Procedural Sedation

University of Florida

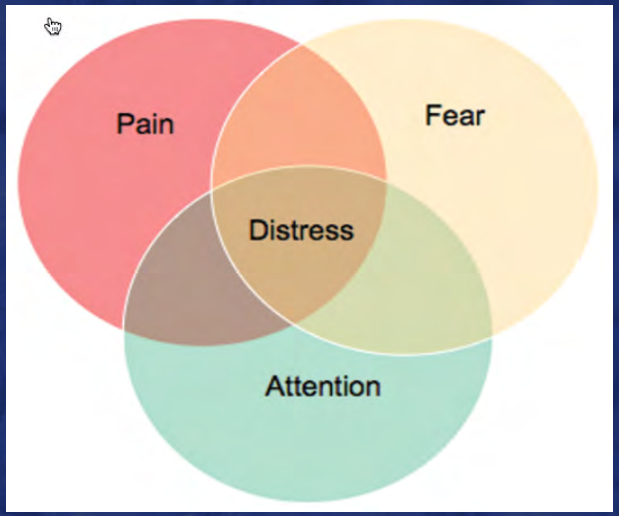
Anesthesiology & Critical Care Clerkship

Not Just Anesthesiology!

- Gastroenterology
- Radiology
- Cardiology
- ENT
- Gynecology
- Psychiatry
- Emergency Medicine
- Pulmonology
- Critical Care
- OMFS
- Surgery
  - General
  - Orthopedics
  - Vascular
  - Plastic

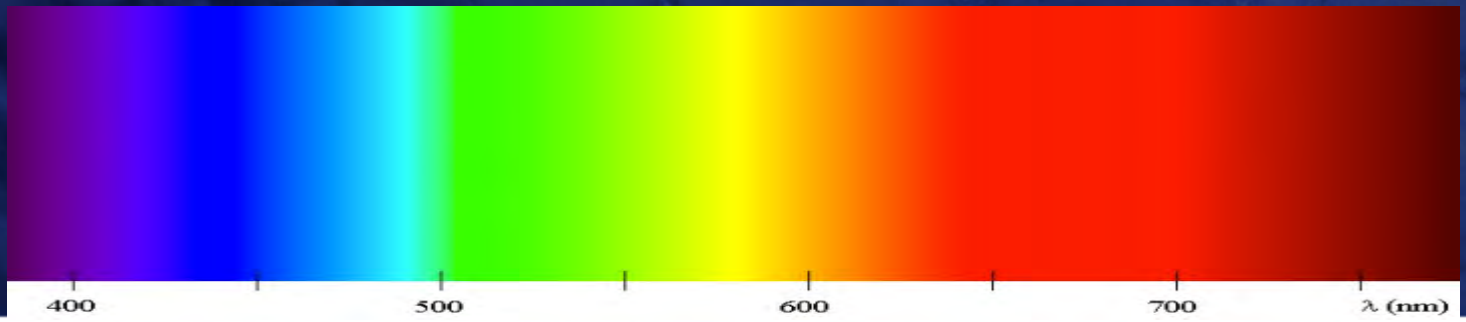
Sedation Goals?

- Patient safety
- Minimizing pain and anxiety associated with procedure
- Minimizing patient motion during the procedure
- Maximizing the success of a procedure
- Recovery to presedation state as quickly as possible



Sedation is a Continuum

- Anxiolysis
- Moderate Sedation (conscious sedation)
- Deep Sedation
- General Anesthesia



Anxiolysis

- Patients respond normally to verbal commands
- Mild cognitive impairment
- No cardiopulmonary affects

Moderate Sedation

- "Conscious Sedation"
- Patients respond to ***verbal*** or light ***tactile*** simulation
- Airway and ventilation remain competent
- Cardiovascular ***usually*** unaffected

Deep Sedation

- Patients respond to ***repeated*** or ***painful*** stimulation
- Airway and ventilation *often* require intervention
- Cardiovascular system ***usually*** unaffected

General Anesthesia

- Patients ***not arousable*** to painful stimulation
- Airway and ventilation ***often*** require intervention
- Cardiovascular system ***often*** impaired
- Often does not require intubation

Sedation Spectrum

	Minimal sedation	Moderate sedation/ analgesia	Deep sedation/ analgesia	General anesthesia
				
Response	Responds normally to verbal commands	Responds purposefully to verbal commands/or light touch	Responds to pain	No response
Airway	Maintained	Maintained	May require support	Requires support
CV support	Not needed	Not needed	May be needed	May be needed

Sedation Spectrum

Provider should anticipate inadvertent advancement or decline in sedation continuum:

- Sedation level is affected by the amount of stimulation from the procedure
- Decline in stimulation causes an increase in sedation independent of any additional sedative administration
- Therefore providers must be trained and capable of rescuing patients from the next level of sedation…

  …And return safely to planned level of sedation

Commonly Used Drugs

- Midazolam
- Fentanyl
- Morphine
- Dilaudid
- Ketamine
- Propofol
- Dexmedetomidine

2 Key Concepts

- Safe & Successful:

1. Titration

2. Synergism

Titration

- Definition: the process of gradually adjusting the dose of a medication until *optimal results* are reached.
- Optimal results? safe, comfortable, immobile,…
- Sufficient time must elapse between doses of concomitant sedative medications to allow the effect of each dose to peak and be assessed before subsequent drug administration.

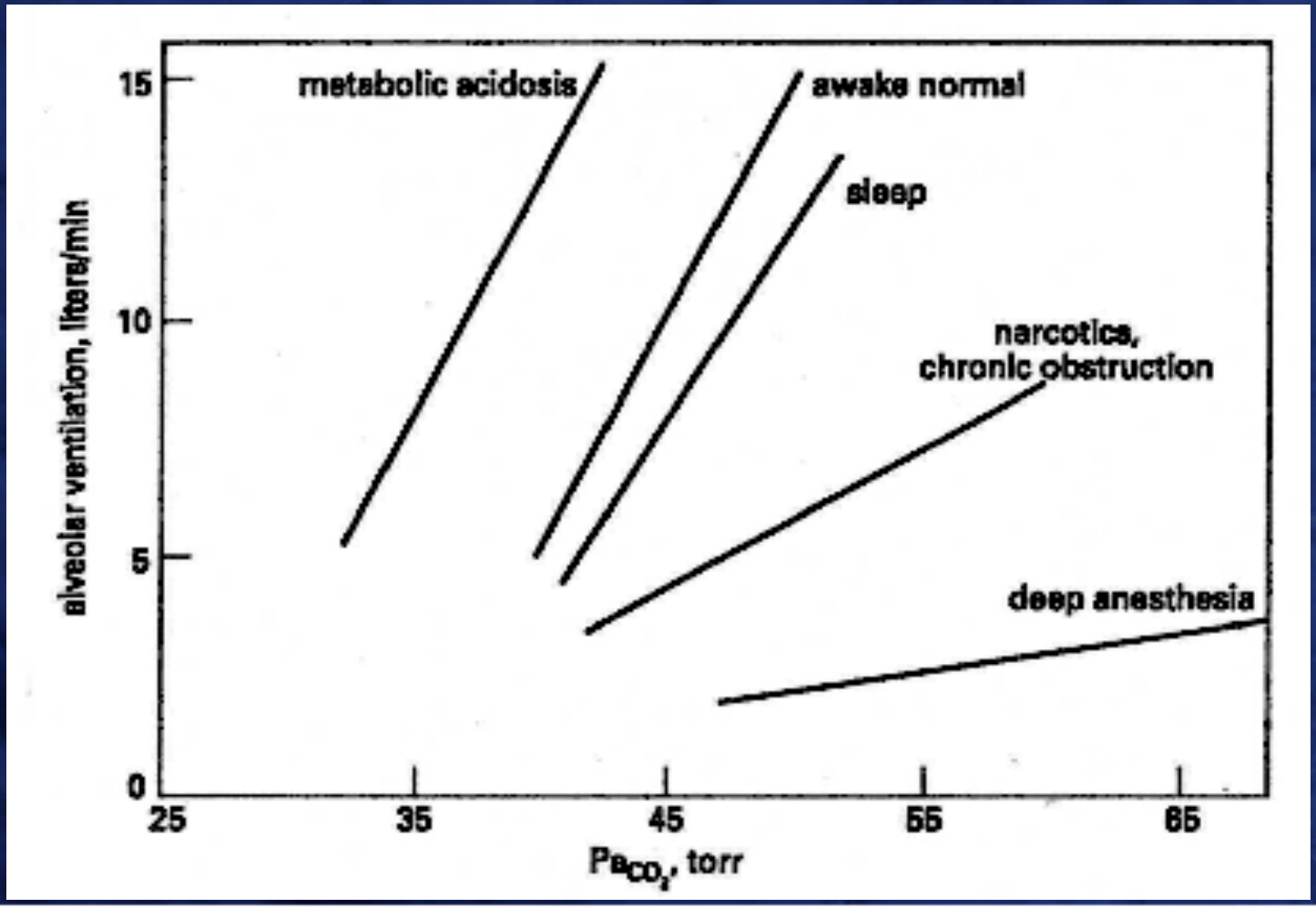
Synergism

- Definition: drugs that work together so that the *total effect* is greater then the sum of the parts.
- Administration of drug A can reduce the amount of drug B in a different class that is needed to achieve the desired sedation.
- Drug synergism increases the likelihood of adverse events and side effects.
- Opioids, midazolam, propofol have prominent synergistic effects

Hypercapnic Respiratory Drive

- $PaCO_2$ activates central chemoreceptors to stimulate respiration (primary respiratory drive)
- Opioids and BZDs significantly decrease the chemoreceptor sensitivity to $PaCO_2$
- $PaCO_2$ increases during sedation
- CO_2 can become a sedative: ***CO_2 narcosis***

Hypercapnic Respiratory Drive



Hypoxic Respiratory Drive

- Body can use O2 peripheral chemoreceptors instead of CO2 receptors to regulate respiration.
- Increases as the PaO_2 goes below 70mmHg
- Often leads to unconsciousness prior to stimulation to breathe
- Sedatives blunt the hypoxic drive
- Likely to experience respiratory arrest prior to stimulating respiration

Reversal Drugs

- Opioids = naloxone aka Narcan
- Benzodiazapines = flumazenil aka Romazicon
- Acute complete reversal of opioid-induced analgesia can result in pain, hypertension, tachycardia or pulmonary edema.
- Acute reversal of BZDs can cause seizures
- Ketamine, precedex, propofol = NO reversal available

High Risk Patients

- Geriatrics
- Pediatrics
- Obese
- Pregnant
- COPD
- CAD
- Drug addiction
- Anomalous Airway
- Liver Disease
- Renal Disease
- Sleep Apnea

Monitoring needs

- Pulse oximetry
- Blood pressure
- Heart Rate (ECG)
- Respiratory monitoring device
- Capnometry

Pulse Oximetry

- Variably delay on Monitor reading vs. Patient
  - Depends on provider setting and probe location
  - 15s, 30s, 60s
- Measurement can be problematic with supplemental Oxygen
  - Saturation may be acceptable 90-100%
    - But hides significant (A-a) gradient if high FiO2
    - But hides high CO2
  - Hypercapnia can create Narcosis

Supplemental oxygen

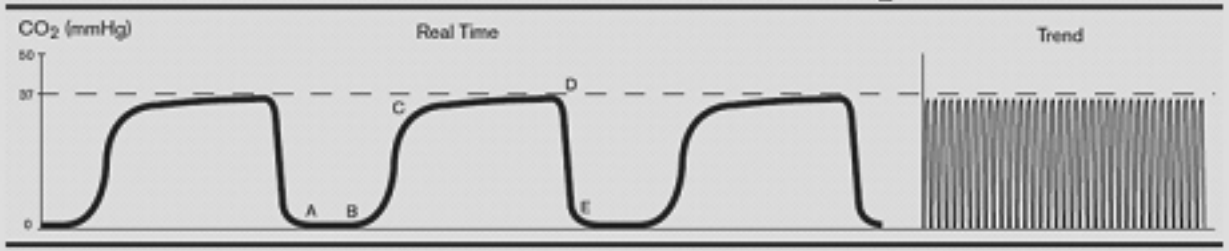
- Alveolar Gas Equation
  - PAO2 = FiO2 (Patm – PH20) – PaCO2/ RQ
  - PAO2 = Gas In – Gas Out
- Compounding problem
  - Sedation dulls CO2 Respiratory drive
  - CO2 builds up in Lungs
  - CO2 limits amount of oxygen gas delivered to patient
  - High FiO2 prevents Hypoxic respiratory drive
  - CO2 narcosis readily ensues

Capnography

- Measures and displays the partial pressure of CO2 in respiratory gases
- Attached to Nasal Cannula (Non-invasive)
- ASA STANDARD of CARE:
  - “During moderate or deep sedation the adequacy of ventilation shall be evaluated by continual observation of qualitative clinical signs and monitoring for the presence of exhaled carbon dioxide unless precluded or invalidated by the nature of the patient, procedure, or equipment."

Capnography

Normal Capnogram — Normal $EtCO_2$: 35 – 45 mmHg



The "normal" capnogram is a waveform which represents the varying CO_2 level throughout the breath cycle.

Waveform Characteristics:

A-B	Baseline	D	End-Tidal Concentration
B-C	Expiratory Upstroke	D-E	Inspiration
C-D	Expiratory Plateau		

Capnography

- Unlike Pulse oximetry:
  - Reveals adequacy of Ventilation
  - < 5 sec delay in machine vs. patient
- Be wary… EtCO2 Value is the lowest value PaCO2 might be.
  - EtCO2 = End-tidal CO2
  - PaCO2 usually at least 5mmhg higher than EtCO2
  - Mixes with tracheal and environmental gas
  - Dilutes CO2 concentration
  - Need PaCO2 to obtain actual PaCO2 value

Monitoring Sedation

- 2 Scales most frequently used
- Ramsay & RASS Scales
- Must be continuously documented by monitoring health care worker
- UF Health uses RASS Scale

RASS Sedation Scale

Richmond Agitation and Sedation Scale (RASS)		
+4	Combative	violent, immediate danger to staff
+3	Very Agitated	Pulls or removes tube(s) or catheter(s); aggressive
+2	Agitated	Frequent non-purposeful movement, fights ventilator
+1	Restless	Anxious, apprehensive but movements not aggressive or vigorous
0	Alert & calm	
-1	Drowsy	Not fully alert, but has sustained awakening to *voice* (eye opening & contact ≥ 10 sec)
-2	Light sedation	Briefly awakens to *voice* (eye opening & contact < 10 sec)
-3	Moderate sedation	Movement or eye-opening to *voice* (but no eye contact)
-4	Deep sedation	No response to voice, but movement or eye opening to *physical* stimulation
-5	Unarousable	No response to *voice or physical* stimulation

Ramsey Sedation Scale

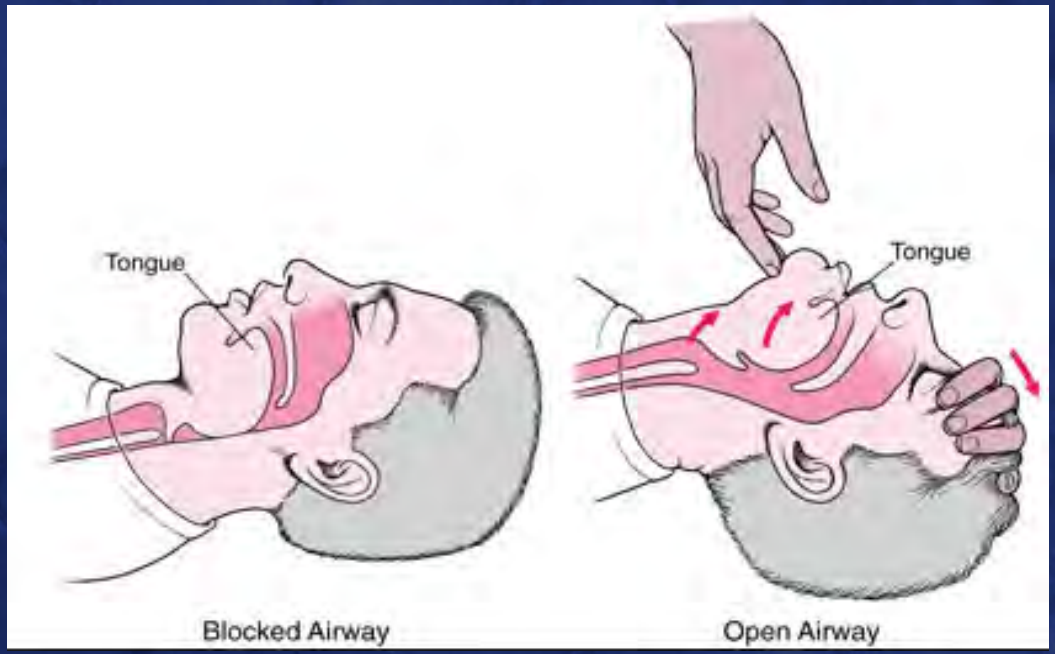
Ramsay Sedation Assessment Scale		
Awake Levels:	Patient anxious or agitated or both	1
	Patient cooperative, oriented and tranquil	2
	Patient responds to commands only	3
Asleep Levels:	A brisk response to a light glabellar tap	4
	A sluggish response to a light glabellar tap	5
	No response	6

Airway Obstruction

- Sedation relaxes airway muscles and can lead to airway obstruction
- High risk groups:
  - Obese
  - Sleep apnea
  - Large Necks
  - Large tongues
  - Large tonsils
  - Small Chin
  - Nasal obstruction
- Treatment:
  - Chin-lift
  - Jaw-Thrust
  - Oral airway
  - Nasal airway
  - Intubation

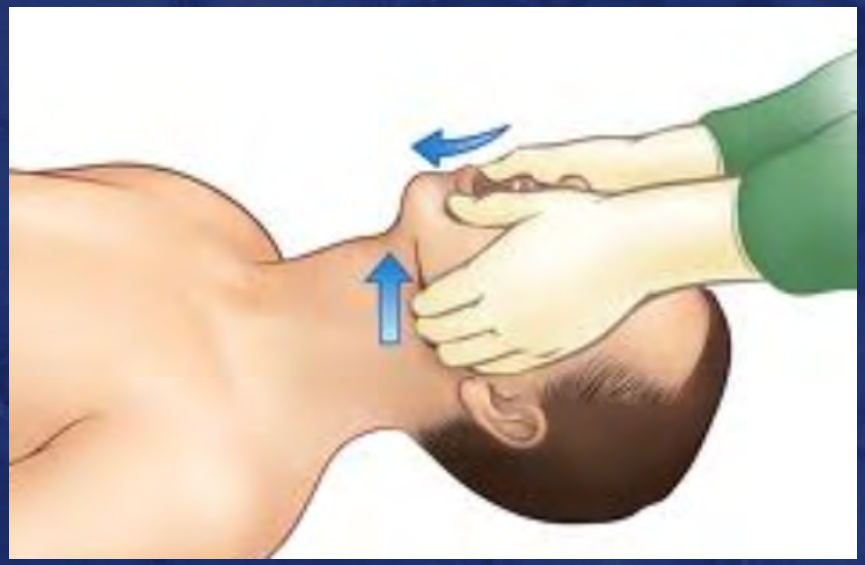
Chin-lift

- First maneuver to help airway obstruction
- Lifting the tongue from the back of the throat.

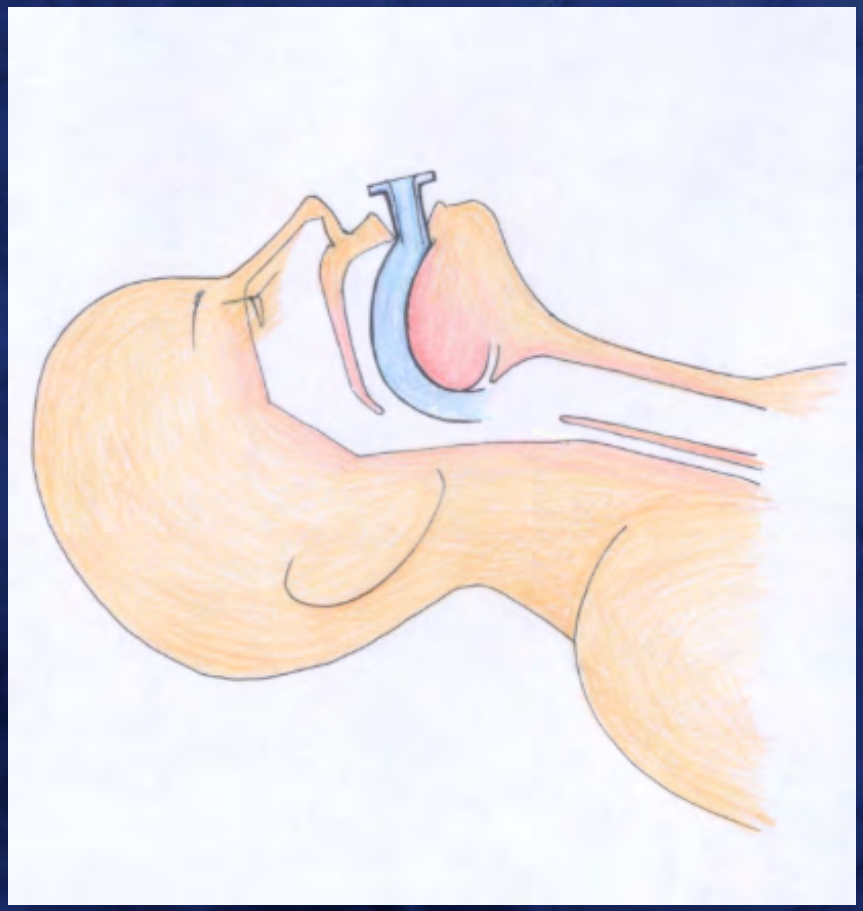


Jaw-Thrust

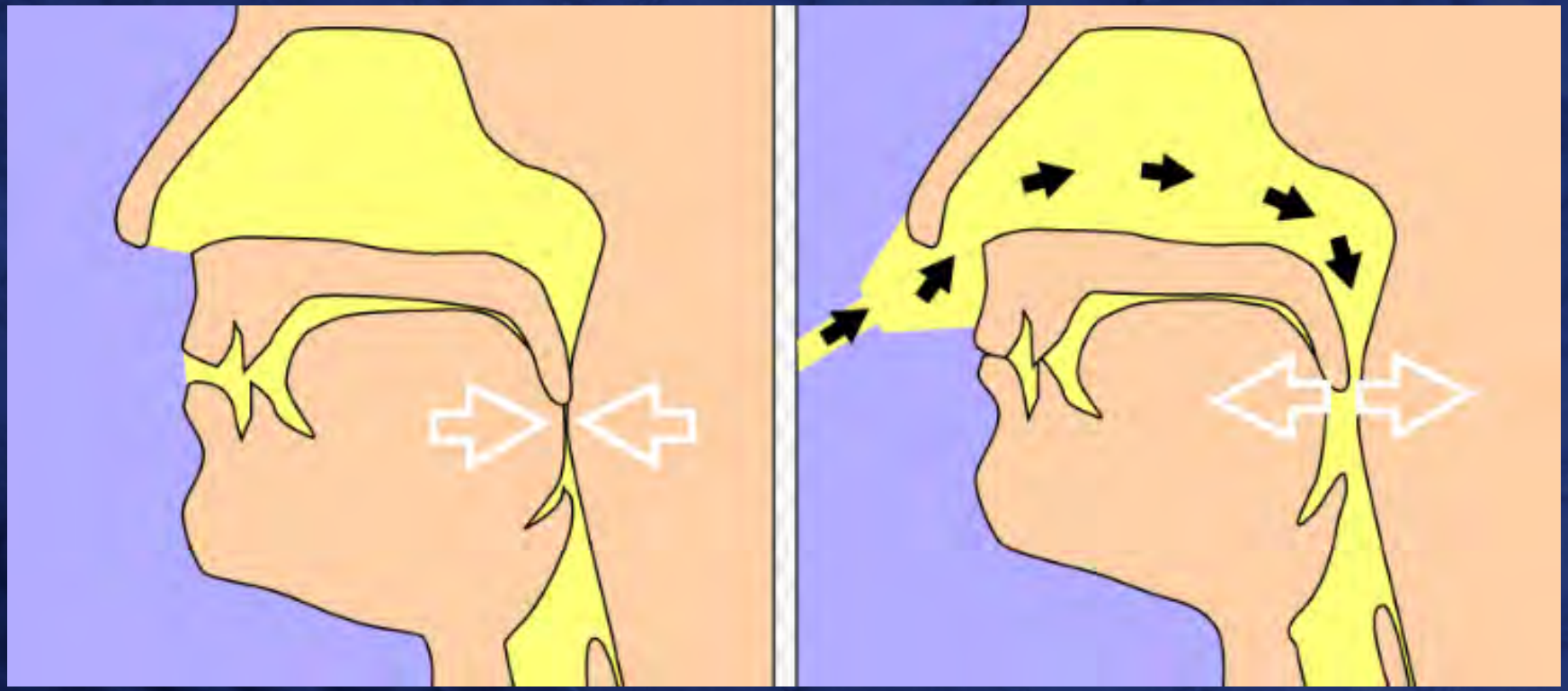
- Index and middle fingers pull the mandible upwards while their thumbs push down on the chin to open the mouth
- Particularly useful in the patient in whom cervical spine injury is a concern



Oral and Nasal Airway



CPAP



Procedural Sedation

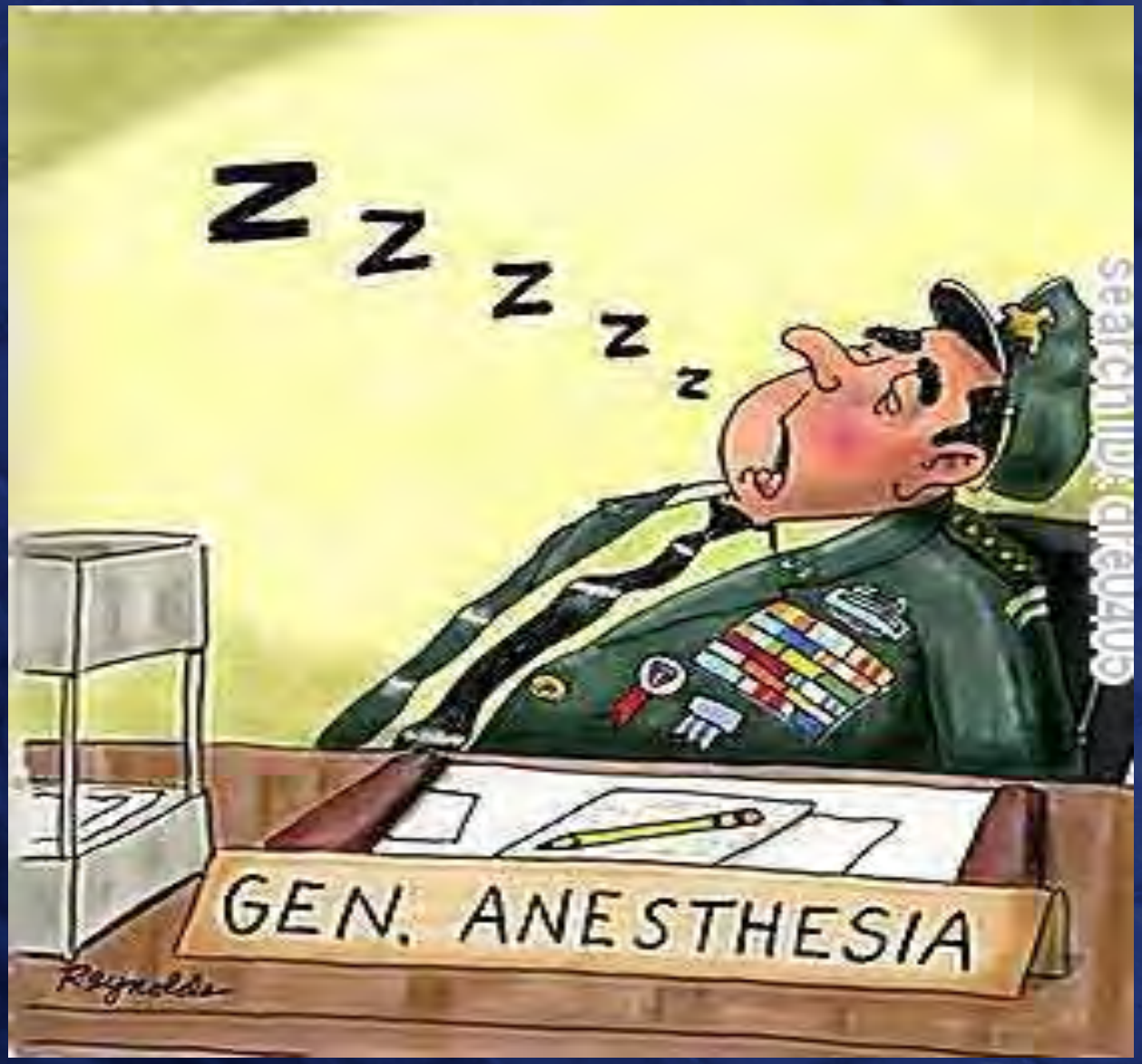
- Checklist prior to commencing sedation
- Many things to accomplish
- Next 2 slides show all prerequisites

Sedation Protocol I

- Credentialed for Procedure by Hospital
- Pre-procedure focused H&P
- Plan formulated / patient appropriate
- Capable of rescue from unanticipated Depth
- Risk / Benefits / Options / Consent

Sedation Protocol II

- Pre-procedure vitals & NPO verified
- No other uninterruptable tasks
- Record of vitals, drugs, oximetry
- Monitored recovery
- Discharge by protocol or provider
- Quality Assurance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