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“Taming the Wild Child”
Pearls, Pitfalls and Controversies in Pediatric Analgesia and Sedation

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Outline

- Myths and Truths
- Pediatric sedation principles
- Reinforce non-PSA options
- Case Presentations
- Current controversies, updates
Myths

- Myth – Kids don’t feel pain
  - “Pediatric patients seldom need medication for relief of pain. They tolerate discomfort well…”
- Kids can’t use pain scales
- Assessment of pain can be difficult in a nonverbal child
Myths

- Young children have no memory of pain
- Worry about addiction
- Fear of side effects
Truth

- Kids less than 2 years get less pain medications than older patients
- Toddlers view pain as punishment
- JCAHO mandates
Children – Not just Small Adults?

- More likely to have airway obstruction during sedation due to a relatively larger tongue, epiglottis and occiput.
- Children desaturate more quickly after apnea than even moderately ill adults.
- Children require more frequent sedation dosing and their sedation level is more difficult to assess.
Children – Not Just Small Adults?

- It is essential that drug dosages be calculated based on a precise weight measurement, not a parent’s estimate.
- Resuscitation equipment must be size and age appropriate.
Procedural Sedation – Monitoring/Equipment

- Pulse oximetry
- Heart rate monitoring
- Blood pressure before, after medication administration, during recovery
  - Every 5 minutes during deep sedation
- Age appropriate resuscitation equipment and supplies
- Capnography
Capnography

- Detects hypoventilation prior to desaturation
  - Particularly if using supplemental oxygen
  - Children stimulated after 15 sec of hypoventilation significantly less likely to desaturate vs. 60 sec of hypoventilation
- More sensitive than clinical assessment
Procedural Sedation - Capnography

- Study of patients undergoing endoscopy
  - Hypoventilation in 56% of procedures and apnea during 24%
  - Staff watching identified hypoventilation in 3% and no apnea
ETCO2 Normal Capnogram

Source undetermined
ETCO₂ and Apnea

- Flatline on capnogram monitor, no chest movement
ETCO$_2$ and Laryngospasm

- Flatline on capnogram monitor, chest movement in attempt to breath
Case

- 3 week old requires evaluation with lumbar puncture for fever and lethargy. Vitals are normal except for fever and tachycardia. What are you going to sedate the child with for the lumbar puncture?
Non-PSA Options for Neonates

- Oral sucrose
- Release of endogenous opiates as a result of sweet taste
- Safe and effective
- Studied in heel stick, venipuncture, lumbar puncture
  - Stevens B. et al. Cochrane Database Syst Rev 2004; (3):CD001069
Non-PSA Options for Children

- **Topical anesthesia**
  - XAP, LET, TAC
  - Get it started early (ie. From triage)
  - Have parent/caregiver “paint” it on

Epinephrine 0.05 %
Lidocaine 4 %
Tetracaine HCl 0.5 %
Non-PSA Options for Children

- Protective restraint
  - Papoosing
  - Best applicable for preverbal child
  - Risk/benefit discussion
EMLA or ELA-max

1 hour to achieve peak effect

30 min to achieve peak effect
Behavioral Techniques

- Gain the child’s trust
- Child life resources
- Distraction
- Parental presence, and parental preparation
- Age appropriate language
- Provide a positive environment for the child undergoing a painful procedure.
Injected Lidocaine - Tips

- For wounds that require precise anatomic alignment, regional block preferable to infiltration
- No evidence that lido with epi on face, nose, ear digit or penis has ischemic complications
- Buffering with NaHCO₃ decreases pain of injection (1 part of 1 mEq/ml to 9 parts lidocaine)
Buffering Lidocaine

1 Parts

9 Parts
Atomized Fentanyl/Versed

**Fentanyl (50 mcg/ml)**
- 1 – 2 mcg/kg
- (max of 100 mcg)
- Repeat ½ to full dose q10 – 15 min as needed for pain

**Midazolam (5mg/ml)**
- 0.2 – 0.5 mg/kg
- (max of 10 mg)
- Repeat ½ to full dose in 10 – 15 min if needed to achieve goal sedation
Case Study

- 20 month old, fall into a coffee table. While waiting in the waiting room, mom gave the child a bag of potato chips and some apple juice. How long should we wait for procedural sedation?
• Fasting
  - ASA guidelines - consensus based
    - Two hours for clear liquids
    - Four hours for breast milk
    - Six hours for formula, non-human milk, and solids
Procedural Sedation and Fasting

- Fasting – ED studies
- 2 large prospective studies involving ketamine, ketamine/versed, fentanyl/versed
- No difference in complications between those that met fasting guidelines and those that did not

1. Should Pediatric patients undergo a period of preprocedural fasting to decrease the incidence of clinically important complications in the ED?

Level B recommendation: Procedural sedation may be safely administered to pediatric patients in the ED who have had recent oral intake.
Procedural Sedation and Fasting

- “Empty mouths, not empty stomachs”
- Insufficient evidence to support the position that fasting guidelines crafted for operative anesthesia should be extrapolated to sedation practice
Fasting and Risk Stratification

- Assess the patient’s Risk
- Assess the timing and nature of recent oral intake
- Assess the urgency of the procedure
- Determine the prudent limit of targeted depth and length of procedural sedation and analgesia
Case

- 5 yo female was playing on the monkey bars who fell and suffered a both bone forearm fracture requiring reduction.
- Mom asks what you will use for sedation because last time she was got ketamine she woke up hysterical and screaming... then threw up.
Ketamine Controversies

- Is adjuvant medication (versed or atropine) needed?
- Is there an advantage to IM versus IV administration?
- What about ketamine and propofol (ketofol)?
Ketamine and Midazolam

- Traditionally given to reduce “emergence” reactions
- Emergence reactions rare
- Adjunctive administration added no benefit in preventing emergence rare
Ketamine and Midazolam

- Why not give it?
- Midazolam increases incidence of oxygen desaturation
  - 7.3 versus 1.6 percent
- Effects were more pronounced in children younger than 10 years of age
Ketamine and Atropine

- Ketamine causes increased salivation
- Atropine or glycopyrolate given with ketamine reduces salivation
- As long as dosed to avoid paradoxical bradycardia (doses less than 0.1 mg) relatively harmless
- Data suggests no benefit
Ketamine – Emergence Reactions

- Diminished emergence reactions by decreasing the amount of environmental stimuli
- “Suggestive dreaming”
IM versus IV Ketamine

- Observational study of 4252 children receiving IV or IM ketamine
  - 20 of 29 cases of laryngospasm occurred in the IM group
  - Overall rate of laryngospasm 7 per 1000 sedations
IM versus IV Ketamine

- IM injection had significantly longer recovery times
  - 129 versus 80 minutes in the IV ketamine group
- More vomiting
  - 26% versus 12% in the IV ketamine group

IM versus IV Ketamine Summary

- Possibly higher adverse respiratory events with IM
- Higher rates of emesis with IM
- Longer recovery period with IM ketamine

When possible, use IV Ketamine
Case

- 10 year old presents with a displaced distal radius fracture with significant apex dorsal angulation requiring reduction. The nurse asks if you want to try the new sedation technique she heard about using both propofol and ketamine.
Ketofol

- Using sub-dissociative doses of ketamine (0.5 mg/kg IV) and propofol (1mg/kg)
- Improved airway preservation, decreased vomiting, and decreased need for opioid use when applicable.
- Fewer boluses to maintain sedation
- Higher patient and physician satisfaction scores
# Ketofol

<table>
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<th>Propofol</th>
<th>Ketofol</th>
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<tr>
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<td>Infrequent</td>
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</tr>
</tbody>
</table>
Shah et al. - Methodology

- Canadian study: Ketamine vs Ketofol
- Double, Randomized controlled trial
- 2-17 yo (orthopedic procedures only)
- 136 patients
- Ketamine (0.5 mg/kg IV) + Propfol (1 mg/kg)
- Ketamine (1 mg/kg IV)

There was less vomiting in the ketamine/propofol (2%) group compared with the ketamine (12%) group.

Ketofol has slightly faster recovery times (13 min) compared to propofol (16 minutes).

Similar efficacy and airway complications.

All satisfaction scores were higher with ketamine.

• Draw up 10ml of Propofol in a 20cc syringe.
  ○ Propofol comes 10mg/ml.
• Discard 2cc from a 10cc saline flush. Drawl up 2cc of Ketamine.
  ○ Ketamine 50mg/ml (adjust the dose if you use a different concentration)
  ○ You now have 10mg/ml
• Inject the Ketamine in the saline flush into a 20cc syringe of Propofol.
• Dose at 0.5 mg/kg IV Ketofol, then redose as needed
3 yo male falls off the bed hitting his head and eye. Positive LOC describe by the older brother (who pushed him). Vomitted x 3 in the ED. Slightly somnolent, but becomes agitated with exam.
Sedation Options

- Versed
- Ketamine
- Pentobarbital
- Propofol
Pentobarbital

- Best effects IV
- Can be given IM, PO, Rectal
- Dose 1-6 mg/kg given in 2 mg/kg aliquots
- Many centers is the sedative of choice for diagnostic imaging
- Better than midazolam or chloral hydrate
Pentobarbital Pros and Cons

**Pros**
- Quick onset (3-5 minutes)
- Lasts 30-40 minutes
- Cerebroprotective

**Cons**
- Burns on infusion unless diluted
- Can cause respiratory depression and hypotension
- Avoid with porphyria
Pentobarbital - Controversies

- Safe, effective sedation
- Standard for diagnostic imaging if propofol not available
- Never been compared directly to propofol
Questions?
Summary Slide

- In pediatric sedation, children are not just small adults
- Capnography is becoming the standard of care for procedural sedation
- Topical anesthetics and distraction can get you a long way
Summary

- Adjunct medications not needed for Ketamine
- IV Ketamine has less side effects than IM Ketamine
- Keep an eye out for Ketofol to gain popularity
- Pentobarbital probably most reliable method of sedation for imaging