PROCEDURAL SEDATION: THE FINER POINTS

Robert J. Vissers MD FACEP
Chief Operating Officer, Executive VP
Boulder Community Health, CO.
Adjunct Associate Professor, Emergency Medicine
OHSU, Portland, OR.

Disclosures

I have no relevant financial relationships to disclose

I will not discuss any off-label use and/or investigational use in my presentation

Procedural Sedation and Analgesia: Talk Objectives

- Definitions
- Moderate versus Deep Sedation
- Drugs – Era of Ultra-short-acting Agents
- Standards and Policies
- Monitoring – how much?
- PSA in complex patients
- Advances

JCAHO definitions

- Minimal sedation
- Moderate sedation/analgesia

"…drugs, doses, and techniques used are not likely to produce a loss of protective airway reflexes"

- Deep sedation/analgesia

"…cannot be easily aroused …. may require assistance in maintaining airway patency and ventilatory effort."

- General anesthesia

Why PSA for procedures?

- Management of anxiety
- Management of pain
- Patient cooperation
- Patient satisfaction
- Ease of procedure

Drug Selection

- Midazolam
- Fentanyl
- Methohexital
- Etomidate
- Propofol
- Ketamine

Benzodiazepines

- Anxiolysis
- Sedation
- Antegrade amnesia
- No analgesia

Benzodiazepines

- Central inhibition, GABA receptors
- Most complications occur when combined with other agents
- Reversible with flumazenil
- Midazolam best choice

Opioids

- Analgesia
- Sedation
- Respiratory depression
- Lower BP, HR
- Reversible

Opioids

- Morphine and Meperidine poor choices
- Fentanyl is opioid of choice
  - Cardiac stable
  - Rapid onset, shorter duration
  - Chest rigidity rare, only with high doses given rapidly

Barbiturates

- Sedation,
- No analgesia
- GABA receptors and depresses RAS
- Cardiovascular depression
- Respiratory depression
- Histamine release
- Not reversible

Methohexital

Prospective EM study:

- 76 adults, average dose of 88mg (50-160 range)
- Only 27 received opiate
- 8 (10.5%) bagged for apnea, 1-2 min
- Average GCS of 6 - deep sedation!
- 96% completely amnestic, stable

Lerman B, Yoshida D, Levitt MA. A prospective evaluation of the safety and efficacy of methohexital in the emergency department. Am J Emerg Med 1996;14:351.

Intraarticular shoulder anesthesia

- 30 patients, anterior shoulder dislocation
- Randomized to intraarticular lido VS morphine and versed
- No difference in pain and success
- Shorter stay (78 vs. 186 min, $p<0.004$)
- Reduced cost by 62%

Matthews DE. **Intraarticular lidocaine versus intravenous analgesic for reduction of acute anterior shoulder dislocations. A prospective randomized study.** *Am J Sports Med* 1995; 23(1): 54-8

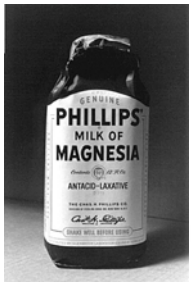
Intraarticular shoulder anesthesia

- 49 patients, anterior shoulder dislocation
- Randomized to intraarticular lido (29) VS morphine and diazepam (20)
- No difference in pain and success
- Lido-only less successful if >5.5 hours
- Patients preferred analgesia

Kosnick J, et al. Anesthetic Methods for Reduction of Acute Shoulder Dislocations: A Prospective Randomized Study Comparing Intraarticular Lidocaine With Intravenous Analgesia and Sedation. *Am J Emerg Med* 1999; 17

Propofol: "Milk of Amnesia"

- Sedative
- No analgesia
- Very rapid
- Continuous infusion vs. boluses
- Not reversible but wears off very quickly



Propofol

- ↓ BP lowered by: ↓ SVR, ↓contractility and ↓ tachy
- Narrow therapeutic window between moderate and deep sedation
- Apnea at almost any dose
- Antiemetic properties, burns on injection

Propofol in the ED

- Recent data on adults – being used
- "they all stop breathing – briefly"
- Compared to ketamine in peds ICU
  - Propofol faster recovery, earlier discharge
  - More apnea and adverse events

Propofol ED Studies

- 108 patients, observational study compared propofol with methohexital, fentanyl/midazolam, and etomidate
- Propofol lowest rate of respiratory depression
- No significant complications.

Miner JR, Biros MH, Heegaard W, et al. Bispectral electroencephalographic analysis of patients undergoing procedural sedation in the emergency department. Acad Emerg Med. 2003;10:638-643.

- Prospective, randomized comparison: methohexital vs. propofol
- Respiratory depression rate the same (48% vs. 49%, P=.88)
- BIS 66.2 for methohexital and 66 for propofol (P=.50)

Miner JR, Biros M, Krieg S, et al. Randomized clinical trial of propofol versus methohexital for procedural sedation during fracture and dislocation reduction in the emergency department. Acad Emerg Med. 2003;10:931-937.

Propofol in the ED

- 10-25mg/minute infusions
- PCA pump
- 1 mg/kg bolus, then 0.5 mg/kg repeat boluses
- Adults: 40mg "tester" then 20-40mg boluses every 1-2 minutes
- Synergy with ketamine?

Etomidate

- Short acting sedative
- Hemodynamic stability
- N&V, myoclonus can occur
- Single dose has no clinically significant adrenal suppression
- No analgesic effect

Etomidate vs midazolam

- Randomized, blinded drug plus fentanyl
- 41 patients with shoulder dislocation
- Similar success
- Etomidate – emesis and myoclonus
- Etomidate PSA 10 min vs 23 min for midazolam

Burton JH, et al. Etomidate and midazolam for reduction of anterior shoulder dislocation: A randomized, controlled trial. Ann Emerg Med 2002;40:496.

Etomidate

Retrospective, uncontrolled EM study:

- 134 patients, mean dose of 0.2 mg/kg
- 68% considered deep sedation, verbally non-responsive
- 4 required bagging
- 15 minutes to full recovery
- One patient vomited while sedated, suctioned

Vinson DR, Bradbury DR. Etomidate for procedural sedation in emergency medicine. Ann Emerg Med 2002;39:592.

Etomidate ED Studies

Prospective, Midazolam Vs. Etomidate:

- 45 patients needing ortho reduction
- Etomidate 0.1 mg/kg vs. Midazolam 0.035 mg/kg
- Sedation quality, dispo time the same
- Sedation time ½ (15 min) for etomidate

Hunt GS et al. Etomidate and midazolam for procedural sedation: A prospective randomised trial. Am J Emerg Med 2005.

Etomidate vs. Propofol in the ED

Prospective, Propofol Vs. Etomidate:

- 214 pts needing PSA
- Propofol 1mg/kg vs.Etomidate 0.1 mg/kg
- Adverse events, dispo time the same
- Myoclonus present in 20% etomidate pts
- Propofol more successful (97% vs. 90%)

Miner JR et al. Randomized clinical trial of etomidate versus propofol for procedural sedation in the emergency department. Ann Emerg Med 2007.

Ketamine

- Dissociation between limbic and higher cortical systems
- Also sedation, analgesia and amnesia
- LD50 is 100 times usual IV dose
- Defies categorization, term "dissociative sedation" proposed

Ketamine

- Catecholamine increase
- Increased BP
- Bronchodilation
- Apnea is rare, large IV boluses, resolves quickly

- Consider antisialagogue when doing oral procedures
- Atropine can be combined in IM syringe (0.01 mg/kg, 0.1 mg minimum, 0.5mg maximum)

Ketamine

- Laryngospasm rare
- In 11,589 cases, only 2 required intubation with no resultant morbidity*
- Emergence reactions uncommon – environment important

*Green SM, Johnson NE. Ketamine sedation for pediatrric procedures: Part 2. review and implications. Ann Emerg Med 1990;19:1033.

Sherwin TS, et al. Does adjunctive midazolam reduce recovery agitation after ketamine sedation for pediatric procedures? Ann Emerg Med 2000;35:229.

Ketofol: Ketamine and Propofol

- Theoretically complementary effects
- Ketamine and propofol in same syringe
- 114 patients PSA, 0.75 mg/kg of each
- Few minor adverse events
- Everybody liked it
- Need dosing trial

Willman EV, Andalfato G. A prospective evaluation of "ketofol" (ketamine/propofol combination) for PSA in the ED. Ann Emerg Med, Jan 2007.

JCAHO Standards

- Provided by qualified individuals
- Sedation risks and options are discussed
- Pre-sedation assessment is performed
- Sedation plan

Patient Selection: ASA Classification

- Used to determine severity of illness
- Never validated nor shown to have predictive value regarding risk for anesthesia

I	Healthy	No PMH	Most Ideal
II	Mild	Controlled DM,HTN, Sz Asthma	Good
III	Systemic illness with functional impairment	Poorly controlled systemic Dz	Weigh risk/ benefits
IV	Severe illness with constant threat to life	Severe CHF, ESRD, Sepis, etc	Poor
V	Moribund w/ <24 h survival	Shock, MOD, Severe trauma,	Very Poor

JCAHO Standards

- Physiologic status is monitored
- Status assessed prior to discharge
- Discharge according to approved criteria
- Outcomes of patients are collected and analyzed

Case 1: Preparation

- Give volume first, "fill the tank"
- Prioritize: CT first to exclude possible bleed and risk for hypotension
- Difficult airway cart ready
- Pre-oxygenate, monitor, oximetry and capnography
- Consent may not be possible – document well

Gastric Emptying

- Lack of evidence relating gastric emptying to outcome in PSA
- Recent food intake is not a contraindication
- It is a consideration regarding agents and depth of sedation

Oxygenation and ventilation

- Pulse oximetry: ACEP clinical policy Level B evidence
- Not a substitute for clinical assessment
- O2 may mask hypoventilation
- So?

Oxygenation and ventilation

- Supplemental O2 during ED PSA. *Deitch K, Ann Emerg Med, Jan 2007.*
- 80 patients randomized to 2L O2 or air during PSA
- No difference in incidence or recognition of resp depression
- Limited power

Oxygenation and ventilation

- No evidence transient hypoxemia associated with bad outcomes
- 43% of men desat during sleep
- May consider capnography
- Will detect hypoventilation sooner
- Will it change outcome? Or what you do

Capnometry

- Identifies hypoventilation by monitoring for increased ETCO2
- Hypoventilation detected before O2 desaturation
- Excellent correlation with PACO2 even with nasal canula

Capnometry

- No evidence that earlier identification, transient hypercapnia without hypoxia has any impact on outcome
- Small studies, not performed in critically ill patients
- Makes clinical sense in complex patients where hypoventilation or hypoxia may have increased significance, or difficult to reverse

Rescue or alternatives

- Reconsider OR or RSI
- Consider regional anesthesia
- Candidate for femoral block
  - Less sedation/analgesia required
  - Safe
  - Easy

Propofol vs. Etomidate in the Critically Ill

- Prospective Study (62 pts)
  - ASA physical status 3 (25%) and 4 (75%)
  - Etomidate or Propofol for sedation
  - Fentanyl with both for analgesia
  - Procedures: Cardioversion 19%, Chest Tube 24%, Orthopedic 58%

Miner et al. Procedural sedation of critically ill patients in the emergency department. *AEM* 2005; 12:124-128.

Evidence for Sedation in the Critically Ill

- Outcomes:
  - Respiratory depression (based on measured CO_2 or oximetry)
    - Etomidate 58% vs 34% for ASA I-II
    - Propofol 61% vs 42% for ASA I-II

Minor et al. Procedural sedation of critically ill patients in the emergency department. *AEM* 2005; 12:124-128.

Evidence for Sedation in the Critically Ill

- Outcomes:
  - Hemodynamic effects
    - Etomidate 5% SBP decrease (mean)
      - 95% CI = 3.0% to 8.1%
      - 4% decrease for ASA I-II
    - Propofol 17% SBP decrease (mean)
      - 95% CI = 9.9% to 24.3%
      - 8% decrease for ASA I-II

Minor et al. Procedural sedation of critically ill patients in the emergency department. *AEM* 2005; 12:124-128.

Ketamine in Head Injury

Can you use ketamine in head injured patients?

- Critical review of literature
- Included 79 studies
- May improve cerebral perfusion
- Neuroprotective
- No negative effects, possibly beneficial

Himmelseher S, et al. Anesth Analg 2005;101:524.

Future: Drugs

- Safer agents
- Propofol and ketamine – positive synergy
- Patient controlled infusions – has been used with propofol for dental and GI procedures