Pediatric Sedation and Pain Control
Outside of the Operating Room

2015 Fall Anesthesia Conference
Supporting our Future Anesthetists Foundation
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Dr. David Turkewitz
Chairman Pediatrics York Hospital
Director Pediatric Emergency Medicine York Hospital
Medical Director York County Children's Advocacy Center
Medical Director Adams County Children's Advocacy Center
Disclosure Announcement

- Dr. Turkewitz has no commercial relationships to disclose.
Objectives

The attendees should be able to:

- List several important pediatric pain management caveats
- Appreciate influence of developmental age, temperament and parental presence on approach to and management of a pediatric patient’s pain and anxiety
- Cite why moderate or conscious sedation is almost never a useful management strategy for children
- Describe the impetus to create a pediatric sedation program for diagnostic and interventional radiology
- Discuss the excellent outcomes that can be achieved with the use of propofol which exceed that of any other sedation agent in terms of efficacy and adverse effects if used properly
Objectives: simplified version

The attendees should:

- believe a child’s pain and anxiety are worth recognizing and treating 100% of the time
- be able to evaluate and manage anxiety, pain and sedation needs, safely and effectively, outside the operating room whether the child is one day old or 21 years old.
- be an advocate and guardian when working with children....
A perspective of pediatric versus adult pain management in the last 30 years

- “in 1985…under treatment of pain and anxiety was very common, and many children were simply immobilized for procedures.”
  - Bauman, McManus. Pediatric pain management in the ED.
• 60% of adults compared to 28% of children received adequate analgesia for long bone fractures in the ED


• 73% of adults compared to 53% of children received analgesics for long bone fractures in the ED


• Children compared to adults presenting with moderate to severe pain were less likely to receive narcotic and non-narcotic analgesics
  • 73% received an analgesic and 54% received a narcotic analgesic
  • Pain severity scores not often recorded

5 year old, case reviewed 9/16 Trauma QI

Fell from monkey bars on her outstretched right arm with immediate pain. She was seen in the ED → evaluation right mid-shaft radius and ulna fracture. Pain rated as 8 and 10 in ED; no pain med given in the ED.

Is this a significant variance in management?
• Within 15 minutes...per nursing reports she seemed comfortable with splint, local ice pack and parental soothing. She went from ED to OR.

• Is this serendipity.....or the result of
• An appreciation that children’s pain is real and deserves management
• Use of serial observations and scoring systems
• Appreciation of all modalities for managing pain
  • What if narcotics were given....
  • What if midazolam was given....
  • What about rectal acetaminophen (....surgical procedure in OR imminent)?
  • What about splinting
  • What about parental presence
  • What about the parents behavior
  • What about the child’s developmental age
  • What about the child’s temperament
Pediatric trauma QI York

- **Interventions:**
  - Pain scales, trauma trifold
  - Pain cards
  - Trauma pediatric order sets
Pediatric Trauma
Analgesia in the ED

- 100% review and reporting on all pediatric trauma with summary and report on all admitted cases

- Multiple filters including pain medication in the ED...
  - Most months – no variance in use of appropriate pain medications in the Trauma Bay/ED
A Comparison of Analgesic Administration Between Pediatric and Adult Trauma Patients Presenting to an Emergency Department in Central Pennsylvania

Bai Yi Ted Chen, Alina Schmidt, Nisha Hariharan, Robert Olympia. Emergency, Pennsylvania State University Hershey College of Medicine, Hershey, PA.
BACKGROUND: Previously studies have shown that pediatric patients are less likely to receive treatment for pain compared to adult patients presenting with similar chief complaints. The misconception that infants and children do not feel pain and the fear of iatrogenic consequences are possible factors contributing to *oligoanalgesia* in pediatric patients.
DESIGN/METHODS

A retrospective review of patients presenting as trauma activations to Penn State Hershey Medical Center between 6/2011 and 6/2013.

Administration of analgesics was stratified by age (pediatric patients < 18 years), mechanism of injury, initial Injury Severity Score (ISS), and dx.
RESULTS
Data analysis was performed on 1254 patients
- 153 pediatric
- 1101 adult
RESULTS
When adjusted for initial ISS, adult patients received analgesics more often than pediatric patients (odds ratio 2.7).
RESULTS
When stratified by mechanisms of injury and diagnosis, a smaller % of pediatric patients compared to adult patients received analgesics for:

- falls [32% (95% CI:18-50) vs. 65% (95% CI:59-70)]
- head injuries [32% (95% CI:23-44) vs. 71% (95% CI:67-75)]
- facial injuries [45% (95% CI:33-57) vs. 71% (95% CI:67-75)],
- thoracic injuries [26% (95% CI:10-48) vs. 83% (95% CI:79-86)]
RESULTS:
When stratified by initial ISS, pediatric patients were less likely to receive analgesics compared to adult patients at:

- ISS 1-10 [58% (95% CI:48-67) vs. 72% (95% CI:68-76)]
- ISS 11-20 [51% (95% CI:35-67) vs. 78% (95% CI:74-82)]
- ISS 21-30 [41% (95% CI:18-65) vs. 79% (95% CI:74-85)]
- ISS > 30 [25% (95% CI:3-71) vs. 87% (95% CI:79-94)].
CONCLUSIONS:
Data demonstrates that pediatric patients presenting as trauma activations received less analgesics during their initial evaluation compared to adult patients, with statistically significant differences for falls, head and facial injuries, thoracic injuries, and various levels of initial ISS.
Why the difference...
Myths

- Infants and young children do not feel pain.
- Because a young child is unable to verbalize and thus report pain, physicians may deny its existence.
Myths

- Infants and young children not only feel pain but in fact may perceive more pain
- By term, pain transmission pathways are fully developed but pain inhibitory systems are not fully developed
Myths

- Withholding sedatives, anxiolytics and pain medications because of disproportionate concerns about safety
Data supports that there are no inherent increased risks of side effects associated with proper pediatric use of analgesics, sedatives and anxiolytics provided the clinician has the appropriate experience and procedural safeguards are in place.
Barriers: Personal Values and Beliefs

- pain builds character

Walco, Cassidy, & Schechter, 1994
Additional Myths and Barriers

- Lack of assessment tools for the presence of pain
- Lack of knowledge of pain treatment

- Validated assessment tools exist
- No excuse

Additional Myths and Barriers

- Addressing pain in children takes too much time and effort
- Is this patient focused?
- Doc…quicker than pain

**PAIN ASSESSMENT IN NEONATES**

**PHYSIOLOGICAL CHANGES**
- Increased heart rate
- Increased heart rate variability
- Decrease oxygen saturation
- Change in respiration rate
- Change in blood pressure
- Increased intracranial pressure
- Increased palmar sweating/skin conductance

**BEHAVIORAL CHANGES**
- Facial activity
- Cry
- Increased body movements
- Inability to regulate behavioral state

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**PAIN ASSESSMENT IN NEONATES**

**FACIAL EXPRESSION**
- Brow bulge
- Eye squeeze
- Naso-labial furrow
- Open lips
- Stretch mouth
  - Horizontal
  - Vertical
- Lips purse
- Taut tongue
- Chin quiver
- Tongue protrusion

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**PEDIATRIC PAIN SCALE**

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Does not hurt</td>
</tr>
<tr>
<td>1</td>
<td>Hurts just a little</td>
</tr>
<tr>
<td>2</td>
<td>Hurts a little more</td>
</tr>
<tr>
<td>3</td>
<td>Hurts even more</td>
</tr>
<tr>
<td>4</td>
<td>Hurts a whole lot</td>
</tr>
<tr>
<td>5</td>
<td>Hurts as much as you can imagine,</td>
</tr>
<tr>
<td></td>
<td>although you don't have to be crying</td>
</tr>
<tr>
<td></td>
<td>to feel this bad</td>
</tr>
</tbody>
</table>

[Face 8, 9, and 10]
Child Development
Developmental Issues

< 6 months old:

- No anticipatory fear
- Level of anxiety reflects parental anxiety
Developmental Issues

6-18 months
- Fear of painful experiences
- Withdraw when pain is anticipated
- Painful associations with doctor’s visits and shots
- Separation anxiety
Developmental Issues

18-24 months: express pain with words:
- “hurt,” “boo-boo,” “owie”.

3 years
- localize, identify the cause. May depend on visual injury—wants a bandaid!
- Control over when and where may improve tolerance: use the treatment room so he will feel safe in his bed.
Developmental Issues

- 5-7 years: Improved understanding of pain, localization and the ability to cooperate.

- Comprehension continues to grow with age.

At what age...can a child think abstractly...(i.e., reason why)
So...with an understanding of child development....at what age is moderate sedation likely to be effective

And explain to me why paradoxical excitation with anxiolytic and moderate sedation is not paradoxical but rather expected
The American Society of Anesthesiology and Joint Commission on Accreditation of Healthcare Organizations Definition of Sedation (effective 01/01/01)
So...with an understanding of child development....at what age is moderate sedation likely to be effective

And explain to me why paradoxical excitation with anxiolytic and moderate sedation is not paradoxical but rather expected
The Myth of Conscious Sedation

What about a child’s temperament...

What is temperament...
- Activity: amount of physical motion during sleep, eating, play, dressing, bathing and so forth
- Rhythmicity: regularity of physiologic functions such as hunger and sleep
- Approach/withdrawal: nature of the initial responses to new stimuli – people, situations, places, foods, toys, procedures
- Adaptability: ease or difficulty of with which reactions to stimuli can be modified in a desirably way
- Intensity: energy level of responses regardless of quality or direction
- Mood: amount of pleasant and friendly or unpleasant and unfriendly behavior in various situations
- Persistence/attention span: length of time particular activities are pursued by the child with or without obstacles
- Distractibility: effectiveness of extraneous environmental stimuli in interfering with ongoing behaviors
- Sensory threshold: amount of stimulation, such as sound or light, necessary to evoke discernible responses in the child
Temperament

- Activity:
- Rhythmicity:
- Approach/withdrawal: negative
- Adaptability: can’t soothe
- Intensity: 200 watt light bulb...magnified response to pain
- Mood: negative
- Persistence/attention span: negative behaviors don’t stop
- Distractibility: low distractibility
- Sensory threshold: low sensory threshold
Allowing (but not requiring) family presence during painful procedures also may be of benefit. Although there is no evidence that family presence decreases pain, their presence for procedures can decrease child distress.\textsuperscript{73–76} Family presence does not usually increase anxiety of the child or decrease the procedure success rate of experienced physicians; however, it is important to monitor parental responses to limit the adverse effects on all parties.\textsuperscript{73,74,77} In addition, involving the parent as a coach for the child during the procedure is useful in reducing anxiety and distress.\textsuperscript{78–82}
Effect of Parental Presence While Children Undergo Common Invasive Procedures

Chatsuman Tantikul MD*,
Chakriya Theeranate MD*

* Department of Pediatrics, Phramongkutklao Hospital, Bangkok, Thailand

Background: Substantial studies showed the preferences of parents to present while their children undergo common invasive procedures. There is no consensus in Thailand regarding this issue so, this study was generated.
Objective: To determine the effect of parental presence on children’s pain, parental satisfaction of care, anxiety of parent and physician, and performance of procedure.
Material and Method: A prospective study was undertaken in convenience sample of 72 in-patient children age under 4 years old at Phramongkutklao Hospital during 8 months period. 22 parents were present with their children during invasive procedures and given instruction to calm down their children, 22 parents were not allowed to be present and the rest willing not to be present which was recruited as control. The authors assessed parental interaction; pain level, anxiety and the success of procedures.
Results: There was no statistical significance in pain response, anxiety levels, and parental satisfaction. There was no statistical difference in proficiency of clinician.

Keywords: Parental presence, Common procedures, Anxiety, Pain, Performance

J Med Assoc Thai 2014; 97 (Suppl. 2): S153-S158
Full text. e-Journal: http://www.jmatonline.com

- I strongly disagree...not for everyone...parents who want to be present...typically very grateful and child’s anxiety is reduced.
Children’s response to pain influenced by

- Age (development)
- Temperament
- Cognitive ability
- Past experiences with pain
- The duration of the pain
- Their control over the situation
What is the inherently safest way to deliver a sedation drug?

- Orally
- Nasally
- Rectally
- Intramuscularly
- Intravenously
- Inhalational

The American Society of Anesthesiology and Joint Commission on Accreditation of Healthcare Organizations Definition of Sedation

- It depends
A perfect sedation agent

- Would not require an IV
- Quick acting
- Works just as long as you want it to work
- No side effects or at worse side effects easy to manage, not too disruptive and of short duration
- Narrow bell curve in delivering the patient to the desired sedation level
A perfect sedation agent – let’s talk about it

- Chloral hydrate
- Phenothiazines
- Antihistamines (diphenylhydramine)
- Benzodiazepine: Midazolam, Diazepam, Lorazepam
- Barbiturates: Pentobarbital
- Propofol
Sexual abuse: the medical exam

- Never use physical force or coercion
- Never...use moderate sedation...if sedation needed deep sedation...no recall of procedure
- Mental adaptive response to rape ➔ mimics pharmacologic sedation
- A minimal to moderately sedated exam ➔ medically condoned rape
Sexual abuse: the medical exam

- How do we examine these fearful children....
  - Lots of time...
  - No surprises...
  - No restraints...
  - Imagery, distraction, cognitive strategies...

- Not driven by a search for abnormal findings...more so, a therapeutic intervention
Pharmacologic interventions
TABLE 4 Guidelines for Use of Sucrose in the ED

Indications

- Use as an adjunct for limiting the pain associated with procedures such as heel sticks, venipuncture, IV line insertion, arterial puncture, insertion of a Foley catheter, and lumbar puncture in neonates and infants younger than 6 mo.

Procedure

1. Administer 2 mL of 25% sucrose solution by syringe into the infant’s mouth (1 mL in each cheek) or allow infant to suck solution from a nipple (pacifier) no more than 2 min before the start of the painful procedure.

2. Sucrose seems to be more effective when given in combination with a pacifier; nonnutritive suck also contributes to calming the infant and decreasing pain-elicited distress.

Contraindications: None.
Sucrose

- Delivered by oral syringe, pacifier, dropper, NG tube
- Stevens 2007 Cochrane review → 21 studies, combined 1616 infants
  - Decreased HR, crying time; facial pain expressions; composite pain scores
  - Clear benefit heel stick/venipuncture; not clear cut benefit circumcision
- Mechanism of action
  - Hypothalamic stimulation → increased CSF levels endogenous endorphins
    - Reports of reversal with nalaxone
Pain Medications

- OTC – acetaminophen, ibuprofen, acetaminophen plus ibuprofen,
- Narcotics
- OTC medication plus narcotics
Ibuprofen versus acetaminophen

High quality evidence that ibuprofen is superior to paracetamol at doses of 200 mg to 512 mg and 600 mg to 1000 mg respectively based on pain relief and use of rescue medication data collected at six hours postoperatively. The majority of this evidence (five out of six trials) compared ibuprofen 400 mg with paracetamol 1000 mg, these are the most frequently prescribed doses in clinical practice. The novel combination drug is showing encouraging results based on the outcomes from two trials when compared to the single drugs.

Cochrane Database Syst Rev Dec 2013
Oral administration of morphine versus ibuprofen to manage postfracture pain in children: a randomized trial

Naveen Poonai MD, Gina Bhullar BSc, Kangrui Lin MD, Adam Papini MD, David Mainprize BSc, Jocelyn Howard MD, John Teefy BSc, Michelle Bale BSc, Cindy Langford RN, Rodrick Lim MD, Larry Stitt MSc, Michael J. Rieder MD PhD, Samina Ali MD

- Canadian Medical Association Journal. December 2014
Abstract

Background: Recent warnings from Health Canada regarding codeine for children have led to increased use of nonsteroidal anti-inflammatory drugs and morphine for common injuries such as fractures. Our objective was to determine whether morphine administered orally has superior efficacy to ibuprofen in fracture-related pain.

Methods: We used a parallel group, randomized, blinded superiority design. Children who presented to the emergency department with an uncomplicated extremity fracture were randomly assigned to receive either morphine (0.5 mg/kg orally) or ibuprofen (10 mg/kg) for 24 hours after discharge. Our primary outcome was the change in pain score using the Faces Pain Scale — Revised (FPS-R). Participants were asked to record pain scores immediately before and 30 minutes after receiving each dose.

Results: We analyzed data from 66 participants in the morphine group and 68 participants in the ibuprofen group. For both morphine and ibuprofen, we found a reduction in pain scores (mean pre–post difference ± standard deviation for dose 1: morphine 1.5 ± 1.2, ibuprofen 1.3 ± 1.0, between-group difference [δ] 0.2 [95% confidence interval (CI) –0.2 to 0.6]; dose 2: morphine 1.3 ± 1.3, ibuprofen 1.3 ± 0.9, δ 0 [95% CI –0.4 to 0.4]; dose 3: morphine 1.3 ± 1.4, ibuprofen 1.4 ± 1.1, δ –0.1 [95% CI –0.7 to 0.4]; and dose 4: morphine 1.5 ± 1.4, ibuprofen 1.1 ± 1.2, δ 0.4 [95% CI –0.2 to 1.1]). We found no significant differences in the change in pain scores between morphine and ibuprofen between groups at any of the 4 time points (p = 0.6). Participants in the morphine group had significantly more adverse effects than those in the ibuprofen group (56.1% v. 30.9%, p < 0.01).

Interpretation: We found no significant difference in analgesic efficacy between orally administered morphine and ibuprofen. However, morphine was associated with a significantly greater number of adverse effects. Our results suggest that ibuprofen remains safe and effective for outpatient pain management in children with uncomplicated fractures. Trial registration: ClinicalTrials.gov, no. NCT01690780.
Number of people needed to treat for one person to get 50% pain relief

<table>
<thead>
<tr>
<th>Medicine</th>
<th>NNT (50%) Pain Relief</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxycodone 15 mg</td>
<td>4.6</td>
</tr>
<tr>
<td>Oxycodone 10 mg + acetaminophen 650 mg</td>
<td>2.7</td>
</tr>
<tr>
<td>Naproxen 500 mg</td>
<td>2.7</td>
</tr>
<tr>
<td>Ibuprofen 200 mg + acetaminophen 500 mg</td>
<td>1.6</td>
</tr>
</tbody>
</table>
Ibuprofen Provides Analgesia Equivalent to Acetaminophen–Codeine in the Treatment of Acute Pain in Children with Extremity Injuries: A Randomized Clinical Trial

Janet H. Friday, MD, John T. Kanegaye, MD, Ian McCaslin, MD, MPH, Amy Zheng, MD, and Jim R. Harley, MD, MPH

Abstract

**Objectives:** This study compared the analgesic effectiveness of acetaminophen–codeine with that of ibuprofen for children with acute traumatic extremity pain, with the hypothesis that the two medications would demonstrate equivalent reduction in pain scores in an emergency department (ED) setting.

**Methods:** This was a randomized, double-blinded equivalence trial. Pediatric ED patients 5 to 17 years of age with acute traumatic extremity pain received acetaminophen–codeine (1 mg/kg as codeine, maximum 60 mg) or ibuprofen (10 mg/kg, maximum 400 mg). The patients provided Color Analog Scale (CAS) pain scores at baseline and at 20, 40, and 60 minutes after medication administration. The primary outcome measured was the difference in changes in pain score at 40 minutes, compared to a previously described minimal clinically significant change in pain score of 2 cm. The difference was defined as (change in ibuprofen CAS score from baseline) – (change in acetaminophen–codeine CAS score from baseline); negative values thus favor the ibuprofen group. Additional outcomes included need for rescue medication and adverse effects.

**Results:** The 32 acetaminophen–codeine and the 34 ibuprofen recipients in our convenience sample had indistinguishable pain scores at baseline. The intergroup differences in pain score change at 20 minutes (−0.6, 95% confidence interval [CI] = −1.5 to 0.3), 40 minutes (−0.4, 95% CI = −1.4 to 0.6), and 60 minutes (−0.2, 95% CI = −0.8 to 1.2) were all less than 2 cm. Adverse effects were minimal: vomiting (one patient after acetaminophen–codeine), nausea (one patient after ibuprofen), and pruritus (one after acetaminophen–codeine). The three patients in each group who received rescue medications all had radiographically demonstrated fractures or dislocations.

**Conclusions:** This study found similar performance of acetaminophen–codeine and ibuprofen in analgesic effectiveness among ED patients aged 5–17 years with acute traumatic extremity pain. Both drugs provided measurable analgesia. Patients tolerated them well, with few treatment failures and minimal adverse effects.

ACADEMIC EMERGENCY MEDICINE 2009; 16:711–716 © 2009 by the Society for Academic Emergency Medicine

Keywords: analgesia, pain, children, emergency
10 mg/kg of acetaminophen
~ q 4 hours
likely to take 4 doses to reach therapeutic range
• Acetaminophen: 15-20 mg/kg/dose (75-90 mg/kg/day) every 4 to 6 hours
  • Israeli published approach...loading dose followed by smaller maintenance dosing

• Ibuprofen 10 mg/kg/dose every 6 hours
Never use codeine

• Exceptions to this rule are....

• ....no exceptions....
~ 8% to 20% lack cytochrome P450 enzyme CYP2D6 enzyme metabolic activity

Prevalence of Ultra-rapid Metabolizers in Different Populations

<table>
<thead>
<tr>
<th>Population</th>
<th>UM Genotypes/Phenotypes (↑ Activity)</th>
<th>Prevalence % (UM/Total n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>African/Ethiopian⁴</td>
<td>UM (active duplicate genes)</td>
<td>29% (35/122)</td>
</tr>
<tr>
<td>African American⁵, ⁶</td>
<td>UM (three active duplicate genes)</td>
<td>3.4% (3/87)</td>
</tr>
<tr>
<td>Asian⁷, ⁸, ⁹</td>
<td>UM (active duplicate genes)</td>
<td>1.2% (5/400)</td>
</tr>
<tr>
<td>Caucasian⁵, ⁶</td>
<td>UM (three active duplicate genes)</td>
<td>3.6% (33/919)</td>
</tr>
<tr>
<td>Greek¹⁰</td>
<td>CYP2D6*2xN/UM</td>
<td>6.0% (17/283)</td>
</tr>
<tr>
<td>Hungarian¹¹</td>
<td>UM (active duplicate genes)</td>
<td>1.9%</td>
</tr>
<tr>
<td>Northern European¹⁰, ¹²</td>
<td>UM (active duplicate genes)</td>
<td>1-2%</td>
</tr>
</tbody>
</table>

UM = ultra-rapid metabolizer; CYP2D6 = cytochrome P450 2D6

FDA Drug Safety Communication August 2012
Recent case reports of codeine fatalities highlighted that the use of this weak opioid, particularly in young children, is associated with a substantial risk in those subjects displaying the UM genotype (Table 1). A boy aged 2 years died owing to codeine overdose after adenotonsillectomy; another previously healthy child aged 29 months of North African descent experienced apnea resulting in brain injury following a dose of acetaminophen and codeine 2 days after an uneventful anesthesia for a tonsillectomy.\textsuperscript{[26,27]}
Never use codeine:

- FDA black box warning “codeine is contraindicated “ to treat pain after tonsillectomy or adenoidectomy.
A breastfed neonate whose mother received codeine 30 mg/day died on day 13 owing to morphine-related respiratory depression. The mother had an UM genotype; thus, high amounts of morphine were formed from codeine, which then were transferred via breastmilk to the baby.\textsuperscript{[16,28]} led to an US FDA warning on the prescription of codeine to nursing mothers.\textsuperscript{[19]}
Combination Pain Medication

- Combination pain medications
  - Acetaminophen and codeine elixir
    - 120 mg acetaminophen, 12 mg codeine
  - Acetaminophen and codeine tablets
    - # 1: 300 mg acetaminophen, 7.5 mg codeine
    - # 2: 300 mg acetaminophen, 15 mg codeine
    - # 3: 300 mg acetaminophen, 30 mg codeine
    - # 4: 300 mg acetaminophen, 60 mg codeine
  - Other combinations
    - Lose flexibility of using OTC med when only OTC med needed

Can not rationally dose
Never use any combination pain medications in children
Narcotic Pain Medications....

- Fentanyl
- Morphine
- Oxycodone and oxycontin
- PCA medications...Child control...not parent controlled.
Ketamine
Ketamine

- Dissociative anesthesia and analgesia; structurally related to phencyclidine

- Often preferred agent in the ED: no IV needed; significant cardiorespiratory compromise rare
Ketamine

Problematic side effects

- Emergence reactions
- Nausea and vomiting
Inverse ordering pain medications

- Medication given until no pain
- Avoid need to have pain and sometimes lots of it...to get pain medication
- Many situations can anticipate likelihood and degree of pain and need for pain medications
Deep sedation program

- Began in 2002 to address a system perfectly designed to achieve the results achieved → chloral hydrate use for MRI’s – typically given 30 to 60 minutes before the procedure; prescribed by physician who scheduled the study
Deep sedation program

- Unhappy parents
- Unhappy pediatric patients
- Frustrated technicians
- Unhappy radiologists
- Unhappy referring physicians
- A patient risk of death or disability
- And a JACHO violation waiting to be noticed....
Deep sedation program

- Modeled program at Boston Children’s
- Deep sedation induced with pentobarbital
Parenteral Pentobarbital

- Average induction dose 4.8 mg/kg
  - Initial dose of ~ 2-2.5 mg/kg over 30 seconds
  - Wait ~ 1 minute, ~ 1.0 mg/kg over 30 seconds and repeat in ~ 1 minutes as needed
  - Range: 2.1 mg/kg to 8 mg/kg
Parenteral Pentobarbital Results

- Average time to induce deep sedation 10.2 minutes
- 100% if patients successfully sedated to a deep sedation level
Deep sedation program

- Looks good…
- Actually awful drug
  - 100% ataxia
  - All seemed to be miserable
  - Visual concerns
  - Nausea and vomiting
  - Prolonged recovery
  - Readmissions
Deep sedation program

- Propofol use….
  - Began using 6/25/03
  - Young teenager with medulloblastoma

- Pump solution

- Never returned to using pentobarbital
Propofol Administration

- Lidocaine ~ 0.5 mg/kg; if over 20 kg; max 10 mg
  - Wait ~ 1 minute
    - With this approach, most children have minimal to no withdrawal to propofol
- Begin infusion 1 cc/kg/hour
  - 166 micrograms/kg/min
  - Wait ~ 1-2 minutes
- Bolus ~0.5 to 1.0 mg/kg given every 20 to 30 seconds until reach deep sedation
  - Typical induction dose to reach deep sedation ~ 1.5- 2.5mg/kg
    - Less than 1 year old likely to need higher dose (max 4.5 mg/kg)
    - Teenagers likely to do well with lower dose (1.0 to 1.5 mg/kg)
**Propofol Administration**

- Maintain drip rate for at least the first 5 to 10 minutes and then reduce drip to usually no less than ~50 micrograms/kg/min.
- Within first 5 to 10 minutes, if no patient movement in response to MRI, begin to decrease infusion:
  - Learned not to decrease less than 0.3 cc/kg/hour (50 micrograms/kg/min).
- Discontinue infusion ~ 1 to 2 minutes before conclusion of MRI.
- IV removed in MRI as patient reaches light/conscious sedation level.
- Returned to Radiology holding area:
  - Allowed to drink as soon as alert (within 15 minutes usually).
  - Discharged 30 minutes after discontinuing propofol.
Propofol
Induction Time to Deep Sedation

Average 4.96 minutes → Now less than 2 minutes
Propofol: time post procedure to enter eyes remaining open after light stimulation

Average 7.65 minutes --> unchanged
Deep sedation program

- ~1000 cases by me
  - 3 BVM interventions
  - ~10% hypotension requiring IVF’s (now give IVF’s prior to deep sedation in infants < 12 months old)

- Expanded to interventional radiology, inpatient units

- Changed from single doc supported program in 2008 with Departmental support from Anesthesia

- Training program, video, competency testing and credential process, Emergency Medicine for bolus dosing; short procedures

1Department of Anesthesia, Children's Hospital Boston

PURPOSE: To prospectively compare the incidence of adverse respiratory events, the need for airway interventions, and the recovery time after propofol sedation with similar data from a retrospective review of data obtained in patients who underwent pentobarbital sedation.

MATERIALS AND METHODS: This HIPAA-compliant study was conducted with institutional review board approval and parental informed consent. The hospital sedation committee approved a 2-month pilot program of propofol sedation as a potential alternative to pentobarbital sedation. Parents were given the choice of having their child sedated with intravenously administered propofol or pentobarbital. Fifty-two patients (18 female, 34 male; mean age, 2.9 years +/- 2.4 [standard deviation]) received propofol. An equal number of patients (21 female, 31 male; mean age, 2.5 years +/- 1.7) who previously received pentobarbital were included. The sample sizes provided 80% power to detect differences in airway manipulations, adverse respiratory events, and recovery time between the groups by using the Fisher exact test and the Student t test. A two-tailed P value of less than .05 indicated a significant difference.
RESULTS: Patients sedated with propofol underwent significantly more airway manipulations to relieve obstruction than did patients sedated with pentobarbital (23% vs 0%, \( P < .001 \)). More adverse respiratory events occurred in the propofol group than in the pentobarbital group (12% vs 0%, \( P = .03 \)). Patients in the propofol group had a faster recovery profile than did patients in the pentobarbital group (34 minutes +/- 17 vs 100 minutes +/- 30, \( P < .001 \)).

CONCLUSION: Propofol is associated with a significantly greater incidence of adverse respiratory events than is pentobarbital.
Deep sedation program

Take home message...don’t believe what you read if the study touts pentobarbital as a sedation agent of choice.

If propofol adverse events seem high...read the methods carefully....
Patients in the propofol group were sedated by one of four anesthesiologists (S.E.Z., K.P.M.), all of whom had 5–12 years of experience with administration of this drug. The protocol began with intravenous administration of a 1–2 mg/kg propofol bolus (Diprivan; Astra Zeneca Pharmaceuticals, Wilmington, Del). After waiting 30–50 seconds, repeat 1 mg/kg boluses were administered until an RSS of 4 or 5 was attained. Once the goal RSS was attained, continuous infusion of propofol was titrated between 150 and 200 mcg/kg per minute and adjusted as needed until the imaging procedure was complete. Once the procedure was complete, as confirmed by the radiologist, infusion was discontinued.
Pediatric Sedation and Pain Control
Outside of the Operating Room

Objectives hopefully met ➔ the attendees should:

- believe a child’s pain and anxiety are worth recognizing and treating 100% of the time
- be able to evaluate and manage anxiety, pain and sedation needs, safely and effectively, outside the operating room whether the child is one day old or 21 years old.
- be an advocate and guardian when working with children....