



# Airway Management

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## Disclosures

- I have no disclosures to report

## Goals of Sedation

- Patient Safety
  - Requires coordinated team
    - BLS/ACLS
  - Monitors, sedation/recovery plan
    - Circulation, Oxygenation vs. ASA monitors
- Patient Comfort
  - Anxiety, Pain
- Proceduralist/Surgeon
  - Patient tolerance ---→ Quiet Procedural Field

## Types of Sedation

- Sedation is a continuum!!!
- Minimal Sedation
  - Anxiolysis
- Moderate Sedation (Conscious Sedation)
  - Anxiolysis and Analgesia
- Deep Sedation
- General Anesthesia

## **Minimal Sedation (Anxiolysis)**

- Drug-induced state
- Patients respond normally to verbal commands
- Cognitive function and physical coordination may be impaired
- Airway reflexes, and ventilatory and cardiovascular functions are unaffected

## **Moderate Sedation/Analgesia**

- AKA “Conscious Sedation”
- Drug-induced depression of consciousness
- Patients respond purposefully to verbal commands, either alone or accompanied by light tactile stimulation
- No interventions are required to maintain a patent airway, and spontaneous ventilation is adequate
- Cardiovascular function is usually maintained

## **Deep Sedation/Analgesia**

- Drug-induced depression of consciousness
- Patients cannot be easily aroused but respond purposefully following repeated or painful stimulation
- Ability to independently maintain ventilatory function may be impaired
- Patients may require assistance in maintaining a patent airway, and spontaneous ventilation may be inadequate
- Cardiovascular function is usually maintained.

## **General Anesthesia**

- Drug-induced loss of consciousness
- Patients are not arousable, even by painful stimulation
- Ability to independently maintain ventilatory function is often impaired
- Patients often require assistance in maintaining a patent airway, and positive pressure ventilation may be required
- Cardiovascular function may be impaired.

## Monitored Anesthesia Care (MAC)

- MAC ≠ Propofol
- Does not describe the continuum of depth of sedation
- “A specific anesthesia service performed by a qualified anesthesia provider, for a diagnostic or therapeutic procedure.”
- Indications are potential for deeper levels of analgesia and sedation than can be provided by moderate sedation (potential conversion to general or regional anesthetic)
  - Requires qualified anesthesia provider and ASA monitors

## Continuum

- It is not always possible to predict a patient will respond
- Practitioners intending to produce a given level of sedation should be able to rescue patients whose level of sedation becomes deeper than initially intended
- Individuals administering Moderate Sedation/Analgesia (“Conscious Sedation”) should be able to rescue patients who enter a state of Deep Sedation/Analgesia
- Those administering Deep Sedation/Analgesia should be able to rescue patients who enter a state of General Anesthesia

## Continuum

- Rescue of a patient from a deeper level of sedation than intended is an intervention by a practitioner proficient in airway management and advanced life support
- Practitioner should return the patient to the originally intended level of sedation, not continue the procedure at an unintended level of sedation

## ASA Sedation

	<b>Minimal Sedation Anxiolysis</b>	<b>Moderate Sedation/ Analgesia (“Conscious Sedation”)</b>	<b>Deep Sedation/ Analgesia</b>	<b>General Anesthesia</b>
Responsiveness	Normal response to verbal stimulation	Purposeful** response to verbal or tactile stimulation	Purposeful** response following repeated or painful stimulation	Unarousable even with painful stimulus
Airway	Unaffected	No intervention required	Intervention may be required	Intervention often required
Spontaneous Ventilation	Unaffected	Adequate	May be inadequate	Frequently inadequate
Cardiovascular Function	Unaffected	Usually maintained	Usually maintained	May be impaired

## **Coding/Billing Sedation**

- Physician providing sedation and doing procedure
  - 99152: Initial 15 minutes of sedation services
  - 99153: Each subsequent 15 minutes of sedation services
  
- Must document patient vitals/monitoring q15 min
- Must document level of consciousness q15 min
  
- Monitoring and documentation must be done by someone other than proceduralist administering sedation

## **Coding/Billing Sedation**

- Physician/APP other than proceduralist doing sedation
  - 99156: Initial 15 minutes of sedation services
  - 99157: Each subsequent 15 minutes of sedation services
  
- Must document patient vitals/monitoring q15 min
- Must document level of consciousness q15 min
  
- If RN is providing sedation, they cannot also perform monitoring and documentation of vitals

## **Coding/Billing Sedation**

- If proceduralist provides sedation:
  - Patient receives bill from proceduralist which includes fee for sedation in addition to procedure
  
- If proceduralist consults anesthesia for sedation services
  - Patient receives bill from procedure for procedure
  - Patient receives separate bill from anesthesia for services

## **Coding/Billing Sedation – Anesthesia**

- CPT 99156: Document accurately why anesthesia services are needed if procedural sedation could also be provided by proceduralist
  
- Certain payors/CMS may not reimburse for anesthesia services if not properly documented/indicated
  - Anxiety
  - Substance Abuse
  - Previous Failed Sedation



## Pre-Sedation Assessment

- ROS, H&P, Medications/Allergies, Social Hx, Pregnancy
  - Previous reaction to sedation
  - NPO status and positioning
- Cardiopulmonary
- Renal/Hepatic
- Endocrinology
- Cerebrovascular
  - Cognitive Impairment/Head Trauma/Motor/Sensory
- Airway
  - Previous intubation? OSA

## ASA Physical Status

<b>ASA I</b>	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use	<b>ASA IV</b>	A patient with severe systemic disease that is a constant threat to life	Recent (<3 months) MI, CVA, TIA or CAD/stents, ongoing cardiac ischemia or severe valve dysfunction, severe reduction of ejection fraction, shock, sepsis, DIC, ARD or ESRD not undergoing regularly scheduled dialysis
<b>ASA II</b>	A patient with mild systemic disease	Mild diseases only without substantive functional limitations. Current smoker, social alcohol drinker, pregnancy, obesity (30<BMI<40), well-controlled DM/HTN, mild lung disease	<b>ASA V</b>	A moribund patient who is not expected to survive without the operation	Ruptured abdominal/thoracic aneurysm, massive trauma, intracranial bleed with mass effect, ischemic bowel in the face of significant cardiac pathology or multiple organ/system dysfunction
<b>ASA III</b>	A patient with severe systemic disease	Substantive functional limitations; One or more moderate to severe diseases. Poorly controlled DM or HTN, COPD, morbid obesity (BMI ≥40), active hepatitis, alcohol dependence or abuse, implanted pacemaker, moderate reduction of ejection fraction, ESRD undergoing regularly scheduled dialysis, history (>3 months) of MI, CVA, TIA, or CAD/stents.	<b>ASA VI</b>	A declared brain-dead patient whose organs are being removed for donor purposes	

## **STOP-BANG (OSA)**

- **STOP**
  - **S**noring
  - **T**ired
  - **O**bserved Apnea
  - **P**ressure/Hypertension
- **BANG**
  - **B**MI > 35 kg/m<sup>2</sup>
  - **A**ge > 50 years
  - **N**eck Circumference > 40 cm
  - **G**ender – Male
- 3 or more = OSA risk

## **Anesthesia Consult?**

- Failed Sedation without Anesthesia
- Chronic opioid/substance use/abuse
- High risk airway/anatomical changes
- Significant co-morbidities? ASA 3 or greater?
- Severe Sleep Apnea? AHI > 30

## **Pre-Anesthesia Assessment**

- More focused cardiopulmonary exam
- Airway assessment
  - Previous Anesthetic Hx
- Functional Status
- Positioning

## **Airway Examination**



## Supplemental Oxygen

- Nasal cannula
  - HFNC
- Simple mask
- Non-rebreather mask
- Bag/mask



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## Before the procedure

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

## **Assessments Q 15min:**

- Level of consciousness
- Blood pressure
- Oxygen/Ventilation
- Respiratory rate
- Cardiac rhythm

## **Until...**

- Patient is awake, alert, and oriented
  - Or back to baseline
- Recovered protective reflexes
- Vital signs returned to normal
- Oxygen saturation > 92% or at baseline

## **Post-procedure transport:**

- Accompanying personnel trained in sedation monitoring
- Supplemental oxygen +/-
- Pulse oximeter
- Ventilation equipment and adjuncts
- Emergency drug supplies
- Cardiac and circulation monitors

## **Post-procedure discharge:**

- Instruction sheet
  - No driving
  - No alcohol or sedatives
  - No operating machinery
  - Phone number for questions
- A responsible adult to accompany  
(travel and at home)

## Airway Support

- Jaw thrust
- Nasal airways
- Oral airways



## Bag / Mask Ventilation

- Technique dependent
- Mask seal essential
- 1 hand vs. 2 hand
- Sniffing Position
- Nasal / Oral airways
- Maintain spontaneous ventilation?



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## Video of Airway Maneuvers



## The Difficult Airway



## Airway Types/Difficulties

- Facemask
- Laryngoscopy – Direct/Video (Visibility)
- Supraglottic airway
- Tracheal intubation/extubation
- Invasive airway
- Inadequate Ventilation

## ASA Definition of the Difficult Airway

- **Difficult facemask ventilation**
  - Inadequate ventilation: seal, excessive gas leak, excessive resistance to ingress or egress of gas
- **Difficult laryngoscopy**
  - Impossible to visualize any portions of the vocal cords after multiple attempts at laryngoscopy (direct and/or video)
- **Difficult supraglottic airway ventilation**
  - Impossible to provide adequate ventilation: difficult placement, multiple attempts, inadequate airway seal excessive gas leak, excessive resistance to ingress or egress of gas

## ASA Definition cont.

- **Difficult/failed tracheal intubation**
  - Requires multiple attempts/fails
- **Difficult/failed tracheal extubation**
  - Loss of airway patency and adequate ventilation after removal of airway device in difficult airway
- **Difficult or failed invasive airway**
  - Anatomic features/abnormalities prevent placement of airway into trachea through front of neck
- **Inadequate ventilation**
  - Absent/inadequate exhaled CO<sub>2</sub>, chest movement, breath sounds, auscultatory signs of obstruction, cyanosis, gastric air entry, decrease O<sub>2</sub> saturation, hemodynamic changes, mental status changes

## Causes of Difficulty

- Anatomical
  - Obesity
  - Short neck
  - Protruding teeth, long high arched palate
  - Receding mandible
  - Increased alveolar-mental distance

## Causes of Difficulty

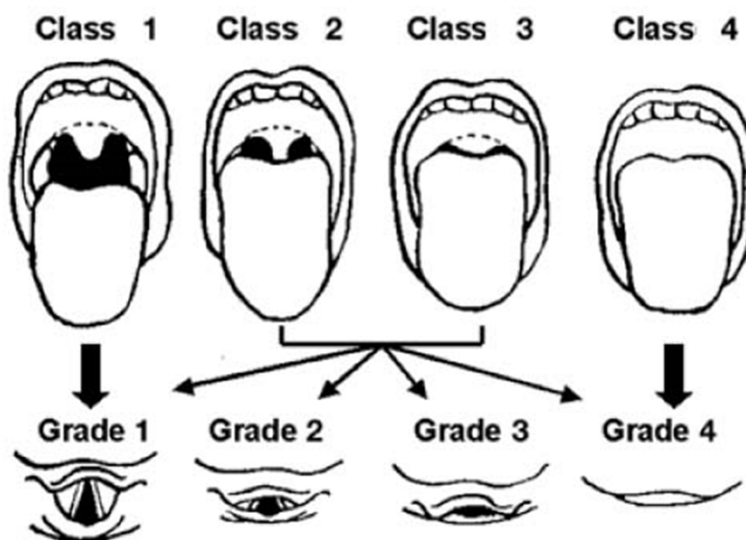
- Acquired
  - Acute neck swelling: trauma, infection, post-operative bleeding
  - Restricted jaw opening: Trismus, fibrosis, rheumatoid arthritis, mandibular fracture, post-surgical changes
  - Restricted neck movement: osteoarthritis, scarring, C-spine tumor, ankylosing spondylitis

## Predicting Difficult Bag & Mask Ventilation

- **B** - beard
- **O** - obese (BMI > 30)?
- **N** - no teeth
- **E** - elderly (> 55yo)?
- **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**

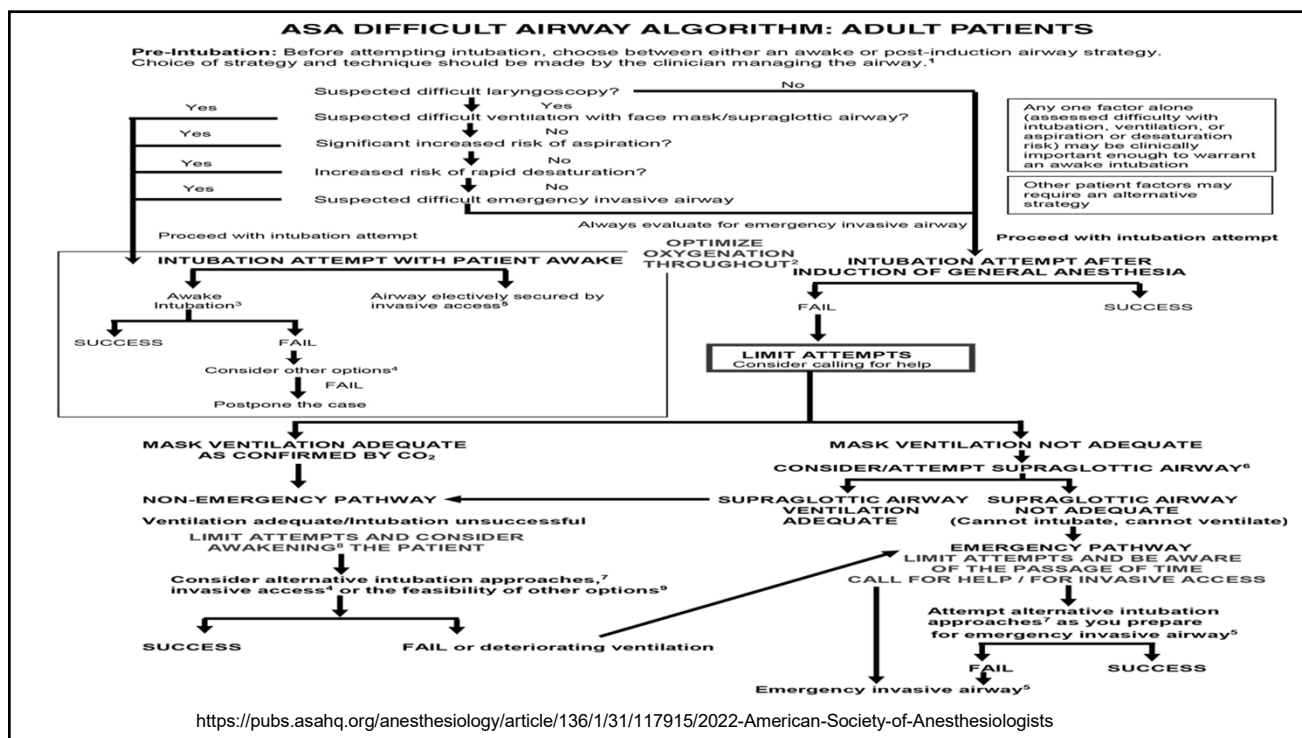
- 3 finger mouth opening
- 3 fingers mentum to hyoid distance
- 2 fingers hyoid to thyroid

## **Managing Difficult Airway**

- Review medical record, history
- Assess
  - Protruding incisors
  - Nares
  - Mallampati score
  - Protruding mandible
  - Thyromental distance, submental space
  - Neck size/circumference and mobility
  - Body habitus

# Managing Difficult Airway

- Preparation
  - Airway Devices
  - Airway Adjuncts
  - Preoxygenation
  - Positioning
  - Medications
  - Personnel





## Pharmacology of Sedatives & Reversal Agents

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### Medications for Procedural Sedation

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

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

## Opioids

- Class II Scheduled Controlled Medications
- Mechanism of Action: Mu Opioid Receptor Antagonists
- Side Effects:
  - Respiratory Depression
  - Hypotension
  - Nausea/vomiting
  - Decreased Gastrointestinal Motility
  - Miosis
  - Hepatic metabolism

## Opioids

	<b>Fentanyl</b>	<b>Meperidine</b>	<b>Morphine</b>	<b>Hydromorphone</b>
IV Onset (minutes)	Immediate	5 minutes	2-5 minutes	2-5 minutes
Duration of Action	30-60 minutes	2-4 hours	<b>2-4 hours</b>	<b>4-5 hours</b>
Active Metabolite	No	Yes	Yes	No
Equianalgesic Dose	100mcg	75-100mcg	10mg	1.5mg
Opioid Class	Phenylpiperidine	Phenylpiperidine	Phenanthrene	Phenanthrene



## **Fentanyl**

- **Preferred** OSUWMC opioid for procedural sedation
- Dosing: 25-50mcg IVP over 2 minutes every 2-3 minutes
- No histamine release
- Black Box Warning with CYP3A4 Agents
- Precautions
  - Skeletal muscle and chest wall rigidity from rapid administration
  - Bradycardia
    - Responds to ephedrine or anticholinergics

## **Meperidine**

- Historically, the opioid of choice for procedural sedation
- No longer first line agent at OSUWMC due to unfavorable pharmacokinetics compared to fentanyl
- Undesirable side effects related to active metabolite
  - Seizures

## Opioid Reversal

- Naloxone: Opioid Antagonist
- Reverses opioid related respiratory depression, sedation, pruritus
- May precipitate withdrawal
- Onset after IVP administration ~2 min
- For overtreatment of pain with therapeutic doses of opioids:
  - If present with RR < 7 AND difficult to arouse:
    - 0.1 mg IVP every 2 minutes until improvement
  - If present with Apnea AND difficult to arouse:
    - 0.4 mg IVP every 2 minutes until RR > 8/min

## Benzodiazepines

- Class IV Scheduled Controlled Medication
- Mechanism of Action:
  - Binds GABA<sub>A</sub> receptor
  - Enhances GABA activity
- Side effects:
  - Hypotension
  - Respiratory Depression

## Midazolam

- Preferred OSUWMC benzodiazepine for procedural sedation
- Dosing: 0.5-2 mg IVP over 2 minutes
- Onset of Action: 2-3 minutes
- Half-life: “Short acting”: 2-5 hours
- Hepatic metabolism
- Drug-Drug interactions
  - CYP3A4 Substrate; CYP 3A4 inhibitors prolong duration

## Midazolam

- Prolonged elimination half-life:
  - Elderly
  - Obesity
  - Congestive Heart Failure
  - Hepatic Impairment
  - Renal Impairment

## Lorazepam

- Dosing: 0.5-2 mg IVP over 2 minutes
  - Doses vary based upon patient characteristics
- Onset of Action: 10-30minutes
- Half-Life: “Intermediate-acting”:10 hours
- Renal excretion

## Diazepam

- Dosing: 2mg IVP
  - Doses vary based upon patient characteristics including obesity & age
- Onset of Action: IV: 5-10 minutes
- Elimination Half-Life: “Long-acting”: 24-48 hours
- Renal excretion & active metabolite

## Remimazolam

- New to market in 2020 with indication for induction and maintenance of procedural sedation in adults undergoing procedures 30 minutes or less
- Onset: Immediate
- Elimination half-life: 30-60min
- Time to full alertness: 11 to 14 minutes after last dose

## Benzodiazepine Reversal

- GABA<sub>A</sub> receptor Antagonist: Flumazenil
- Onset: 1 - 2 minutes
- Duration: 45 - 60 min
- Immediate reversal: 0.2 - 0.3 mg IV; May be repeated every minute for up to 4 additional dose(max: 1 mg total)
  - If re-sedation occurs: 1 mg every 20 min as needed(max: 3 mg/hr total)

## Etomidate

- **\*\*Physician must be at bedside for use\*\***
- Non-barbiturate benzylimidazole hypnotic
- Mechanism of Action: Binds GABA<sub>A</sub> receptor and enhances GABA activity
- Onset: 30-60 seconds; Duration: 3-5 minutes
- Side effects:
  - BP and HR neutral
  - Myoclonus
  - Respiratory depression
  - Decrease in cortisol levels for 4-8 hours
- Dosing:
  - Induction: 0.1 - 0.2 mg/kg IVP over 30- 60 seconds
  - Maintenance: 0.05 mg/kg IV every 3-5 minutes

## Propofol

- Mechanism of Action
  - Positive modulation on inhibitory effects of GABA-A receptor
- Lipid Emulsion
  - Onset~ 30 seconds, Short half life- 2-8 minutes
- Side effects:
  - Respiratory depression: **MUST** be able to manage airway
  - Cardiovascular depressant!
    - Hypotension & bradycardia

## Propofol

- Patient can transition in unpredictable fashion to deeper level of sedation
- OSUWMC physician MUST be credentialed for Deep Sedation
  - CANNOT be administered by nurses for Procedural Sedation
- Dosing:
  - IVP 0.5-1 mg/kg over 2-3 minutes once, then 0.5mg/kg every 3 - 5 minutes prn

## Ketamine

- Mechanism of action: Inhibition of N-methyl-D-aspartate (NMDA) receptors
- Anesthetic & analgesic properties
- Onset: ~ 1 minute; Duration: 5-10 minutes
- Dosing: 0.5-1 mg/kg IVP over at least 60 seconds

## **Ketamine**

- . Side effects:
  - . Hallucinations
  - . Emergence reactions (12%)
  - . Hypertension- sympathomimetic
  - . Respiratory depression (much less than others)
  - . Increase in intracranial pressure
  - . Hypersalivation
  - . Nystagmus

## **Ketamine**

- Emergence Reactions (12-15%)
  - Severity varies
  - Less common in children & elderly
  - Less frequent with intramuscular administration
  - Minimize verbal, tactile, visual stimulation during recovery
  - Pretreatment with benzodiazepine may help lessen or prevent



## **Methohexital**

- Class IV Controlled Barbiturate
- Provides amnestic, sedative & anxiolytic properties
- Mechanism of Action: GABA agonist & glutamate antagonist
- Ultra short-acting duration 3-8 minutes
- Onset: 2-45 seconds
- Dosing: 0.5-1mg/kg IVP
- Side Effects:
  - Respiratory depression & hypotension

## **Dexmedetomidine**

- Mechanism of Action: Alpha-2 adrenergic agonist
- Not approved for Procedural Sedation in non-mechanically ventilated patients unless managed by Anesthesiologist
- Dosing: 0.5 to 1 mcg/kg IVP over 10 minutes
- Side Effects:
  - Hypotension
  - Bradycardia
  - Respiratory depression

## Procedural Sedation Dosing

- Combination agents have additive benefits & risks
- No set doses!
- Consider patient factors:
  - Age (especially age  $\geq 65$ )
  - Weight
  - Past Medical History
  - Current organ function
  - Medication History
  - Sedative requirements during past procedures
  - Goal depth of sedation

## Procedural Sedation Dosing

- Titrate to effect:
  - Small incremental doses
  - Efficient time must lapse between doses to evaluate effect of previous dose
  - Allow more time between doses for non-intravenous routes

## **Policy: Medication Administration & Documentation**

- Sterile technique when preparing
- Proper labeling:
  - Immediate administration: No label required
    - Verbal verification of medication & concentration by person preparing & person administering
  - Not immediate administration: Label required
    - Medication name & concentration
    - Expiration date & time