COX-3 or COX-1 variant)
  - essentially no anti-inflammatory effect

## Mild pain: Acetaminophen

- Risk of hepatic damage
  - Beware the starved child or other states with reduced glutathione
  - Few studies of repetitive dose pharmacokinetics, but appears relatively safe
  - Are febrile children at greater risk?
  - OTC availability may introduce increased risk of overdose (multiple formulations, more is better)

## Mild pain: Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

- Very effective all age groups
- Opioid sparing effect
  - demonstrable in various surgical models
- “Around the clock” offer/dose
- Combinations with other adjuvants

## Mild pain: Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

- Short onset, long duration
- Multiple choices but few parenteral forms in U.S.
- Available with codeine
- Mechanism of action
  - variable inhibition of cyclo-oxygenase (COX-1 and/or COX-2)

## Mild pain: Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)

- Risks
  - GI ulceration, renal failure, platelet inhibition and bleeding, bone healing?
  - COX-2 antagonist market withdrawal
  - Over-the-counter availability may introduce risk of overdose and side effects to uninformed caregivers (more is better, multiple formulations)

## Moderate pain: Opiates (the gold standard)

- Oral dosing and other routes available
  - Convenient, cost effective
  - Variable bioavailability, onset, peak, and duration
- Combination formulations
  - Usually acetaminophen or aspirin
- “Around the clock” offer/dose

## Moderate pain: Opiates (the gold standard)

- Balancing analgesia *versus*
  - Sedation
  - Dysphoria and sleep disturbance
  - Itching, histamine release
  - Nausea
- Naloxone is specific antagonist
  - SMALL doses (smaller than PALS) and wait

## Warning: Opiates (the gold standard)

- RESPIRATORY DEPRESSION occurs in children (even at low doses!)
  - Usually manifested as a late effect after dosing
  - **APNEA LIKELY** when sleeping, especially if central or obstructive sleep apnea present!
  - Frequent observation with pulse oximetry

## Severe pain: Opiates (the gold standard)

- Intermittent parenteral administration
  - Route dependent absorption, onset, duration
    - Rectal, mucosal
    - Subcutaneous, intramuscular
    - Intravenous
  - Route dependent acceptance and reliability
    - May result in disincentive for use
- Most effective as treatment for “breakthrough” pain

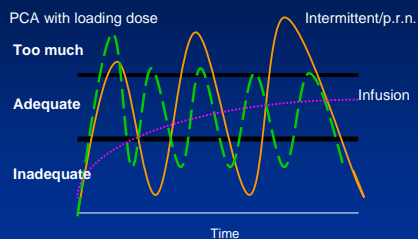
## Severe pain: Opiates (the gold standard)

- Regular parenteral administration
- “Around the clock” offer/dose
  - Improves analgesia coverage
  - May reduce individual dose requirement
  - Does not correlate to infusion requirement
    - May be less over time

## Severe pain: Opiates (the gold standard)

- Continuous infusion
  - Stable dose
    - good if stable/constant pain, provides baseline
    - may increase total dose requirement over time
    - poor choice for acute changes in pain
  - Accumulation of metabolites (meperidine, morphine)
    - seizures, prolonged sedation, dysphoria

## Severe Pain: IV opiates, delivery mode and levels



## Severe Pain: Patient Controlled Analgesia (PCA)

- Caveats:
  - Patient requested and delivered with controlled dosing
  - Parent or surrogate control is prone to error (JCAHO flag issue)
  - Lockout interval related to onset and peak effect
  - Continuous infusion usually not necessary in acute pain management

## Severe Pain: Patient Controlled Analgesia (PCA)

Agonist	Dose (mcg/kg)	Lockout (min)
Morphine	10-30	5-10
Hydromorphone	2-5	5-10
Fentanyl	0.25-0.5	5-10*

## Severe Pain: Patient Controlled Analgesia (PCA)

- Caveats continued:
  - Expect dose adjustments, both up and down
  - Patient education needed for dosing appropriately and not just by the clock
  - Beware of programming, loading, and syringe fill errors
  - Nursing monitoring requirements should include respiratory rate, sedation state, pulse oximetry, in addition to standard protocols

## Severe Pain: Patient Controlled Analgesia (PCA)

- Patient selection
  - Age versus cognitive and expressive ability
  - Able to discriminate mild, moderate, and severe pain
  - Understanding of delivery mode and delayed effect
  - No significant unaddressed co-morbid limiting factors
  - IV PCA requires that the patient act as advocate as well as care giver

## Severe pain: opioid conversion

Agent	P.O.	I.V.	Metabolite
Morphine	3-5	1	Yes
Hydromorphone	0.5-1	0.2	Yes
Codeine	20	10	Yes
Fentanyl	0.1*	0.01	No
Oxycodone	1		No
Methadone	1**	1	No

Adapted from Yaster, Krane, Kaplan, Cote, Lappe 1997

## Adjuvant agents (off label uses)

- Antidepressants for chronic pain
- Anti-spasmodics
- Calcium channel blockers and Alpha-2 agonists
- Antiepileptics (membrane stabilizers)
- NMDA blocking agents
- Magnesium, other trace minerals

## Adjuvants: Anxiolytic/Sedative agents

- Do not provide significant analgesia!
- Various classes and formulations
- Synergistic effects with opiates and other analgesics
- Often difficult to titrate for optimal effect
  - Overdose is easily achieved
  - Accumulation is common

## Adjuvants: Acupuncture

- Developing body of reports and clinical studies demonstrating good tolerance in children
- Demonstrate improved function, reduced medication consumption

## Adjuvants: other manipulations

- Massage
- Reiki
- Reflexology
- Music
- Play
- Distraction with virtual reality programs, movies, electronic games

## Severe Pain: Invasive pain management

- Local anesthetics topical or infiltration
- Peripheral regional analgesia
- Neuraxial regional analgesia
- Neuraxial opiate and adjuvant techniques
- Acupuncture

## Severe pain: Local anesthetics

- Blockade of neural action potential
  - Fast acting generally shorter duration
  - Slow acting generally longer duration
  - Toxicity related to prolonged action in CNS, cardiac conduction system and myocytes, and axonal tissue
  - Other untoward effects associated with clearance

## Severe pain: Local anesthetics

- Mucosal surfaces: Ophthalmic, oral, otic, GU, GI
  - Liquid, suspension, jelly, ointment
- Skin: Topical helpful for venipuncture, skin injection
  - EMLA cream (lidocaine/prilocaine)
  - LMX "ElaMax" (lidocaine)
  - Iontophoresis/transdermal patches?

## Severe pain: Local anesthetics

- Local injection
  - Easy, effective, but painful
  - Use sodium bicarbonate (1:10) in lidocaine and mepivacaine
  - Vascular tissues with high uptake
  - Epinephrine will increase duration of lidocaine and mepivacaine

## Severe pain: Peripheral Regional Analgesia

- Digital blocks
- Metacarpal or metatarsal blocks
- Wrist, elbow, ankle blocks
- Hematoma blocks are potentially dangerous

## Severe pain: Peripheral Regional Analgesia

- Major conduction blocks with or without indwelling catheters for continuous infusion
- Brachial plexus
- Lumbar/sacral plexus
- Sciatic (classic, proximal femoral, popliteal)
- Femoral “sheath”

## Severe pain: Neuraxial analgesia

- Epidural
- Caudal
- Intrathecal (spinal)
  - With local anesthetic (outpatient or inpatient)
  - With catheter (inpatient)
  - With preservative free opioid (inpatient)

## Conclusion: Transition between regimens

- The current regimen is ineffective
  - Does the patient tolerate the medication and route of administration?
  - Has the regimen been maximized?
  - Is dosing on reasonable regular interval?
  - Are adjunct measures being used?
  - Are alternative regimens reasonable?

## Conclusion

- Pediatric pain assessment must be performed and reevaluated frequently
- Analgesics and adjuvants should be applied in a structured and simultaneous manner
- Growing experience suggests that PCA and invasive management options work in children