KIDS DO FEEL PAIN:
PICU AND NICU PAIN MANAGEMENT
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DISCLOSURES
• Financial Disclosure: No company has given me any money
• All pictures are obtained from Bing image search on PowerPoint
ABOUT ME
• Pediatrics in Kansas City (Children’s Mercy Hospital)
• Anesthesia in Colorado (University of Colorado)
• Pediatric Anesthesia (Seattle Children’s Hospital)
• Pediatric Pain (Seattle Children’s Hospital)
• Recruited to University of Wisconsin to create their Pediatric Chronic Pain Program
• Currently Medical Director of Pediatric Chronic Pain

LEARNING OBJECTIVES
• Understand the quick history of NICU pain (and the early beginning of pediatric pain)
• Describe techniques to be used for common NICU procedures
• Identify medications and dosages for treating pediatric pain
• Describe different varieties of blocks that can be used in the treatment of ICU pain
NICU

QUICK TIMELINE OF PEDIATRIC PAIN (NICU)

Before 1985

Infants don't experience pain

1985 - 2000s

Paralytics

Pain being treated

Use of gas, opioids, benzodiazepines

2000s - present

More focus on early pain and later development of chronic pain

Increased use of regional anesthesia
Possible times for pain in babies

Circumcision
Heel sticks
Vaccination
IV starts

Why does this matter?

• Pain early in life can lead to lifelong changes in the nervous system.

Hypoalgesia
Hyperalgesia
HOW DID WE DO IN THE NICU IN THE 2000S?

- Increased sucrose 12%
- 12% with topical local
- No analgesia 37%
- No analgesia 57%
- No analgesia 10%

Pain in Canadian NICUs Have we Improved over Past 12 years; Clin J Pain 2011;27:225-232

PROCEDURAL PAIN

- Vaccinations, IV’s, phlebotomy
- Premies average 14 painful procedures per day
- Circumcision without analgesia increases pain responses to vaccination
- Needle phobia and care avoidance later in life
- “It’s just a poke”
- Nonpharm, topical anesthetics
- Neonates: sucrose, swaddling, kangaroo

Orally administered sucrose is safe and effective.

Minimally effective dose of 24% sucrose was 0.1 ml

Should consider use with many painful NICU procedures (heel sticks, IV, circumcisions)

Evidence helpful up to 12 months
Plasma concentrations of albumin and alpha-1-acid glycoprotein diminished at birth
Plasma esterase levels low
Adequate though ↓ clearance of many drugs in the first months of life
Even ↓ in preterm

EXAMPLES
- Local anesthetics have higher unbound concentrations
  - Use chloroprocaine in neonates in epidurals
  - Morphine and active metabolites accumulate in neonates
  - Fentanyl and bupivacaine plasma terminal half-lives are both greater than 8 hours in neonates
  - Higher plasma concentrations of drug at a given dose
NEURAXIAL BLOCKS

- Epidural and Caudal
  - Catheter placed just outside of dura, at vertebral level of incision
  - Local anesthetic ± opioid ± clonidine
  - Long duration with catheter

- Spinal (subarachnoid):
  - Local anesthetic ± opioid placed directly in CSF
  - Dense blockade
  - Duration – a few hours

From *A Practice of Anesthesia in Infants and Children*. 4th ed; 2009.


NEURAXIAL BLOCKADE

- Some institutions (University of Vermont) do a lot surgical cases using spinal anesthesia [can also do awake caudal as well]
  - Can be done quickly and effectively, even by CA-1's
  - Utilize sweeties, small sub cutaneous lidocaine

- Other cases:
  - Patients with tenuous lung function
  - Infants with high opioid usage
  - Prune belly
TIPS ABOUT NEURAXIAL

• Can go up to 1 ml/kg of chloroprocaine
• Consider adding clonidine
• Can cause apnea in premature infants
• If having issues or uncomfortable with thoracic or lumbar epidurals, consider placing caudal and threading up
• Utilize ultrasound

MECHANICAL VENTILATION

• Ideal method of analgesia for assisted ventilation is unknown
• Mechanical ventilation leads to changes in neuroendocrine parameters, pain scores and physiologic responses
• Opioids cause improved ventilator synchrony, pulmonary function and decreased neuroendocrine response
• Not to treat includes side effects from the opioids

NEOPAIN TRIAL

- Improved long-term outcomes at school age from morphine-treated group
- Recommendations:
  - If irritable, first assess optimization of ventilation
  - Treat acute pain and stress as needed
  - Do not pre-emptively treat pain


PAIN ASSESSMENT FOR NEONATES/INFANTS

- Observational scales
  - Neonatal Infant Pain Scale (NIPS)
  - Neonatal Pain Agitation Sedation Scale (N-PASS)
- Brain oriented
  - HRV
  - NIRS
  - Skin Conductance
  - Facial metrics

PICU

MULTIMODAL ANALGESIA
ACUTE PAIN MANAGEMENT

- IV PCA
- Epidural
- Regional

Oral medications (both opioids and non-opioid)
Pain coping strategies

PAIN TREATMENT: NON-PHARMACOLOGIC

- DISTRACTION
- Therapeutic Massage
- Acupuncture/Acupressure
- Heat
- Cold
- Vibration
- Electrical Stimulation (TENS)
- Breastfeeding (infants)
KETAMINE

- Noncompetitive NMDA receptor antagonist
- Can be used as a bolus or as an infusion
- Useful when part of multimodal therapy
- Titrate to effect
- In general, starting range should be 0.1-0.2 mg/kg/hr

LIDOCAINE

- Local anesthetic
- Run as infusion
- Run between 0.5-3 mg/kg/hr ideal body weight
- Try to limit for 24-48 hours
- If going longer than that, check MEGX or lidocaine levels
- GI surgery
DEXMEDETOMIDINE

• Alpha 2 agonist
• Pain and sedation
• Used mostly for sedation
• Run 0.5-1.5 mcg/kg/hr
• May run into issues with blood pressure/heart rate

ADJUVANT MEDS

• Gabapentin
  • Modulates glutamate release at presynaptic Ca channels [not at GABA receptors]
• α-2 Agonists
  • Augments descending modulation
• PCA
  • Similar amount compared to IV
  • Better pain control
  • Better sleep
  • Avoids delays in treatment

CONTROVERSIES

• Basal infusion
• PCA by Proxy
  • Nurse
  • Parent
SUMMARY

• Consider using pharmacologic or non-pharmacologic techniques for common NICU procedures (including use of sucrose)
• Untreated pain in the NICU can lead to long lasting effects
• Use a combination of medications/techniques to best treat pain in the NICU or PICU (ketamine, opioids, lidocaine, regional)
THANK YOU!!

REFERENCES