Today’s goals

- Understand PSA especially in children
- Indications for pediatric PSA
- Patient selection
- PSA medications
- Monitoring
- Discharge
REMEMBER
INFLECTING PAIN IS
NEITHER DIFFICULT NOR
RESPECTED. A GOOD
DOCTOR PRODUCES HAPPY
PATIENTS WHO WOULD
BE WILLING TO HAVE THE
PROCEDURE AGAIN
IMPORTANT!!

- PSA is for *Brief* painful/unpleasant experiences
But what is PSA???

• The giving of drugs to facilitate performance of a painful or anxiety producing procedure.

• Remember if you don’t think you can get an airway you shouldn’t do this. Call for help.
SEDATION/ANALGESIA
In Reality a Continuum

Awake

Minimal  Moderate  Deep

General Anesthesia

We Like BOXES
Minimal

- **Anxiolysis**: Respond normally to verbal commands may have cognitive impairment.
Moderate

- Former oxymoron called “conscious sedation”
  - Depressed consciousness with maintained airway, ventilation, and cardiovascular function
DEEP

- Drug induced depression of consciousness during which patients cannot be easily aroused but respond purposefully to repeated or painful stimuli. May have impaired airway and ventilation, but maintained cardiovascular function.
General Anesthesia

• Drug induced loss of consciousness during which patients are not arousable, even by painful stimulation. The ability to maintain a patent airway and normal ventilation is often impaired. Positive pressure ventilation may be required. Cardiovascular function may be impaired.
PSA Goal
TO THIS

Change THIS
PSA FOR DUMMIES
Ideal PSA Agent

- Rapid onset
- Rapid offset
- Large therapeutic index
- Short half life
- Amnestic, analgesic, and sedative
- Reversible
- Controllable
What about fasting?

- ED study 1014 patients
- 56% did not meet established ASA guidelines.
- CONCLUSION? No association between fasting state and adverse events.
- ASA: “The literature does not provide sufficient evidence to test the hypothesis that fasting results in decreased incidence of adverse outcomes in patients undergoing Either moderate or deep sedation”. 
Questions To ask

1. What am I trying to accomplish?
2. What are my treatment options?
3. What are my available medications?
Simple Analgesia

- **Oral**
  - APAP
  - NSAIDS
  - Narcotics

- **Intranasal**
  - Fentanyl
  - ketamine

**Injectable**

- Ketorolac
- Narcotics IM IV SC

New kid is sub-dissociative ketamine
ANXIOLYSIS

Just need sedation not analgesia

• Benzodiazepines
• Barbiturates
• Etomidate
• Chlora Hydrate
• Propofol
• Dexmedetomidine
Midazolam

- Long history
- Great amnesia
- No analgesic properties
- Compared to Etomidate and propofol longer period of sedation
- Paradoxical hyperactivity in kids
Methohexital

- Ultra short acting barbiturate.
- Onset 10-15 sec. duration 5-10 Min
- Complications:
  - Resp. depression
  - Hypotension (releases histamine)
  - Lowers seizure threshold
- 1 small study no difference with propofol
Pentobarbital

- Ultra-short acting Barbiturate (IV, IM, PR)
- Duration IM or PR 1-3 hrs
- Primarily used for pediatric procedures
- Complications:
  - Respiratory depression
- Does not lower the seizure threshold
Etomidate

- Ultra-short acting (in its own class)
- Duration 5-10 minutes
- Minimal cardiovascular effects
- No analgesia
- Myoclonus
- Adrenal suppression
Etomidate Evidence

Use of Etomidate for Pediatric Procedural Sedation

Buck et. Al Pediatric Pharmacotherapy 2008

- Review of multiple studies conclusion:
  - Nausea & Vomiting about the same as propofol, ketamine
  - Less tachycardia
  - Only agent to produce myoclonus
PROPOFOL

• Immediate onset (1 arm brain circ time)
• Potent
• Anti-emetic
• ? Antiarrythmic
• Euphoric
• Deep sedation
• Studies suggest less resp depression than other sedative agents. (?used capnography)
• Clinically important risk is actually hypotension
• RIP CMS
Propofol Evidence

- Bassett et al (393) ED pediatric patients
  - Dec. BP 84% (92% transient <2min.)
  - Desat. 5% median 1 min max 3 min 0.8% required BVM (5 sec-1 min) Not significantly higher than Midazolam/Fentanyl
Propofol Evidence

- Guenther 291 consecutive prescheduled events administered by ED physicians in short stay unit.
  - 90% ASA class 3
    - Hypoxia 5%, assisted vent 1%
- Miner et al ETCO2 monitoring (74 pts)
  - 33% resp depression
    - 80% Midazolam/Fentanyl
    - 66% etomidate
    - 47.5% methohexital
    - 19% propofol
    - 15% required assisted ventilation
Dexmedetomidine

- A2 adrenoreceptor agonist
- Sedation and NO analgesia
- Not much Respiratory Depression
- Very limited literature for pediatric
- Best to just give IV maintenance dose (0.5 mcg/kg)
- Much more expensive
Analgesia

- Morphine
- Fentanyl
- Sucrose
- Sub-dissociative ketamine
Sucrose

- Works well (most studies) for minor pain in neonates
- Easy
- Safe
Painful Procedures

- Fractures
- Lacerations
- LP’s
- Others
Fentanyl

- Ultra short acting Narcotic
- Can be given IN
- Minimal cardiovascular effects
- Generally used with sedative
- Good for painful procedures
- Remifentanyl very similar but little evidence to date
- Much more hypoxia/resp depression with narcotics especially with benzo’s
Acad EM 2009 Use of Intranasal Fentanyl for the Relief of Pediatric Orthopedic Trauma Pain

- 81 patients enrolled Peds with suspected fracture. IN Fentanyl
- Conclusions: Intranasal fentanyl at a dose of 2 mcg/kg provides effective analgesia for pediatric ED patients with painful orthopedic trauma within 10 minutes of administration.
KETAMINE

Special K

Ketamine & Quantum Psychiatry

Ketamine & The Near Death Experience

Is Your Kid On K?

PLANT K
Ketamine

- “Dissociative anesthetic”
- Excellent sedation and analgesia
- Short acting
- No loss of airway reflexes
- Minimal respiratory depression
- Widely studied
- Historically used in pediatrics
- Huge therapeutic ratio
- Bronchodilator
Ketamine

• Big advantage is can be given IM/IN
• 1 mg/kg IV or
• 3 mg/kg IM
• 9 mg/kg IN for dissociation
Pediatric EM 2012
Intranasal Ketamine for Procedural Sedation in Pediatric Laceration Repair

- All got ketamine at differing doses IN
- Showed required at least 9mg/kg to get adequate sedation
Pain 2004: Safety and Efficacy IN Ketamine for breakthrough pain

- Cancer patients with breakthrough pain
  - Good relief
  - None of usual breakthrough pain meds required
  - No significant side effects.
Safety

- Greene et al: 9 cases of inadvertent ketamine OD
  - 3 pts 5X
  - 5 pts 10X: Intended dose
  - 1 pt 100X
  - All had prolonged sedation
  - 4 Brief resp depression
  - 2 pts without resp. depression/hypoxia electively intubated

- No adverse outcomes
Ketamine and Kids

• Add vagolytic (atropine Glycopyroloate) <5 years old
• Don’t use under 3 months
• Careful with URI/secrections
Smart guys
Thinking late one night.

Propofol
- Depresses Respirations
- Lowers Blood Pressure
- Anti emetic
- No Analgesia
- Sedative

Ketamine
- Maintains Respirations
- Raises Blood Pressure
- Occasional vomiting
- Excellent Analgesia
- Agitation/emergence
Ketafol was born
Ketafol

- Various combinations no real comparisons.
- Use 10mg/ml of each in same syringe and single injection 1.5 mg/kg of drug.
- Must be given IV
Studies

• Frey et al Anesth & Analgesia “use of ketamine faster onset improved quality of sedation.


• Goh et al Anaesth & Intensive Care 2005 (diff times) Ketamine improved hemodynamics
PSA Equipment

- Resuscitation equipment
- Monitoring equipment
- Personnel
- Oxygen
Resuscitation Equipment

- Able to rescue from 1 level deeper than intended level
- Ventilatory equipment
- Airway Equipment (including failed airway)
- Antiarrythmic therapy/Defibrillator
Personnel

• Recommended that there be someone assigned to monitor the patient who is not the same person performing the procedure.
• Rarely possible to have 2 docs or mid levels in ED but nurse OK
• I bet RT would be excellent since virtually all problems are respiratory
Monitoring equipment

- Blood pressure/EKG
- Oxygen saturation
- Ventilation
  - Observation
  - ETCO2
  - Capnography
Why capnography?

- Normal healthy adult breathing 100% oxygen stops breathing (apnea)
  - May take 8+ minutes for SAO2 to fall below 90%
  - By then pt has a large oxygen debt that will require time to replace
CAPNOGRAPHY

• Detects apnea within one respiratory cycle
• Detects changing respirations more rapidly and reliably than clinical observation
• Early finding versus late SAO2
• Is generally considered standard care.
Why???

Ventilation

SAO2=98
JACHO Reporting Criteria

- A reversal agent used
- Assisted ventilation required
- SaO2 remains below 10% of baseline for > 2min.
- Recovery time > 4 hrs (not stable for D/C).
- Procedure plan altered as result of medications.
- The patient required admission or higher level of care because of sedation
- Drug reaction occurred
After the party’s over!!

- When do they get in trouble??
- Newman et al 1,341 children
  - Adverse events 13.7% (data available in 159/184)
    - Hypoxia 96%
    - Stridor 2.5%
    - Hypotension 1.3%
  - 92% occurred during procedure
    - Median 2.5 min after last dose (2 min in “serious” events)
    - 3 events 26-40 min post (all had had previous hypoxia)
Discharge

• No good data for discharge home
• Important to have criteria
• Aldrete score one commonly used
• Recognize that reversal agents may wear off
• Must have written discharge instructions:
  - Continued observation at home
  - Criteria for return
  - Limit activities
  - Limited meals and activity
Why is PSA important???

- Good customer service
- Press ganey
- Good for patients
Neonates

The “NOPAIN” Study

- Preemptive analgesia for painful procedures
  Three groups continuous IV
  - Placebo
  - Midazolam
  - Morphine
Results

- Poor neurological outcomes in:
  - 24% placebo
  - 32% in Midazolam group
  - 4% in morphine group
Conclusions

• Our patients depend on us to provided for them in as comfortable way as possible
• The more “tools” you have the better you can fulfill this expectation
• You must know the drugs you use and fit them to the patients you have
• Don’t forget the patient after the procedure
Questions???

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