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OF Anesthesiology



New Jersey Dental Society of Anesthesiology
October 7th, 2026

Emergency Monitors and Armamentarium

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Financial Disclosures

I have no relationships to disclose.

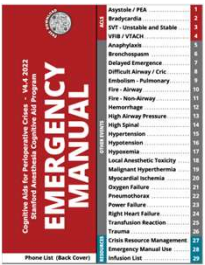
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Stanford Emergency Manual

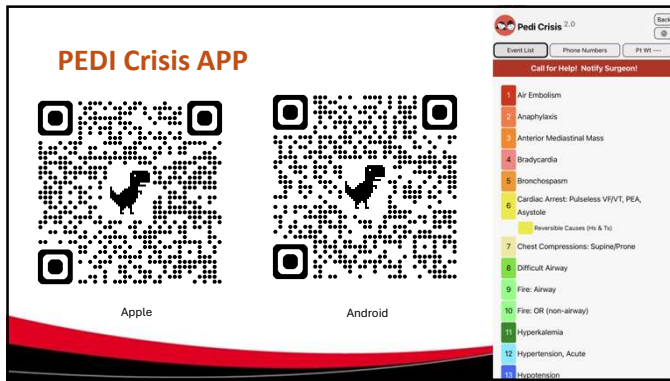


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What Equipment Do I Need?

ADA Guidelines

Minimal Sedation: A minimally depressed level of consciousness produced by a pharmacological method, that retains the patient's ability to independently and continuously maintain an airway and respond normally to tactile stimulation and verbal command. Although cognitive function and coordination may be modestly impaired, ventilatory and cardiovascular functions are unaffected

- **Positive pressure oxygen delivery system available** (i.e. bag valve mask)
- **Nitrous:** must have scavenging system and not allow for delivery of less than 30% oxygen
- **Consciousness:** level of sedation continually assessed (i.e. verbal commands)
- **Oxygenation:** Continuous pulse oximetry should be considered
- **Ventilation:** Visual monitoring of chest rise and respirations
- **Circulation:** Blood pressure and Heart Rate evaluated pre and post operatively, intraop prn



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What Equipment Do I Need?

ADA Guidelines

Moderate Sedation: A drug induced depression of consciousness during which 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

- **Positive pressure oxygen delivery system:** must be available(i.e. bag valve mask)
- **Inhalation Equipment:** must have scavenging system and not allow for delivery of less than 30% oxygen or in-line oxygen analyzer with audible alarm
- **End Tidal CO2 and auscultation of breath sounds:** must be available
- **Intravascular or Intraosseous equipment:** should be available
- **Consciousness:** level of sedation continually assessed (i.e. verbal commands)
- **Oxygenation:** Continuous pulse oximetry
- **Ventilation:** Visual monitoring of chest rise and respirations. Monitor ventilations with end-tidal CO2. Monitoring breath sounds with precordial or pre-tracheal stethoscope
- **Circulation:** Continuous ECG monitoring of patients should be considered if significant cardiovascular disease. Must continually evaluate blood pressure and heart rate



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What Equipment Do I Need?

ADA Guidelines

Deep Sedation: A drug induced depression of consciousness during which patients cannot be easily aroused but respond purposefully following repeated or painful stimulation. The 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.

- **Positive pressure oxygen delivery system:** must be available(i.e. bag valve mask)
- **Inhalation Equipment:** must have scavenging system and not allow for delivery of less than 30% oxygen or in-line oxygen analyzer with audible alarm
- **Equipment and drugs:** to provide advanced airway management and ACLS must be available
- **End Tidal CO2 and auscultation of breath sounds:** must be available
- **Intravascular or Intraosseous equipment:** must be available
- **Resuscitation and defibrillator:** must be available
- **Consciousness:** level of sedation continually assessed (i.e. verbal commands)
- **Oxygenation:** Continuous pulse oximetry
- **Ventilation:** Visual monitoring of chest rise and respirations. Monitor ventilations with continuous end-tidal CO2. Respiration rate continually monitored.
- **Circulation:** Continuous ECG monitoring of patients
- **Temperature:** device to measure temperature must be available



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Electrocardiogram (ECG)

What is an ECG?

- The heart works through contraction and relaxation to pump the blood
- Contraction and relaxation occurs due to depolarization and repolarization of myocardial cells
- ECG measures the electrical activity produced by the heart

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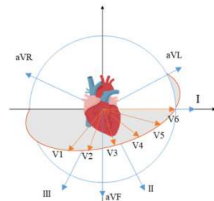


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Electrocardiogram (ECG)

What are Leads?

- Leads I, II, III, aVR, aVL and aVF are the limb leads, they view the heart in a vertical plane
- Leads V1, V2, V3, V4, V5, V6 are the chest leads, they view the heart in a horizontal plane



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Electrocardiogram (ECG)

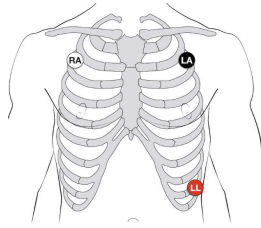
12-lead ECG	Monitor ECG	Place	12-lead ECG	Monitor ECG	Place
I			V1		
II			V2		
III			V3		
aVR			V4		
aVL			V5		
aVF			V6		

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Electrocardiogram (ECG)

3 Lead placement

- Black over Red (smoke over fire)



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ECG Wrist Clips

Disposable electrode pads

- Cost effective
- Permit setting ECG for augmented vector and V lead

Wrist Clips

- More artifact than electrode pads
- Lead I right and left wrist placement
- Lead II right wrist and left ankle
- Lead III left wrist and left ankle. Do not set monitor on Lead III as left wrist clip has both left leads in the clip.

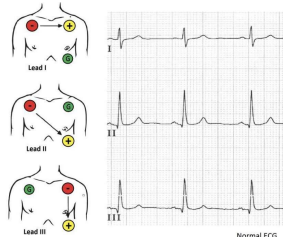


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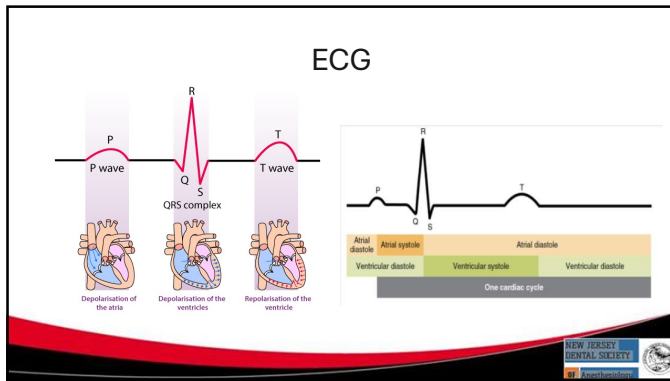
Electrocardiogram (ECG)

Most monitors are set up to Lead II for the display

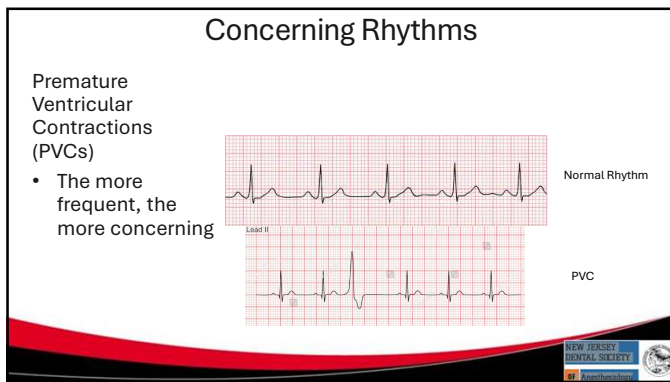
- Lead II looks at electrical impulse as it travels from right atria toward left ventricle
- Lead II looks at inferior heart, most common MI is inferior MI



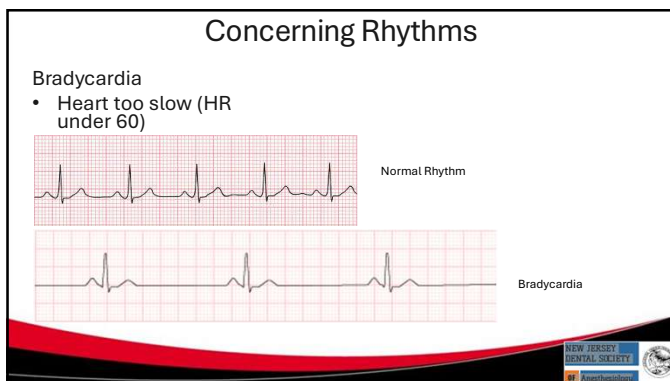
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Concerning Rhythms

Sinus Tachycardia

- Heart too fast (HR over 100)



Normal Rhythm



Tachycardia



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Concerning Rhythms

ST elevation

- Myocardial Infarction (Heart Attack)



Normal Rhythm



ST Elevation



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Concerning Rhythms

Supraventricular Tachycardia



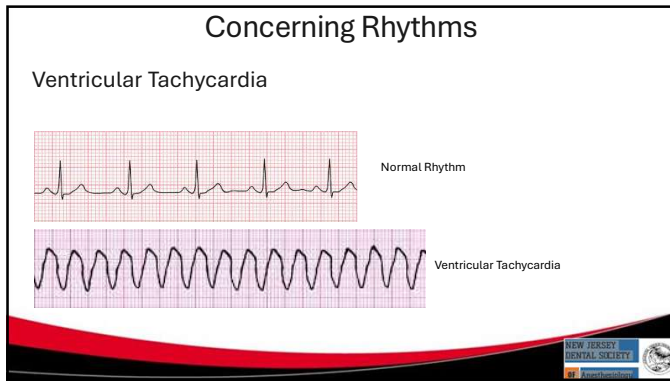
Normal Rhythm



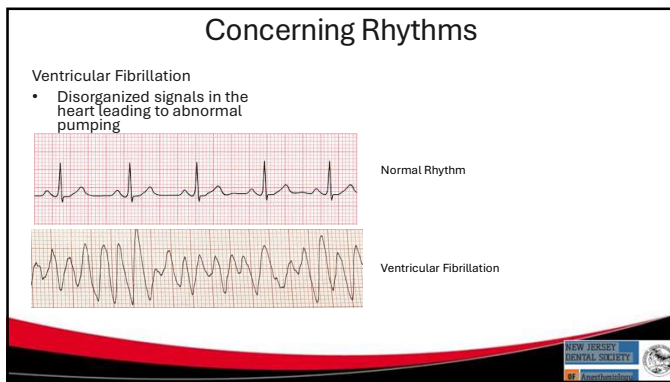
Supraventricular Tachycardia



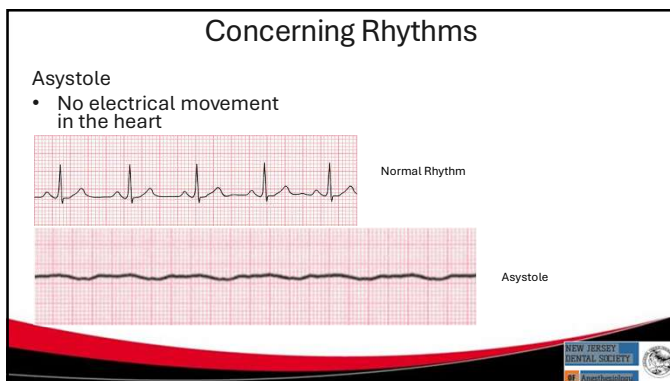
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Blood Pressure (Sphygmomanometer)

Definition: The force of blood pushing against the walls of your arteries

Sphygmomanometer (BP cuff)- measures systolic and diastolic pressures



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Blood Pressure Trouble Shooting

Proper Cuff size

- Cuff too small: pressure reads high
- Cuff too large: pressure reads low

Frequency of Measuring

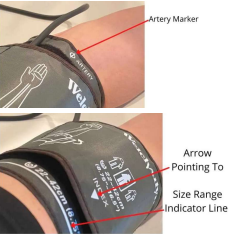
- Most offices use an automatic cuff during sedation. Check if the cuff is set to automatic or manual and the frequency it is checking BP

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Blood Pressure Trouble Shooting

Proper placement for arm cuff

- BP Cuff should fit below the armpit and above the elbow crease
- Artery marker should be lined up with Brachial artery
- Cuff should be snug but should still be able to fit 2 fingers between cuff and the arm when deflated
- Index arrow has to be within size range indicator line
- Cuff should be placed at heart level



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Pulse Oximetry

What does it do?

- Shows peripheral oxygen saturation

Why does this matter?

- Gives an idea of the oxygen available for vital organs

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Pulse Oximetry

How Does it work?

- Two main parts, pair of light emitting diodes (LEDs) and a processor
- Red LED has wavelength of 660nm
- Infrared LED has wavelength of 940nm
- LEDs shine through translucent portion of the body, i.e. fingertip or earlobe and processor detects absorption of light
- Light absorbed is different between oxygenated hemoglobin and deoxygenated hemoglobin



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Pulse Oximetry

How Does it work?

- The differential of infrared to red absorption determines the amount of oxygenated or deoxygenated hemoglobin
- Deoxygenated hemoglobin absorbs more red light resulting in more infrared light passing through and being detected on the processor
- Oxygenated Hemoglobin absorbs more infrared light allowing more red light to pass through with greater detection on the processor



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Pulse Oximetry

Plethysmograph

- Hemoglobin is in the blood, as it passes through the body it does so in pulsatile fashion in the arteries. Plethysmograph measures the volumetric changes with arterial blood flow

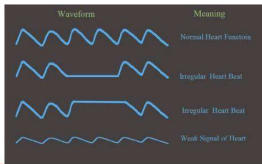


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Plethysmograph Tracing

What is meant by a good or bad tracing?

- A consistent wave form increases the likelihood of an accurate reading



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Pulse Oximeter

- If pulse oximeter is working and plethysmograph waveform is present, the systolic blood pressure is above 80 mmHg in the adult patient
- If a waveform is present, chest compressions are not required on the unresponsive, apneic patient
- If no waveform and unresponsive patient check carotid pulse. Carotid pulse indicates BP over 60 mmHg



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Pulse Oximetry

Reasons for poor or no waveform

- Cold hands
- Acrylic nails/nail polish
- Probe fell off
- Inadequate circulation of blood



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Pulse Oximetry

Solutions in a stable patient:

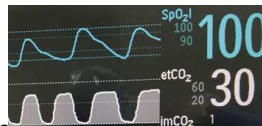
- Warm the hands
- Remove acrylic nail/nail polish
- Try a second location (ear lobe)
- Place an alcohol packet over the pulse oximeter



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Pulse Oximetry

- Pulse oximeter information is 30 seconds old.
- This a result of the delay from oxygen in the lungs reaching the fingertips
- Check capnography waveform to ensure the patient is breathing



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Pulse Oximetry

- Avoid placing BP cuff on the same arm as pulse oximeter. Every time the cuff cycles, the pulse oximeter will alarm due to stopping circulation in the hand.

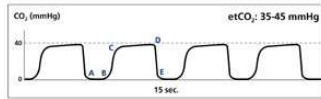


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Capnography

Definition: The measurement of carbon dioxide in a patient's exhaled breath

- Is a form of ventilation monitoring



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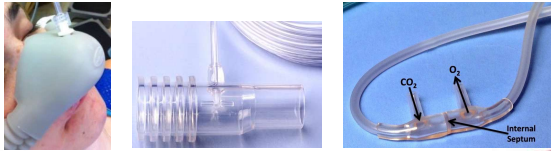


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Capnography

How is it measured?

- CO₂ sampling line depends on sedation set up



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CO₂ Sampling

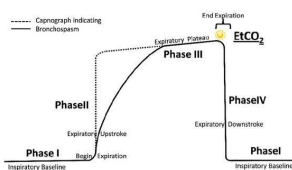
- Make sure as you switch between oxygen delivery devices you have the ability to continue to monitor CO₂



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Capnography

What does the waveform mean?

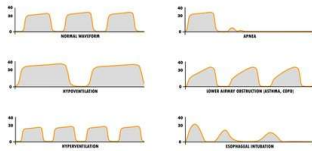


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Capnography

What can we tell from the waveform?

CAPNOGRAPHY WAVEFORM

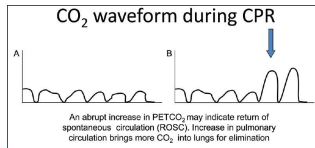


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Capnography

What else can we tell from the waveform?

- Good compressions during CPR will result in $\text{CO}_2 > 10 \text{ mmHg}$



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Airway Equipment

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Precordial Stethoscope

- Monitors respiratory rate and breath sound changes
- Manual or amplified electronics
- May provide an earlier indication of respiratory issue



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Oral Airways

- Aid in opening the airway
- Decrease airway obstruction
- Difficult to operate around

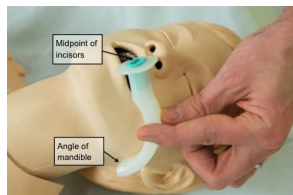


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Oral Airways

Measuring Correct Size

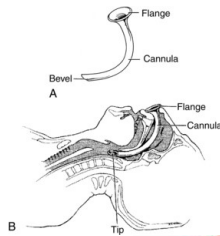
- Quick and easy method is from the angle to lips/incisors



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Nasopharyngeal Airways

- Aid in opening the airway
- Decrease airway obstruction
- Allows for continued, unobstructed operating in the oral cavity

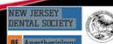


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Nasopharyngeal Airways

Measuring Correct Size

- Quick and easy method is from the earlobe to the nose



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Nasopharyngeal Airways

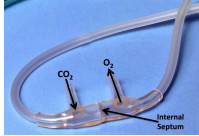
Newer models allow for CO₂ sampling and O₂ administration



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Nasal Canula

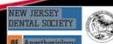
- Max Flow Rates: limited to 5-6 L/min
- Allows for CO₂ monitoring
- Less bulky to work around



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Nasal Hood

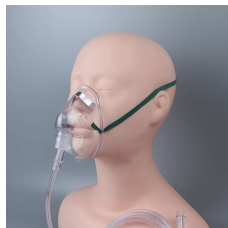
- Max Flow Rates: Similar to nasal cannula, limited to 5-6 L/min
- Allows for CO₂ monitoring
- A little bulkier but allows for Nitrous delivery



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Simple Facemask

- Flow Rates: 6-10 L/min



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Non-Rebreather

- Flow Rates: 10-15 L/min
- Increased oxygen concentration by not allowing for rebreathing of CO₂



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OXYGEN THERAPY

There are many different oxygen delivery devices which offer different flow and concentration (FIO₂), and should be titrated as ordered.

	FLOW L/min	FIO ₂ %
NASAL CANNULA	2-6	25-40
SIMPLE FACE MASK	6-10	35-50
VENTURA MASK	3-10	24-60
NON REBREATHER	10-15	80-90
HIGH-FLOW NASAL CANNULA	30-60	100

This is not a complete list but these are the most frequently used. Oxygen can also be utilized with CPAP or BiPAP machines to improve not only oxygenation but also ventilation.

HealthandWillness.org



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Bag valve mask

- Flow rate run at 15L/min



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NOT ALL BAGS ARE CREATED EQUAL

- Some Bag valve masks allow for continuous delivery of oxygen even when the bag is not squeezed, others do not
- Some Bags have pressure pop off valves



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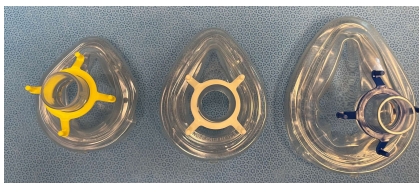
“Improved” Resuscitation Bag

- Ambu improved bag allows for oxygen to be continuously delivered on the spontaneously ventilating patient, not just with assisted and controlled ventilation.
- Override (pop off) valve has 2 settings, open or closed. Open avoids excessive pressure during mask ventilation preventing inflation of the stomach
- Ambu ships bags with the Override open. CPR has been compromised if the Code Teams were not familiar with the override valve
- verify you have closed the Override when checking equipment to avoid this disaster.



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Make sure to have size appropriate masks



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Metered Dose Inhaler Adapter

- Ensure you have the ability to deliver albuterol via BVM
- Make sure your adapter works with the MDI in your emergency cart



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Advanced Airways

- Recommend early placement of advanced airway in unresponsive, apneic patients
- **Permits Continuous CPR:** Advanced airways allow for continuous compressions and ventilations allowing for no drop in coronary or cerebral perfusion pressures. Chest compressions are increased from 150 to 200 compressions per each two minute interval.

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LMA Advanced Airway

- Simple rapid insertion: blind insertion, takes the same time to place as oropharyngeal airway
- Unlike the mask, LMA permits > 20cm of pressure for patients with bronchospasm, emphysema, and/or obesity
- Venting models allow for releasing gastric pressure due to over zealous mask ventilation thus preventing emesis and aspiration

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Different types of LMAs

- Flexible LMA
- Traditional LMA
- I-gel
- LMA Supreme



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i-gel LMA vs. Classic LMA

- Both seal over the glottis permitting the ability to increase pressure >20cm



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Advantages of the LMA i-gel

- Immediate advanced airway for ventilation inserted as rapidly as supraglottic airway
- No cuff to inflate
- Built in bite block preventing airway collapse
- Vents gastric pressure avoiding aspiration
- Buys time while intubation considered

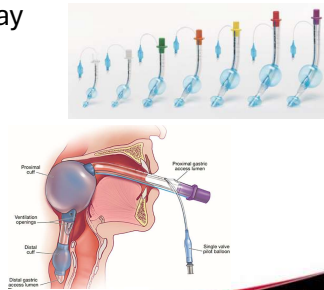
Size 4 adult on UCMC Crash Carts



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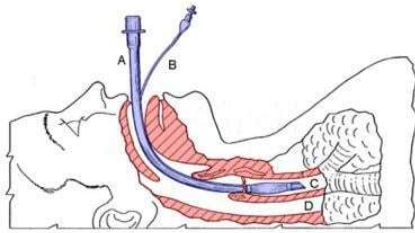
King Supraglottic Airway

- Tube passes into the esophagus with lower balloon blocking it off
- Ventilatory opening between the two cuffs
- Proximal balloon seals off the upper airway



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Endotracheal Tubes

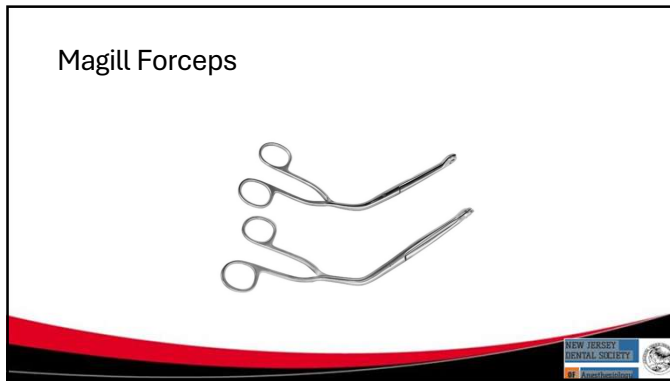


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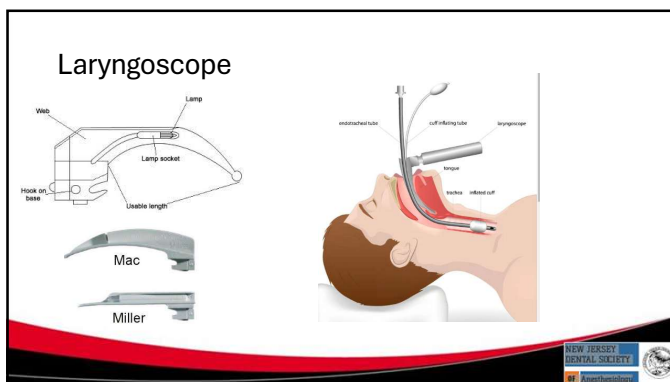
Endotracheal Tubes



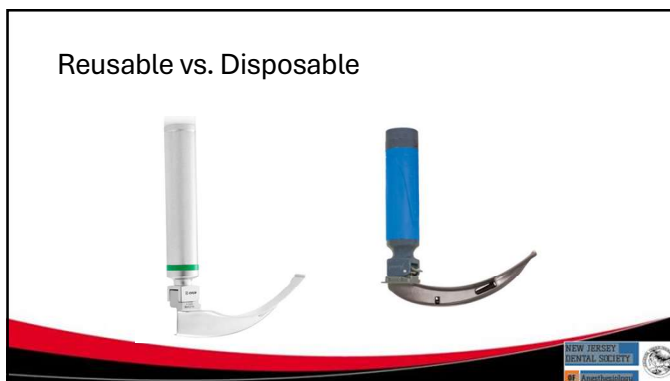
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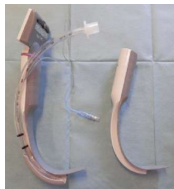
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Video Laryngoscopes



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King Vision



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Glidescope GO2 Portable



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McGrath



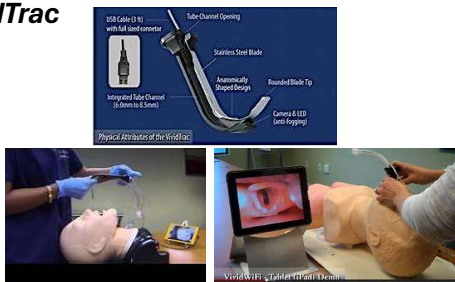
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Airtaq



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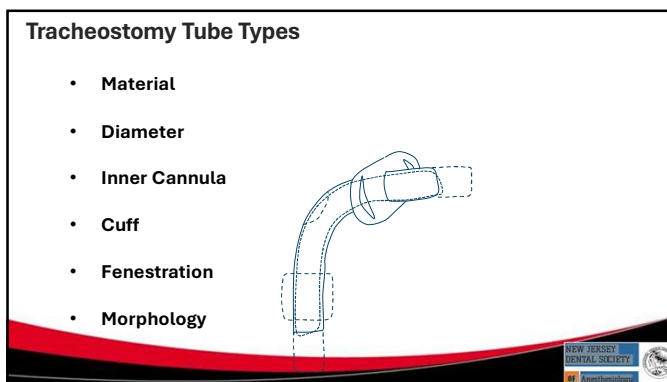
VividTrac



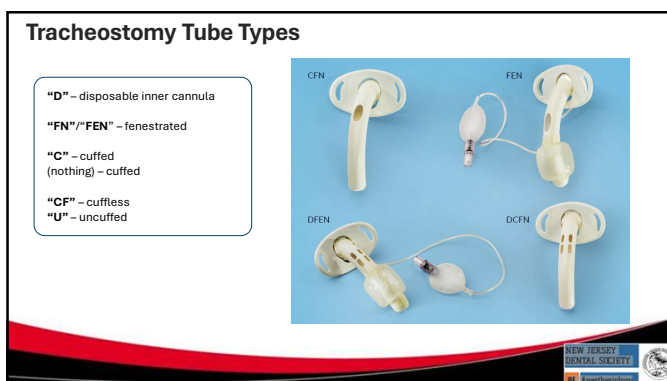
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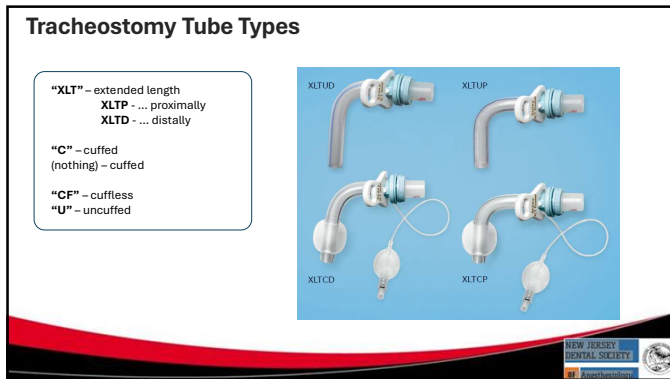
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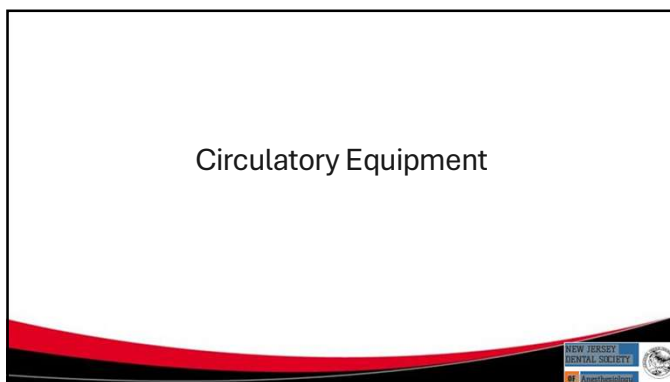
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Intravenous Access

Rate of Fluid Administration

- 14g 330ml/minute
- 16g 205ml/minute
- 18g 105ml/minute
- 20g 65ml/minute
- 22g 38ml/minute
- 24g 20ml/minute
- What do we do if we can't place a PIV?



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Vein Finder

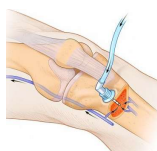
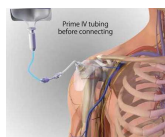
- Can aid in placement of PIV
- Depending on the model, can be expensive



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Intraosseous Infusion

- IO can be a great option if you are unable to obtain a PIV during an emergency
- Proximal Tibia or Humerus are common location for placement
- If the patient is conscious, push lidocaine prior to flushing the line



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Electricity

Defibrillator Vs. AED



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AED

- Only place AED on a **PULSELESS** patient
- AED only looks at the rhythm, not the stability of the patient
- Will potentially shock an alive tachycardic person
- In emergency have it available but wait to place it until pulseless



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AED

- Know where the shock button is
- Know where the on/off button is
- Cannot synchronize cardiovert
- Cannot Pace the patient



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Defibrillator/Pacer

- Can manually adjust settings and electricity delivered
- Can pace and synchronized cardiovert
- Allows for full monitoring from the device
- Expensive



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CPR Board

- CPR backboard is needed for effective compressions in the surgical chair
- Otherwise move patient to the floor



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Thank You
pheroja@ucmail.uc.edu



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