

Pediatric Procedural Sedation: Nightfloat Curriculum

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Objectives

- Define the levels of sedation within the continuum of procedural sedation
- List 4 criteria used to determine the depth of sedation required for a procedure
- Understand the mnemonic SOAPME
- Begin to understand triage of sedation events after hours.

Procedural Sedation

- The new term for using medications with power to depress consciousness and provide analgesia to perform a procedure
- The term Conscious Sedation is outdated and perhaps an oxymoron

Procedural Sedation

- A continuum of sedation and analgesia
- Minimal sedation
- Moderate sedation
- Deep sedation
- General Anesthesia

Minimal Sedation (anxiolysis)

- This is a state of relaxed consciousness
- The patient is awake and verbal
- No loss of protective airway reflexes or effort
- The patient is “drunk”
- Typical agents-Midazolam or nitrous oxide as a single agent

Moderate Sedation (“Conscious Sedation”)

- This is a state of depressed consciousness
- The patient responds to verbal or tactile stimulation
- No loss of protective airway reflexes or effort
- Typical agents-Midazolam/Fentanyl, Chloral Hydrate

Deep Sedation

- Respond to intense repetitive physical stimulation or very loud verbal command
- Protective airway reflexes may not be maintained
- May not independently maintain airway or respiratory drive
- Typical agent-Propofol

General Anesthesia

- Deeper than Deep
- Patient cannot be aroused
- Often requires assistance to maintain airway
- Often requires positive pressure ventilation
- Cardiovascular status may be impaired

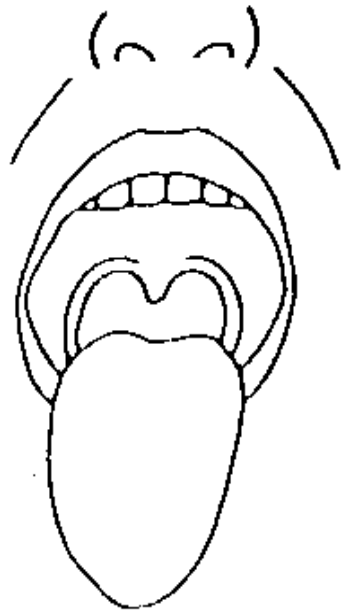
Sedation ≠ Analgesia

- Always remember sedation is not the same as analgesia. There are many sedative agents (Versed) and many analgesic agents (Fentanyl). There are a few sedative analgesics agents (Ketamine).

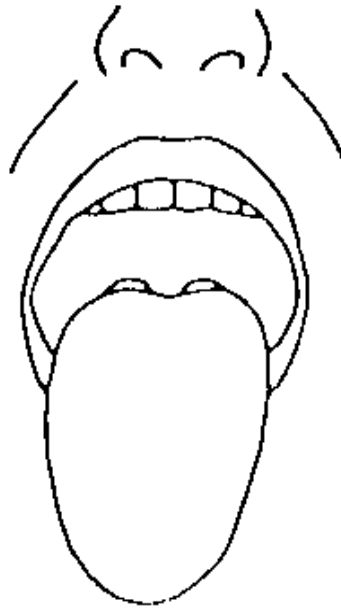
ASA Classification

- I - Healthy normal patient
- II - Mild systemic disease, no functional limitation (fever, mild dehydration, asthma controlled)
- III - Moderate to severe systemic disease (hypoxia, moderate dehydration, appendicitis)
- IV - Severe systemic disease that is constant threat to life (PICU patient)
- V - Moribund, survival $>24^{\circ}$ unlikely

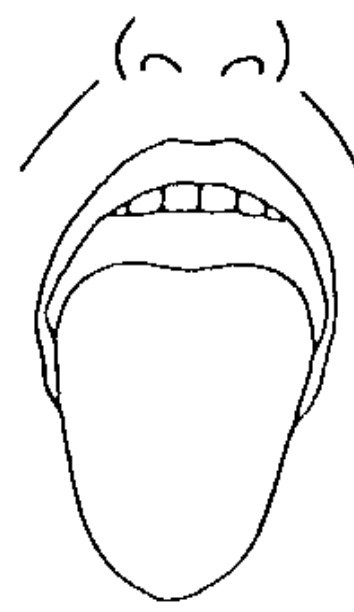
Mallampati Classification



CLASS I



CLASS II



CLASS III

What it takes to safely and efficiently perform a sedation event

- Qualified staff (MD, PA/APRN, RN)
- Evaluation at time of procedure
- Equipment
- Pharmacology: Selection/administration of medications
- Recovery
- Follow up

Evaluation Mnemonic for Procedural Sedation

- Evaluation: AMPLE
 - Allergies
 - Medications
 - Past Medical History
 - Last Meal
 - Events/Exam
- Why is pre-procedural history and physical helpful?

Evaluation: High Risk Conditions

- Premature infants
- History of apnea
- Abnormal airway
- Cardiac disease
- Renal or liver disease
- Neuromuscular disease
- Neurologic injury

Evaluation: Elective Dietary Restrictions

- No solid food for 6-8 hours
- No milk or formula for 6-8 hours
- No breast milk for 3 hours
- No clear liquids for 2 hours
- The larger the meal, the longer the wait

Emergency Dietary Restrictions

- How can we balance safety and efficiency?
- Delay the procedure
- Limit the level of sedation
- Consider airway/drug prophylaxis

Equipment Requirements (SOAPME)

- Suction catheters and apparatus
- Oxygen
- Airway adjuncts and Bag valve mask
- Pharmacy: Medications/Reversal Agents
- Monitors:
 - Blood pressure measurement
 - Pulse Oximeter and Cardiac monitor
- Emergency: Code Cart

Monitoring

- Continuous monitoring
 - Pulse oximetry
 - Heart rate
- Intermittent recording
 - Respiratory rate
 - Blood pressure
 - Level of consciousness

Pharmacology: What Drugs?

- Review patient status-Age/Health/PO intake?
- How long is procedure?
- Is this a painful procedure?
- Can adjuncts make it tolerable?
 - Distraction?
- How sedated does patient need to be?

Adjunctive/Alternative Therapies

- Child Life
- Singing
- Toys
- Bubbles
- DVD's
- I-pod touch (not an endorsement)

Pharmacology: How much of a Drug?

- Be prepared!!
- Procedural Sedation is a continuum
- Titrate, titrate, titrate!!!
- Reassess
- Allow drugs time to work

Recovery

- Monitoring continues until the patient has recovered
- Patient is typically safe @ one hour post peak medication effect
- Oxygen saturation $>95\%$ with stable pulse and respiratory rate

CT scan sedation

- Review patient status
 - Age/Health/PO intake and specifically is there ICP?
- How long is procedure?
 - 3-5 minutes all together?
- Is this a painful or painless procedure?
 - painless
- Can adjuncts make it tolerable?
 - maybe
- How sedated (motionless) does patient need to be? Asleep and immobile for best images

CT scan sedation- What Drugs?

- Chloral Hydrate
- Midazolam
- Pentobarbital
- Propofol

Chloral Hydrate

- Produces unconsciousness and potentially loss of airway reflexes.
- 50-75 mg/kg PO or PR
- Use a good dose the first time
- Prolonged sedation: 30-45 minutes
- High failure rate in literature, @ CCMC >95% success

Midazolam

- Short acting benzodiazepine
- Sedative and amnestic
- IV dose 0.05-0.1 mg/kg-takes effect in 1-2 minutes, duration of action 10-15 minutes (min)
- PO dose 0.5 mg/kg with 20 mg max single dose-takes effect in 15 min/lasts 15-20 min
- Literature has shown this drug to be less efficacious for CT scan when used in recommended dosages.

Pentobarbital/Barbiturates

- Barbiturate and CNS depressant
- Sedative and amnestic
- No analgesic activity/long $T^{1/2}$ (hours)
- Pentobarbital (Nembutal) dosing
 - 1-3 mg/kg IV-takes effect in 3-5 minutes
- Methohexital (Brevital) dosing, rapid onset and rapid recovery
 - 20-30 mg/kg PR

Pentobarb vs. Versed

- Randomized comparison for CT
- 28/29 (97%) successfully scanned with pentobarbital alone
- 5/26 (19%) successfully scanned with versed alone)
- Acad Emerg Med 2000;7:1370-1375.

Propofol-for reference only

- Deep Sedation agent-so use restricted to Anesthesia and attendings in ICU/ED/sedation services
- Sedative and amnestic
- No analgesia
- 1-2 mg/kg bolus dose
 - IV infusion 50-200 mcg/kg/min
- Rapid onset (seconds)
- Brief sedation (3-5 minutes)

Propofol-for reference only

- Side effects
 - painful administration
 - hypotension
- Contraindications
 - cardiac compromise
 - hypovolemia
 - potentiated by opioid, CNS depressants, alcohol, age extremes
 - Mitochondrial diseases

Painful Procedures (i.e., debridement of wound/burn)

- Review patient status-PO intake?
- Is this a painful or painless procedure?
 - absolutely
- How long is procedure?
 - Depends upon how big wound is
- Can Child life/distraction alone make it tolerable?
 - Doubtful, it really hurts
- How sedated does patient need to be?
 - Some movement is tolerable, maybe not if near eye

Choices?

- Midazolam-probably not enough as no analgesia
- Midazolam/Fentanyl
- Ketamine alone or with Midazolam
- Ketamine/Propofol

Midazolam/Fentanyl

- Provides both analgesia and anxiolysis
- The prototypical and most common agents
- My experience: Give the maximum dose Midazolam first (0.1 mg/kg or 6 mg max); don't give small doses to get to maximum dose
- Titrate the Fentanyl (1-2 mcg/kg) to avoid respiratory depression and “stiff paralytic” chest wall

Ketamine: Basic Information

- Sedative and Analgesic
- Provides deep sedation level of consciousness with moderate sedation safety profile
- Dose
 - IV= 1-2 mg/kg-takes effect in 2-3 minutes/duration 15 min
 - IM= 2-4 mg/kg-takes effect in 3-5 minutes/duration 15 min
- Side effects
 - Increased secretions
 - Treated with atropine prn
 - Hallucinations during recovery
 - Hypertension/tachycardia

Ketamine -the new evidence

- Emergence phenomena do not appear age or drug related
- Pretreatment with Midazolam without decrease in Ketamine dose:
 - does not decrease emergence
 - does increase complications
- Pretreatment with Atropine does not decrease hypersalivation events
- ICP does not seem to be an issue but use in head injury patients still limited

Ketamine/Midazolam

- Sedative action in both drugs/Analgesia with Ketamine
- You can give less Ketamine to decrease any side effects (vomiting/secretions) and hopefully get same sedative effect
- Would give maximum dose of Versed (0.1 mg/kg or 6 mg) then Ketamine (1 mg/kg).
- Can give more Ketamine in 1 mg/kg boluses for further analgesia if needed (titration)

Ketofol 2007-2009-reference only

- A 1:1 mixture of Ketamine and Propofol
- Create a balance between Ketamine's emetogenic and hallucinogenic properties and Propofol's hypotension and lack of analgesia
- Literature and personal experience support the safety and efficacy of this combination.
Unfortunately, it is deep sedation so use is restricted (not for residents).

Contact Information

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■ References

- AAP Guideline *Pediatrics* 2006:118; 2587-2602
- AAP Guideline *Pediatrics* 2002:110; 836-838
- AAP Guideline *Pediatrics* 1992:89; 1110-1115