Delivering Evidence-Based Pediatric Pain Management

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Disclosure Information

I have nothing to disclose that may be perceived as a conflict of interest.

Objectives

1. Recognize current evidence related to pediatric pain.

2. Choose evidence based, developmentally appropriate therapies, both pharmacological and nonpharmacological, to manage pain in the pediatric surgical population.

3. Design organization relevant position statements related to pediatric pain management.
Knowledge: Evolutionary

Painless interval post-injury allows ‘fight or flight’ response
Pain provokes awareness of injury
Pain commands immobilization of injured area

Knowledge: Historical

Pain had magical, religious, and emotional undercurrents
- Treatment was ritual based
  - Included “cleansing”
  - Performed by a specialist—sorceress, priest, shaman
- Early use of herbs, plants, electric fish
- Acupuncture 2800-2600 BC

Knowledge: Outdated

Infants are incapable of feeling and less sensitive to pain
Infants cannot express pain
Pain cannot be accurately assessed
No safe medications
A sleeping child does not have pain
No long term effects of pain
Kids don’t have chronic pain
Knowledge: Current

Nociceptive
  Somatic
    Superficial
    Deep
  Visceral

Neuropathic
  Central
  Peripheral

Inflammatory
  Chemical soup of inflammation
directly affects nociceptors
  Nerve recruitment
  Wind up

Psychogenic pain
  Not a diagnostic term
  Psychological factors
  Report of pain may not match
  symptoms
  Pain is real!!

Knowledge: Current

Acute Pain
Persistent Pain—constant, episodic, recurrent
Procedural Pain
Surgical Pain
Acute on Persistent
Functional Pain

Why is This Important?

“The management of pain is a cornerstone of the compassionate practice of medicine. The knowledge exists to ameliorate pain in most of our patients. We now require the will to do so.”

Schacter, Berde, & Yaster (2003)
## Knowledge: Future

- Mouse models to study various types of pain
- Improved understanding of neuropathic pain
  - Alpha 2 delta (receptor subunit)
    - Upregulated after nerve injury
    - Contributes to tactile allodynia by central sensitization
    - Shown to have central neuro-immune component
- Targeted therapy based on genetics
- New knowledge regarding the role of the endocannabinoid system

## Multimodal Pain Management

- Pharmacological Therapies (multimodal)
- Nonpharmacological Techniques
- Psychosocial Therapies
- Interventional Therapies
- PT/OT

## Multimodal Pain Management

- Integrative Therapies
- Alternative
- Complementary
- CAM
## Integrative & Complementary Therapies

### Manipulative / Body-Based Therapies
- Acupuncture, Chiropractic / Spinal Manipulation, Massage

### Mind-Body Therapies
- Cognitive-Behavioral Therapy, Music, Imagery, Meditation, Prayer, Yoga

### Movement Therapies
- Yoga, Tai Chi, Qigong

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## Integrative & Complementary Therapies

### Natural Products
- Herbs, Vitamins, Nutritional Supplements, Aromatherapy

### Energy Therapies
- Healing Touch, Therapeutic Touch, Reiki, Magnets

### Other Systems of Care
- Ayurvedic Medicine, Homeopathy, Naturopathy, Stress Management, Tibetan Medicine, Traditional Chinese Medicine, Tribal Medicine

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## Pharmacological Therapies: Topical

- Buffered lidocaine
- Bacteriostatic saline—benzyl alcohol
- Eutectic mixture of local anesthetics (e.g., EMLA)
- Liposomal lidocaine cream (e.g., Ela-Max)
- Coolants/Ice
- Cool vibration (e.g., Buzzy Bee)
- J-tip delivery of lidocaine
### Pharmacological Therapies: Nonopioids

- **Opioid use is less when acetaminophen or NSAIDs are given concurrently**
- **Monitor hepatic and renal function**
- **Can be given at the same time or alternated**
  - Alternating works best for fever management but is not necessary for analgesia

### Pharmacological Therapies: Opioids

#### Morphine
- **Gold standard**
- **Dose:**
  - 0.05 - 0.10 mg/kg IV Q2H
  - Individual variation in requirements

#### Hydromorphone
- **Dose:**
  - 0.015 - 0.03 mg/kg IV Q2H
  - PO, PR forms also available
  - 7 times more concentrated than morphine

#### Fentanyl
- **Dose:** 0.5-2 mcg/kg IV Q1H

#### Methadone
- **Long half life but delay to steady state**
- 0.05-0.1 mg/kg IV/PO Q4-24H
- Clinically challenging to use
- Lower doses if patient has been on high doses of other opioids
Pharmacological Therapies: Opioids

**Hydrocodone**
- Generally in combination—typically with APAP 325 mg
- PO only
- Dose: 0.05-0.15 mg/kg Q4H of hydrocodone
- Elixir: 7.5mg hydrocodone & 500 mg APAP/15 mL
- Dose: 0.2 mL/kg

**Oxycodone**
- Dose: 0.1 - 0.2 mg/kg PO
- Often given with acetaminophen
- PO only

Pharmacological Therapies: Adjuncts

**Anticonvulsants** (gabapentin, pregabalin, topiramate, etc)

**Antidepressants** (TCAs, SSRIs, SNRIs, atypicals)

**NMDA Receptor Agonists** (ketamine)

**Alpha 2 Agonists** (clonidine, dexmedetomidine)

Pet Peeve

Just say no to “Narcotic”
- No such drug class
- Pejorative (legal term)
- Socially loaded
- Stigmatizing
Nonpharmacological Therapies

- Guided Imagery
- Interactive Storytelling
- Virtual Reality
- Self-talk
- Relaxation Techniques
- Positioning / Swaddling
- Play
- Music
- Cold / Vibration
- Oral Sucrose
- Nonnutritive Sucking
- Kangaroo Care
- Breastfeeding
- Thermal (heat, cold)
- Hypnosis
- Biofeedback

Psychosocial Therapies

- Addressing depression, anxiety, sleep disruption
- Psychoeducation about pain—reframing pain
- Developing coping skills

Interventional Therapies: Epidurals

- Catheter is placed (outside the dura) close to the spinal nerves of appropriate dermatome
- Analgesic spread from catheter tip is dependent on local anesthetic volume and opioid hydrophilicity (fentanyl = lipophilic = less spread)
- Placement may be thoracic, lumbar, caudal
- "T" is for tummy
- "L" is for legs
Indications for Epidurals

Postoperative
  Orthopedic, Urologic, General, Cardiac
Impaired Pulmonary Function
Trauma

Contraindications for Epidurals

Infection—systemic or skin
Bleeding Disorders
Other
  Patient, parent refusal
  Degenerative CNS disease
  Allergy to any of the medications

Patient Outcomes

Improved pain control—acute and chronic pain conditions
Increased patient/parent satisfaction
Less medication needed—intraoperatively and postoperatively
Decreased LOS
### Patient Outcomes

- Improved pulmonary effort
- Earlier return of bowel function
- Increased activity sooner—OOB
- Decreased risk of lower extremity clots

### Epidural Complications

- Failure of placement
- Infection (local or systemic)
- Dural puncture
- Vascular puncture
- Epidural hematoma
- Catheter fracture or laceration

### Epidural Medications

- **Local Anesthetics (BUPivacaine, ROPIvacaine, LIDOcaine):**
  - Block nerve conduction through dorsal root at the sodium channel
  - Increasing concentrations allow blockade of nerves of increasing diameter and myelination, i.e., autonomic << pain << touch << motor

- **Opioids (Morphine, hydromorphone, fentanyl, sufentanil):**
  - Inhibit pain transmission in dorsal horn of spinal cord
  - Must be preservative free
Local Anesthetic Side Effects

- Motor Blockade
- Sympathetic Blockade
  - Flushing, hypotension, hypothermia
- Urinary Retention
- Systemic Toxicity

- Flushing, hypotension, hypothermia
- Urinary Retention
- Systemic Toxicity

Local Anesthetic Toxicity

- CNS
  - visual disturbances, tinnitus, headache, anxiety, garrulousness
  - muscle twitching, excitement
  - convulsions, cardiorespiratory depression, coma, death
- Cardiovascular
  - vasodilation, hypotension
  - ventricular dysrhythmias
  - myocardial depression
  - cardiovascular collapse

Dosing of Local Anesthetics

- Neonates: Up to 0.25 mg/kg/H
- All others: Up to 0.5 mg/kg/H
- Toxicity determines end point of therapy

- BUPIvacaine 0.0625%, 0.1%, 0.25% and 0.5%
- ROPIvacaine 0.0625%, 0.1%, 0.25% and 0.5%
- Remember 0.1% = 1.0mg/mL
### Dosing of Opioids

<table>
<thead>
<tr>
<th>Opioid</th>
<th>Dose Range (mcg/kg/H)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
<td>3-9</td>
</tr>
<tr>
<td>Hydromorphone</td>
<td>2-3</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>0.5-1.0</td>
</tr>
</tbody>
</table>

### Opioid Side Effects

- **Pruritus**
- **Sedation**
- **Respiratory depression**
- **Nausea/vomiting**
- **Urinary retention**
- **Constipation**

### Side Effect Management

- Decrease infusion by 10-25%
- If pain increases or inadequate relief treat symptoms
  - Pruritus: Naloxone, nalbuphine
  - Sedation: Naloxone
  - Nausea/vomiting: Ondansetron, metoclopramide, promethazine
  - Urinary retention: Foley, naloxone
  - Constipation: Bowel regimen
Case Study

15 month old, 8.5 kg, S/P abdominal surgery with T10 catheter
BUPI 0.1% + HM 2 mcg/mL TRA 4 mL/h
BUPI 1 mg/mL x 4 mL/h = 4mg/H
4 mg/H ÷ 8.5 kg = 0.47 mg/kg/H
Recall—dose is up to 0.5 mg/kg/H
HM 2 mcg/mL x 4 mL/H = 8 mcg/H
8 mcg/H ÷ 8.5 kg = 0.94 mcg/kg/H
Recall dose is 2-3 mcg/kg/H

Case Study

9 year old, 31 kg, S/P abdominal surgery with T8 catheter
BUPI 0.1% + HM 4 mcg/mL TRA 8 mL/h & PCEA 2 mL with 30 minute lockout
BUPI 1 mg/mL x 8 mL/h = 8 mg/H
8 mg/H ÷ 31 kg = 0.25 mg/kg/H
Recall—dose is up to 0.5 mg/kg/H
HM 4 mcg/mL x 8 mL/H = 32 mcg/H
32 mcg/H ÷ 31 kg = 1.03 mcg/kg/H
Recall dose is 2-3 mcg/kg/H
Don’t forget to include the PCEA amounts!!!
BUPI: an additional 0.13 mg/kg/H (0.38 total)
HM: an additional 0.25 mcg/kg/H (1.28 total)

Interventional Therapies: Nerve Blocks

A single injection or continuous infusion of anesthetic.

Injection is made near a major nerve or group of nerves.
This blocks the nerve(s) from sending painful stimuli to the central nervous system.

Can be used both intraoperatively and/or postoperatively.
**Locations**

- Interscalene
- Supraclavicular
- Infracavicular
- Axillary
- Femoral
- Sciatic
- Popliteal
- Lumbar plexus
- Paravertebral

**Peripheral Nerve Block Benefits**

- Decreased anesthetic requirements when performed before surgical incision
- Less inhaled anesthetic = more rapid awakening, less emergence delirium
- Less muscle relaxant = fewer post-op respiratory complications
- Superior analgesia vs. IV opioids or local anesthetic infiltration
- Decreased intraop and post-op opioid = decreased PONV, pruritus, sedation

**Peripheral Nerve Block Complications**

- **Device**
  - Trauma to nerves from block needle
  - Catheter misplacement, kinking, knotting, or rupture
- **Faulty Technique**
  - Bacterial contamination
  - Nerve compression
  - Injection in wrong space
- **Anesthetic**
  - Toxicity from wrong solutions or preservatives in solutions
  - Allergies
  - Masking complications where pain is warning sign (e.g., compartment syndrome)
Nursing Care Responsibilities

- Verifying and implementing orders
- Efficient pump knowledge/operation
- Patient/family education
- Documentation according to standards
- Monitoring
  - Patient's pain level and response to therapy
  - Side effects and treating as ordered
  - Monitoring catheter site
- Contacting Pain Service for any unresolved pain or side effect issues

Switching Gears

Now What?

You have:
- Evidence/ Knowledge
You want:
- To change practice
You need:
- Help
You can:
- Make a difference
Developing a Position Paper

Identify:
- Need
- Content experts

Establish:
- Consistent processes for:
  - Development/Approval
  - Dissemination
  - Maintenance

You want me??

A Different Role in Each

Procedural Pain Management: A Position Paper with Clinical Practice Recommendations

American Society for Pain Management Nursing Position Statement: Pain Management in Patients with Substance Use Disorders
http://www.aspmn.org/documents/PainManagementinthePatientwithSubstanceUseDisorders_JPN.pdf

Position Statement: Male Infant Circumcision Pain Management

Lessons Learned

- Have at least one person with publication experience
- Create a timeline
- Have a “keeper of the document”
- Hold people to deadlines
- Don’t recreate the wheel—are there other organizations with statements to endorse or partner with for new work
- GREAT way to gain knowledge, skills, and experience
References


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