

Pain Management in Neonates

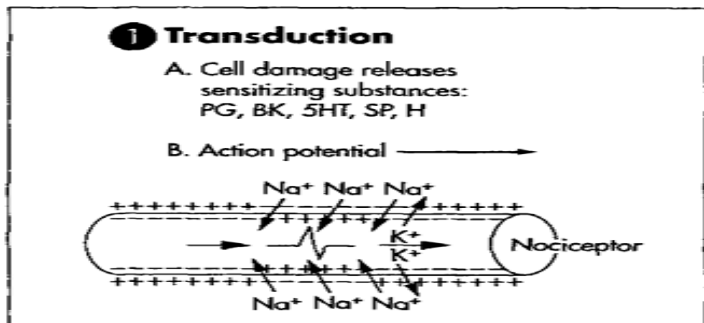
Timur Azhibekov, NICU Fellow

Pain

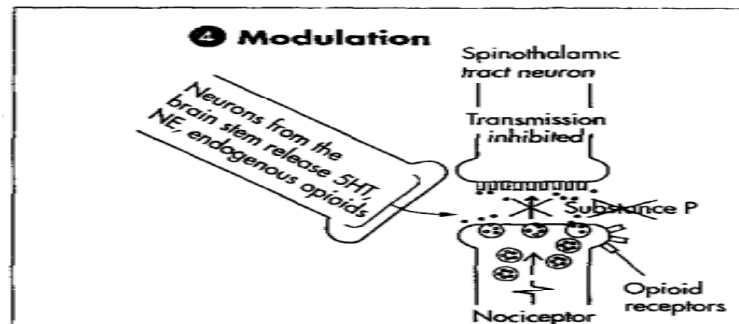
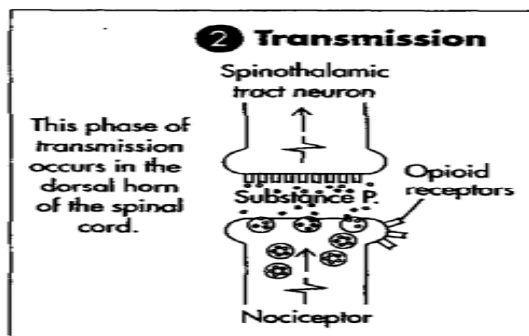
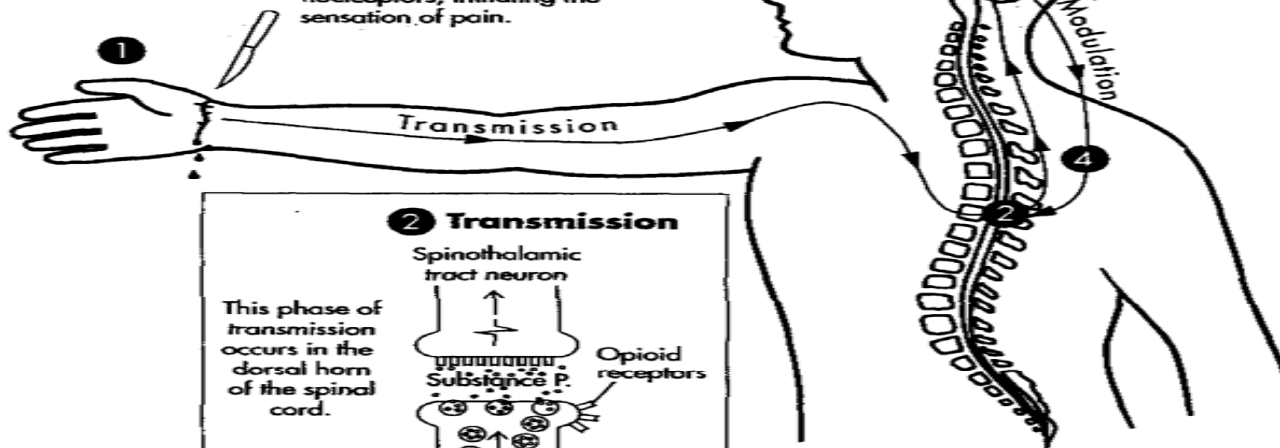
- Definition of Pain per The International Association for the Study of Pain:
 - Pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage
- McCaffery (1968) defines pain:
 - "Whatever the experiencing person says it is, existing whenever he says it does"

Pain Pathway

- Incoming sensory stimuli reach the nociceptors and send a signal to the dorsal horn of the spinal cord via the afferent nerves.
- The dorsal horn transmits the information to the brain via the spinothalamic tract to the thalamus, midbrain, cortex and limbic system
- The midbrain activates the descending modulatory system



Example of noxious stimuli that damage cells and stimulate nociceptors, initiating the sensation of pain.



May be duplicated for use in clinical practice. As appears in McCaffery M, Pasero C: *Pain: Clinical manual*, p. 21, 1999, Mosby, Inc.

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 FIGURE 2.2—cont'd ■ Illustrates the four basic processes involved in nociception; 1, transduction; 2, transmission; 3, perception; and 4, modulation.

Developed by McCaffery M, Pasero C, Paice JA.

Cell Bodies of the Afferent Nerves

- Are located in the dorsal root ganglion close to the spinal cord and they reach out to the skin and viscera
- A beta: light touch, non-pain
- A delta: first real pain conductor (sharp, rapid, shooting)
- C fibers: more prolonged sensations of pain (dull, aching, burning)

Activation Substances

- Potassium and Histamine
- Bradykinin and Prostaglandin
- Substance P

Pain

- Pain is often undertreated due to myths that both patients and caregivers have regarding pain and treatment for pain

Pain Myths in Pediatrics

- Neonates and infants do not feel pain
- Children do not exhibit pain related behaviors or report their pain
- Opioids are inappropriate for children

Pain Truths in Pediatrics

- Pain related behaviors may stop or decrease as pain intensifies or continues
- Prolonged pain may also change activities of daily living
- Prolonged pain may also delay or halt development
- Sleep is used by children of all ages as a way to avoid or prevent pain
- Crying is an uncertain indicator of pain

General Guiding Principles

- Neonates feel pain
- Neonates respond adversely to irritating and painful environmental and therapeutic interventions
- Neonates benefit from assessment of these reactions and subsequent intervention
- Certain procedures are known to be painful

Assessment of Pain

- Upon admission
- With change in behavioral or physiologic parameters indicative of pain
- With procedures

Assessment of Pain

N-PASS:

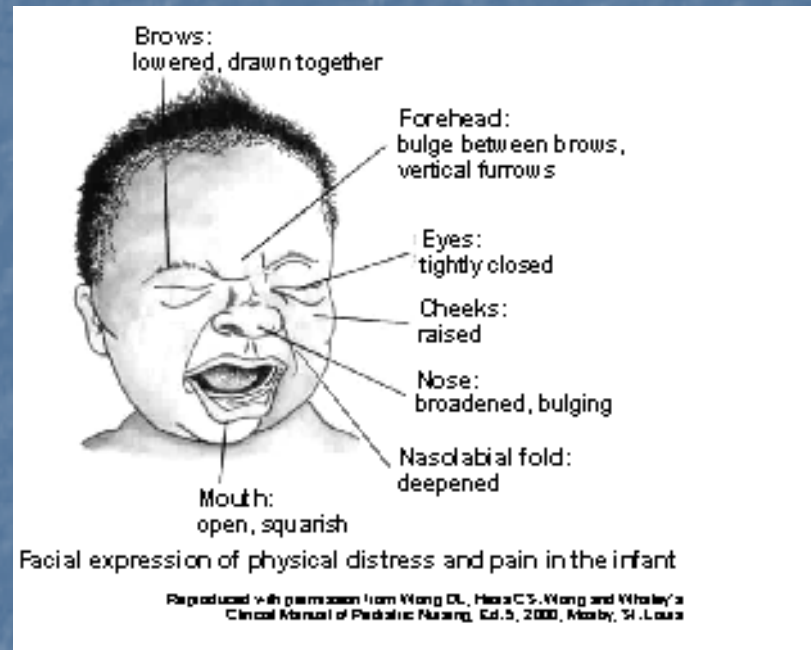
Neonatal Pain, Agitation, & Sedation Scale

Pat Hummel MA, RNC, NNP, PNP, APN/CNP & Mary Puchalski MS, RNC, APN/CNS

Assessment Criteria	Sedation		Normal	Pain / Agitation	
	-2	-1	0	1	2
Crying Irritability	No cry with painful stimuli	Moans or cries minimally with painful stimuli	Appropriate crying Not irritable	Irritable or crying at intervals Consolable	High-pitched or silent-continuous cry Inconsolable
Behavior State	No arousal to any stimuli No spontaneous movement	Arouses minimally to stimuli Little spontaneous movement	Appropriate for gestational age	Restless, squirming Awakens frequently	Arching, kicking Constantly awake or Arouses minimally / no movement (not sedated)
Facial Expression	Mouth is lax No expression	Minimal expression with stimuli	Relaxed Appropriate	Any pain expression intermittent	Any pain expression continual
Extremities Tone	No grasp reflex Flaccid tone	Weak grasp reflex ↓ muscle tone	Relaxed hands and feet Normal tone	Intermittent clenched toes, fists or finger splay Body is not tense	Continual clenched toes, fists, or finger splay Body is tense
Vital Signs HR, RR, BP, SaO₂	No variability with stimuli Hypoventilation or apnea	< 10% variability from baseline with stimuli	Within baseline or normal for gestational age	↑ 10-20% from baseline SaO ₂ 76-85% with stimulation □ quick recovery ↑	↑ > 20% from baseline SaO ₂ ≤ 75% with stimulation □ slow recovery ↑ Out of sync with vent

Assessment of Pain

- Following facial expressions of physical distress and pain should be assessed



**Premature
Pain
Assessment**

- +3 if < 28 weeks gestation / corrected age.
- +2 if 28 - 31 weeks gestation / corrected age.
- +1 if 32 - 35 weeks gestation / corrected age.

Assessment of Pain

Interpretation of results:

- No Pain – score of 0
- Mild pain – 1-3/10 - should be responded to comfort measures & sugar solution
- Moderate pain – (scores 4-6/10) should be responded to comfort measures, sugar solution, and analgesia
- Severe pain - scores of 7 or above should be responded to with above measures supplemented by opioid pharmacologic interventions

Reassessment of Pain

Reassess for pain and effectiveness of interventions after:

- Non-pharmacologic interventions
- Pharmacologic interventions after peak effect
- Titration of pain medication
- Conversion from parenteral to oral
- Discontinuation of pain medications

Non-Pharmacologic Management

- Developmentally supportive care strategies:
 - support self-regulating behaviors
 - decrease noxious stimuli in environment
 - non-nutritive sucking
 - positioning
 - swaddling
 - decrease lighting
 - music therapy
 - infant massage

Non-Pharmacologic Management

- Sucrose/Dextrose
 - dipped pacifier
 - oral (if preferred no pacifiers) - 0.5-1 ml
 - 12.5% dextrose made by pharmacy
 - stable 24 hr in refrigerator

NSAIDS

- Action: inhibit prostaglandins, decrease inflammation at the injury site, acts as an antipyretic
- Side effects
 - Gastric irritation
 - Increase INR
 - Nephrotoxicity
 - Hepatotoxicity
- Analgesic Ceiling
- Little respiratory depression or sedative effect

Tylenol

- Action: inhibits prostaglandins, decreases inflammation in the CNS
- Dose: 10-15 mg/kg/dose orally
- Side effects:
 - Hepatotoxicity

Opioids

- Natural and synthetic
- Bind to opioid receptors in the Central Nervous System
 - Mu receptors: pure agonists
 - Kappa and delta receptors: agonist-antagonist

Pure Agonists

- Produce analgesia and:
 - Euphoria
 - Sedation
 - Itching
 - Urinary retention
 - Nausea and vomiting
 - Hypotension
 - Respiratory depression

Pure Agonists, continued

- Examples
 - Morphine
 - Fentanyl
- Can be blocked by opioid antagonists such as Narcan

Tolerance

- Can occur but is not likely to increase need
- The analgesic effects and side effects of increased doses diminish over time although the pathology is stable
- Can occur without a ceiling for tolerance and side effects

Treatment of Tolerance

- Delay tolerance by combining opioids with non-opioids
- Increase the dose of opioid
- Shorten the dose interval
- Switch to an alternative analgesic

Dependence

- A physiologic state where abrupt withdrawal or a decrease in a drug causes physiologic effects
- Can be prevented by the gentle weaning of a drug
- Symptoms include irritability, high-pitch cry, tremor, seizures, fever, tachypnea, nasal stiffness, vomiting and diarrhea

Morphine

- Dose: 0.05-0.2 mg/kg/dose
- Disadvantages: Histamine release may induce hypotension

Fentanyl

- Dose: 1-4 mcg/kg/dose
- Advantages: No histamine release
- Disadvantages: Tolerance may develop rapidly following continuous infusion. Reverse chest wall rigidity with neuromuscular blocker (vecuronium 0.1 mg/kg/dose)

Narcotic Drips

■ Morphine

- loading dose of 100 mcg/kg over 1 hr
- followed by 10 mcg/kg/hr
- increase 1mcg/kg/hr up to 15 mcg/kg/hr based on pain score
- Wean 50% every 24° if on >48 °
- Naloxone should be readily available to reverse adverse effects: 0.1-0.2 mg/kg IV/ET/IM

Narcotic Drips

- Fentanyl
 - 1-2 mcg/kg/hr
 - may increase by 1 mcg/kg/hr to 5mcg/kg/hr based on pain scoring
 - Wean 50% every 24^o if on >48 ^o
 - Naloxone should be readily available to reverse adverse effects: 0.1-0.2 mg/kg IV/ET/IM

Ventilated Infants

- Use of narcotics and sedatives should be considered on an individual basis
- Elective intubations - consider use of :
 - Fentanyl 1-4 mcg/kg/dose slow IV push
 - Morphine 0.05-0.2 mg/kg/dose slow IV push, IM or SC
 - VLBW infants require smaller, less frequent doses

Ventilated Infants

- Emergency Intubations
 - urgency may prohibit use of narcotics
 - after procedure, consider use of narcotics based on pain score
- Ongoing mechanical ventilation:
 - consider use of narcotics based on pain score

Post Operative Procedures

(Thoracotomy, Laparotomy, VP shunt,
Meningomyocele, etc.)

- Major procedures should be followed with minimum of 24^o of continuous drip
- Titration should occur based on pain score
- Wean 50% every 24^o if on >48^o
- Consider intermittent dosing or PRN after drips discontinued

Diagnostic Procedures

Lumbar Puncture

- Non-pharmacologic pain management
- Dextrose (12.5%)
- EMLA cream (infants ≥ 37 wks)
- Lidocaine (SC)

Diagnostic Procedures

Eye Exams

- Non-pharmacologic pain management
- Dextrose (12.5%)
- Local eye anesthesia

Therapeutic Procedures

Chest Tube Insertion/Removal

- Non-pharmacologic pain management
- Dextrose (12.5%)
- EMLA cream (infants ≥ 37 wks) - insertion
- Lidocaine (SC) - insertion only
- Post-procedure: consider Morphine/Fentanyl

Elective Procedures

Circumcision

- EMLA cream (infants ≥ 37 wks)
- Dorsal Penile block
- Subcutaneous Circumferential Ring Block (evidence suggests preferred method)
- Tylenol: 15 mg/kg every 6 hrs x 24
- Non-pharmacologic pain management
- Dextrose (12.5%)

Questions

1. Describe pain pathway and its major parts that mediates pain perception.
2. What are the myths and truths about pain in pediatric population?
3. What are the major criteria for pain assessment (N-PASS)?
4. List non-pharmacologic interventions to control pain in newborns.

Questions

5. What is Dependence, its symptoms and prevention?
6. What are the principles of postoperative pain management?