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

  Emergency Medicine Australasia (2002) 14 (3) , 275–280

- 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**

  Annals of Emergency Medicine. 49(3):335-40, 2007 Mar.

- 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**

Age (years)	Approx. weight	Initial dose (µg)
1 - 3	10 - 14	20
3 - 7	15 - 24	25
8 - 12	25 - 36	50

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 opiod 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.**

  Academic Emergency Medicine. 13(6):617-22, 2006 Jun.

- **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 + N_2O and standard, midaz and N_2O**
- **continuous-flow N_2O 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% N_2O/ haematoma block**
- **102 children 5 – 17 years**
- **Assessed using Procedure Behavioural Checklist Scores**
- **N_2O/HB more effective than ketamine/midaz with fewer adverse effects and markedly shorter recovery times**

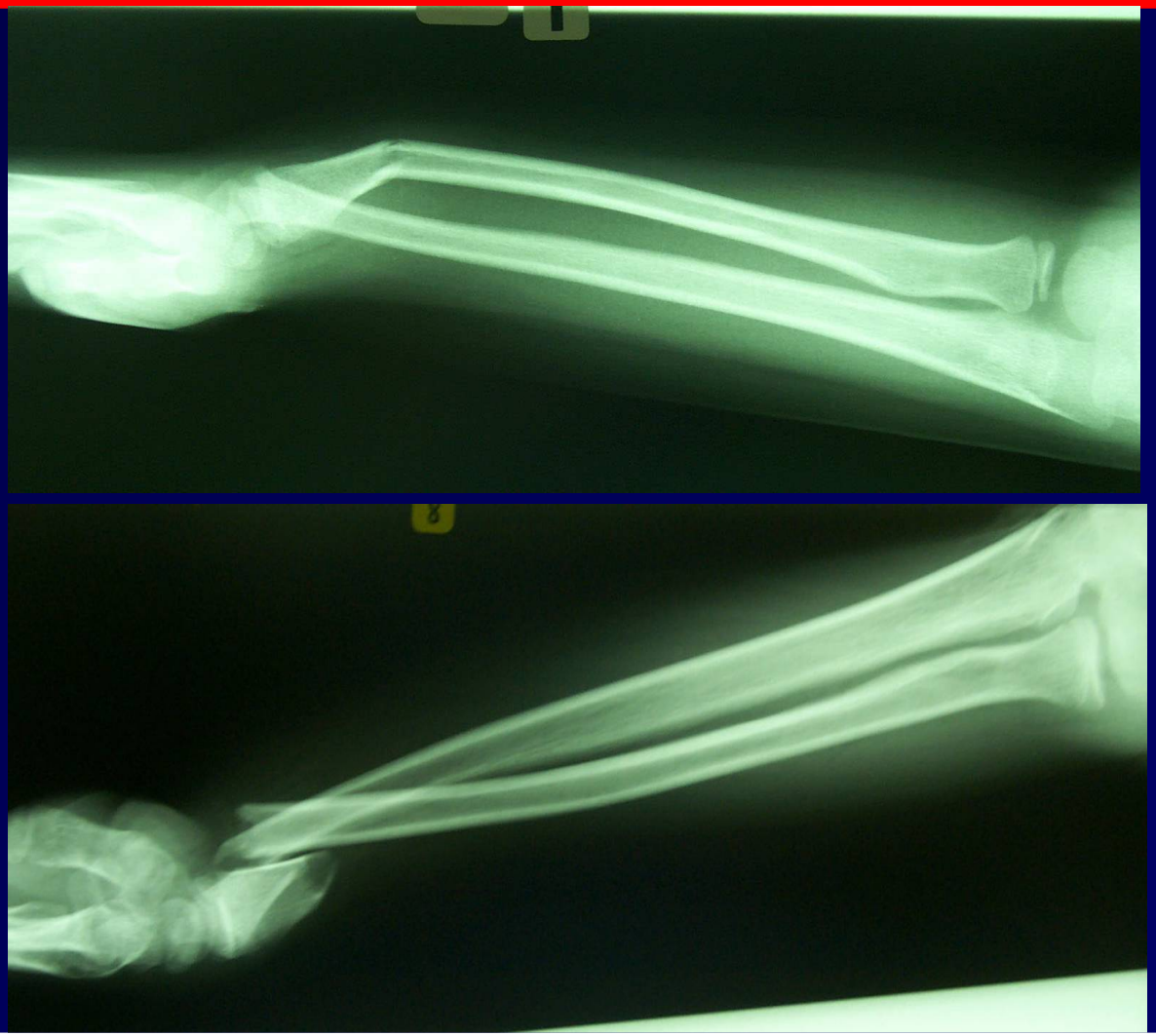
- **High incidence of vomiting in both groups (24/26%)**

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 N_2O 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

- Ramsook et al A randomized clinical trial comparing oral Ondansetron with placebo in children with vomiting from acute gastroenteritis. Ann Emerg Med. 2002 Apr;39(4):397-403.
- 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

  Pediatrics. 2002 Apr;109(4):e62.

- 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.

N Engl J Med. 2006 Apr 20;354(16):1698-705.

- 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

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