Acute Pain Management in Children—an update

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Overview

• Some pain basics
• Why we don’t treat pain and why we should
• Non-pharmacologic approaches to pain management
• Topical pain management
• Intranasal medications for pain management
• New uses for older drugs
What is pain?

• Broadly speaking, a sensation caused by injury to the body, sometimes iatrogenic (IV start, vaccinations, etc), and sometimes physiologic (appendicitis, broken bone, etc)

• A series of ascending neural pathways transmit pain to the brain

• non-pain pathways compete with pain impulse to mitigate pain response, the so-called “gate theory”
The Pain Pathway

1. Site of injury
   - Slow, unmyelinated C-fibers
   - Fast, myelinated A-fibers

2. Spinal cord
   - Afferent nerve fiber

3. Brainstem
   - Spinothalamic tract
   - Synapse
   - Dorsal ganglion

4. Cerebrum
   - Somatosensory cortex
   - Limbic system
   - Thalamus
   - Reticular formation
   - Mid-pons
Why we DON’T treat pain

• “Is it pain or anxiety? I can’t tell…”
• No time
• No IV
• Will I mask symptoms and/or delay diagnosis?
• Lack of confidence treating pediatric patient
• Lack of support from medical control
Why we SHOULD treat pain

• For the good of the child
  • Immediate physiologic stress from pain
  • Long term physiologic changes to brain
  • Emotional response to later medical care

• For the good of the practitioner
  • More cooperative patient
  • More likely to have success with procedures
  • Better assessment of underlying problem
  • Less stressful to provider, child and family!
Non-pharmacologic interventions to treat acute pain

- Pain and anxiety are linked -> decreasing anxiety can help manage pain.
  - Calm atmosphere
  - Age appropriate prep for procedures
  - Parents role: coach but don’t add to stress!!
- Sucrose - best for 0-6 month age
- Remember, taking the time to “set the stage” will help in the long run!
Topical Anesthetics

• Work by binding Na+ channels of free nerve endings, inhibiting repolarization of the cells

• To be effective agent must penetrate epidermis to get to nerve endings in dermis
  • More lipophilic agent is better
  • Areas of thinner skin better
  • More vascular areas better

• Time, heat, occlusive dressings can improve penetration into dermis
EMLA

- lidocaine 2.5% and prilocaine 2.5%
- Fatty acid emulsion so highly lipophilic
- Most effective after 60 minutes, but benefit at 30-45 minutes
- Prilocaine (and others?) can induce methemoglobinemia
  - Congenital methemoglobinemia
  - Agent left on skin too long
  - Agent on area of significant mucosal injury
LMX-4

- Liposomal suspension of 4% lidocaine
- Effect within 30 minutes
- No (?) risk for methemoglobinemia
- After removal, anesthetic effect may not be as long lasting as EMLA
- Cost comparison:
  - EMLA $7/5 gm tube
  - LMX $4/5 gm tube
SYNERA

- Tetracaine 7%/lidocaine 7%
- Delivered as a patch containing an iron powder warming agent, resembles an adhesive bandage
- Greater depth of anesthesia than EMLA or LMX
- Given Fe component, REMOVE BEFORE MRI!!
- More expensive the EMLA or LMX: $13/patch
LET

- Lidocaine 4%/epinephrine 0.18%/tetracaine 0.5%
- Can be used on broken skin
- Generally good effect after 20 minutes
- Effect lasts 20-30 minutes after removal
- Plastic surgery literature suggests safe to use on fingers/fingertips
- Cost: roughly $3/3 ml syringe
Injectable local anesthetics

• Typically lidocaine 1 or 2%
• consider bupivicaine 0.25% 1:1 with lidocaine for more prolonged effect
• Injection pain can be minimized by
  - Buffering lidocaine with bicarb, 1:10
  - Using finest gauge needle possible (30 g optimal)
  - Slow infiltration rate
  - Subcutaneous (vs intradermal) injection
  - Warming medication to body temp
Intranasal medications - benefits

• Convenient
  • No IV required
  • “low tech” delivery equipment
• Safe - very low risk of resp depression compared with IV
• Effective
  • Quickly enter blood stream through vascular mucus membranes
  • Quickly achieve high CNS levels through “nose-brain barrier”
Intranasal meds- limitations

• Less effective if child has significant rhinorrhea
• Less effective if active nosebleed
• Less effective if decreased mucosal blood flow
  • recent vasoconstrictive medication
  • Cocaine abuse, chronic or acute
Delivery techniques

• Maximize mucus membrane surface
  • Use both nostrils- ½ volume per nostril
  • Use small particles given by brisk delivery (atomize, don’t drip!)
  • Use most concentrated form of medication to limit volume- limits “run-off”
• Ideal volume per nostril: 0.3 ml, but as much as 1 ml/nostril ok
• Point applicator up and out (to top of ear on same side as nostril being medicated)
More about IN medications

• Doses will be higher than with IV equivalent
• Medications can be titrated, as with IV, with repeated doses every 10-15 minutes
• Depending on clinical situation:
  • consider IN as bridge to getting IV started
  • repeat IN dosing as needed
  • consider po pain med shortly after IN to allow po to have effect as IN wears off
IV vs IN serum drug levels - theoretical example of an opiate

- IV medication levels above respiratory depression threshold
- Respiratory depression threshold
- IN medication achieves therapeutic threshold
- Therapeutic efficacy threshold

- Intravenous
- Intranasal
Dosing of IN medications

• Fentanyl
  • 2 mcg/kg, titrate every 10-15 minutes
  • Consider pulse ox to monitor

• Ketamine (for pain)
  • 0.5-1 mg/kg (subdissociative dosing)
  • Titrate every 15 minutes
IN Ketorolac

• Sold under trade name Sprix
• Limited information for pediatric use
• One study of kids 12-17, only 20 patients
  • Pharmacokinetics similar to IM
  • Effect in 15 min, peak at 45 min
• 30 mg dose for patient >50 kg
• 15 mg for pediatric dosing?
• Current trial in early stages 8-17 yo
IN med doses for indications other than pain

- Versed
  - for anxiolysis: 0.5 mg/kg, max 10-12 mg
  - for seizures: 0.2-0.3 mg/kg, max 10 mg
- Ketamine
  - for sedation: 10 mg/kg
  - for pain: 0.5-1 mg/kg
- Dexmedetomidine for sedation: 3 mcg/kg
- Naloxone for opiate overdose: 2 mg
Ketamine- old drug, new use

- Low-dose (sub-dissociative)
- IV- 0.1-0.5 mg/kg, IN- 1 mg/kg
  - Bolus dosing
  - Can be titrated
- NMDA receptor antagonist
- Decrease need for opiates
- Opioid tolerance
- 2014 article in Annals of EM- equivalent pain control when compared with IN fentanyl
Propofol- for acute pain??

- Most literature is in adult medicine, all focused on intractable migraine pain
- Small study in PEC 2012 in kids
  - Excellent pain relief
  - Decreased LOS (122 min vs 203 min!)
- Propofol also effective antiemetic
- Give as slow boluses, q3-5 minutes
  - 0.5 mg/kg, max 50 mg
  - Monitor as with procedural sedation
Summary

• Treating pain (or not) has long term consequence for kids
• Treatment options are not “either/or”, but rather multi-modal
• For IN meds, maximum concentration, minimum volume
• For more IN med information, check out intranasal.net
No Pain, ALL GAIN!!