What’s New in the Paediatric Emergency Department

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Paediatric Emergency

- Analgesia and Procedural Sedation
- Antiemetics
Importance of good pain management

Significant advances made in pain but…

1. Despite the establish efficacy of pain management techniques, studies show pain is poorly managed

2. Compared to adults, children are less able to communicate their pain, and may have significant anxiety that contributes to their perception of pain

3. Children still suffer from inadequate or absent analgesia when compared to adults suffering from similar, painful conditions

4. Poor control of acute severe pain in children can cause long term problems such as poor coping skills, PTSD, phobias etc
Medications used for Analgesia and/or Sedation in the PED

- Oral analgesics
- Topical anaesthetics
- Sucrose
- Fentanyl
- Morphine
- Nitrous oxide
- Midazolam
- Ketamine
- Others?
Emergency Department Uses of Procedural Sedation

- Wound care
- Laceration repair
- Burn debridement
- Incision and drainage
- Reductions
  - Dislocation
  - Fracture
  - Hernia
  - Paraphimosis
- Diagnostic imaging
  - CT scan
  - MRI
- Chest tube placement
- Suprapubic catheter placement
- Cardioversion
- Lumbar puncture
- Arthrocentesis
- Foreign body removal
- Foley catheter placement
- Slit lamp examination
- Sexual assault exam
Medications used for Analgesia and Sedation in the PED

Ideal analgesic drug

- Easy and painless to administer
- Potent analgesic effects
- Rapid and predictable effect
- Wide margin of safety
- Minimal side effects
- Retains protective airway reflexes
Intranasal Fentanyl

- Pure mu opioid agonist
- Rapid, virtually painless, non invasive administration
- Highly fat soluble drug and intranasal route bypasses first pass metabolism
- Does not cause histamine release, with low ciliotoxic effect
  Therapeutic levels in 10min
- Duration of action 30 to 60 min
- Unlikely to cause haemodynamic instability or respiratory compromise

Side Effects
- Mild Nausea and vomiting, sedation
- Mild respiratory depression
Intranasal Fentanyl

- Borland et al. Intranasal fentanyl reduces acute pain in children in the emergency department: A safety and efficacy study
  

- 45 children in acute pain aged 3-12 yrs
- Dose 20 µg 3-7 yrs, 40 µg with additional doses as required
- 5 minutely vital signs and pain scores

Results
- Median dose 1.5 µg/kg (0.5 – 3.4 µg/kg)
- Onset within 10 minutes and sustained
- 1 child required IV morphine
- No significant change in vital signs
- No side effects
Intranasal Fentanyl

• Borland et al. A randomized controlled trial comparing intranasal fentanyl to intravenous morphine for managing acute pain in children in the emergency department

• 67 children in acute pain from long bone fractures aged 7-15 yrs
• IN Fentanyl 1.4 µg/kg vs IV Morphine 0.1 mg/kg
• 5 minutely vital signs and pain scores

• Results
  • Mean total fentanyl dose 1.7 µg/kg and mean total morphine dose 0.11 mg/kg
  • No significant differences in VAS between treatment arms
  • 1 child required IV morphine
  • No serious adverse events
Intranasal Fentanyl - Uses

- Initial analgesia for Children age 1 to young adults with acute pain:
  - Fractures, dislocations, soft tissue injuries
  - Burns/burns dressings
  - Lacerations
  - Abdominal pain
  - Adjunct to procedural sedation
Intranasal Fentanyl

Contraindications
• Rapid IV access needed for stabilization
• Allergy to Fentanyl / Opioids
• Altered conscious state/Head Injury
• Current URTI or nasal infection/obstruction

Advantages
• Effective and well tolerated route of administration
• Good safety profile and Suitable for pre-hospital use
• Can titrate dose to effect
Nasal Drug Delivery Device
MAD®

Fast and effective intranasal medication delivery a viable option to IV/IM/rectal dosing in select cases

Reduces pain and bleeding associated with nasal and oral instrumentation and nasogastric tube placement

Controlled delivery for topical anesthetics and vasoconstrictors
Intranasal Fentanyl - Dosing

Dosage Regime

- Based on age and weight
- Solution 100mcg/2ml
  - average dose 1.5 microgram/kg
- Dose may be repeated at 10min if no effect
- May give a further dose at 30min if required

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Approx. weight</th>
<th>Initial dose (µg)</th>
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<tbody>
<tr>
<td>1 - 3</td>
<td>10 - 14</td>
<td>20</td>
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<td>3 - 7</td>
<td>15 - 24</td>
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<td>8 - 12</td>
<td>25 - 36</td>
<td>50</td>
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Intranasal fentanyl

- WCH experience
  - Effective and well tolerated analgesic
  - Side effects rare
  - More effective if dose divided between nostrils
  - Small volume/high concentration most effective
  - Avoids or delays the need for IV insertion
  - MAD also useful for administering midazolam
Sucrose

• Sucrose has been shown to be an effective method of procedural analgesia in young infants in a number of clinical trials

• Taste-induced analgesia is thought to be mediated by endogenous opioid mechanisms – controversial!

• A recent Cochrane review concluded that sucrose was safe and effective for reducing procedural pain from a single painful events in neonates.

BUT…
Sucrose

- Rogers et al. A randomized, controlled trial of sucrose analgesia in infants younger than 90 days of age who require bladder catheterization in the pediatric emergency department.  

- There was no overall treatment effect
- Possible small benefit in infants < 30 days
Sucrose

- Curtis et al. A randomized controlled trial of sucrose and/or pacifier as analgesia for infants receiving venipuncture in a pediatric emergency department
  
  *BMC Pediatrics 2007, 7:27*

- Sucrose did not significantly reduce the FLACC score, crying time or heart rate

- Pacifier did not significantly reduce FLACC score or heart rate but did reduce crying times
Sucrose - dosing

• Supplied by pharmacy as a 66.7% solution
• Diluted to 26% solution with sterile water
• Infants < 1 month 1ml
• Infants 1 month – 12 months 2ml
• 0.25 ml immediately before procedure, remainder during procedure
• Use with a pacifier
Sucrose

- WCH experience
  - Some analgesic effect in neonates where other techniques not appropriate
Nitrous oxide

- Weak anaesthetic
- Strong analgesic
- Mechanism of action?
- Rapid onset
- Short duration of action and rapid recovery compared to ketamine
- Low incidence of respiratory depression
- Up to 15% incidence of vomiting
- Entonox vs variable flow
Nitrous oxide

- Luhmann et al. A randomized clinical trial of continuous-flow nitrous oxide and midazolam for sedation of young children during laceration repair
  
  Annals Emerg Med 2001

  - 204 children aged 2-6 years, facial laceration repair
  - 4 groups – standard, standard + midaz, Standard + N₂O and standard, midaz and N₂O
  - continuous-flow N₂O was more effective in reducing distress, and had fewer adverse effects and shorter recovery times than midazolam
Nitrous oxide

- Luhmann et al. A Randomized Comparison of Nitrous Oxide Plus Hematoma Block Versus Ketamine Plus Midazolam for Emergency Department Forearm Fracture Reduction in Children
  
PEDIATRICS Vol. 118 No. 4 October 2006

- Ketamine/midazolam vs CF 50% \( \text{N}_2\text{O} \)/ haematoma block
- 102 children 5 – 17 years
- Assessed using Procedure Behavioural Checklist Scores
- \( \text{N}_2\text{O}/\text{HB} \) more effective than ketamine/midaz with fewer adverse effects and markedly shorter recovery times

- High incidence of vomiting in both groups (24/26%)
Nitrous oxide
Nitrous oxide – WCH experience

- Currently most common form of procedural sedation for fracture reductions in the PED
- Important to give several minutes for N₂O to reach maximal effect
- Depth of sedation variable
- Significant amnesic effect in many cases
- Rapid recovery a significant advantage but emesis common
- ? Role of adjuvant sedative/analgesic agents
Nitrous oxide – WCH experience
Vomiting

- Common PED presenting symptom
- Often due to gastroenteritis but not always
- Worldwide, acute gastroenteritis accounts for 3-5 billion cases annually
- ORS safe and cost effective
- Studies of a variety of anti-emetic medications have shown variable efficacy and frequent side effects
- WCH data 2007
  - ~ 4000 presentations (10% of workload)
Ondansetron

- Selective 5-HT antagonist
- Available for clinical use from 1991
- Good evidence for efficacy and safety as an antiemetic for chemotherapy induced vomiting and post operative vomiting
- Variety of routes of administration
Ondansetron

  

- 145 patients 6 months – 12 years,
- Ondansetron vs placebo followed by oral rehydration
- **Results**
  - No reduction in frequency/proportion of patients with vomiting
  - Reduced hospital admissions
  - Reduced IVT
  - Increased diarrhoea (3x) and ED attendances in Ondansetron group
Ondansetron

• Reeves et al. Ondansetron decreases vomiting associated with acute gastroenteritis: a randomized, controlled trial


• 107 children, 1 month – 22 years, IVT for gastro
• IV Ondansetron 0.15 mg/kg vs placebo

• Results
  • Significant reduction of vomiting on Ondansetron group (70% v 51%)
  • Reduced hospital admission rate (not significant)
Ondansetron

Freedman et al. Oral ondansetron for gastroenteritis in a pediatric emergency department.


- 215 children 6 months – 10 years
- SL Ondansetron vs placebo followed by ORS

- Results
  - Significant reduction in vomiting (14 v 35%), better intake, reduced IVT rates and shorter PED stay
  - No significant reduction in admission rates or return visits
  - More diarrhoea in Ondansetron group
Further Information

Please contact Dr Malcolm Higgins

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