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

Intraarticular shoulder anesthesia

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


Intraarticular shoulder anesthesia

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


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.


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)

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

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


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


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%)

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

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


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

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<th></th>
<th>Healthy</th>
<th>No PMH</th>
<th>Most Ideal</th>
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<tbody>
<tr>
<td>I</td>
<td></td>
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<tr>
<td>II</td>
<td>Mild</td>
<td>Controlled DM, HTN, Sr Asthma</td>
<td>Good</td>
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<tr>
<td>III</td>
<td>Systemic illness with functional impairment</td>
<td>Poorly controlled systemic Dz</td>
<td>Weigh risk/ benefits</td>
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<tr>
<td>IV</td>
<td>Severe illness with constant threat to life</td>
<td>Severe CHF, ESRD, Sepsis, etc</td>
<td>Poor</td>
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<tr>
<td>V</td>
<td>Moribund w/ &lt;24 h survival</td>
<td>Shock, MOD, Severe trauma,</td>
<td>Very Poor</td>
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### 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

- 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%


Evidence for Sedation in the Critically Ill

- Outcomes:
  - Respiratory depression (based on measured CO₂ or oximetry)
    - Etomidate 58% vs 34% for ASA I-II
    - Propofol 61% vs 42% for ASA I-II


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

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


Future: Drugs

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