



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

	Minimal Sedation Anxiolysis	Moderate Sedation/ Analgesia (“Conscious Sedation”)	Deep Sedation/ Analgesia	General Anesthesia
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

ASA I	A normal healthy patient	Healthy, non-smoking, no or minimal alcohol use	ASA IV	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
ASA II	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	ASA V	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
ASA III	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.	ASA VI	A declared brain-dead patient whose organs are being removed for donor purposes	

STOP-BANG (OSA)

- STOP
 - Snoring
 - Tired
 - Observed Apnea
 - Pressure/Hypertension
- BANG
 - BMI > 35 kg/m²
 - Age > 50 years
 - Neck Circumference > 40 cm
 - Gender – 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 CO₂, chest movement, breath sounds, auscultatory signs of obstruction, cyanosis, gastric air entry, decrease O₂ 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

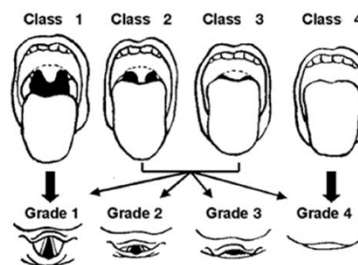
- Acquired
 - Acute neck swelling: trauma, infection, post-operative bleeding
 - Restricted jaw opening: Trismus, fibrosis, rheumatoid arthritis, mandibular fracture, post-surgical changes
 - Restricted neck movement: osteoarthritis, scarring, C-spine tumor, ankylosing spondylitis

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.
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Predicting Difficult Intubation 3 – 3 – 2 Rule

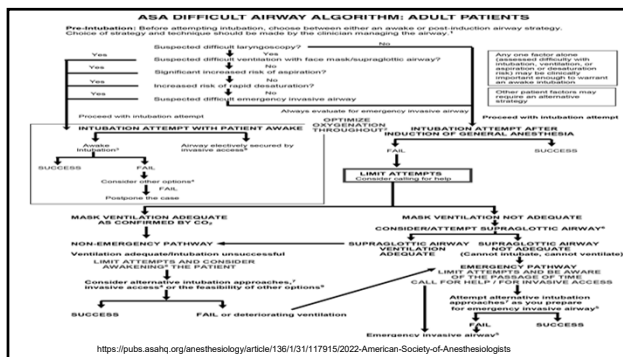
- 3 finger mouth opening
- 3 fingers mentum to hyoid distance
- 2 fingers hyoid to thyroid


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

	Fentanyl	Meperidine	Morphine	Hydromorphone
IV Onset (minutes)	Immediate	5 minutes	2-5 minutes	2-5 minutes
Duration of Action	30-60 minutes	2-4 hours	2-4 hours	4-5 hours
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_A 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_A 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_A 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