Goals of sedation:
1. Patient safety
2. Patient comfort

Conscious Sedation
- Minimal Sedation (anxiolysis)
- Moderate Sedation
- Deep Sedation
- Anesthesia

Minimal Sedation (Anxiolysis)
- Patients respond normally to commands
- Cognitive function and coordination may be impaired
- Ventilatory and cardiovascular functions are unaffected

Moderate Sedation
- Depressed consciousness
- Patients respond purposefully to verbal commands
- No interventions are required to maintain airway
- Spontaneous ventilation is adequate
- Cardiovascular function is usually maintained
### Deep Sedation

- Depressed consciousness
- Patients cannot be easily aroused but will respond after repeated or painful stimuli
- Ventilatory function may be impaired
- May require airway assistance
- Spontaneous ventilation may be inadequate
- Cardiovascular function is usually maintained

### General anesthesia

- Patients are not arousable even with painful stimuli
- Ventilatory function is often impaired
- Often require airway assistance
- May require mechanical ventilation
- Cardiovascular function may be impaired

---

The sedation plan must be clearly articulated among all members of the procedure team.
## Pre-sedation history

- Cardiac conditions
- Pulmonary conditions
- Renal disease
- Hepatic disease
- Endocrine disorders
- Head trauma
- Prior surgical or airway issues
- Prior intubation
- Stridor
- Snoring
- Sleep apnea
- Previous reactions to sedative medications

## STOP-BANG

<table>
<thead>
<tr>
<th>S – Snore: have you been told you snore</th>
</tr>
</thead>
<tbody>
<tr>
<td>T – Tired: are you tired during the day</td>
</tr>
<tr>
<td>O – Obstruction: do you stop breathing at night</td>
</tr>
<tr>
<td>P – Pressure: do you have high blood pressure</td>
</tr>
</tbody>
</table>

- B – BMI: is your BMI greater than 28
- A – Age: 50 or over
- N – Neck: circumference greater than 17 inches
- G – Gender: male

Yes to 3 or more = increased risk for sleep apnea

## Other key elements of the history:

- Current medications
- Allergies
- Pregnancy status
- Last oral intake
- Need for isolation for infections
- Alcohol, tobacco, and drug use

## Physical examination

- Cardiac exam
- Pulmonary exam
- Ability to lay in the proper procedure position
- Airway assessment
### ASA Physical Status

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>normal healthy patient</td>
</tr>
<tr>
<td>P2</td>
<td>mild systemic disease</td>
</tr>
<tr>
<td>P3</td>
<td>severe systemic disease</td>
</tr>
<tr>
<td>P4</td>
<td>severe systemic disease that is a constant threat to life</td>
</tr>
<tr>
<td>P5</td>
<td>moribund and likely to die</td>
</tr>
<tr>
<td>P6</td>
<td>brain dead organ donor</td>
</tr>
</tbody>
</table>

### When to consider anesthesia consult?

- Significant co-morbid disease
- Significant sleep apnea
- History of airway problems during sedation
- History of adverse reaction to sedation
- High risk airway
- Chronic opioid or sedative use

### Coding and billing for sedation

- For the physician doing both the procedure and the sedation:
  - 99152: Initial 15 minutes of sedation services
  - 99153: Each subsequent 15 minutes of sedation services
- For the physician doing only the sedation:
  - 99156: Initial 15 minutes of sedation services
  - 99157: Each subsequent 15 minutes of sedation services

### Airway Assessment

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Assistant Professor  
Clinical Anesthesiology  
The Ohio State University Wexner Medical Center
Four Types of Difficulty

- Difficult to bag/mask ventilate/oxygenate
- Difficult laryngoscopy
- Difficult intubation
- Difficult to perform cricothyroidotomy

How Does the ASA Define the Difficult Airway?

- Difficult mask ventilation
  - Impossible for an unassisted anesthesiologist to prevent or reverse signs of inadequate ventilation during positive pressure mask ventilation

How Does the ASA Define the Difficult Airway?

- Difficult rigid laryngoscopy
  - It is not possible to visualize any portion of the vocal cords with conventional laryngoscopy
- Difficult intubation
  - Proper insertion of an endotracheal tube requires more than 3 attempts or greater than 10 minutes

Causes of Difficulty

- Anatomical
  - Obesity
  - Short neck
  - Protruding teeth, long high arched palate
  - Receding mandible
  - Decreased distance between occiput and spinous process
  - Increased alveolar-mental distance
## Causes of Difficulty

- **Acquired**
  - Acute neck swelling: trauma, infection, post-operative bleeding
  - Restricted jaw opening: Trismus, fibrosis, rheumatoid arthritis, mandibular fracture
  - Restricted neck movement: osteoarthritis, scarring, C-spine tumor, ankylosing spondylitis

## Predicting Difficult Bag & Mask Ventilation

- B - bearded
- O - obese /obstetric
- N - no teeth
- E - elderly
- S - snores/sleep apnea

## Predicting Difficult Intubation Mallampati Classification

- **Class 1:** view of the entire posterior oropharynx to the bases of the tonsillar pillars
- **Class 4:** no view of the posterior oropharynx or uvula

---

Published online 2010 October 31
Predicting Difficult Intubation

3 - 3 - 2 Rule

• 3 finger mouth opening
• 3 fingers mentum to hyoid distance
• 2 fingers hyoid to thyroid

Predicting Difficult Intubation

• Review medical record, history
• Assess
  – teeth especially protruding incisors
  – patent nares
  – open mouth & extend tongue (mallampati)
  – protrude mandible
  – thyromental distance, submental space
  – neck - short, thick ?, overall mobility & sniffing position
  – body habitus

Video of Airway Examination

Airway Management
### Supplemental Oxygen

- Nasal cannula
- Simple mask
- Non-rebreather mask

### Airway Support

- Jaw thrust
- Nasal airways
- Oral airways

### Bag / Mask Ventilation

- Technique dependent
- Mask seal essential
- 2 are better than 1
- Incorporate jaw thrust
- Nasal / Oral airways
- Assist spontaneous ventilation

### Video of Airway Maneuvers
Before the procedure

- There must be signed written consent for:
  - The procedure
  - The sedation
- If 2 procedures are planned, get consent for both before giving sedation
- A “time-out” must be performed

Q 5 minutes during the procedure:

- Level of consciousness
- Blood pressure
- Oxygen saturation
- Respiratory rate
- Cardiac rhythm (only required in patients with known heart disease)

Monitoring every 15 minutes until:

- Patient is awake, alert, and oriented
- Recovered protective reflexes
- Vital signs returned to normal
- Oxygen saturation > 95% or at baseline

Post-procedure transport:

- Accompanying personnel trained in sedation monitoring
- Pulse oximeter
- Supplemental oxygen
- Ventilation equipment
- Nasal and/or oral airways
- Emergency drug supplies
- Cardiac monitor (in patients with heart disease)
Post-procedure discharge:

- Instruction sheet
- No driving
- No alcohol or sedatives
- No operating machinery
- Phone number for questions
- A responsible adult to accompany (taxis do not count!)

Pharmacology of Sedatives & Reversal Agents

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Specialty Practice Pharmacist, Emergency Medicine
The Ohio State University Wexner Medical Center

Agents for Procedural Sedation

- Opioids
- Benzodiazepines
- Etomidate
- Ketamine
- Methohexital
- Propofol
- Dexmedetomidine

Opioids

- Class II Controlled Substances
- Mu receptor agonists
  - Fentanyl
  - Hydromorphone
  - Morphine
  - Meperidine
- Hepatic metabolism with varying t½
### Opioids

#### Adverse Effects
- Respiratory depression
- Hypotension
- Miosis
- Decreased GI motility
- Urinary retention

#### Estimated IV Potency
- Fentanyl 75 - 100 micrograms
- Hydromorphone 1.5 mg
- Meperidine 75 mg
- Morphine 10 mg

---

### Fentanyl
- Phenylpiperidine opioid agonist
- Preferred opioid for procedural sedation
- Precautions
  - Skeletal muscle and chest wall rigidity
  - Dose and administration rate related
  - Reversible with naloxone
  - Bradycardia
- Black box warning with CYP3A4 inhibitors

### Benzodiazepines
- Class IV Controlled Substances
- GABA and Benzodiazepine agonists
  - Midazolam
  - Lorazepam
  - Diazepam
- Hepatic metabolism with varying t½
### Benzodiazepines

#### Adverse Effects
- Respiratory depression
- Hypotension
- Paradoxical reactions
- Nausea/vomiting
- Hiccoughs

#### Estimated Potency
- Diazepam 5 mg
- Lorazepam 1 mg
- Midazolam 2 mg

---

### Midazolam
- Preferred BZD for procedural sedation
- CYP3A4 substrate
- Elimination t½ prolonged
  - CHF
  - Renal function impairment
  - Hepatic function impairment
  - Obesity
  - Elderly

### Etomidate
- Not currently controlled substance
- Nonbarbiturate benzylimidazole hypnotic
- 0.1 – 0.3 mg / kg IVP over 30-60 seconds
### Etomidate
- Inhibits 11-β hydroxylase
- Blocks cortisol production
- Myoclonus (up to 33%)
- Injection site pain (30-80%)
  - Propylene glycol
- Minimal effect on hemodynamics
- Decreases ICP and seizure threshold

### Ketamine
- Class III Controlled Substance
- NMDA receptor antagonist and PCP derivative
- Analgesic properties appealing
- IM or IV administration
- 0.5 – 2 mg/kg IVP over at least 60 seconds

### Ketamine
- Respiratory drive maintained
- Three concentrations available
  - 10 mg/mL
  - 50 mg/mL
  - 100 mg/mL (dilute if administered IV)

### Ketamine
- Emergence reaction (12 - 50%)
  - Severity varies
  - Less common in < 15 yrs and > 65 yrs
  - Less frequent with IM administration
  - Minimize verbal, tactile, visual stimulation during recover
  - ?pretreat with BZD or butyrophenone
**Ketamine**
- Emergence reaction (12-50%)
- Hypersalivation? pretreat?
- Nystagmus
- Increases ICP/IOP
- Minimal affect on BP/HR or increase
- Increased skeletal muscle tone

**Methohexital**
- Class IV controlled substance
- Ultrashort acting IV barbiturate anesthetic
- pH of 1% solution is 10-11
- Contraindicated in porphyria
- Hypotension
- Respiratory depression
- Dose 0.25 – 1 mg/kg at <10mg/5 seconds
- 500 mg vials!

**Propofol**
- Currently not controlled substance
- Patient can transition in unpredictable fashion to deeper level of sedation
- At OSUWMC physician must be credentialed for deep sedation
- Cardiovascular depressant – hypotension!

**Propofol**
- Contraindicated if
  - egg allergy (?)
  - soy intolerance (?)
  - peanut allergy (?)
- 0.5 - 1 mg/kg IV over 2-3 min once then
  0.5 mg/kg every 3-5 min if needed
Dexmedetomidine

- “relatively selective” alpha₂ adrenergic agonist
- FDA approval in 2008
  ✓ Sedation of nonintubated patients prior to and/or during surgical and other procedures
- Limited published experience for procedural sedation (ablation, hysteroscopy, etc)

Dexmedetomidine

- Hypotension 54% vs 30% (Placebo)
  ✓ SBP<80 or DBP <50 or ↓ >30% from baseline
  ✓ 72% in ≥ 65yo patients (n=131)
- Bradycardia/sinus arrest 14% vs 4% (Placebo)
  ✓ <40BPM or ↓ >30% from baseline

Approaches Being Explored

- Alternative routes of administration
  ✓ Intranasal
  ✓ Nebulized
- Alternative combinations of medications
  ✓ Ketamine + Propofol
  ✓ Ketamine + Dexmedetomidine

<table>
<thead>
<tr>
<th>Drug</th>
<th>Onset (Min)</th>
<th>Peak (Min)</th>
<th>Duration (Min)</th>
<th>Elimination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fentanyl</td>
<td>Immed</td>
<td>Immed</td>
<td>30-60</td>
<td>Hepatic</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1-2</td>
<td>2-2.5</td>
<td>30</td>
<td>Hepatic + (Renal)</td>
</tr>
<tr>
<td>Etomidate</td>
<td>&lt;1</td>
<td>1</td>
<td>3-5</td>
<td>Hepatic</td>
</tr>
<tr>
<td>Ketamine</td>
<td>1</td>
<td>1</td>
<td>15-20</td>
<td>Hepatic</td>
</tr>
<tr>
<td>Methohexitol</td>
<td>Immed</td>
<td>Immed</td>
<td>10-20</td>
<td>Hepatic</td>
</tr>
<tr>
<td>Propofol</td>
<td>½</td>
<td>1</td>
<td>3-10</td>
<td>Hepatic</td>
</tr>
<tr>
<td>Dexmedetomidine</td>
<td></td>
<td></td>
<td>4 hours</td>
<td>Hepatic</td>
</tr>
</tbody>
</table>
### Recommended Agents at OSUWMC

- Midazolam ± fentanyl agents of choice
- Propofol limited to physicians credentialed in deep sedation
- Meperidine not for routine use
- Alternative agents used by physician experienced in their use

<table>
<thead>
<tr>
<th></th>
<th>Amnestic</th>
<th>Analgesic</th>
<th>Anxiolytic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzodiazepines</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Opioids</td>
<td>-</td>
<td>+</td>
<td>-/+</td>
</tr>
<tr>
<td>Etomidate</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Ketamine</td>
<td>+</td>
<td>+</td>
<td>Dissociative properties</td>
</tr>
<tr>
<td>Methohexital</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Propofol</td>
<td>+/-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>Dexmedetomidine</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

### Dose

- No universally safe & effective dose
- Variable dose requirements
  - Age (especially >65 yrs)
  - Weight
  - Medical condition
  - Medication history
  - Previous requirements during procedures
  - Goal depth of sedation
- Combination agents have added risks/benefits
- TITRATE
  - Small incremental doses
  - **Sufficient time must elapse** between doses to evaluate effect of previous dose
  - Time between doses longer for nonintravenous routes
### Fentanyl: Typical Initial Regimen*  
- 25-100 micrograms SLOW IVP  
- IVP over at 1 - 2 minutes  
- Dilute to permit slower administration  
- Additional doses in 2 minutes if needed  
- Administer prior to midazolam if using combination regimen  

*Dose is highly variable

### Midazolam: Typical Initial Regimen*  
- 0.2 – 2.5 mg IVP  
- IVP over at least 2 minutes  
- Dilute to permit slower administration  
- Additional dose(s) in 3 minutes if needed  
- Administer after opioid if using combination regimen  

*Dose is highly variable

### JCAHO & Medication Administration During Procedures
- Sterile technique!  
- Proper product labeling  
  - Label: drug name, strength, and amount  
  - Single individual process and immediate administration = no label  
  - Two individual process = product verification with vial and label  
- Complete charting  
  - Medication  
  - Dose  
  - Route  
  - Time of administration  
  - Who administers
### Reversal Agents
- Used to reverse sedatives or treat overdose
- Half lives can be shorter than sedative
- Can precipitate withdrawal symptoms
- May not completely reverse all complications of sedatives

### Flumazenil
- Onset of action 1-2 minutes
- Half life 41-79 minutes
- Flumazenil use requires 90 min monitored recovery time
- Hepatic clearance

### Flumazenil
- **Adverse Effects**
  - Seizures
  - Panic attacks and emotional lability
  - Withdrawal symptoms
  - Dizziness
- **Reversal of Procedural Sedation**
  - 0.2mg IVP q 1 min prn to MAX of 1mg
  - Repeat every 20 min as needed

### Naloxone
- Opiate receptor antagonist
- Onset of action 2-3 minutes
- Half life 30-81 minutes
- Naloxone use requires 90 min monitored recovery time
- Duration of effect varies (45min – 4 hrs)
- Hepatic clearance
Naloxone

- Dosing
  - 0.1 – 0.2 mg IVP every 1-2 minutes
  - Doses up to 2 mg may be required
  - May need to redose if naloxone wears off before opiate
- Adverse Effects
  - Opiate withdrawal
  - Pulmonary edema
  - Acute hypertension and dysrhythmias
  - Seizures

Moderate and Deep Sedation

Deep sedation

- Emergency medicine
- Pulmonary medicine
- Critical care
- Oral maxillary facial surgery
- Or demonstrated advanced airway expertise and intubation skill