## 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

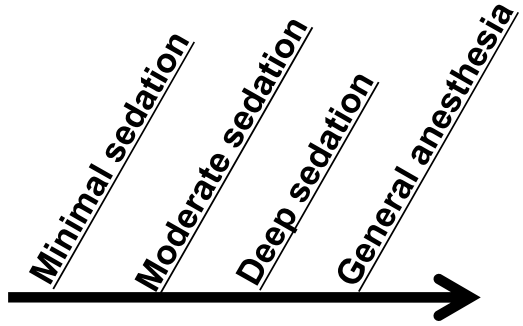
- Depressed consciousness
- Patients respond purposefully to verbal commands
- No interventions are required to maintain airway
- Spontaneous ventilation is adequate
- Cardiovascular function is usually maintained

## Deep Sedation

- Depressed consciousness
- Patients cannot be easily aroused but will respond after repeated or painful stimuli
- Ventilatory function may be impaired
- May required 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

S – Snore: have you been told you snore
T – Tired: are you tired during the day
O – Obstruction: do you stop breathing at night
P – Pressure: do you have high blood pressure
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

P1 - normal healthy patient
P2 – mild systemic disease
P3 – severe systemic disease
P4 – severe systemic disease that is a constant threat to life
P5 – moribund and likely to die
P6 – brain dead organ donor

## 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 <u>both</u> the procedure and the sedation:
  - ✓ 99152: Initial 15 minutes of sedation services
  - ✓ 99153: Each subsequent 15 minutes of sedation services
- For the physician doing <u>only</u> the sedation:
  - ✓ 99156: Initial 15 minutes of sedation services
  - ✓ 99157: Each subsequent 15 minutes of sedation services

## Airway Assessment

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## 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

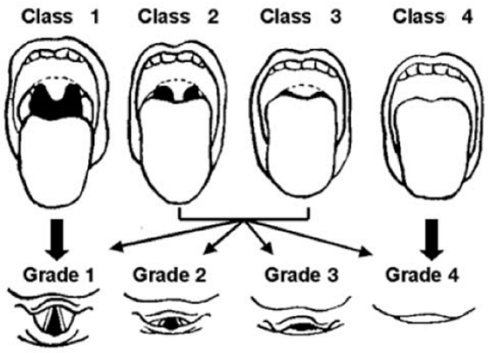
- Acquired
  - Acute neck swelling: trauma, infection, post-operative bleeding
  - Restricted jaw opening: Trismus, fibrosis, rheumatoid arthritis, mandibular fracture
  - Restricted neck movement: osteoarthritis, scarring, C-spine tumor, ankylosing spondylitis

# 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




Korean J Pediatr. 2010 October; 53(10): 863–871.
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

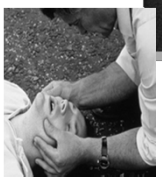
## Supplemental Oxygen

- 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 and Reversal Agents

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## 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 t ½

## Opioids
### Adverse Effects

- **Respiratory depression**
- **Hypotension**
- **Miosis**
- **Decreased GI motility**
- **Urinary retention**

## Opioids
### 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 t ½

## Benzodiazepines
### Adverse Effects

- Respiratory depression
- Hypotension
- Paradoxical reactions
- Nausea/vomiting
- Hiccoughs

## Benzodiazepines
### Estimated Potency

- **Diazepam 5 mg**
- **Lorazepam 1 mg**
- **Midazolam 2 mg**

## Midazolam

- **Preferred BZD for procedural sedation**
- **CYP3A4 substrate**
- **Elimination t ½ 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" alpha$_2$ 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**

| | Onset (Min) | Peak (Min | Duration (Min) | Elimination |
|---|---|---|---|---|
| Fentanyl | Immed | Immed | 30-60 | Hepatic |
| Midazolam | 1-2 | 2-2.5 | 30 | Hepatic + (Renal) |
| Etomidate | <1 | 1 | 3-5 | Hepatic |
| Ketamine | 1 | 1 | 15-20 | Hepatic Active Metabolite |
| Methohexital | Immed | Immed | 10-20 | Hepatic |
| Propofol | ½ | 1 | 3-10 | Hepatic |
| Dexmedetomidine | | | 4 hours | Hepatic |

| | Amnestic | Analgesic | Anxiolytic |
|---|---|---|---|
| Benzodiazepines | + | - | + |
| Opioids | - | + | -/+ |
| Etomidate | + | - | + |
| Ketamine | + | + | Dissociative properties |
| Methohexital | - | - | + |
| Propofol | +/- | - | + |
| Dexmedetomidine | + | + | + |

# 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**

# 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**

# Dose

- **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

## JCAHO & Medication Administration During Procedures

- Document waste of Controlled Substances
- 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

# Case #1: 50 year-old man undergoing screening colonoscopy

**Case #2: 60 year-old woman with COPD exacerbation and respiratory failure requiring intubation**

**Case #3: 50 year-old man with HIV on anti-retroviral medications needs a colonoscopy**

**Case #4: 23 year-old undergoing dental procedure requires oxygen then develops bradycardia**

**Case #5: 21 year-old man with pneumothorax needs a chest tube**

**Case #6: patient with atrial fibrillation needs external cardioversion**

**Case #7: after TEE, patient develops cyanosis, headache, and SaO2 = 85%. Blood looks brown**