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Procedural Sedation in the Emergency Department

University of Utah
Division of Emergency Medicine
Zach Sturges
Scientists sedate giant whale at sea

Boston Globe, 3.11.09
• Alcohol is the anesthesia by which we endure the operation of life.
  » George Bernard Shaw

• Dawn: When men of reason go to bed.
  » Ambrose Bierce
Objectives

- Review ACEP clinical policy on procedural sedation
- Understand pharmacology of different agents used for ED sedation
- Discuss the literature supporting different agents and monitoring requirements
- Discuss unique aspects of procedural sedation in community EDs
- See a sweet picture of Joey
Overview

• Definitions
  – ASA classification
  – Levels of sedation
• Case Discussion
  – Agent selection and pharmacology
  – Preparation
  – Monitoring
  – Complication management
• Literature Review and Research Questions
• Wrap-up
Definitions

• Procedural Sedation
  – What is it?
Definitions

• Procedural Sedation
  – Administration of sedatives or dissociative agents with or without analgesia
  – to induce a state that allows patient to tolerate unpleasant procedures while maintaining cardio-respiratory function
Definitions of Sedation

Dissociation

– Ketamine, agent used for moderate sedation. Disconnection between thalamoneocortical system and limbic system preventing processing of sensory stimuli. Airway, respiratory and cardiovascular system intact.

– Now, please draw the neural connections disrupted in this process.
# Levels of Sedation

<table>
<thead>
<tr>
<th></th>
<th>Minimal</th>
<th>Moderate</th>
<th>Deep</th>
<th>General</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Responsiveness</strong></td>
<td>Normal response to verbal stim</td>
<td>Purposeful response to verbal stim</td>
<td>Purposeful response to repeated verbal or painful stim</td>
<td>Unarousable</td>
</tr>
<tr>
<td><strong>Airway</strong></td>
<td>Normal</td>
<td>No intervention req’d</td>
<td>Intervention may be req’d</td>
<td>Intervention usually required</td>
</tr>
<tr>
<td><strong>Ventilation</strong></td>
<td>Normal</td>
<td>Adequate</td>
<td>May be inadequate</td>
<td>Usually inadequate</td>
</tr>
<tr>
<td><strong>CV fxn</strong></td>
<td>Normal</td>
<td>Usually maintained</td>
<td>Usually maintained</td>
<td>May be impaired</td>
</tr>
</tbody>
</table>

American Society of Anesthesiologists. Continuum of depth of sedation definition of general anesthesia and levels of sedation/analgesia. October 27, 2004
Does targeting level of sedation matter?

- JEM 2007 RCT assigned pts to target of mod vs deep sedation for reduction
  - No sig differences between groups in outcome or comp
  - Only about 50% in each group were actually sedated to the planned level

- Annals Jan 07 Editorial by S Green
  - Notes that studies show recurrent overshoot into general anesthesia briefly with no adverse outcome
  - Unknown whether levels of sedation are actually a reasonable surrogate for aspiration risk
ASA Risk Index Assessment

- Dawson (I)
- Mallin (II)
- Zach (III)
- Carl (IV)
- The Zarl (V)

- Normal, healthy
- Discrete systemic illness
- Serious, non-incapacitating, systemic illness
- Life threatening, incapacitating systemic disease
- Death expected within 24 hrs regardless of procedure
Cases

• Groups of 2 or 3
• Hand out for your case
• Take 5 minutes, write down how you would approach this patient-
  – Agents and rationale, preparation/evaluation, monitoring, anticipated complications
Case 1

• 77 y/o male
• History of CAD and stent placement and px CVA within the last 5 years
• Home oxygen for COPD
• Presents in new onset a-fib for 14 hrs
• He is mentating well, has good cap refill and moderately strong pulses.
• SBP 100/40 HR 150 RR 12 Sats 92% on his home 2 L NC oxygen. Slows to 100 on Dilt, BP 102/49
• You decide to electrically cardiovert this patient.
Case 2

- 3 y/o female who was toddling around and fell and hit her lip on a coffee table
- No LOC, cooperative until you touch her lip, she then transforms into an out of control, screaming, fighting child.
- Lip lac thru vermilion border, fairly significant
- No PMH
Case 3

• 39 y/o ped struck
• Bilat hip dislocations
• Pt is obese, in c-collar. Has been given moderate amount of dilaudid, is slightly somnolent but screams whenever you move his legs.

• Ortho wants to reduce him right now
Pharmacology

• Propofol
• Ketamine
• Etomidate
• Fentanyl
• Morphine
• Remifentanil
• Midazolam
Propofol

- **Onset:** 60 secs
- **Duration of action:** 10-30 minutes
  - No alteration in renal/hepatic dz
- **Dose:** 0.5-1mg/kg bolus followed by 0.5mg/kg repeat boluses q 3-10min
  - GTT protocols (10-20mg/min)
- **Acute ARs**
  - Anaphylaxis (egg/soy), hypotension, resp. depression, bradycardia
- **Time to full reorientation:** 10-20 minutes
Ketamine

- Onset: 60 secs IV, 3-4 min IM
- Duration of action: 10-15 min IV, 10-25 min IM
- Dose: 1-1.5 mg/kg IV, 3-4 mg/kg IM
  - 0.25-0.75 mg/kg for anesthetic properties alone
  - Redose IV after 5-10 min prn
- Acute ARs (greater w/ IM route):
  - Emergence phenomenon (10-20%), salivation (atropine), bronchospasm, autonomic sx, vomiting (ondansetron)
- Time to reorientation: 20-30 min IV, >60 min IM
Etomidate

- Onset: 20-60 secs
- Duration of action: 4-10 minutes
  - No alteration in renal/hepatic dz
- Dose: 0.1-0.2 mg/kg bolus followed by 0.05mg/kg q 3-10 min
  - Give medication over 60 secs to reduce myoclonus
- Acute ARs
  - Hypotension, myoclonus, ? > emetigonecity
- Time to full reorientation: 20 minutes
Fentanyl

- Onset: 1-3 minutes, peak 20-30 min later
- Duration of action: 30-60 min (up to 100mcg in single dose)
- Dose: ~1mcg/kg
- Acute ARs: rigidity (high dose), bradycardia
- IV Equianalgesia: 100mcg=10mg morphine
Morphine

- Onset: 3-5 minutes, peak 30-40 minutes
- Duration of action: ~4 hours
- Dose: 5-10mg, 0.1-0.2mg/kg
- ARs: as above
- IV Equianalgesia: standard to which all others compared
Remifentanil

- Onset: 1-2 minutes
- Duration of action: 3-10 minutes
- Dose: 0.5-3mcg/kg
- ARs: as above
- IV Equianalgesia: not studied, slightly less potent than fentanyl
- Sufentanil > fentanyl > remi > alfentanil
Midazolam

- Onset: 3-5 minutes IV/IN, 5-7 min IM, peak effects 5-7 min IV/
- Duration of action: 30-40 minutes
  - Rapidly dissipating efficacy
- Dose:
  - IV 1-2mg q3 minutes (0.025-0.1mg/kg)
  - IM: 0.1-0.15mg/kg
  - IN (anxiolysis only): ~0.4mg/kg, max 10mg
- Acute ARs: predictable
- Reduce dose in elderly, ARI/CRI
Safety

• Complication rates vary widely
  – 1-23% in various studies, mostly university settings

• Vary by drugs used
  – Propofol and ketamine felt to have lowest complication rate
  – Midazolam, hydromorphone and fentanyl typically higher
ACEP Clinical policy on Procedural Sedation

• During mod and deep sedation qualified support person should be present. Should be supervised by EDMD or other appropriate person. C

• NPO status not contraindication but should be considered. C

• Oxygen, suction, reversal agents, ACLS meds and equipment percent C

• Pulse-ox if high doses or mult drugs. B

• Rapid sedative hypnotics Ketamine for kids A, Propofol B, Etomidate C
Monitoring

• Pulse-ox

• ETCO2
  – Several studies of different designs
  – ETCO2 changes generally but don’t always precede resp depression. Many ETCO2 changes are not clinically significant. Loss of waveform, inc of 10mm HG or over 50mm HG are most specific. Decrease to less than 30 with good waveform maybe more sensitive. Variable time preceding clinical manifestations. Basically may be an early warning but not clearly clinically significant.

• ECG
Supplemental Oxygen

• Preoxygenation
• Two studies with 2-3 L NC vs no O2
  – Same authors, propofol in one, versed in other
  – No change in versed (low rate of resp dep)
  – Trend toward reduction of desats (10% difference) in other
  – Less recognition of increased ETCO2 in supp oxygen group
Ketofol

• Review article of 8 clinical trials of fixed dose ketamine/propofol. No sig advantage to propofol monotherapy
• Ketofol in ED -Annals 2007. No control. Fairly low incidence of BVM 1%
• Sub-dissociative Ketamine vs Fent plus propofol. AEM Oct 2008. Low dose ketamine vs mod dose fent - fewer complications with ketamine despite higher propofol requirement
• Anyone want to do a propofol/fent vs ketofol trial?
Propofol vs Etomidate

- Both are fairly well documented to be safe, likely more cost effective and better sedation than fentanyl/versed
- Annals Jan 07 - prospective trial RCT of propofol vs etomidate (plus morphine). No statistically significant difference in resp complications (4-5%) or hypotension. Significant difference in success (97 vs 88) favors propofol. Myoclonus in 20% Etomidate and 2% propofol
- Annals 03, RCT Etomidate vs Propofol vs Versed (with or without flumazenil). Propofol equal success/ complications but less myoclonus or resedation or prolonged sedation
Fasting

• No real trials for fasting and ED sedation
• Likely different than GET since shorter duration
• AEM 2002 - Green and Kraus review of lit for ED sedation, GET, and GET for L and D pts- no evidence of correlation between fasting and aspiration, no reports of aspiration in medical lit for ED sedation
• Fasting duration should not preclude ED sedation when medically indicated
• In practice NPO status generally disregarded
Fasting

- ASA Preprocedure Fasting Guidelines
- Clear liquids: 2hrs
- Breast milk: 4hrs
- Light meal/”nonhuman milk”/etc.: 6hrs
- Corned beef and hash: 365 days
Can I do it all by myself?

- Prospective, observational database
- 252/1028 incidences of EP doing both sedation and procedure
- Overall 0.6% complication rate (apnea/hypoxia)
- 885/1028 incidences
- 4% complication rate (equal amongst EP monitored and RN monitored pts)
- No changes in pt. disposition.

Conclusion? Thoughts? UUMC/IHC policy?
Summary

• Relax. Get a watch. Understand pharmacokinetics and don’t be pressured by consultants.
• Literature overwhelmingly supports safety but politics may not.
• Aspiration and clinically significant ARs are rare
• Propofol, ketamine and fentanyl are the best studied agents
• IM agents are a valid option in kids