AUTHORIZED PROCEDURES

Airway Adjuncts

Bougie

CPAP

Endotracheal Intubation

Pharmacologically Assisted Intubation

Supraglottic (LMA or iGEL)

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Cricothyrotomy

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Pleural Decompression

Vascular Access

Push-Dose Epinephrine

Dual Sequential Defibrillation

Cardiac Ultrasound

Lung Ultrasound

Vascular Ultrasound

Spinal Immobilization for Football

Final Authorized Procedures

AIRWAY PROCEDURES

Basic Airway Adjuncts

- Bag-Valve-Mask (BVM)
  - 

  - Indications:
    - Assisted ventilation for both adults and pediatric patients.
  - Technique:
    - Create a good seal between mask and the patients face by using one or two person technique
    - Assure the mask is properly sized for the patient's face
- Oropharyngeal Airway (OPA) and Nasopharyngeal Airway (NPA)
  - Indications:
    - Assist in maintaining an open airway in patients with inadequate breathing
    - OPA is indicated only in patients with *no gag reflex*
    - NPA can be used in patients with an *intact gag reflex* or clenched jaw
  - Technique (OPA):
    - Choose the correct size OPA by measuring “lip to lobe”.
    - In an adult, insert the OPA upside down until resistance is met, then rotate 180 ° and advance until flange is at the lips

        - For pediatric patients use a tongue depressor to guide the OPA into position right side up
    - Technique (NPA):
        - Choose the proper size by measuring from nose to lobe
        - Lubricate the NPA and insert into the nostril while pushing the tip of the nose up
        - Gently advance until the flange rests against the nostril
        - Contraindicated if suspected nasal/facial fractures or suspected basilar skull fractures (raccoon eyes, battle signs, blood from ear canal)
    - Complications:
        - Regurgitation and aspiration of gastric contents
        - If facial trauma or skull fracture, insertion of an NPA can cause further damage and penetrate into the cranial cavity

Bougie (Endotracheal Tube Introducer)

- Indication:
    - The Gum Elastic Bougie is helpful in achieving endotracheal intubation when there is a restricted view of the glottic opening. It is not necessary to use on every patient, but it may be useful when a difficult airway is anticipated. The Bougie is not for "blind" intubation - you should always visualize the tip of the epiglottis, arytenoids, or a partial view of the vocal cords
    - Note that a bougie will only fit as small as approximately 6.0 ETT
- Technique:
    - Once the best possible laryngeal view is obtained, pass the bougie into the patient's mouth and through the glottic opening
    - If unable to visualize the vocal cords, advance the bougie anteriorly under the epiglottis and feel for clicks as it slides along the tracheal rings

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- While maintaining the best laryngeal view, slide the endotracheal tube over the bougie, and advance it to the desired depth, while maintaining proximal control of the bougie. It is important to leave the laryngoscope in place to view the tube sliding over the bougie. It will require two operators. Alternatively, you can preload the bougie into the endotracheal tube, prior to intubation.
-  
- If resistance is encountered while passing the tube, try rotating the bougie and tube 90° counterclockwise

- Complications:
    - Esophageal intubation
    - Vomiting and aspiration
    - Bronchospasm
    - Oral Trauma
    - Exacerbation spinal injuries
    - Laryngospasm

Continuous Positive Airway Pressure (CPAP)

- Indications:
    - Congestive heart failure/pulmonary edema
    - Pulmonary edema secondary to near drowning
    - Asthma
    - COPD
    - Hypoxia refractory to non rebreather
    - Undifferentiated respiratory distress
- Contraindications/Precautions:
    - Age less than 8 years of age (unless pediatric size CPAP mask available)
    - Unable to maintain a patent airway
    - Decrease level of consciousness
    - Pneumothorax
    - Facial Trauma/Burns
    - Systolic BP less than 90 mmHg
    - Recent surgery to face or mouth
    - Epistaxis
    - Patient unable to tolerate mask or pressure
    - Pneumonia (relative contraindication)
- Equipment Needed:
    - CPAP Flow generator
    - CPAP Mask kit
    - Adjustable CPAP/PEEP valve
    - Oxygen tank
    - Quick connect pigtail
    - Cardiac Monitor
    - SpO2 Monitor
    - ETCO2 Monitor

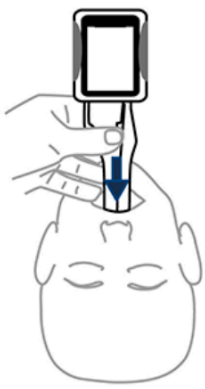
- Procedure:
    - Assemble mask kit during morning routine or after the last CPAP call. Set CPAP/PEEP valve per appropriate guideline.
    - Patient should be in an upright position, ensure dentures are removed
    - Assure all monitoring devices are attached
    - Connect CPAP generator to quick connect pigtail
    - Turn on oxygen tank
    - Reassure the patient and explain procedure
    - Hold the mask on the patient's face, gradually creating a seal
    - When the patient tolerates the mask, secure head straps, ensure snug fit.
    - Monitor patient condition and vitals every 5 minutes
    - Reassess patient breathing effort
    - For COPD patients, administer IN-LINE nebulized Albuterol/Atrovent per appropriate guideline.
    - If necessary, titrate CPAP / PEEP valve up to 10 cm/H2O if vitals are stable and breathing difficulty has not improved
    - If SpO2 does not increase, titrate FiO2 to a SpO2 of at least 90% or administer supplemental oxygen via mask port for non-adjustable CPAP generators.
        - Advise receiving hospital that you are transporting a patient that is a CPAP “Alert”

Endotracheal Intubation

- Indications:
    - Respiratory or cardiac arrest
    - Inadequate ventilation with bag valve mask
    - Impending respiratory failure or apnea
    - Hypoxia unresponsive to 100% oxygen, and any of the following:
        - Respiratory rate < 8 breaths per minute
        - Poor ventilatory effort (with hypoxia unresponsive to 100% oxygen)
        - Inability to maintain patent airway
        - Airway obstruction
- Equipment:
    - Laryngoscope handle with appropriate size blade.
    - Proper size endotracheal tube (ETT) plus backup ETT 0.5-1.0 mm smaller
    - Water soluble lubrication gel, (lubricate distal end of tube at cuff)
    - 10-12 ml syringe

    - Stylet, (insert into ET tube and do not let stylet extend beyond tip of ET tube)
    - ETT securing device
    - Proper size oropharyngeal airway
    - BVM
    - Oxygen source
    - Suction device
    - Stethoscope
    - Digital capnography and oxygen saturation monitors
- Technique:
    - Assure all equipment is readily accessible and functioning
    - Have capnography equipment ready
        - Note: pre-loading the capnography attachment onto the BVM can lead to false capnography readings or failure of capnography to read
    - Inflate the cuff of the endotracheal tube to check for leaks
    - With the stylet in place, maintain the tube's natural curve or reshape into "hockey stick" shape
    - Position the patient so that the patient's ear is level with their sternal notch
    - Unless there are contraindications, move the patient into the "sniffing" position by placing a pillow or folded towel under the patient's occiput
        - Ear should be level with sternal notch
    - When intubating an infant, you typically do not need to provide additional head support because the infant's large occiput naturally causes the head to assume the sniffing position
        - Simply maintain ear to sternal notch position
    - If the clinical situation allows, preoxygenate the patient with a non-rebreather mask with flow rate turned all the way up or high flow O2 with nasal cannula with maximum flow rate for at least 3 minutes prior to intubation. This may obviate the need for bag-valve mask ventilation, thereby reducing risk of aspiration.
        - This step may minimize the need for BVM ventilation, thus reducing the risk of aspiration
    - While holding the laryngoscope in your left hand, open the patient's mouth with your right hand
    - Insert the laryngoscope blade to the right of the patient's tongue and gradually move the blade to the center of the mouth, pushing the tongue to the left
    - Slowly advance the blade along the tongue and locate the epiglottis

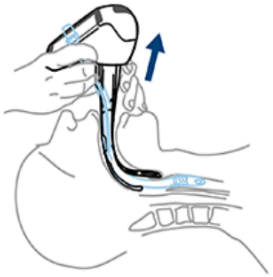
        - If using a curved blade, place the blade tip into the vallecula epiglottica
        - If using a straight blade, lift epiglottis up with the tip of the blade
    - With the tip of the blade in position, lift the laryngoscope upward and forward at a 45 degree angle to expose the vocal cords
    - Try to achieve the best possible view of the vocal cords before attempting to pass the endotracheal tube
    - To avoid dental injury do not rock the blade against the patient's teeth as this will do nothing to improve the view
    - While maintaining your view of the vocal cords, insert the endotracheal tube into the right side of the patient's mouth
    - The tube should not obstruct your view of the vocal cords during this critical part of the procedure
    - Pass the tube through the vocal cords until the balloon disappears into the trachea
    - Advance the tube until the balloon is 3 to 4 cm beyond the vocal cords
        - Typical depth in centimeters is "3 times the tube size" (e.g. 21cm for a 7mm, 24cm for an 8mm tube)
    - Inflate the endotracheal balloon with air and assess for proper placement using waveform capnography
    - If no alveolar waveform is seen on capnography, the tube must be removed. This includes a waveform that diminishes after a few breaths.
    - Secondary assessment of placement should include auscultation over the epigastrium and auscultation of both lungs fields for symmetry
    - If an alveolar waveform is present secure the tube using a commercial tube holder
- Complications:
    - Esophageal Intubation
    - Aspiration of gastric contents
    - Bradycardia
    - Oral Trauma
    - Exacerbation of Spine Injuries
- AirTraq:
    - With your left hand, insert the laryngoscope midline with the blade along the center of the patient's tongue and advance slowly until you can visualize the epiglottis



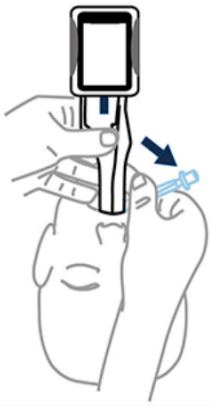
1. Slide midline around the tongue

2. Center vocal cords

- Pass the tube through the vocal cords until the balloon disappears into the trachea



3. Push ETT



4. Remove midline

- Advance the tube until the balloon is 3 to 4 cm beyond the vocal cords
  - Typical depth in centimeters is “3 times the tube size” (e.g. 21 cm for a 7mm, 24 cm for an 8 mm tube)
- Inflate the endotracheal balloon with air and assess for proper placement using waveform capnography
- If no alveolar waveform is seen on capnography the tube must be pulled.
- Secondary assessment of placement should include auscultation over the epigastrium and auscultation of both lung fields for symmetry.
- If an alveolar waveform is present, secure the tube using a commercial tube holder

Pharmacologically Assisted Intubation

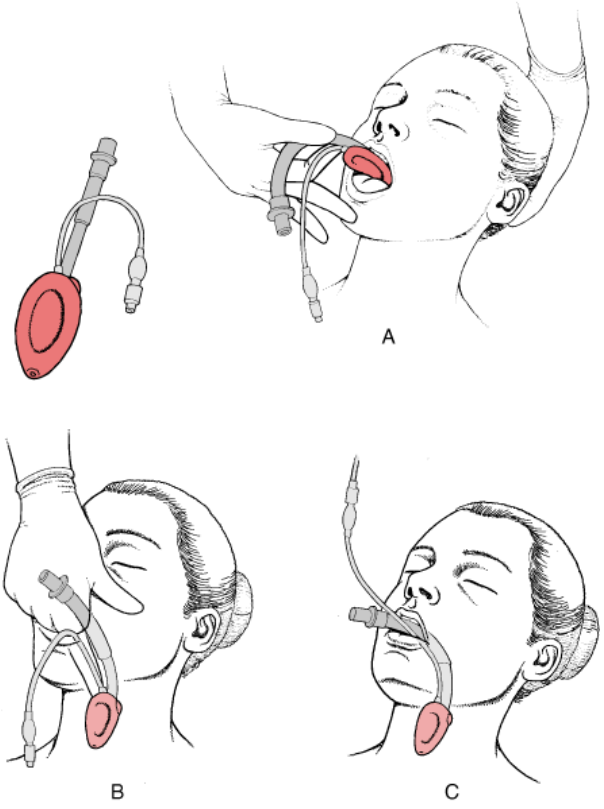
- Indications:
    - Patient requiring an advanced airway with an intact gag reflex and/or still conscious
- Equipment:
    - Working IV
    - Syringe to pull up medication
    - Medication (etomidate, ketamine, versed, etc.) for induction
    - Backup airway adjunct
- Technique:
    - Ensure functioning IV that easily flushes and does not have evidence of extravasation (difficult to flush, swelling and/or redness of arm developing just above IV site when attempting to flush IV)
    - Hook patient up to monitor and obtain full set of vital signs prior to pushing any sedative medications (including capnography)
    - Resuscitate patient prior to intubation attempt with IV fluids and/or push-dose epinephrine, if indicated
    - Ensure adequate pre-oxygenation (3-5 minutes) prior to intubation attempt
    - Ensure proper volume of medication has been drawn up
    - Have suction set up and ready to go
    - If possible, position patient in neutral or sniffing position to prepare for intubation
    - Have backup airway adjunct and additional intubation equipment readily available (supraglottic airway, smaller endotracheal tube, additional laryngoscope blade and video-laryngoscope)
    - When all team members are ready, have another paramedic push the sedative medication
    - Proceed with intubation attempt

Supraglottic Airway (Laryngeal Mask Airway or iGEL)

- Indications:
    - Respiratory or other emergencies requiring assisted ventilation
- Contraindications:
    - Responsive patients with an intact gag reflex
    - Patients with known esophageal disease
    - Patients who have ingested caustic substances

- Equipment:
    - Correctly sized airway device (refer to manufacturer's recommendations)
    - Water based lubricant
    - Inflation syringe (for LMA)
    - Suction device
    - Bag-Valve-Mask
    - Oxygen
    - Endotracheal tube holder
    - Capnography and oxygen saturation monitors
    - Stethoscope
- Technique:
    - Test cuff by injecting maximum amount of air into the cuff, then deflate for insertion (for LMA, no inflation required for iGEL)
    - Apply lubricant to the back of the mask, careful not to lubricate the anterior surface of the cuff that communications with the airway
    - Pre-oxygenate with BVM
    - Position the head in the sniffing position if no cervical spinal injury is suspected
    - Use the neutral position if cervical spinal injury is considered
    - While holding the supraglottic airway in your dominant hand, use your non-dominant hand to open up the patient's mouth
        - Apply a chin lift if no cervical spinal injury suspected
    - Insert the supraglottic airway into the patient's mouth - when inserting the mask, hold it like a pen with the index finger placed at the junction of the cuff and tube. Press the tip up against the hard palate and verify it lies flat against the palate and that the tip is not folded over, before pushing further into the pharynx
        - A jaw-thrust or chin lift may have to be performed by an additional team member to allow for easy passage of the supraglottic airway by displacing the tongue anteriorly
        - Do NOT apply excessive force when inserting the airway device
    - Using the index finger, push the mask backwards while maintaining pressure against the palate, to avoid touching the epiglottis. As insertion progresses, the whole index finger should lie along the tube, keeping it firmly in contact with the palate
        - When meeting resistance, the finger should be fully inserted into the mouth. Use the other hand to hold the tube while withdrawing the finger from the mouth

- If using an LMA, inflate the cuff without holding the tube, as this will allow the tube to move into its optimal position. Inflate the cuff with sufficient air to obtain a low pressure seal.
- If using an iGEL, no inflation is required
- Attach resuscitation bag and deliver a gentle breath
- Confirm proper placement by assessing capnography waveform and by auscultating lungs sounds
- If available, place bite-block and secure the device using a commercial tube holder

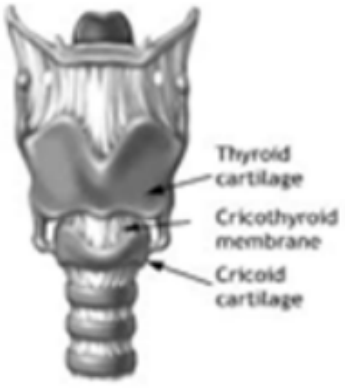


- Complications:
  - Regurgitation and aspiration
  - Inability to achieve seal and ventilate
  - Obstruction can occur if the device becomes dislodged or is incorrectly inserted. The epiglottis may be pushed down with improper insertion
  - Localized trauma
  - Laryngospasm

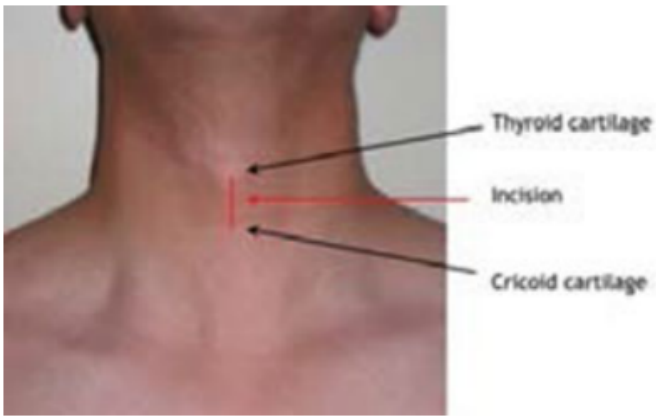
ETCO2 Monitoring

- Can be performed with nasal cannula capnography or in-line capnography for more invasive airways
- Elevated End-Tidal Values:
    - Hypoventilation- increase rate of bagging if this occurs
    - Partial airway obstruction- reassess airway and tube if this occurs
    - COPD (chronic CO2 “retainers”) or Impending respiratory failure in asthmatics- refer to appropriate protocol
- Decreased End-Tidal Values:
    - Sepsis
    - Cardiac Arrest
    - Hyperventilation with bag valve mask

Cricothyrotomy (Surgical, Percutaneous with Seldinger Technique, and Needle with Jet Ventilation)

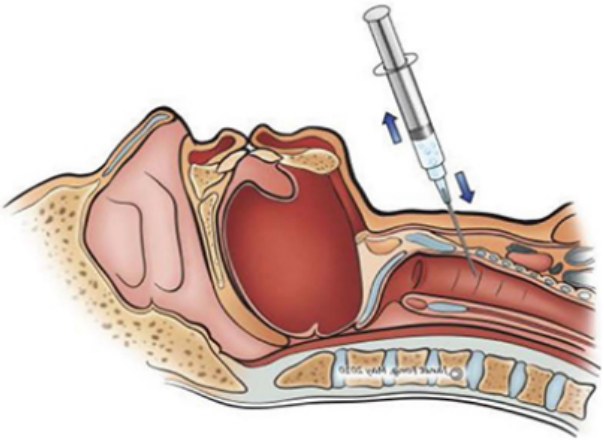
- Indications:
    - Inability to secure an airway using nonsurgical methods
    - As a last resort in a “cannot intubate, cannot ventilate” scenario
    - Needle cricothyrotomy is the surgical airway of choice for children less than 12 years
    - 

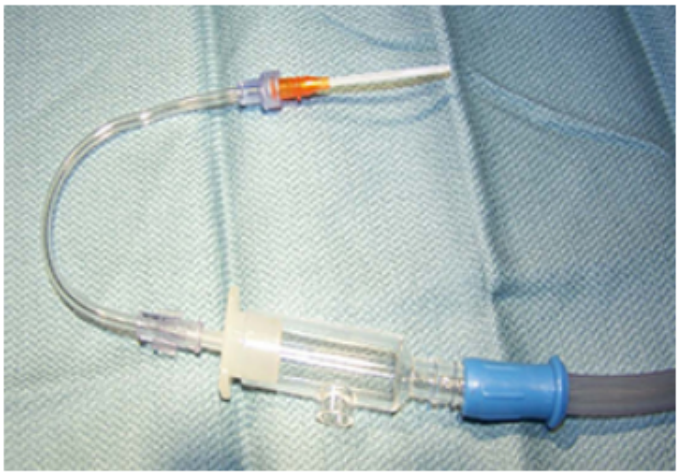
- Contraindications:
    - In true emergencies, there are no absolute contraindications
    - Airway obstruction distal to the cricoid membrane
    - Inability to identify anatomical landmarks
    - Infection at the incision site

- Equipment:
    - Cricothyrotomy
        - Cuffed endotracheal tubes (5 and 6mm)
        - Scalpel, No. 11
        - Trousseau dilator (if available)
        - Tracheal hook (if available)
        - Bougie
        - 4 X 4 gauze/sponges
    - Percutaneous Cricothyrotomy using Seldinger Technique
        - Commercial cricothyrotomy kit
        - Scalpel, No. 11
        - 4 X 4 gauze/sponges
    - Needle Cricothyrotomy
        - Decompression needle or 14-gauge needle catheter
        - 3 mm endotracheal tube adapter
        - 4x4 gauze
        - 10 mL saline syringe
        - IV extension set
        - Meconium aspirator
        - Securing device/tape (pediatric tube holder upside down)
        - SPO2 monitor, ETCO2 monitor, Cardiac monitor
- Technique: Cricothyrotomy
    - 

    - Position the patient supine, with the neck in the neutral position
    - Clean the patient's neck using antiseptic swabs
    - Identify the cricothyroid membrane, between the thyroid and cricoid cartilage
    - Using the non-dominant hand, stabilize the trachea
    - Make a 2-3 cm midline vertical incision through the skin from the caudal end of the thyroid cartilage to the cephalic end of the cricoid cartilage

    - Once the membrane is again felt and identified through the first cut, make a 1-2 cm transverse incision through the cricothyroid membrane
    - Always ensure you keep the space open after making the 2 incisions. You can do this by, next, inserting either a bougie or hemostat. Rotate the hemostat 90 degrees
    - If available, use a tracheal hook to lift the caudal end of the opening to allow passage of a cuffed endotracheal tube directly into the trachea (No. 5 or 6)
    - Insert the tube into the trachea with the assistance of a hemostat or over the bougie
    - Advance until balloon is within the airway and no longer visible
    - Inflate the cuff and confirm placement using Capnography (mandatory) and by assessing chest rise and lung sounds
    - Secure the tube
- Technique: Percutaneous Cricothyrotomy using Seldinger Technique
    - Use a commercially available kit that has been authorized by the Medical Director
    - In addition to manufacturer recommended procedures, follow the first 4 steps of the cricothyrotomy technique
    - 
    - Direct the needle at a 45° angle caudally while maintaining negative pressure to the syringe. A small, superficial skin incision may allow for easier penetration of the needle
    - Once air is aspirated remove the syringe, leaving the needle in place, and pass the guide wire into the trachea
    - Insert the dilator/airway tube combination over the guide wire
    - Once the airway tube is in place, remove the dilator and guide wire
    - Attach to a ventilation device and secure the device
    - Confirm placement using capnography (mandatory)

- Technique: Needle Cricothyrotomy
    - Surgical procedure used in medical / trauma patients requiring an emergent airway when the patient cannot be oxygenated and ventilated by another secondary device (I-Gel, King LT, ET Tube, LMA, BVM, etc.)
        - Indicated in patients < 12 years of age
    - Prepare and gather equipment
    - Identify anatomy and landmarks and clean site
    - Attach 14-gauge catheter to a 10 mL saline syringe containing 5 mL of Normal Saline
    - Insert 14-gauge catheter into the cricothyroid membrane towards the patient's feet at 30° - 45° angle
    - 
    - Aspirate while inserting needle - when air is noted (bubbles), you have entered the trachea
    - Advance the catheter (as if inserting an IV) until the hub rests at the skin surface, and remove needle & syringe
    - Secure catheter in place (or hold in place by hand)
    - Connect the catheter to an IV setup with a 3.0 mm ETT adapter
    - Attach the adapter to the meconium aspirator
    - Attach suction tubing - to the meconium aspirator at one end, and to the oxygen source at the other

- 
    - Flow oxygen at 15 L - except if newborn or small toddler, start at 8L and titrate up
    - Place finger over hole in the aspirator until chest rise is noted, then release to allow for expiration
    - Repeat this at an appropriate respiratory rate
    - Control hemorrhage and verify placement (auscultation of lung sounds, SPO2 monitor, ETCO2 monitor)
    - Secure tube (pediatric tube holder upside down) and monitor for possible complications
    - 
        - If meconium aspirator is not available, a 3.0 mm ETT adapter can be connected to the IV catheter and BVM can be connected to the adapter for ventilations
- Complications:
    - Aspiration
    - Hemorrhage
    - Unrecognized misplacement
    - Thyroid perforation

- Inadequate ventilation/hypoxia
- Esophageal or tracheal laceration
- Mediastinal or subcutaneous emphysema
- Vocal Cord Injury

MEDICATION ADMINISTRATION

- Mucosal Atomization Device (MAD)

Using the LMA® MAD Nasal™ Intranasal Mucosal Atomization Device

LMA® MAD Nasal™ INTRANASAL MUCOSAL ATOMIZATION DEVICE

MATERIALS

TIPS TO IMPROVE SUCCESS

1. Minimize volume, maximize concentration
   - 1/3 mL per nostril is ideal, 1 mL is maximum
   - Use the appropriately concentrated drug
2. Maximize total mucosal absorptive surface area
   - Atomize the drug (rather than drip it in) to cover broad surface area
   - Use BOTH nostrils to double the absorptive surface area
   - Aim slightly up and outwards to cover the turbinates and olfactory mucosa
3. Beware of abnormal mucosal characteristics
   - Mucous, blood and vasoconstrictors reduce absorption
   - Suction nostrils or consider alternate drug delivery method in these situations

PROCEDURE

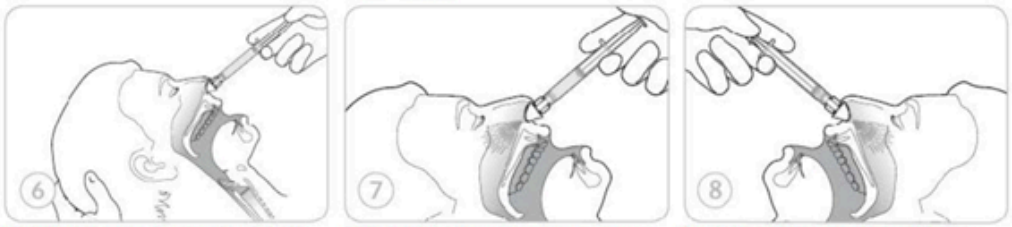
STEP 1: Remove and discard the green vial adapter cap.

STEP 2: Pierce the medication vial with the syringe vial adapter.

STEP 3: Aspirate the proper volume of medication required to treat the patient (an extra 0.1 mL of medication should be drawn up to account for the dead space in the device).

STEP 4: Remove (twist off) the syringe from the vial adapter.

STEP 5: Attach the MAD Nasal™ Device to the syringe via the luer lock connector.



STEP 6: Using the free hand to hold the occiput of the head stable, place the tip of the MAD Nasal™ Device snugly against the nostril aiming slightly up and outward (toward the top of the ear).

STEP 7: Briskly compress the syringe plunger to deliver half of the medication into the nostril.

STEP 8: Move the device over to the opposite nostril and, repeating steps 6 and 7, administer the remaining medication into the nostril if indicated.

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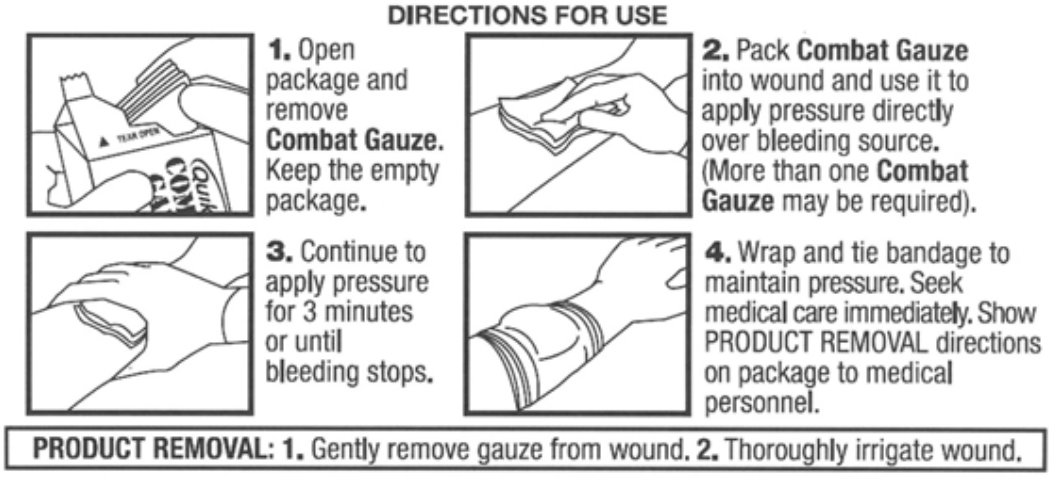
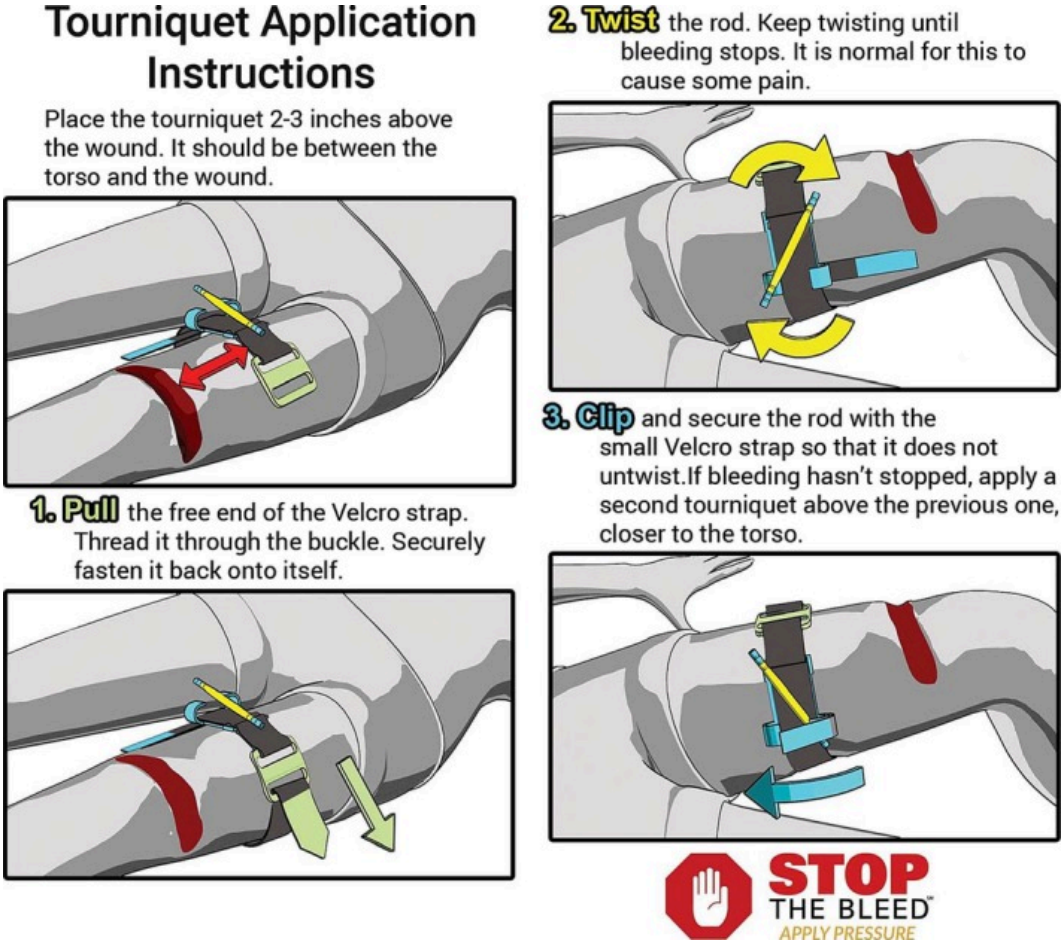
HEMOSTATIC CONTROL PROCEDURES

- Hemostatic Dressing
  - 

- Tourniquet Application
  - 

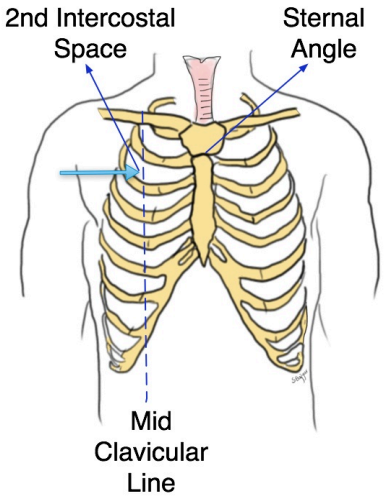
  - Make sure to write the time the tourniquet was applied directly on the tourniquet
  - MUST notify hospital of incoming patient with tourniquet in place

SPINAL IMMOBILIZATION FOR FOOTBALL PLAYERS

- EMS providers must use extreme caution when evaluating and treating an injured football player, especially when the extent of the injury remains unknown. Suspect spinal injury in any football player who has altered mental status or any other neurologic complaint. If the football player isn't breathing, work quickly and effectively with the athletic trainer staff to remove the face mask and administer care. In most situations, the helmet and shoulder pads should not be removed in the field. Manage head and neck injuries with the helmet and shoulder pads in place, removing only the face mask from the helmet.
- Football Face Mask Removal:
    - The face mask should be removed prior to transportation, regardless of current respiratory status
    - 
    - Those involved in prehospital care of injured football players must have the tools for face mask removal readily available
- Indications for Football Helmet Removal:
    - The athletic helmet and chin strap should only be removed if:
        - The helmet and chin strap do not hold the head securely, such that immobilization of the helmet does not also immobilize the head
        - The design of the helmet and chin strap is such that even after removal of the face mask the airway cannot be controlled, or ventilation be provided
        - The face mask cannot be removed after a reasonable period of time
        - The helmet prevents immobilization for transportation in an appropriate position
- Helmet Removal Technique:
    - If it becomes absolutely necessary, spinal immobilization must be maintained while removing the helmet

- Due to the varying types of helmets encountered, the helmet should be removed with close oversight by the team athletic trainers and/or sports medicine staff
- In most circumstances, it may be helpful to remove cheek padding and/or deflate air padding prior to helmet removal
- Appropriate spinal alignment must be maintained during care and transport using backboard, straps, tape, head-blocks or other necessary equipment
- Be aware that the helmet and shoulder pads elevate an athlete's trunk when in the supine position
- The front of the shoulder pads can be opened to allow access for CPR and defibrillation

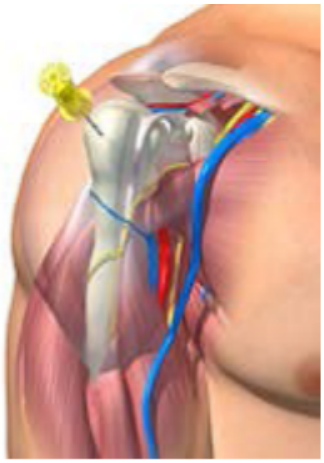
PLEURAL DECOMPRESSION FOR SUSPECTED TENSION PNEUMOTHORAX

- Indications:
  - Suspected tension pneumothorax with patients exhibiting absent unilateral breath sounds AND systolic BP < 90 (< 50 in pediatric patients) with altered mental status
  - Cardiac Arrest after blunt trauma involving the chest or abdomen
    - Unless the injury is clearly unilateral, consider bilateral pleural decompression
- Equipment:
  - 14 gauge 2 - 5 inch catheter over the needle
  - Tape
  - Sterile gauze pads
  - Antiseptic swabs
  - Occlusive dressing
- Technique:
  - Locate the decompression site
    - Identify the 2nd intercostal space in the midclavicular line on the same side as the suspected tension pneumothorax
    - 

  - Prepare the site with an antiseptic swab
  - Firmly introduce catheter immediately ABOVE the 3rd rib in the midclavicular line
  - Insert the catheter into the thorax until air exits
  - Advance the catheter and remove the needle
  - Secure the catheter, taking care to not allow it to kink
  - Reassess lung sounds, patient condition, and respiratory status

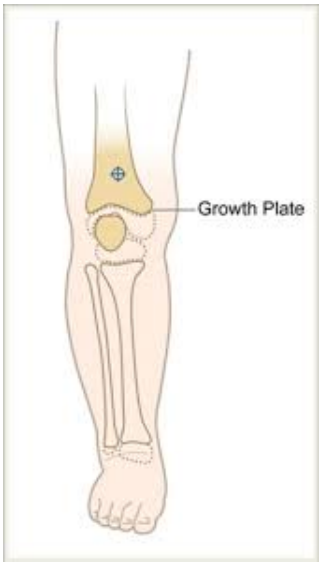
VASCULAR ACCESS PROCEDURES

- Intraosseous Access using the EZ-IO
    - Indications:
        - When vascular access is essential in the management of a severely ill adult or child and no other option is readily available
        - Cardiac Arrest
        - Patients where rapid peripheral IV access is unavailable after two attempts under any of the following conditions:
            - Multisystem trauma with hypovolemia
            - Significantly burned patient with no IV access
            - Severe dehydration with acute altered mental status and hypotension
            - Respiratory failure/respiratory arrest
            - Peri-arrest
        - IO access will NOT be utilized for prophylactic care
        - Humerus is the preferred site of insertion for adult patients while distal femur IO is the preferred site of insertion for pediatric patients
    - Contraindications:
        - Child < 1 year of age (pediatric IO needle to be inserted manually in child < 1 year of age)
        - The only absolute contraindication is fracture of the tibia, humerus or long bones sites for potential intraosseous access
        - Previous insertion within 24 hours
        - Infection over the insertion site (should be avoided but not strictly contraindicated)
        - Relatively contraindicated if other adequate vascular access is readily available
    - Technique: Humeral Head Insertion
        - The humerus is most easily palpated at the insertion point for the deltoid muscle, between the bicep and tricep muscles
        - Palpation of the bone requires firm pressure due to overlying structures
        - The surgical neck can be located by palpating up the length of the humerus until you feel a "notch" or "groove"
        - The appropriate insertion site is approximately 1 cm above the surgical neck for most adults



- Place the patient's hand over their abdomen (elbow adducted and humerus internally rotated)
- Cleanse the area with a sterilizing solution and perform insertion using aseptic technique
- Using the EZ-IO® drill insertion device, place the needle tip at the selected insertion site, keeping the needle perpendicular to the skin
- Push the needle through the skin and make contact with the bone (ensure at least one black line is visible)
- When ready press the trigger while maintaining gentle steady pressure on the handle
- Once the needle hub has contacted the skin release the trigger
- If properly placed, the needle should stand up from the bone without assistance
- Remove the inner trocar and use a syringe to aspirate bone marrow
- Obtaining marrow confirms placement
- If marrow does not return when aspirated, flush with 5-10 ml of Normal Saline if unconscious or Lidocaine if conscious
    - For conscious patients, slowly infuse Lidocaine 1 mg/kg (up to 40mg) IO over 120 seconds. Allow Lidocaine to dwell in IO space for 60 seconds. Flush with 5-10mL of Normal Saline. An additional dose of Lidocaine 0.5mg/kg (up to 20mg) over 60 seconds can be given as needed.
- Significant resistance or extravasation suggestd improper placement
- If flow is good, and no extravasation is seen, attach IV tubing and secure in place
- Immobilize the arm to prevent dislodgement

- Technique: Distal Femur Insertion (pediatric patients)
    - Ensure the patient's leg is fully extended
    - Identify the patella by palpation; the IO insertion site is just proximal to the patella and approximately 1-2 cm medial to midline



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- Technique: Tibial Insertion
    - Identify and palpate the tibial tuberosity just below the knee
    - Locate a consistent flat area of bone 2 cm distal and slightly medial to the tibial tuberosity

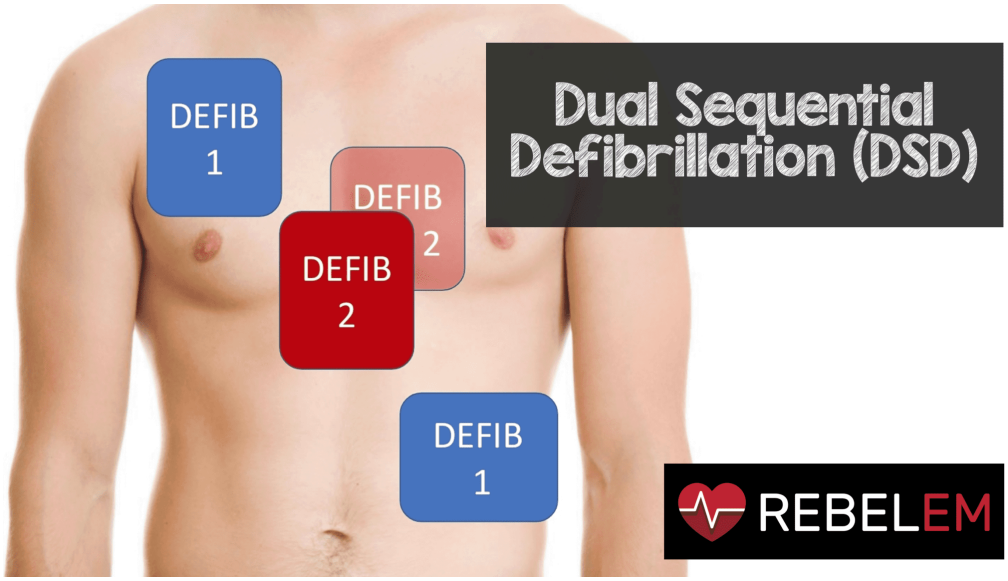
- Support the flexed knee by placing a hand or towel under the calf
- Cleanse the area with a sterilizing solution and perform insertion using aseptic technique
- Using the EZ-IO® drill insertion device, gently pierce skin until the needle touches bone. Ensure at least one black line is visible on the needle (if not, select larger needle size)
- Squeeze the trigger while maintaining gentle, steady pressure on the handle
- Release the trigger when you feel a decrease in resistance (hub may be flush with skin)
- If properly placed, the needle should stand up from the bone without assistance
- Remove the inner trocar and use a syringe to aspirate bone marrow
- Obtaining marrow confirms placement
- If marrow does not return when aspirated, flush with 5-10 ml of Normal Saline if unconscious or Lidocaine if conscious
    - For conscious patients, slowly infuse Lidocaine 1 mg/kg (up to 40mg) IO over 120 seconds. Allow Lidocaine to dwell in IO space for 60 seconds. Flush with 5-10mL of Normal Saline. An additional dose of Lidocaine 0.5mg/kg (up to 20mg) over 60 seconds can be given as needed.
- Significant resistance or extravasation suggests improper placement
- If flow is good, and no extravasation is seen, attach IV tubing and secure in place

- Complications:
    - Extravasation of fluid or caustic medications
    - Pain, fracture, hematoma, growth plate injury
    - Compartment syndrome
    - Osteomyelitis
    - Cellulitis at the insertion site

- Push-Dose Epinephrine
    - How to prepare 1:100,000 Epinephrine from 1:10,000 Epinephrine
        - Using a 3-way stopcock
            - Connect Epi 1:10,000 prefilled syringe
            - Connect Normal Saline 10 mL flush

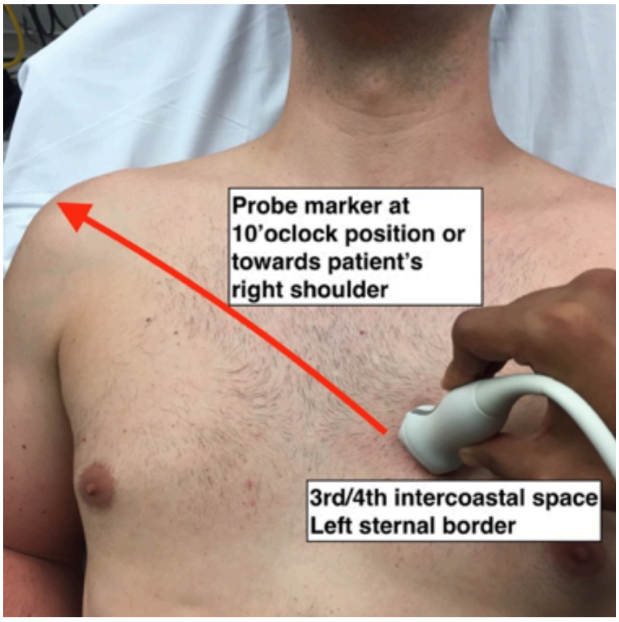
        - Select the Epinephrine on the 3-way stopcock by facing OFF towards NS flush
        - Waste 9 mL (0.9 mg) of 1:10,000 Epinephrine prefilled syringe into a container
        - Select mixing by facing OFF towards the Male Luer-lock
        - Expel 9 mL Normal Saline into Epinephrine prefilled syringe and mix solution
    - Concentration yield is 0.01 mg/mL (1:100,000)
    - Administer 1 mL IVP of 1:100,000 (0.01 mg or 10mcg) every minute, titrating to a Systolic BP of 90 mmHg
        - Maximum of 10 mL to be administered (0.1 mg)

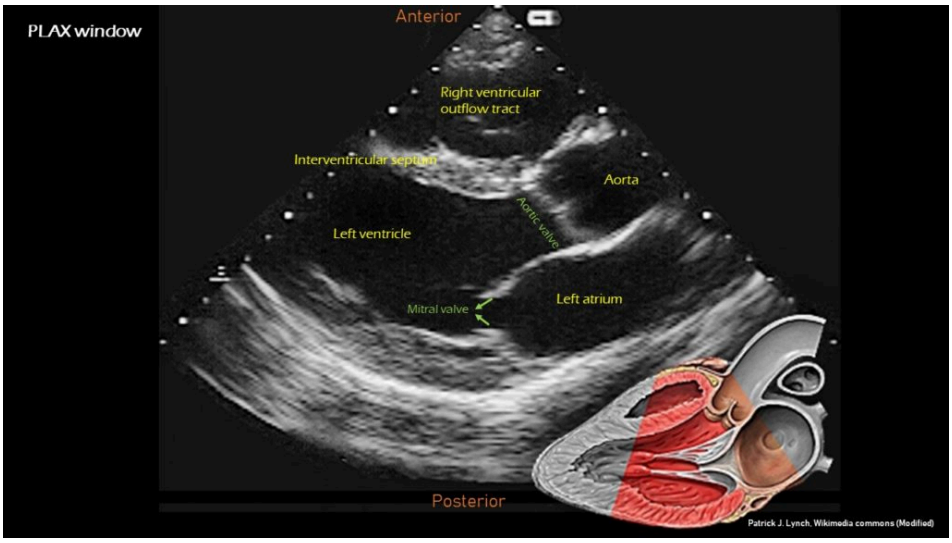
DUAL-SEQUENTIAL DEFIBRILLATION

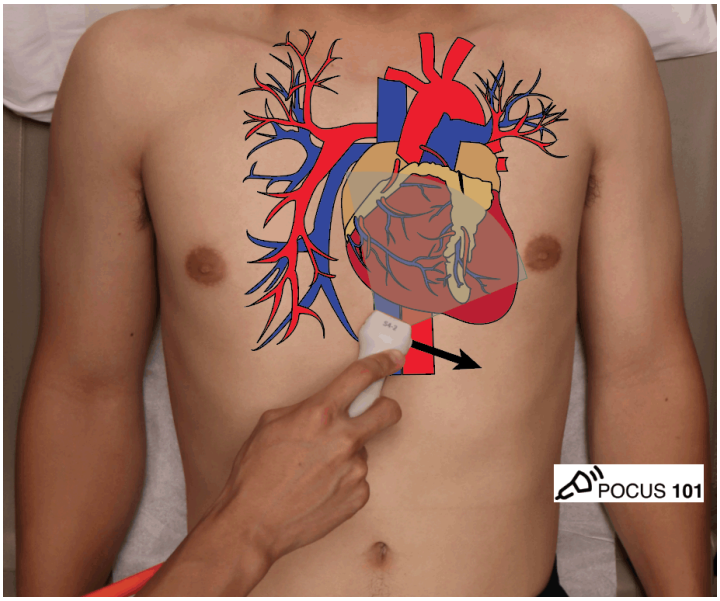
- Indications:
  - Refractory ventricular fibrillation or refractory ventricular tachycardia in cardiac arrest
- Contraindications:
  - Cardiac arrest that is NOT refractory v-fib or refractory v-tach
  - If cardiac pads are unable to be placed on the patient without any overlapping of the pads
- Equipment:
  - 2 LifePak monitors
  - 2 sets of cardiac pads
- Technique:
  - With LifePak already attached to the patient, have the cardiac pads placed in the typical anterolateral position of right upper chest and left lateral chest
  - With a second LifePak, hook up the cardiac pads and place them in the anterior and posterior placement on the patient
    - If the pads cannot be placed without overlapping, do NOT attempt dual-sequential defibrillation
  - 

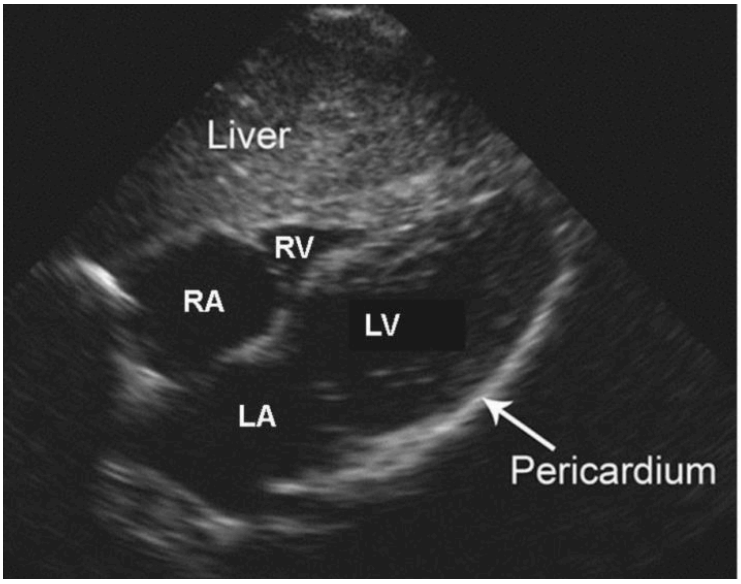
  - On both LifePak monitors, ensure the rhythm remains to be ventricular fibrillation or ventricular tachycardia
  - Charge both LifePak monitors to 360 J on the asynchronous cardioversion (defibrillation setting)
  - Once both LifePaks are charged to full, ensure all crew members clear the patient and administer both shocks back-to-back
    - The goal is to have the shocks as close to each other in timing without being completed at the exact same time
  - After both shocks have been delivered, immediately resume CPR if doing manual CPR or continue with Lucas device compressions if mechanical compressions being utilized

ULTRASOUND PROCEDURES

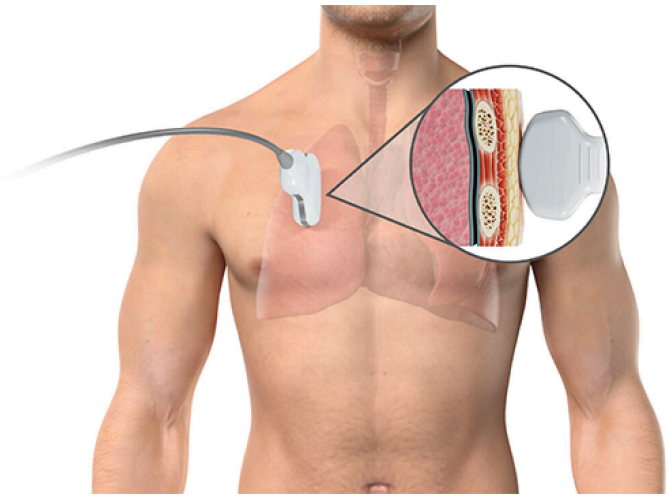
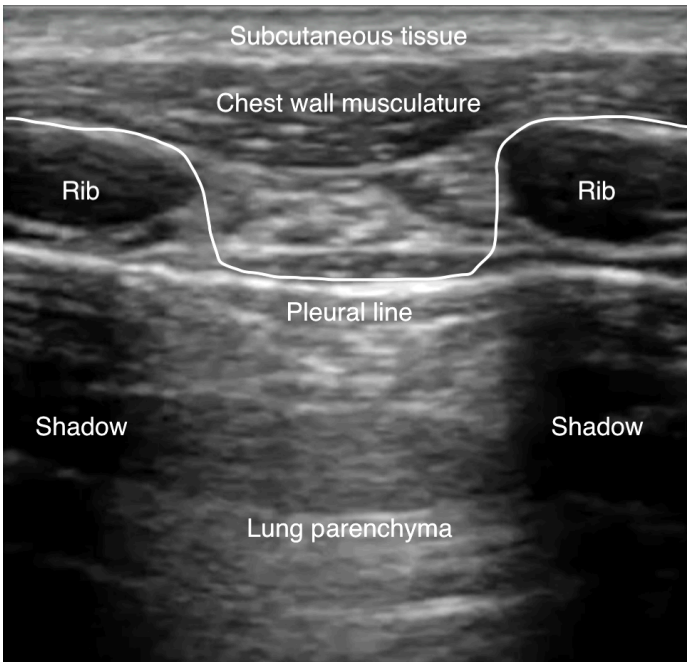
- Cardiac Ultrasound
  - Ultrasound can be used to evaluate the heart during a medical or traumatic cardiac arrest patient. Select the “cardiac” setting on the Butterfly App and apply gel to the ultrasound probe. For the parasternal view, place the ultrasound probe over the left side of the chest, just lateral to the sternum, at about the fourth intercostal space. A view of the heart should come into the field (note: you may have to turn the probe, change your angle, or completely move into a different intercostal space to get a view). With this view, you are observing for cardiac movement or cardiac standstill. This view is also used to evaluate for evidence of a pericardial effusion.
  - 

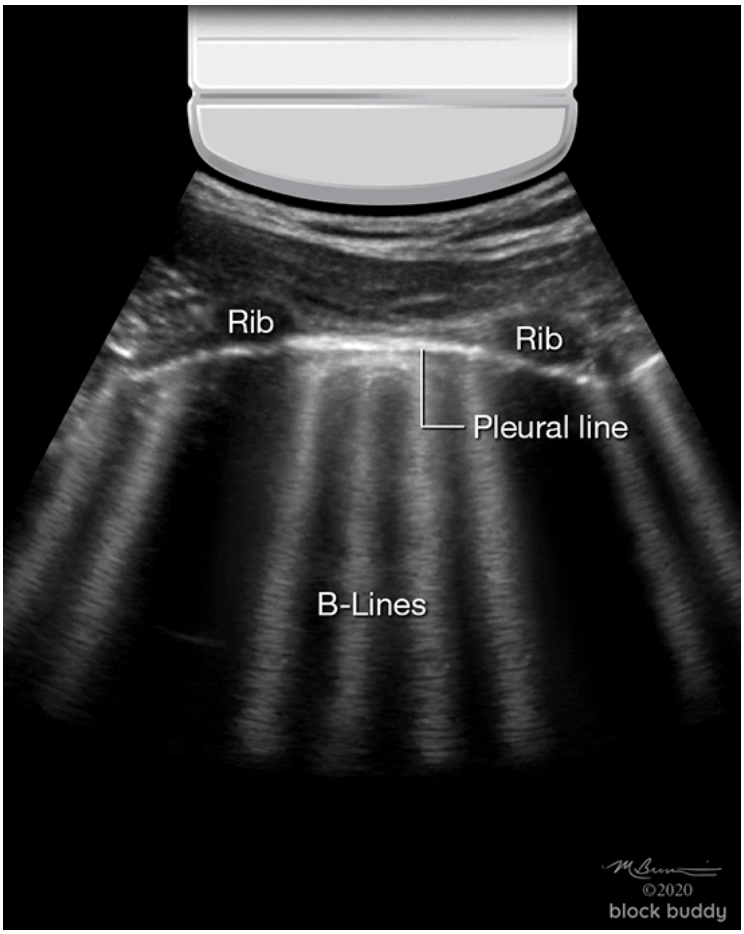
  - Image 1[i]: Probe placement for PSLA view
  - 

- The other view we can use is the subxiphoid view. You will still use the “cardiac” setting for the Butterfly App. To obtain this view, you will place the ultrasound probe just inferior to the xiphoid process and aim the probe upward and to the patient’s left shoulder. Note that to obtain this view, you may have to apply some pressure on the probe to get the heart into view. This view is used for evaluating for cardiac movement, cardiac standstill, and presence of a pericardial effusion.
- 

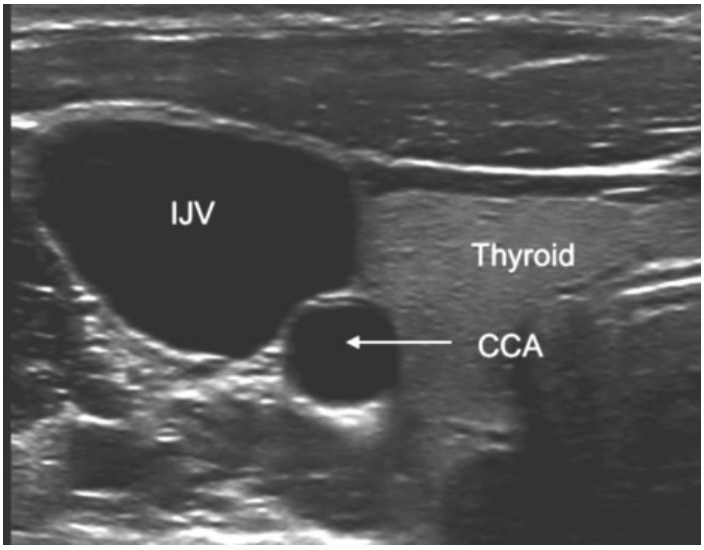
- 

- Pearls: the subxiphoid view may be an easier view to get when the Lucas device is on
- Note: there are many other uses for cardiac ultrasound. We are primarily focusing on the cardiac arrest patients

- Lung Ultrasound
    - Ultrasound can be used to evaluate the lungs for many disease processes. Our primary use will be to evaluate for presence or absence of B-Lines and to evaluate for evidence of lung sliding.
    - For an ultrasound of the lungs, switch the mode to “lung” in the Butterfly App. Put gel on the probe and place the probe on the patient’s chest (ensure the blue dot marker on the probe is pointing up towards the patient’s head).
    - The lung ultrasound will require two scans (one for each lung). The probe will be placed on one side of the chest, mid-clavicular, at about the third intercostal space. Our goal is to get two ribs in the view.
    - The first thing to evaluate is the presence or absence of lung sliding. As the patient breathes, the lung will move to allow for inhalation and exhalation. Lung sliding is described as “ants on a log” moving back and forth. If there is no evidence of lung sliding, the patient likely has a pneumothorax.
    - 
    - 

- Once we confirm lung sliding, we will evaluate for B-lines. This finding will be helpful to determine if a wheezing patient is wheezing due to lung pathology (COPD, asthma) or cardiac pathology (heart failure, pulmonary edema). B-lines are described as rockets shooting down in the lungs and are present where there is fluid in the lungs (whether from pneumonia, heart failure, etc.). If there are more than three B-lines present in a single lung view, we can assume the patient has fluid on the lungs.
- 

- Pearls: not everything that wheezes is asthma, lung ultrasound can be extremely useful for differentiating cardiac wheezing from pulmonary wheezing.

- Vascular (Carotid) Ultrasound
    - Ultrasound can be used in a cardiac arrest patient to assess for pulse during pulse/rhythm checks. For carotid ultrasound, select the “vascular: carotid” setting on the Butterfly App. Place the ultrasound probe (with gel on probe) on the patient’s neck and look for the two large vessels (internal jugular vein and carotid artery). The artery will have a thicker wall than the vein and will not be easily compressible (if you push down with the probe, veins will collapse before arteries due to the thinner wall and lower intra-vessel pressure when compared to arteries). You can also select the color doppler setting to evaluate for pulsating color change in the vessel.
    - During pulse check, look for pulsating of the artery and/or color doppler signal. If there is no evidence of pulsation or color doppler signal, there is no pulse and CPR should be continued.
    - 

        - IJV: Internal Jugular Vein
        - CCA: Common Carotid Artery
    - Pearls: you can find the vein/artery during compressions and mark the site with a marker so you do not have to hold the ultrasound over the carotid artery throughout the entirety of the code.