

Baby It Hurts

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Outline

- **What is pain?**
- **Misconceptions about pain**
- **Problems with neonatal pain management**
- **Pain assessment**



Our view of pain?



"I don't need that exercise stuff
— I cross the pain threshold just
getting out of bed in the morning."

definitions...

- **Pain:** An unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage (International Association for the study of Pain: IASP)
- **Discomfort:** Something that would ordinarily be considered to disturb one's comfort or cause annoyance

Common **mis**conceptions (“myths”)

- **Myth 1:** The neuronal and endocrine systems of the newborn infant are not developed to the point that allows neonates to feel pain
- **Myth 2:** Newborn infants cannot “**remember**” pain and, therefore, there can be no sequelae of pain
- **Myth 3:** Pain cannot be **assessed** in the newborn infant

(Adapted from the CPS statement on neonatal pain)

Is pain prevention utilized?

- **A 1997 study of 14 Canadian NICU's (Johnston et al, Clin J Pain) found that despite the expressed belief that infants feel as much pain as adults, infants undergoing a wide range of painful procedures did not receive pharmacologic or comfort measures.**
- **This was confirmed in two other large surveys of U.S. NICU's**

Has this changed since 1997?

- **Yes**

- **A 2006 statement by the American and Canadian Pediatric Societies recommend that pain be assessed regularly using validated tools and that pharmacologic agents be used for neonates experiencing pain.**
- **The Joint Commission on Hospital Accreditation in the United States has declared pain as the fifth vital sign and requires all NICUs to assess pain on a routine basis**

And no

- Study of 430 neonates, 14 days. 70,000 procedures, 70% of which were painful, 30% stressful. Median of 115 procedures
- Of 42,413 painful procedures, analgesia was given in 20.8% of pts, 18% non-pharmacologic and 2% pharmacologic (Carbajal et al 2008. JAMA)



Rationale: why should pain be prevented?

Neonates and infants can perceive pain...

...which can have adverse short-term consequences...

...and adverse long term consequences...

...which may be attenuated by analgesia



Rationale: why do it ? (contd.)

● Perception of pain:

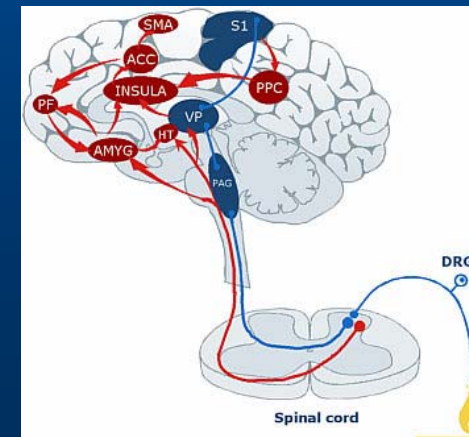
- Neonates and infants perceive pain on behavioral, physiological, and biochemical measures (KJS Anand et al: PCNA 1989; 36:795-822 & NEJM 1987; 317: 1321-1329; Craig KD et al: Pain 1993; 53: 287-299 & Pain 1987;28:395-410)
- Even the fetus *in utero* mounts a hormonal (cortisol and β -endorphin) response to needling (Giannakouloupoulos X et al. Lancet 1994; 344: 77-81)

● Parental perception of pain:

- Vivid memories of parental stress (even 3 years post-NICU) related to neonatal appearance and behavior, and the pain and procedures endured.

Long-term effects of pain

- **Recent MRI study** (Hohmeister et al 2010 Pain) **looked at ex-prems 11-16 yrs of age**
- **Compared to full-term infants, NICU graduates showed different brain patterns when exposed to pain.**
- **Greater sensitization and lack of habituation**



Long-term effects

- **Infants of diabetic mothers who had repeated heel sticks exhibited more intense pain responses to later venipunctures (Taddio et al 2002. JAMA)**



Causes of Pain

Acute pain

Diagnostic and therapeutic procedures

Minor surgery

Suctioning oral/nasal/tracheal

Established pain

Postoperative pain

Inflammatory pain

Thermal/chemical burn

Prolonged pain

Meningitis

Necrotizing enterocolitis

Phlebitis

Osteomyelitis from repeated heelsticks

Principles of Pain Assessment

- **Assess and document at least q 4-6h**
- **Standardized, valid reliable tools should be used**
- **Pain assessment should include behavioral and physiologic indicators**
- **Assessment instruments should be specific for gestational age and type of pain**
- **Pain assessment should be performed after each potentially painful clinical intervention**
- **Anand and International Evidence-based group for Pain, 2001**

Pain assessment methods



- **Behavioral assessment**

- Subjective - crying, agitation etc
- Semi-objective - scoring systems such as NIPS, PIPP (also includes HR, SpO₂) , NFCS etc

- **Physiologic variables**

- HR, BP, SpO₂, intracranial pressure etc

- **Biochemical assessment**

- Cortisol, catecholamines, β -endorphin etc

Pain assessment: which method to use?

- Often a lack of significant correlation between physiologic, biochemical, and behavioral indicators of pain - there is no “**gold standard**”
- Behavioral indicators often used as they are:
 - easier to measure
 - baseline better established
 - non-invasive (esp. for repeated measurements)
 - more “honest signal” of pain

Neonatal Infant Pain Scale (NIPS)

- (Lawrence et al, Neonatal netw.12:59-66, 1993)
 - **Face:** relaxed (0) or grimace (1); **Cry:** no (0), whimper (1), vigorous (2); **Breathing patterns:** relaxed (0) or change in breathing (1); **Arms:** relaxed/restrained (0) or flexed/extended (1); **Legs:** relaxed/restrained (0) or flexed/extended (1); **State of arousal:** sleeping/awake (0) or fussy (1)
- Scoring in one-minute intervals; **x2** before time/ procedure, **x 5** during time/procedure, and **x3** after time/procedure. Total scores for each minute range from 0-7
- Response to acute painful stimuli in non-intubated babies.
- Full validation done, but score is time-consuming, and items such as breathing patterns and cry difficult to interpret in intubated neonates

Premature Infant Pain Profile (PIPP)

(Stevens B et al. Clin J Pain 12: 13-22, 1996).

- **Gestational age:** >36 wks (0), 32-35.6 (1), 28-31.6 (2), < 28 wks (3)
- **Behavioral state:** active/awake, eyes open, facial movements (0), quiet/awake, eyes open, no facial movements (1), active/sleep, eyes closed, facial movements (2), quiet/sleep, eyes closed, no facial movements
- **Heart rate:** 0-4 bpm increase (0), 5-14 (1), 15-24 (2), >25 increase (3)
- **O2 saturation:** 0-2.4% decrease (0), 2.4-4.9% (1), 5-7.4% (2), >7.5% decrease (3)
- **Brow bulge:** None, 0-9% of time (0), Minimum, 10-39% (1), Moderate (40-69%), Maximum ($\geq 70\%$)
- **Eye squeeze:** None, 0-9% of time (0), Minimum, 10-39% (1), Moderate (40-69%), Maximum ($\geq 70\%$)
- **Nasolabial furrow:** None, 0-9% of time (0), Minimum, 10-39% (1), Moderate (40-69%), Maximum ($\geq 70\%$)

Behavioral assessment (contd.)

- Premature Infant Pain Profile (PIPP) (contd.)
 - Observe baseline HR, SpO₂ in 15 s before event. Scoring in 30 s after event.
 - Scores for 7 indicators summed for total pain score. Max score dependent on GA: youngest up to 21, larger up to 18.
 - Scores of ≤ 6 indicate minimal or no pain, >12 moderate to severe pain.
- Validated research tool, cumbersome and time-consuming for clinical purposes. Use in intubated neonates is questionable:
 1. baseline obtained while infant is under chronic stress
 2. if pre-intubation baseline is used, O₂ saturation not an indicator of pain but rather of disease process
 3. items such as nasolabial furrow difficult to discern

CRIES

- **Kretchel & Blidner, 1995**
- **Crying: none or not high pitched (0)**
 - High pitched but consolable (1)
 - High pitched, not consolable (2)
- **Requires increased oxygen**
 - None (0)
 - < 30% (1)
 - > 30% (2)
- **Increased vital signs: no change (0), <20% increase (1), > 20% increase (2)**



CRIES

- **Expression:** no grimace (0), grimace (1), grimace + cry (2)
- **Sleeplessness:** continuous sleep (0), frequent awake (1), constantly awake (2)
- **Face, content, discriminant + concurrent validity**
- **Designed for post-operative pain assessment**



NPASS

- **Developed by a Neonatal Nurse from Chicago**
- **Addresses both pain and sedation**
- **Used in our units for the past 4 years with good results**
- **Some research validation, = PIPPs**
- **<http://www.n-pass.com/index.html>**

N-PASS

Assessment	Sedation		Sedation/Pain	Pain / Agitation	
Criteria	-2	-1	0/0	1	2
Crying Irritability	No cry with painful stimuli	Moans or cries minimally with painful stimuli	No sedation/ No pain signs	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	No sedation/ No pain signs	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	No sedation/ No pain signs	Any pain expression intermittent	Any pain expression continual
Extremities Tone	No grasp reflex Flaccid tone	Weak grasp reflex ↓ muscle tone	No sedation/ No pain signs	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	No sedation/ No pain signs	↑↑ 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

Physiologic assessment

- **Physiologic indicators (FT= full term; PT= preterm)**
 - Heart rate : usually increased (FT, PT)
 - SpO₂: usually decreased (FT, PT)
 - Vagal tone: decreased (FT)
 - Resp rate: increased (FT)
 - ICP: increased (PT)
 - Variability in HR and RR: increased (PT)
- **Cannot be unequivocally interpreted as pain as they are more clearly associated with stress (Stevens B et al. Clin J Pain 12: 13-22, 1996)**

Biochemical indicators

- **Catecholamines (Epinephrine, Norepinephrine)**
- **Cortisol (blood, saliva, or urine can be used)**
- **β -Endorphin**
- **Growth hormone, glucose, and lactate have also been studied**

Developing an approach to pain assessment

- **Discuss pain assessment and management daily**
- **Review type of pain and pain scale scores**
- **Review physiologic parameters indicative of pain**
- **Review analgesics ordered (type, dose, timing, route, effectiveness and side-effects)**

Pain management

- **Systematic approach to prevent pain required, rather than “as needed” basis**
- **Reduce number of painful procedures**
- **Minimize stress due to noxious stimuli**
- **A systematic plan for managing pain**



Neonatal pain management: problems

- **Confusion regarding Stress vs. Pain vs agitation**
 - Pain is always stressful
 - Stress is not always due to pain or associated with pain
- **Pain assessment**
 - pain is **subjective** in its assessment
 - **no “gold standard”** for evaluation of neonatal pain
 - **Indications** for, and monitoring of, analgesia therefore uncertain

Neonatal pain management: problems

- **Analgesia in the newborn period**

- Pharmacodynamics and pharmacokinetics vary, depending on the **agent, gestational age, postnatal age**, underlying **disease** process, and many other factors

- **Focus on evidence-based medicine**

- Lack of sufficient data on value of analgesia regarding important **short-term and long-term outcomes, and reduction of costs** in both full-term and preterm infants
- Absence of evidence is not evidence of absence!

Another problem: What to give

- **Sucrose- up to four doses shown to be effective for short-term procedural pain**
- **New evidence suggests it may be more of a sedative than an analgesic**
- **Concerns over lack of research on repeated doses (Holsti & Grumau 2010 Pediatrics)**

Opioids

- **2008 Cochrane review: insufficient evidence to recommend routine use of opioids in newborns**
- **Use selectively**
- **Not as effective as previously thought**
- **Morphine infusions do not alter neurologic outcomes and may not be effective in acute pain (Anand 2007 J Perinatol)**

opioids

- **Morphine causes histamine release which may lead to hypotension**
- **The NOPAIN study (Ananad et al 2004) there was a trend toward poorer neurologic outcomes in the morphine group of infants compared to those given a placebo**

Opioid Withdrawal and Tolerance

- **Care-providers must remain alert for signs of tolerance (more drug for the same effect)**
- **Can occur after 3-4 days of use**
- **and withdrawal as the drug is discontinued**



The answer

- **First- non-pharmacologic methods**
 - Kangaroo care
 - Facilitated tucking
 - Cautious use of sucrose



Second

- **Investigation of alternative pharmacologic approaches**
 - Methadone, ketamine, nozinan (methotrimeprazine),
 - local anesthetics



Gracias

