Pediatric Trauma Rounds

Pain Management in Polytrauma

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Outline

- History
- MUHC Pediatric Opioid Therapy Guidelines
- Case studies
  - Opioid and non-opioid
  - Modes of administration
  - Regional analgesia
  - Compartment syndrome
- Non-pharmacological treatments
History

Explanations:

• "Paediatric patients seldom need medication for the relief of pain."
• "They tolerate discomfort well."
• "The child will say he does not feel well or that he is uncomfortable, that he wants his parents but often he will not relate this unhappiness to pain"

History

• 25 Charts of post-op children
  – 13 patients no analgesia
  – 12 patients received a total of 24 doses of analgesia

• 18 Charts of post-op adults
  – 626 doses of analgesia

History

• Premature babies $\rightarrow$ minimal anaesthesia
  $\rightarrow$ ↑ stress response
  $\rightarrow$ ↑ morbidity
  $\rightarrow$ ↑ mortality

History

Reproduction of the study made by Eland and collaborators in the same institution 16 years earlier.

- 968 analgesic doses given in 1991
- 24 analgesic doses given in 1974

I- CHOOSING MEDICATION ACCORDING TO INTENSITY OF PAIN

- **Mild (Pain score 1-3)**
  
  eg. Superficial cuts, bruises, sprains
  
  1) Acetaminophen or Non-Steroidal Anti-Inflammatory (NSAIDs)

- **Moderate (Pain score 4-6)**

  eg. Significant cuts on the extremities, minor surgical procedures, chronic pain and cancer pain

  1) Regular dosing of acetaminophen **and/or** NSAIDs

  2) Consider adding opioids such as codeine or oxycodone

- **Severe (Pain score 7-10)**

  eg. Moderate to major surgical procedure, kidney stones, biliary colic, traumatic injuries, severe chronic pain and cancer pain, sickle cell crisis.

  1) Give regular dosing of acetaminophen **and/or** NSAIDs

  **WITH**

  2) Opioids PO or IV such as morphine, hydromorphone or oxycodone
II- PRESCRIBING OPIOIDS

A) Take into consideration:
   1- RISK FACTORS that may increase predisposition to respiratory depression (refer to section IV)
   2- ALLERGIES AND INTOLERANCES
   3- Potential drug INTERACTIONS.

B) START WITH LOWER DOSES in patients with increased predisposition to respiratory depression (refer to section IV).

C) ADJUST REGULARLY the opioid dose according to intensity of pain and level of sedation. Progressive DOSE ESCALATION may be required. In some cases of severe pain, it should be done rapidly (minutes-hours).

D) PRESCRIBE ONLY ONE OPIOID and ONE ROUTE at a time. When two routes are necessary, prefer the use of the same opioid.

E) With a new prescription of opioids, DISCONTINUE OPIOIDS PREVIOUSLY ORDERED to avoid administration errors.

F) Prescribe EQUIANALGESIC DOSAGE when changing 1- from one opioid to another and 2- from one route to another. Note that the equianalgesic table does not take into account incomplete cross-tolerance between opioids.

G) DO NOT ORDER DOSE RANGES (eg. avoid 2-4 mg every 4-6 hour as needed, prescribe 4 mg every 4 hours as needed).

H) WRITE CLEARLY. Avoid zeros following a decimal (eg. avoid morphine 5.0 mg, prescribe morphine 5 mg). Always write the zeros preceding decimal (eg. avoid morphine .5 mg, prescribe morphine 0.5 mg).

I) NEVER USE ABBREVIATIONS for medication name.

J) PREFER THE ORAL (PO) ROUTE. The second choice is intravenous (IV) route. Avoid SC/IM for the pediatric population (avoid trauma and pain from needles).

K) PREFER MORPHINE as first line for IV route. (Note that hydromorphone has been frequently implicated in respiratory depression in opioid-naive patients).

L) Prescribe appropriate medication to treat opioid SIDE EFFECTS (nausea/vomiting, pruritus) using the least sedating agent and dosage.

M) Prescribe stool softeners and/or laxatives to treat CONSTIPATION when opioids are administered regularly or for the post-operative period.

N) Attention should be paid to patients that are OBSE or OVERWEIGHT. Calculation of opioid dosage should be based on the lean weight.
Table 1. Starting dosage for opioid-naive pediatric patients (Older than 3 months old*)

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Risk Factors</th>
<th>No Risk Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO (mg/kg)</td>
<td>IV (mg/kg)</td>
</tr>
<tr>
<td>Morphine</td>
<td>0.15 max 5 mg/dose</td>
<td>0.05 max 2.5 mg/dose</td>
</tr>
<tr>
<td>HYDROMORPHINE</td>
<td>0.02 max 1 mg/dose</td>
<td>0.01 max 0.5 mg/dose</td>
</tr>
<tr>
<td>OXICODONE</td>
<td>0.05 max 2.5 mg/dose</td>
<td></td>
</tr>
<tr>
<td>CODEINE</td>
<td>0.5 max 30 mg/dose</td>
<td></td>
</tr>
</tbody>
</table>

Restricted use: refer to pharmacy manual and sedation protocols

*For infants ≤ 3 months requiring opioids, doses should 0.02mg/kg/dose IV.

Table 2. Opioids equianalgesic table for moderate to severe pain without hepatic or renal dysfunction

<table>
<thead>
<tr>
<th>Drugs</th>
<th>Equianalgesic Dose</th>
<th>Onset of Action</th>
<th>Peak of Action</th>
<th>Duration of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IV/SC</td>
<td>PO</td>
<td>IV/SC</td>
<td>PO</td>
</tr>
<tr>
<td>Morphine</td>
<td>10 mg</td>
<td>30 mg</td>
<td>2-5 min.</td>
<td>15-60 min.</td>
</tr>
<tr>
<td>HYDROMORPHINE</td>
<td>2 mg</td>
<td>4 mg</td>
<td>5 min.</td>
<td>30 min.</td>
</tr>
<tr>
<td>OXICODONE</td>
<td>15 mg</td>
<td>15-30 min.</td>
<td></td>
<td>60 min.</td>
</tr>
<tr>
<td>CODEINE</td>
<td>200 mg</td>
<td>30-60 min.</td>
<td></td>
<td>60-90 min.</td>
</tr>
<tr>
<td>FENTANYL Injectable</td>
<td>100 mg</td>
<td>&lt; 5 min.</td>
<td>5-15 min.</td>
<td>20-60 min.</td>
</tr>
</tbody>
</table>
IV- RISK FACTORS FOR RESPIRATORY DEPRESSION

A) Agents that may increase sedative effects of opioids (not exhaustive):
   • **Anxiolytics/Sedative agents** (e.g. lorazepam, diazepam, clonazepam, oxazepam, midazolam)
   • **Musculo-skeletal relaxants/Antispasmodic agents** (e.g. methocarbamol, baclofen, cyclobenzaprine)
   • **Antipsychotics** (e.g. haloperidol, olanzapine, prochlorperazine)
   • **Antidepressants** (e.g. amitriptyline, venlafaxine, citalopram, trazodone)
   • **Anticonvulsants** (e.g. carbamazepine, phenytoin, valproic acid, phenobarbital, gabapentin)
   • **Anti-histaminics** (e.g. diphenhydramine)
   • **Anti-nausea medication** (e.g. dimenhydrinate, metoclopramide)

B) **Conditions that may increase predisposition to respiratory depression:**
   • Children less than 12 months old
   • Renal or hepatic insufficiency
   • Pulmonary disease or compromise
   • Neuromuscular disease
   • Obstructive sleep apnea – *Snoring*
   • Obesity
   • Polypharmacy with sedative effect (see A)
   • Opioid-naive patients (Opioid response to be determined, no recent exposure to opioids)
   • Head trauma / craniotomy
   • Non-verbal patients / cognitive impairment
   • Sudden cessation of the cause of pain
<table>
<thead>
<tr>
<th>Patient characteristics</th>
<th>Monitoring equipment</th>
<th>Surveillance &amp; documentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased risk factors for respiratory depression</td>
<td>Continuous SpO₂ monitoring * RR monitoring non-obligatory</td>
<td>1- Q1 hour observation. 2- Routine vital sign with pain score and sedation score. 3- Sedation score, pain score, SpO₂ and RR before bolus administration AND 30 min after bolus completion.</td>
</tr>
<tr>
<td>Low risk factors for respiratory depression</td>
<td>Continuous SpO₂ monitoring non-obligatory</td>
<td>1- Q1 hour observation. 2- Routine vital signs with pain score and sedation score. 3- Sedation score, pain score and RR before bolus administration AND 30 min after bolus completion. *Continuous respiratory rate and apnea monitoring should be considered for patients with increased risks of respiratory depression and for patients less than 12 months old. *Opioid-naïve patients may be on a continuous SpO₂ monitor during titration (especially during sleep) or until response to opioids is determined for the first 24 hours.</td>
</tr>
<tr>
<td>All patients</td>
<td>Continuous SpO₂ AND RR monitoring</td>
<td>1- Q1 hour observation. 2- Routine vital signs with pain score. 3- Sedation score, SpO₂ and RR Q1hour. 4- Sedation score, pain score, SpO₂ and RR before bolus administration AND 30 min after bolus completion.</td>
</tr>
<tr>
<td>All patients</td>
<td></td>
<td>1- Q1 hour observation. 2- Routine vital signs with pain score. 3- Sedation score, pain score and RR before the administration of medication AND 30-60 min after.</td>
</tr>
</tbody>
</table>
VI. PAIN MEASUREMENT TOOLS

A) Self Report (gold standard)

1- Faces Pain Scale-Revised Bieri
   4 years and older

“These faces show how much something can hurt. This face (point to the left-most face) shows no pain. The faces show more and more pain (point to each from left to right) up to this one (point the right-most face), which shows the worst pain. Point to the face that shows how much you hurt right now”. Pain intensity is scored from left to right 0 – 2 – 4 – 6 – 8 – 10.

2- Numeric Rating Scale
   8 years and older

“On a scale from 0 to 10 where 0 is no pain at all and 10 the worst possible pain, how much do you hurt right now?”

3- Visual Analogue Scale (10 cm scale or thermometer)

“On this scale the very bottom means no pain at all and the top means the worst possible pain. Show me how much you hurt right now.”

B) Behavioral

1- FLACC scale:
   For children 0-4 years and/or unable to self report pain

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Face</strong></td>
<td>No particular expression or smile</td>
<td>Occasional grimace or frown, withdrawn, disinterested</td>
<td>Frequent to constant quivering chin, clenched jaw</td>
</tr>
<tr>
<td><strong>Legs</strong></td>
<td>Normal position or relaxed</td>
<td>Uneasy, restless, tense</td>
<td>Kicking, or legs drawn up</td>
</tr>
<tr>
<td><strong>Activity</strong></td>
<td>Lying quietly, normal position, moves easily</td>
<td>Squirming, shifting back &amp; forth, tense</td>
<td>Arched, rigid or jerking</td>
</tr>
<tr>
<td><strong>Cry</strong></td>
<td>No cry (awake or asleep)</td>
<td>Moans or whimpers, occasional complaint</td>
<td>Crying steadily, screams or sobs frequent complaints</td>
</tr>
<tr>
<td><strong>Consolability</strong></td>
<td>Content, relaxed</td>
<td>Reassured by touching, hugging, or being talked to, distractable</td>
<td>Difficult to console or comfort</td>
</tr>
</tbody>
</table>
**VII-GUIDELINES TO TREAT OPIOID-INDUCED RESPIRATORY DEPRESSION**

A) Identification of opioid-induced respiratory depression:

- Excessive sedation (sedation score of 3) and/or
- Respiratory rate falls below lower normal limit and/or
- Episodes of apnea over 10-15 seconds and/or
- $\text{SpO}_2 < 92%$

*Consider general status of patient rather than one indicator*

B) Medical response for opioid-induced respiratory depression:

- Stimulate the patient - Administer 100% $\text{O}_2$ by face mask – Contact treating physician

- **Good Patient Response** (maintains airway and saturation, awakable with stimuli)
  - Maintains constant surveillance of patient – stimulation – until sedation score maintained at/or below 2;

- **Patient not responsive and deteriorating (does not maintain patent airway and $\text{SpO}_2$ decreases)**
  - Call a code – Start ABC for resuscitation
  - Give **Naloxone** IV (SC if IV route is not available): **0.01 mg/kg**. Give
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#### Series 200 Medication and Other Substances

- 200-5.3.1 - Pediatric Drug Challenges and Desensitization Protocol
- Acetaminophen Ingestion Protocol
- Collective Order: Initiation of Oxygen therapy
- Diabetic Ketoacidosis Orders - Explanations
- Montreal Children’s Hospital Protocol for Febrile Neutropenia in Pediatric Cancer Patients
- MUHC Pediatric Opioid Therapy Guidelines
- O2 Therapy Initiation/Titration Algorithm
- Protocol for the Use of, and Therapeutic Drug Monitoring of Arninoglycosides at the Montreal Children’s Hospital
- Pulse Oximetry Protocol

#### Series 300 - Examinations, Diagnostic Tests and Measures

**300-1 - Posiflush Syringes**

- 300-1.1 - Interprofessional Protocol: Using a Posiflush pre-filled saline syringe in the Pediatric patient
Case Presentation #1
Patient: Polly Tromma

- 16 y.o. female, 57 kg, previously healthy
- Passenger in high-velocity MVC (100 km/hr), unbelted
- Intubated and stabilized at outlying hospital
- Presented with:
  - Bilateral hemopneumothorax
  - Multiple L rib fractures
  - L lung contusion
  - Grade IV splenic laceration
  - Grade III liver laceration
  - Grade II R kidney laceration
  - Bladder dome laceration
  - Unstable pelvic fractures
Polly

• Transferred to MCH; taken to CT, then to OR

  ➢ Exploratory laparotomy
  ➢ Chest tubes (x3) inserted
  ➢ Pelvic external fixator applied by orthopedics

• Transferred to PICU intubated and ventilated
Pain Management in Trauma

- Multimodal approach, based on WHO analgesic ladder - helpful in increasing pain control, decreasing opioid consumption

WHO Analgesic Ladder

Key = MULTIMODAL APPROACH


- **Non-opioids**
  - Acetaminophen
  - NSAIDs

- **Opioids**
  - Morphine, hydromorphone, fentanyl …

- **Adjuncts**
  - Anti-convulsants, a-adrenergic agonists, ketamine, benzodiazepines, anti-depressants, etc.
Back to Polly

- No acetaminophen
- No NSAIDs
- Morphine:ketamine via PCA started on day 7 after MVC, once patient extubated
Opioids

• Morphine = Gold Standard; most studied, most utilized

• Minimum effective analgesic concentration (MEAC) – similar to analgesic corridor

• MEAC differs among patients

• For morphine: 12 ng/mL requires a loading dose of 0.05-0.1 mg/kg and an infusion rate of 10-30 mcg/kg/hr (Lynn et al. 1984. Crit Care Med 12: 863-6).
Opioids

• Other choices include **hydromorphone, nalbuphine, & fentanyl**

• **Hydromorphone:**
  – Also used in patients with renal failure; metabolites inactive analgesically but may be neurotoxic in accumulation *(Smith. 2000. Clin Exp Pharm & Phys 27: 524-528).*
  – To be avoided in opioid-naïve patients; linked to ↑ risk of respiratory depression *(Rapport du groupe de travail sur l’analyse de situations de décès reliés à l’utilisation d’analgésiques opiacés, MSSS Québec, 2006).*
  – Used as alternative to morphine if patient having excess pruritus and/or nausea
Modes of Administration of Opioids

1. Intermittent IV boluses
2. PCA ± continuous infusion
3. Others (PO, PR, etc.)
1. Intermittent IV Boluses

- Opioid given at regular intervals by IV over 20 mins.

- **Advantages** compared to PCA/NCA
  - No need for advanced technology
  - No need for teaching, reinforcement

- **Disadvantages** compared to PCA/NCA
  - Plasma levels are more often supra and infra-therapeutic
  - No direct link between patient’s level of pain and dosing
1. Intermittent IV Boluses

Analgesic Corridor

Figure 4.2  Intermittent intravenous opioid analgesia
2. PCA

- **Patient-Controlled Analgesia**
  - Allows for rapid titration of opioid based on patient’s pain stimulus
  - Doses smaller but more frequent
  - Usually used in patients ≥ 6 y.o.
  - Requires teaching & reinforcement on part of RN
Figure 5.1 Patient-controlled analgesia is more likely to keep blood concentrations of opioid within the ‘analgesic corridor’ and allows rapid titration if there is an increase in pain stimulus, requiring higher blood levels of opioid in order to maintain analgesia.
2. PCA

• **Advantages**
  - Gives patients sense of control $\Rightarrow$ high sense of satisfaction *(McDonald et al. 2001. Paediatr Drugs 3: 273-284.)*
  - Minimal delay between request for pain relief & analgesia

• **Disadvantages**
  - Slightly higher opioid consumption *(Hudcova et al. 2009. Cochrane DSR. Pp 1-84.)*
  - Requires a certain level of comprehension
Background Infusions

• Generally used in cases of severe pain with high opioid intake (eg. Scoliosis surgery, sickle cell pain)

• Advantages

• Disadvantages
Safety of PCA

- PCA = very safe method of post-operative analgesia when used in appropriate patients & with appropriate monitoring (Hudcova et al. 2009. Cochrane DSR. Pp 1-84.)

- Average risk of respiratory depression (RR < 8-10) in adults using PCA = 1.2% (Cashman et al. 2004. Br J Anaesth 93: 212-223.)

- Here at MCH: 0% (0/187) in 2009
  1% (2/191) in 2008
Back to Polly

- Started on PCA
- Initial settings = morphine/ketamine 1.5 mg Q10 mins
- Also started on clonidine 50 mcg PO BID >>> adjunct
Adjuncts

- Ketamine
- Clonidine
- Gabapentin
- Others…
Ketamine $^{1,2,3}$

- Morphine-sparing effect
- ↓ post-operative nausea and vomiting in the first 24 h after surgery
- Adverse effects are mild or absent

Ketamine

The Early and Delayed Analgesic Effects of Ketamine After Total Hip Arthroplasty: A Prospective, Randomized, Controlled, Double-Blind Study

- Perioperative 24-h low-dose ketamine infusion in adults for THA in the presence of other antihyperalgesic drugs
  - ↓ morphine consumption by 28% for the first 24 h and the first 7 days after.

Ketamine

Analgesic effects of ketamine were still present 6 months after surgery.

Clonidine

• Alpha$_2$-adrenergic agonist
  • Alpha-2 receptors
    – located on the brain stem, spinal cord, and peripheral sensory nerves

• Analgesic effects
  – Inhibition of the release of nociceptive neurotransmitters
  – ↓ neurotransmission of peripheral nerve fibers (Ad & C)
Clonidine

Indications
Premedication
Improvement of caudal / epidural analgesia
analgesia
Clonidine

- **Routes of administration available in Canada**
  - oral, transdermal (approved in Canada)
  - neuraxial, parenteral

- **Advantages**
  - Favorable pharmacokinetics

- **Side effects**
  - Sedation
  - ↓ Response to atropine
  - ↓ Hyperglycemic response to stress
Gabapentin

• Mechanism of action
  – Reduces the hyperexcitability of dorsal horn neurons
    • alpha$_2$-delta subunit of presynaptic voltage-gated calcium channels is its main site of action

• Indications
  – neuropathic pain
  – postoperative pain
    • ↓ early postoperative pain
    • ↓ opioid consumption over the first 24 h following surgery of 35%
    • ↓ opioid-induced side effects

Gabapentin

A Comparison of Gabapentin and Ketamine in Acute and Chronic Pain After Hysterectomy

PCA morphine requirement was significantly reduced for the first 24 h with ketamine and gabapentin

Gabapentin prevented chronic pain in the first 6 postoperative months.

Back to Polly

• To ward on post-MVC day 9 (day 2 after extubation) with PCA

• Multiple adjustments of PCA required
  » Increased bolus dose
  » Lockout decreased
  » Continuous infusion started

• …Finally!! Patient reports feeling much better with new parameters on post-MVC day 10… however, now c/o generalized, intolerable pruritus.
Side-effect Management

“Dosis facit venenum”
The dose makes the poison

• The higher the dose of opioid ⇒ the higher the likelihood of opioid-related side effects

• Most common include:
  • Pruritus
  • Nausea/vomiting
  • Urinary retention
  • Constipation

• The only side-effect that will not decrease over time?
Side-effect Management

Choose least sedating agents to treat side-effects

• **Pruritus:**
  – Prefer naloxone over diphenhydramine
  – Low dose naloxone (1-2 mcg/kg/hr) = ↓ opioid-induced pruritus without reversing or diminishing analgesia *(Kjellberg et al. 2001. Eur J Anaesthesiol 18: 346-57.)*

• **Nausea/vomiting:**
  – Prefer ondansetron over dimenhydrinate

• **Urinary retention:**
  – Small boluses of naloxone or nalbuphine (1-2 mcg/kg) can help reverse this effect (briefly)
Back to Polly

- Started on naloxone infusion, 2 mcg/kg/hr, for pruritus
- Started on docusate sodium

- Polly does relatively well for 3 days
- Average IV morphine intake = 140 mg/24 hrs
Back to Polly

• On post-MVC day 13, patient c/o of increasing pain to back, ribs (8/10)
• PCA and adjuncts adjusted

• Average IV morphine/ketamine intake over past 24 hrs increased to **164 mg**

*What is causing Polly’s increased opioid consumption??*
Increasing Opioid Consumption as an Indicator

- Fear of “masking” ongoing process can lead to under-treatment
- More pain = poorer healing, slower recovery

By treating pain and monitoring opioid consumption, can follow any changes in patient’s status

- Polly’s CXR reveals large bilateral pleural effusions and L lung consolidation
- Taken back to OR for chest tube on post-MVC day 14
Back to Polly

- Post-op, requires same morphine-equivalent doses (140 mg/24hrs) as before pleural effusion
- Small adjustments to PCA settings made to ensure adequate pain control
- Pt discharged to rehab on post-MVC day 25
Case Presentation #2
Little Boy

• 22 month-old boy, 14 kg, previously healthy
• Farm accident, left forearm amputation with multi-level injury of left upper extremity.
• Stabilized at outlying hospital
• Operation under GA:
  – Reimplantation of forearm amputated left upper extremity
  – ORIF proximal humerus
  – Intraoperative brachial plexus nerve block via an infraclavicular approach with a catheter
Postoperative Course

• PICU
  – Sedated & ventilated
  – Continuous infusion via the PNB catheter with ropivacaine 0.1% at 3 mL/h

• Surgeries
  – POD 1: Thrombectomy vein graft anastamosis, artery microanastomosis
  – POD 2: Amputation left arm with skin graft

• Extubated POD 3
  – Withdrawal syndrome

• Gabapentin POD 4
  – To prevent neuropathic and/or phantom pain

• Continuous PNB infusion
  – D/C POD 6
Regional Anesthesia

- Decreased requirements for
  - inhalational & iv anesthetic agents
  - opioids
- Decrease hormonal-metabolic stress response to surgery
- Earlier extubation
- Postoperative analgesia
- Provides sympathetic blockade
Regional Analgesia

Options

- Epidural (caudal, lumbar, thoracic)
- Spinal (single shot)

- Peripheral nerve blockade
Local Anesthetics

• Cause a reversible block to the conduction of impulses along nerve fibers
• Local concentration >>> plasma concentration after absorption.

Ropivacaine

http://en.wikipedia.org
Local Anesthetics - Mode of action

• Membrane of nerve fibers
  – Lipid bilayer
  – Proteins including the sodium channels

• Local anesthetics block the propagation of the nerve impulse by preventing the sodium channel from opening.
Local Anesthetics

Signs and symptoms of systemic toxicity

Compartment Syndrome

The controversy of regional anesthesia in patients at risk of compartment syndrome

Dr. Mira Kapala
Compartment syndrome

• Trauma lesions and surgeries at greater risk
  • Displaced supracondylar fractures of the humerus
  • Tibial shaft fractures
  • Intramedullary fixation of pediatric arm fractures

• Complication
  • Volkmann’s contracture

• Treatment
  • Decompression by fasciotomy
Orthopedic literature

“All surgeons should be very suspicious of compartment syndrome, and we recommend that local anesthesia should not be used in trauma of the arm or the leg to avoid the possibility of conflicting opinion and diagnostic delay”

Anesthesia literature

Hazard of compartment syndrome: is the torture chamber the solution?

“The development of excruciating pain in a child deprived of any analgesic medication should no longer be considered the ‘presenting’ symptom of a compartment syndrome”

“Adequate pain management of children may even help when there is the suspicion of an early development of a compartment syndrome”

Dalens B. Some current controversies in paediatric regional anaesthesia
Do epidurals mask compartment syndrome?

Yes

– Case reports

No

– Case reports
  • Beerle BL, Rose RI. *Lower extremity compartment syndrome from prolonged lithotomy position not masked by epidural bupivacaine and fentanyl*. Regional Anesthesia 1993 18(3):189-90.

– The national Pediatric Epidural Audit
Is Patient-Controlled Analgesia Safe?

Acute compartment syndrome masked by intravenous morphine from a patient-controlled analgesia pump

P. Harrington\textsuperscript{a,*}, J. Bunola\textsuperscript{b}, A.J. Jennings\textsuperscript{a}, D.J. Bush\textsuperscript{a}, R.M. Smith\textsuperscript{a}

Compartment syndrome

Clinical presentation

Number of patients

10/33 children had PCA/NCA

The onset of increasing analgesia requirement preceded that of other symptoms by an average of 7.3 hours.

Compartment Syndrome
Conclusions

• Diagnosis is difficult
• Adequate pain control should be offered to all patients
• No evidence that well conducted continuous epidurals or nerve blocks with local anesthetics of low concentration can mask compartment syndrome
• Importance of regular monitoring
  • Pain, ↑ analgesics requirement, neuro/vascular, skin integrity
• Patient at risk should be identified
Main Pain Pathway

Figure 1.1

Voies de la douleur :
de la périphérie au cortex

- Système limbique (composante émotionnelle)
- Thalamus (noyaux intralaminares et ventro postéro-latéral)
- Vers le cortex somatosensoriel primaire (SI)
- 2e contact synaptique

- Bulbe rachidien
- 2e neurones de la voie nociceptive qui projettent de la moelle (neurones NS et WDR des voies spinothalamique et spinétiq
- 2e contact synaptique
- 1er neurones de la voie nociceptive qui projettent de la périphérie à la moelle (fibres Aδ et C)
- 1er contact synaptique
- Moelle épinière
- Faisceau spinothalamique
- Corne dorsale
- Axones des racines dorsales de fin diamètre

D’après Bear et coll., 1997

• Cortical areas involved in pain
  – Primary somato-sensory cortex (S1)
  – Secondary somato-sensory cortex (S2)
  – Anterior cingular cortex (CCA)
  – Insula

Determined with brain imaging studies with PET scan during painful stimulation in humans.

Interactions between emotions and sensations during the experience of pain

Hypnosis

1795-1860
James Braid and Alexandre Bertrand
“Subject’s suggestibility”

“Hypnosis” Greek root “Hypnos”, sleep
Etienne Felix d’Henin de Cuvillers 1820
Hypnosis

1830s
Documentation of hypnosis as adjunct to surgical therapy

1845 to 1851
Scottish physician
James Esdaile
Hypnosis

Reintroduced in 1958

Experimental studies:
• Changes in the perception of experimental pain under hypnosis.
• Psychologic correlates of hypoanalgesia.

Clinical studies:
• Studies involving intraoperative suggestions to patients under general anesthesia.
• Perioperative hypnosis and general anesthesia.
• Hypnosis as part of conscious sedation and monitored anesthesia care.
How hypnosis can modify the pain experience!


(Downloaded from www.sciencemag.org on October 27, 2009)
Self-hypnosis
Helping children help themselves

SDBP
Society for Developmental & Behavioral Pediatrics
Hypnosis

Don’t move your arm.
↓
Keep you arm still or Relax your arm
Teaching Coping Skills

Understandable rational

Coaching
Relaxation

Practice makes perfect
Breathing Exercises

Model appropriate breathing patterns and use their imagination
Distraction

- Watching a movie
- Counting, singing
- Listening to music
- Playing video games
- Telling or reading a story
Guided Imagery

Cognitive distraction technique
Control

• To decrease powerlessness
  – Amount of information
  – Power to make decisions
  – Choice of accompaniment
Sucrose

- < 18 months
- 24% sucrose solution prepared by the pharmacy
- Endorphins

Overgaard C & Knudsen A 1999
Johnston C et associés 1999
Gibbins S et associés 2002
Massage

Relaxes muscles
Positive association with touch sensation
Conclusion

• MUHC Pediatric Opioid Therapy Guidelines
• PCA is only a mode of administration of opioids
  • Patients need to be carefully selected
  • Teaching and surveillance is essential
• Multimodal analgesia is the key to success
• Use non-pharmacological approaches as often as possible!
More Bibliography

