Errors in Procedural Sedation & Analgesia

reuben j. strayer
emupdates.com
error: emergency physicians do conscious sedation
<table>
<thead>
<tr>
<th>Sedation Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal Sedation</td>
<td>“patients respond normally to verbal commands”</td>
</tr>
<tr>
<td>Moderate Sedation</td>
<td>“respond purposefully to verbal commands or light tactile stimulation”</td>
</tr>
<tr>
<td>Deep Sedation</td>
<td>“cannot be easily aroused but respond purposefully to painful stimulation”</td>
</tr>
<tr>
<td>General Anesthesia</td>
<td>“not arousable, even by painful stimulation”</td>
</tr>
</tbody>
</table>

Efficient and humane reduction of fractured wrist (CMS 2011)
“Ventilatory and cardiovascular functions are unaffected.”

“No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate.”

“Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate.”

“Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required.”

minimal sedation

moderate sedation

deep sedation

general anesthesia

PSA

prepared

solve

apnea

ventilation

apnea

PSA
error: PSA is lower risk than endotracheal intubation
lower risk for the patient does not mean lower risk for you

be at least as vigilant in PSA preparation as you are for intubation
### Pre-Procedure Assessment

- Past medical history (note history of OSA)
- Prior problems with sedation/anaesthesia
- Allergies to food or medications
- Procedure
- Dentures: none / upper / lower
- Cardiorespiratory reserve: no or mild impairment / moderate impairment / significant impairment
- Difficult airway features: none / mild concern / significant concern
- Last oral intake (see fasting grid on reverse)
- Weight (kg)
- Will delay procedure until
- Benefits of proceeding with PSA exceed risks

### Difficult Airway Features

- Difficult Laryngoscopy: Look externally, Evaluate 3-3-2 rule, Mallampati score, Obstruction, Neck Mobility
- Difficult BVM Ventilation: Beard, Obese, No teeth, Elderly, Sleep Apnea / Snoring
- Difficult LMA: Restricted mouth opening, Obstruction, Distorted airway, Stiff lungs or c-spine
- Difficult Cricothyroidotomy: Surgery, Hematoma, Obesity, Radiation distortion or other deformity, Tumor

**Is this patient a good candidate for ED procedural sedation and analgesia?**

The less cardiorespiratory reserve, the more difficult airway features, and the less procedural urgency, the more likely the patient should not receive PSA in the emergency department. If not a good candidate for ED-based PSA, other options include regional or local anesthetic; PSA or GA in the operating room; or endotracheal intubation in ED.

### Pre-procedure Preparation

- Analgesia: maximal patient comfort prior to PSA
- Informed consent for PSA and procedure
- Patient on monitor: telemetry, NIBP, SpO2, EtCO2
- Oxygenate with NC O2 and high flow face mask O2
- Select and draw up PSA agent(s)
- Reversal agents and paralytic via at bedside
- Prepare for endotracheal intubation

### Airway Equipment

- Ambu bag connected to oxygen
- Laryngoscopy handles and blades
- Suction, oral & nasal airways
- Endotracheal tubes & stylets
- LMA with lubricant and syringe
- Colorimetric capnograph
- Bougie & difficult airway equipment

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**Heart your PSA checklist**

**verify appropriateness of ED PSA**

**Prepared to Solve Apnea**

**full intubation setup for every PSA**
error: I’m using ketamine so airway and breathing are not an issue

central apnea
airway malpositioning
laryngospasm
hypersalivation
error: delaying emergency PSA for fasting
Clinical Policy: Procedural Sedation and Analgesia in the Emergency Department

From the American College of Emergency Physicians Clinical Policies Subcommittee (Writing Committee) on Procedural Sedation and Analgesia:

Volume 63, No. 2 : February 2014

CRITICAL QUESTIONS
1. In patients undergoing procedural sedation and analgesia in the emergency department, does preprocedural fasting demonstrate a reduction in the risk of emesis or aspiration?

Recommendations

Level A recommendations. None specified.

Level B recommendations. Do not delay procedural sedation in adults or pediatrics in the ED based on fasting time. Preprocedural fasting for any duration has not demonstrated a reduction in the risk of emesis or aspiration when administering procedural sedation and analgesia.

Level C recommendations. None specified.
error: aggressive, early bag mask ventilation
the ABCs of PSA adverse events

Airway
- obstruction
- loss of airway reflexes
- hypoventilation

Breathing
- hypoventilation

Circulation
- hypotension
- hypertension
- bradycardia
- tachycardia

Detonate (vomiting)
- [anaphylaxis]

Everything else
- hypertonicity / myoclonus
- hypersalivation
- agitation
- rash
intubation

- airway problems and oxygenation deficit common
- BMV more likely to be difficult
- patient usually paralyzed
- vomiting less likely
- ventilation unlikely to improve soon

bag early and often

PSA

- airway problems and oxygenation deficit rare
- BMV less likely to be difficult
- patient never paralyzed
- vomiting more likely
- ventilation likely to improve soon

bag as part of a stepwise approach

bag slowly and gently
intervening during PSA

detect hypoventilation

stop the drugs

position the patient

jaw thrust
push from behind
grasping the body of the mandible by the sides, attempting to pull the jaw forward - poor technique
1. open the mouth
2. Push the mandible anterior to the maxilla using four fingers behind the ramus and thumbs pushing against the maxilla
3. Shift your hands so that your thumbs and index fingers are free to hold a mask to the face.
intervening during PSA

detect hypoventilation

- stop the drugs

- position the patient

- jaw thrust

- suction if needed

- laryngospasm notch pressure
intervening during PSA

detect hypoventilation

→ stop the drugs

→ position the patient

→ jaw thrust

→ suction if needed

→ laryngospasm notch pressure

→ nasal airways

→ consider reversal agents

→ bag mask ventilation

→ oral airway, ventilation

→ intubate
intervening during PSA

detect hypoventilation

stop the drugs

position the patient

jaw thrust

suction if needed

laryngospasm notch pressure

nasal airways

consider reversal agents

bag mask ventilation

oral airway, ventilation

intubate
intervening during PSA early

detect hypoventilation

1 minute or 10 minutes

stop the drugs

position the patient

jaw thrust

suction if needed

laryngospasm notch pressure

nasal airways

consider reversal agents

bag mask ventilation

oral airway, ventilation

intubate
error: if the patient's saturation is OK, everything is OK
hypoventilation → hypoxia → hypercapnia → acidemia

PSA → hypertension, hypotension, bradycardia, tachycardia

hypertonicity / myoclonus, hypersalivation, agitation, rash

vomiting → loss of airway reflexes → airway obstruction → aspiration

C E F A B
hypotension
hypertension
bradycardia
tachycardia
vomiting
hypertonicity / myoclonus
hypersalivation
agitation
rash

aspiration

vomiting

loss of airway reflexes

airway obstruction

ventilation demonstrates airway patency

ventilation predicts oxygenation

hypoxia

hypercapnia

acidemia

PSA
Hyperventilation is king.
intubation is not PSA

NIV is fantastic unless the patient vomits

chest rise requires patience and is inaccurate

breath sounds requires a precordial stethoscope

assessing ventilation

pulse oximetry is a great monitor of ventilation
if and only if
the patient is not receiving any supplemental oxygen

Baskett 1996
Poulton 2011
Witting 2005
Davidson 1993
Weingart 2012
if I can provide oxygen and keep the saturation up, and hypercapnia isn’t important, why do I have to worry about ventilation?
you need to know about hypoventilation.

you may choose to do nothing but observe, but you need to know about hypoventilation.

and the most effective way to detect hypoventilation is capnography.
**synypnea**

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<th>Complaint</th>
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</table>
bradypneic hypoventilation

bradypnea
rate slows but volumes are relatively preserved
slowly rising ETCO2
hypopneic hypoventilation

hypopnea
tidal volumes are low
rate can be normal or slow
ETCO2 falls because more of each breath is dead space
apnea

central apnea
airway obstruction
laryngospasm
should I use capnography?

detect hypoventilation early while providing supplemental oxygen

ACEP: “Continuous capnography is not mandatory, but is increasingly being recommended for deep sedation.”

hard to improve on damn safe
we don’t have capnography. should I use supplemental oxygen?

early detection of hypoventilation

oxygenation reserve
we don’t have capnography. should I use supplemental oxygen?
we don’t have capnography. should I use supplemental oxygen?

- early detection of hypoventilation
- monitoring patients at risk for respiratory depression
- oxygenation reserve
PSA oxygenation: nasal cannula under face mask (+capnography)
error: fentanyl/midazolam is safer than propofol or ketamine
Adverse events

- Fentanyl 9.5%
- Midazolam 6.4%
- Propofol 0.8%
- Ketamine 0.7%
peak effect

midazolam  2-3 minutes
fentanyl    4-5 minutes

agony vs. apnea
propofol and ketamine are enormously safe for different reasons

the gap between privileges and patient care
error: you cannot use ketamine for PSA in adults
psychiatric distress on emergence

15%

easily managed with midazolam or propofol

pre-induction comfort

pre-induction coaching

emerge somewhere other than an emergency room

if your patient freaks out a bit when they’re waking up, it’s OK
hypertension tachycardia

transient and almost always irrelevant

propofol
ketofol

combination of ketamine and propofol in the same syringe

effects of one counteract the effects of the other

safe and effective for PSA

as safe and effective as ketamine or propofol monotherapy but not more so

very different pharmacokinetics

Andolfatto 2012
Green 2011
error: an opiate needs to be added to ketamine or propofol during PSA
ketamine + opioid = makes no sense

propofol + opioid = propofol-sparing

makes no sense for brief procedures
use single slug of propofol

be careful with propofol for longer procedures
gradual drip titration safe and effective but requires patience
you can run into trouble with repeated boluses

pre-induction comfort
error: the dosing strategy you learned for fentanyl/midazolam will work for propofol
single slug: 1-2 mg/kg over 20 seconds
error: not respecting the sensitivity of the elderly to fentanyl, midazolam, and propofol

start low, go slow
error: ignoring the IM route for ketamine in kids
an IM shot is much less painful than starting an IV

pre-induction comfort with intranasal fentanyl

if you want, start an IV after induction

pre treat with ondansetron
a word about etomidate for PSA
errors in PSA: avoiding them

- **pre-induction comfort**
  - preparation: use a checklist
    - brief procedures
      - muscle relaxation
    - longer procedures
      - kids
  - patient selection
    - full intubation setup

- **propofol**
- **ketamine**

- early detection of hypoventilation

- stepwise approach to management of hypoventilation
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