JOHNSON COUNTY EMS SYSTEM
MEDICAL DIRECTOR

EMS Skills Dictionary

2022/04/29

Change Log:

04/29/22	**Advanced Airway Placement** • Updated Adult Supraglottic Airway with revised ETCO2 info • Updated Pediatric Supraglottic Airway with revised ETCO2 info • Updated Endotracheal Intubation with revised ETCO2 info • Updated CPAP with revised ETCO2 info **End Tidal CO2** • Revised Initializing / Placement info regarding order of steps
03/15/22	**Defibrillation** • Updated information regarding the use of ONLY the Disarm button to dump unnecessary charges • Updated information on Pediatric pad use **Synchronized Cardioversion** • Updated information regarding the use of ONLY the Disarm button to dump unnecessary charges • Updated information on Pediatric pad use **Transcutaneous Pacing** Updated information on Pediatric pad use
02/01/22	**Cover Page:** • Updated department logos • Added Version date to footer **Advanced Airway Placement:** • Updated Supraglottic Airway to reflect change to i-gel Resus Pack for Adult patients • Added new Pediatric Supraglottic Airway entry • Updated Endotracheal Tube Placement information on securing and ETCO2 monitoring **End Tidal CO2 Detection:** • Updated to reflect i-gel Resus use and added images and information on troubleshooting **Suctioning:** • Updated Artificial Airway Suctioning entry to reflect i-gel Resus use **Automated External Defibrillator (AED) Use:** • Created new entry focusing on ZOLL AED 3 • Created new entry focusing on use of ZOLL X-Series in AED mode
11/18/21	**Change Log**: • Added Change Log **12-Lead Placement / Acquisition / Transmission**: • Added Defib Pad placement for 12-Lead monitoring. • Replaced pictures to correct locations for V1/V2 •
10/07/21	

EMS Skills Dictionary

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Introduction

The EMS Skills Dictionary is a living document, with the intent of demonstrating the many common and uncommon procedures and skills that are performed by EMS Providers within the Johnson County EMS System. As a living document, the Skills Dictionary will be updated periodically to refine the included techniques and add new skills as they are developed.

The steps in this dictionary are intended to show the current, best practice for the given skill demonstrated and providers should strive to perform the skills as described in this dictionary to standardize the performance of the skills, while individualizing care for each patient.

The steps for performing a given skill, verified by Credentialing, will come from this dictionary, though not necessarily all skills in this dictionary will be verified through Credentialing.

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12-Lead Placement / Acquisition / Transmission (ZOLL®)

*This entry assumes the monitor is powered on.

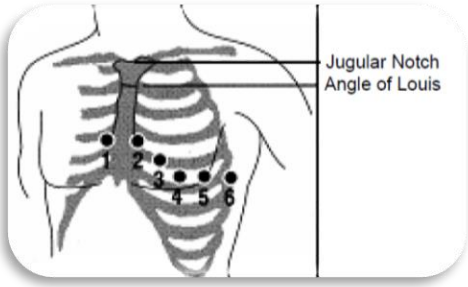
1. **Prepare the patient**
   - ▽ Explain the procedure to the patient
   - ▽ Prepare the patient's skin
     - Slight abrasion to the area where the electrodes are to be placed will significantly improve tracing quality and decrease artifact.
       - Use a small piece of abrasive material such as skin prep tape or scrape the area with the edge of the plastic sheet that holds the electrodes.
     - Clean oily skin with an alcohol prep.
     - Rub wet or sweaty skin briskly to dry.
     - Apply benzoin to improve adhesion if necessary.

2. **Attach 4-Lead electrodes and cables**
   - ▽ Connecting the lead wire to the electrode prior to placing the electrode on the patient is best practice as it is easier for the provider, more comfortable for the patient, and minimizes risk of displacing the conductive gel.
     - Patients with fragile skin may experience skin tears by attempting to apply the lead wire to an electrode already attached to the patient
   - ▽ To obtain a 12-Lead with diagnostic value, the limb leads MUST be placed on the limbs.
     - Limb Leads may be placed anywhere beyond the Shoulder joint and Hip joint.
       - Limb Leads may be placed generally anywhere along the length of the limb but should be placed in the same general location of each arm and each leg.
       - Large bony prominences and large muscle groups should be avoided

3. Attach the Precordial Leads (V-Leads / Chest Leads) and cables

▽ Locating the V1 position (4th intercostal space) is critically important because it is the reference point for locating the placement of the remaining V-Leads.
- Place your finger on top of the jugular Notch
- Move your finger slowly downward about 1.5 inches until you feel a slight horizontal ridge or elevation. This is the "Angle of Louis", where the manubrium joins the body of the sternum.
- Locate the 2nd intercostal space on the patient's right side, lateral to and just below the Angle of Louis.
- Move your finger down two more intercostal spaces to the 4th intercostal space which is the V1 position.

▽ Attach V1 electrode at the position described above.
▽ Attach V2 electrode to the Left of the sternum, across from V1, at the 4th intercostal space.
▽ Attach V4 electrode in the 5th intercostal space at the Left midclavicular line.
▽ Attach V3 electrode midway between V2 and V4.
▽ Attach V5 electrode at the Left anterior axillary line, at the same horizontal level as V4.
▽ Attach V6 electrode at the Left midaxillary line, at the same horizontal level as V4 and V5.
▽ When placing electrodes on patients with pendulous breast tissue, always place leads V3-V6 under the breast rather than on the breast.
▽ Attach the V-Lead connector to the 4-Lead cable.



NOTE

ALL STEMI PATIENTS SHOULD HAVE DEFIB PADS APPLIED AS SOON AS POSSIBLE AFTER RECOGNITION.

USE THE FOLLOWING PLACEMENT LOCATIONS FOR DEFIB PATCHES TO ALLOW FOR CONTINUED 12-LEAD MONITORING:

Anterior – Lateral Placement:

Anterior – Posterior Placement:

4. Position the patient

▽ The patient needs to be as still as possible to produce a 12-Lead with minimal artifact and consistent baseline.

- Ensure they are still from just prior to acquisition and until the acquisition process is complete.

▽ Instruct the patient to "relax and breathe normally"

- Instructing the patient to "Hold still" may cause the patient to grab arm rests or cot rails or tense skeletal muscles, which contributes to artifact.

▽ If serial 12-Leads are obtained, the patient should be in similar positions for all 12-Leads, if possible, for the greatest comparative value.

5. Navigate to 12-Lead View and Menu

▽ Press 12-Lead quick access key

▽ Press Patient Info quick access key

▽ Use arrow and select buttons to enter patient's age, gender and name.
- You can also use quick access navigation keys on Left of screen.

▽ It is important to enter each patient's age and gender prior to performing ECG analysis using the 12-Lead Interpretive Algorithm. Providing age and gender will ensure the highest accuracy of analysis.
▽ If age is not entered, default of 45yo is used. If gender is not entered, default of male is used.

6. Acquire 12-Lead

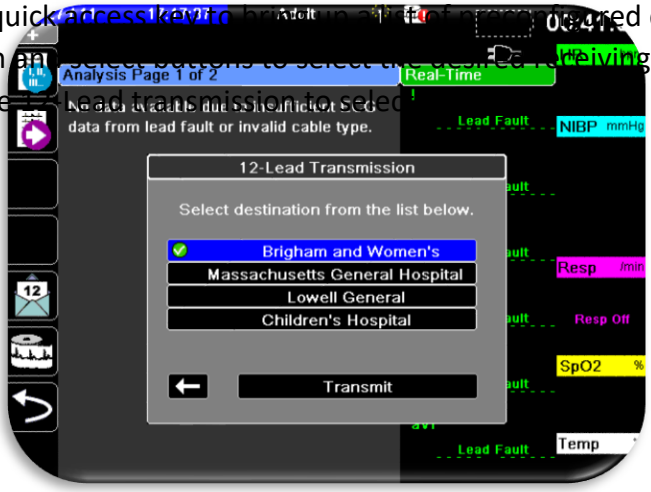
▽ Once all patient information has been entered, view the leads display to ensure all leads are connected and displaying correctly, acquire the 12-Lead
▽ Push the Acquire quick access key.
- A message and status bar will display showing "Acquiring 12-Lead" and then "Saving 12-Lead"
- If you need to stop either process, you can use the Stop quick access key.

▽ Once the 12-Lead is acquired and saved, a 12-Lead Interpretive Analysis is displayed.
- The 12-Lead Interpretive Analysis is intended for Adult patients only.

- The 12-Lead Interpretive algorithm's interpretive statements are designed to enhance the diagnostic process. They are no substitute for the qualified judgement of a properly trained clinician. Always give consideration to patient symptoms, history and other relative factors.

7. Transmit the 12-Lead Snapshot

▽ Press the 12-Lead Review Next quick access key to display a list of acquired 12-Leads
▽ Use the arrow navigation and select buttons to select the desired 12-Lead
▽ Press the 12-Lead Send quick access key to bring up a list of preconfigured distribution list.
▽ Use the arrow navigation and select buttons to select the desired receiving facility
▽ Select Transmit to initiate 12-lead transmission to selected



8. Removal

▽ When removing lead wires from patient, do not grasp cables together and forcefully pull off all wires from the electrodes at once as this may cause injury, skin tears, discomfort to the patient and damages the cables
▽ When removing wires, unclip each wire from electrodes individually to minimize chance of injuring patient or damaging cables
▽ If removing electrodes from patient, pull gently
- On patients with delicate skin, stabilize skin around electrode during removal to minimize shearing force and risk of skin tear

PEDIATRIC 12-LEADS

1. Pediatric 12-Lead Placement / Acquisition / Transmission

▽ The processes for Lead placement, acquisition and transmission of 12-leads for children is identical to adult patients.
▽ Landmarks for lead placement are the same, though the size of electrodes may make placement difficult. 12-Lead accuracy and quality should not be affected by overlapping the adhesive portions of the electrodes, but do not overlap the conductive portions of the electrodes.
▽ The displayed / printed analysis text is not to be considered accurate for pediatric patients. The provider's own interpretation, along with a solid clinical assessment and online medical direction, if necessary, should guide treatment.

Airway Management

Basic Airway Maneuvers

This entry contains directions for us of Nasopharyngeal Airway, Oropharyngeal Airways and 1 and 2 Person Bag Valve Mask (BVM) Device use

Nasopharyngeal Airway

1. Select appropriately sized airway

- ∇ Measure airway from the patient's nares to angle of jaw
- ∇ Apply lubricant as needed

2. Insert airway

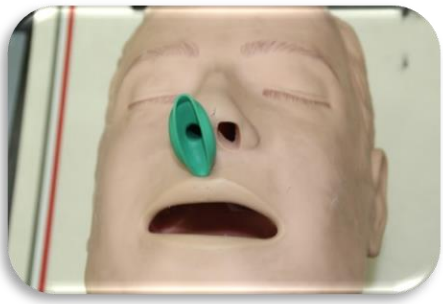
- ∇ Insert airway posteriorly (backwards), not superiorly (upwards)

- ∇ If for some reason, resistance is met, do not force. The airway can be placed in the other nare
  - The airway must be oriented with the bevel against the septum (the airway will not be in a position resembling the natural curvature of the nose in the beginning if placing in the left nare)

- ∇ Once entry into the nare has been made, gently rotate the airway until it is oriented like the natural curvature of the nasal cavity and advance straight down

3. Verify position

- ∇ If properly inserted the flange of the airway should rest on the nares



Oropharyngeal Airway

1. **Select appropriately sized oropharyngeal airway**
   - ∇ Hold the airway in the position it will be oriented once inserted
   - ∇ Place against the side of the patient's face – measure the airway by placing the flange portion of the airway at the corner of the patient's mouth and the end of the curve at either the angle of jaw or the tip of the ear

2. **Insert airway**
   - ∇ Insert using one of the following methods:
     - Insert the airway with the end pointing towards the roof of the mouth until it contacts the posterior pharyngeal wall.
     - Next, rotate the airway 180° and insert until the flange rests on the patient's lips. The airway curvature should now follow the natural curvature of the patient's airway.

OR

- Insert the airway with the end pointing towards the patient's cheek.
- When in contact with the posterior pharyngeal wall rotate 90° so that the airway will now follow the natural curvature of the patient's airway.
- Advance the airway until the flange rests on the patient's lips.

OR

- Depress the patient's tongue using a tongue blade.
- Insert the airway already aligned with the curvature of the patient's airway and advance over the tongue until it rests on the patient's lips.

3. Monitor airway status

- ∇ Assess patient's airway for signs of retching or vomiting following insertion

One Person Bag Valve Mask (BVM)

1. **Select/assemble equipment**
   - ∇ Assemble bag, reservoir and proper size mask

   - ∇ Attach BVM to oxygen supply set at 15 LPM flow and fully inflate reservoir bag, if present
   - ∇ Observe for full inflation of reservoir bag, if present

2. **Apply and maintain face-to-mask seal**
   - ∇ Work facing the top of patient's head when environment allows
   - ∇ Position mask by placing pointed end of mask over the patient's nose until mask is sealed firmly against the bridge of nose

Appropriate fit (bottom fits on chin)

Inappropriate fit (mask does not fit on chin)

- ∇ Use the EC technique to completely seal the mask to the face
  - EC technique: Hold mask to face with thumb and index finger and place other fingers under the mandible and bring the chin into the mask until a seal is made
- ∇ Head must be maintained in extension throughout this procedure (non-trauma patient)

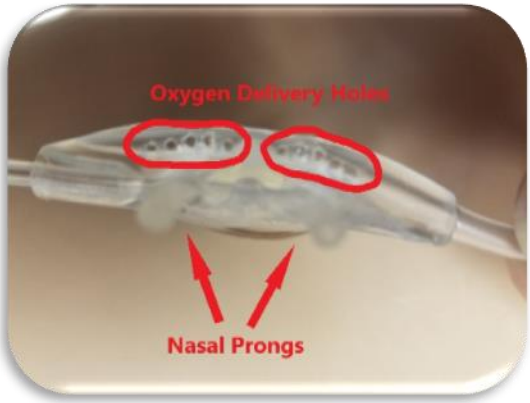
3. Ventilate

- ∇ While maintaining face-to-mask seal with one hand, squeeze bag slowly, delivering a ventilation (evidenced by chest rise) over 1-2 seconds (ventilation volume may vary depending on age, clinical situation, and $ETCO_2$). Completely release bag and allow for full refill between ventilations.

Use 2 fingers to ventilate

- ○ When monitoring ETCO2 while providing ventilations using a BVM and mask, the CapnoLine nasal cannula provides the most accurate readings.
  - Especially during BVM and mask ventilation, poor mask seal can result in diluted and incorrect readings when using the FilterLine Airway Adapter. Because the CapnoLine nasal cannula samples from much closer to the mouth and nose, it provides more reliable readings when BVM mask seal is not consistent.
  - The tubing of the Capnoline nasal cannula should not create a significant enough leak, where it passes under the CPAP or BVM mask, to result in measurably diluted samples.
  - If the ETCO2 levels are below 35 mm Hg (in a perfusing patient), the provider should slow ventilation rate to reach this optimum range.
  - If the ETCO2 levels are above 45 mm Hg (in a perfusing patient), the provider should increase ventilation rate to reach this optimum range.

- ∇ The pictures below show use of the CapnoLine nasal cannula under BVM mask.



- ∇ Continue to ventilate (this may vary depending on age, clinical situation, and $ETCO_2$)
- ∇ Watch for gastric distention evidenced by increasing resistance to BVM ventilation and increasing belly size (keep manometer on BVM <20 cmH_20 during ventilation to minimize gastric distension).
- ∇ If this is a cardiac arrest, ventilate every 10^{th} compression

4. Reassess patient status

- ∇ Continually reassess pulse oximetry, $ETC0_2$ and compliance with ventilation

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Two Person Bag Valve Mask (BVM)

1. **Select/assemble equipment**
   - ∇ Assemble bag, reservoir and proper size mask

   - ∇ Attach BVM to oxygen supply set at 15 LPM flow and fully inflate reservoir bag, if present

2. **Apply and maintain face-to-mask seal – Rescuer #1**
   - ∇ Work facing the top of patient's head when environment allows
   - ∇ Position mask by placing pointed end of mask over the patient's nose until mask is seal firmly against the bridge of nose

Appropriate fit (bottom fits on chin)

Inappropriate fit (bottom of mask does not fit on chin)

- ∇ Use the thenar eminence (TE) technique to completely seal the mask to the face
  - TE technique: Hold mask to face with thumbs and place other fingers under the mandible and bring the chin into the mask until a seal is made

- ∇ Head must be maintained in extension throughout this procedure. (non-trauma patient)
- ∇ The TE technique allows for jaw thrust without head extension for trauma patients.

3. Ventilate

- ∇ **Rescuer #1:** Squeezes bag slowly with ONE HAND ONLY or just a couple of fingers, delivering a ventilation (evidenced by chest rise) over 1-2 seconds (ventilation volume may vary depending on age, clinical situation, and $ETCO_2$). Completely release bag and allow for full refill between ventilations.

Use 2 fingers to ventilate

- ∇ **Rescuer #2:** Maintains face to mask seal during ventilation
- ∇ Continue to ventilate (this may vary depending on age, clinical situation, and $ETCO_2$)
- ∇ Watch for gastric distention evidenced by increasing resistance to BVM ventilation and increasing belly size (keep manometer on BVM <20 cm H_20 during ventilation to minimize gastric distension).
- ∇ If this is a cardiac arrest, ventilate every 10^{th} compression

4. Reassess patient status

- ∇ Continually reassess pulse oximetry, $ETC0_2$ and compliance with ventilation

*****For further information on monitoring ETCO2 during Bag Valve Mask ventilation, please see the End Tidal Capnography Skill Dictionary**

Advanced Airway Placement

This entry includes information on placement of the i-gel® O2 Resus Supraglottic Airway Device for Adults, i-gel® Anesthesia Model Supraglottic Airway Device for Pediatrics, Endotracheal Intubation and QuickTrach® Percutaneous Airway Device.

Adult Supraglottic Airway Insertion i-gel® O2 Resus

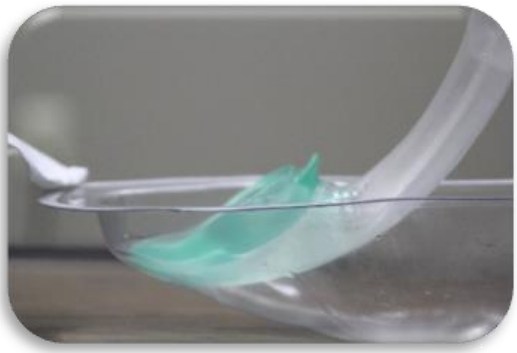
1. **Knowledge Points**
   - ∇ This entry demonstrates use of the Adult i-gel O2 Resus Pack.
   - ∇ For Pediatric use, see Supraglottic Airway Insertion – PEDIATRIC (Anesthesia i-gel®)

2. **Prepare Equipment**
   - ∇ Assure oxygenation and ventilation is maintained during equipment preparation.
   - ∇ Select correct size – See chart below
     - Colors **do not** correlate with any Length Based Tape sizes.

	Description	Weight	Height
●	i-gel O_2 Resus Pack, large adult – includes a size 5 i-gel O_2 with orange hook ring, sachet of lubricant, airway support strap and a 12FG suction tube	90+kg	>6 ft
●	i-gel O_2 Resus Pack, medium adult – includes a size 4 i-gel O_2 with green hook ring, sachet of lubricant, airway support strap and a 12FG suction tube	50–90kg	5-6 ft
●	i-gel O_2 Resus Pack, small adult – includes a size 3 i-gel O_2 with yellow hook ring, sachet of lubricant, airway support strap and a 12FG suction tube	30–60kg	<5 ft

     - I-gel packaging is marked with a weight-based sizing range. The height-based rule of thumb measuring can also be used.
       - Orange Size 5 – Height >6 ft
       - Green Size 4 – Height 5-6 ft
       - Yellow Size 3 – Height <5 ft
     - If first attempted size does not fit, attempt a size up or down.

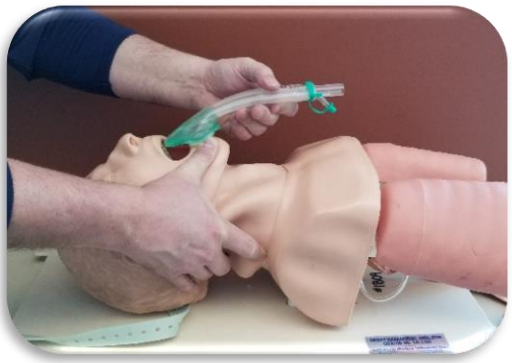
- ∇ Lubricate back, sides and front of cuff and place back in cradle
  - Generous lubrication is critical to prevent friction in the airway which can lead to bleeding
  - Do not allow a large bolus of lube to collect in the lumen of the i-gel or occlude the distal suction port



- ∇ Prepare Suction
  - Vomiting and fluids in the pharynx are possible when placing an airway and may present challenges to the airway seal and ventilation

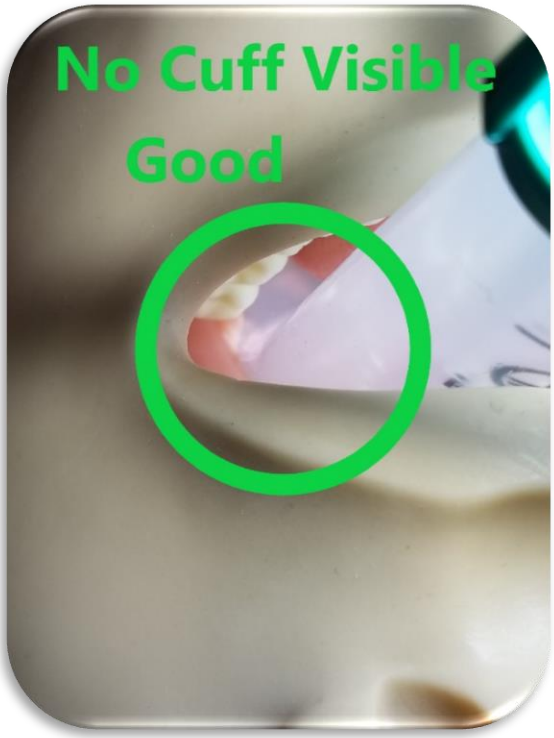
3. **Prepare Patient**
   - ∇ Remove Dentures which may become loose during insertion and be pushed into airway
   - ∇ Place patient in sniffing position unless maintaining Spinal Motion Restriction is necessary
     - Optimal positioning is obtained by aligning the ears with the sternal notch

4. **Insert Airway**
   - ∇ Grasp integral bite-block at midshaft, cuff facing patient's chin
     - Integral bite block and shaft are sturdy and can successfully guide airway. No fingers need enter mouth or between teeth
   - ∇ With your other hand, open mouth by pushing chin down
     - Opening mouth facilitates passage of cuff through oropharynx



   - ∇ Insert leading soft tip, gently advancing at midline toward hard palate
     - Some resistance may be felt as cuff passes tonsillar area of pharynx, but continue insertion
     - Stop when definitive resistance is felt
       - Tip of cuff should rest in upper esophageal opening

- No portion of the cuff should be visible when looking in the mouth

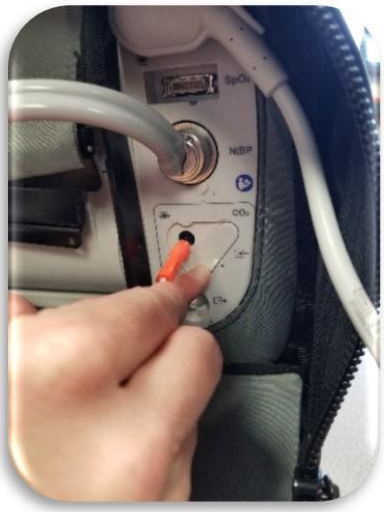


5. **Confirm Placement**
   - ∇ Confirm with capnography
   - ∇ Patient must be ventilated with BVM to assess proper placement
   - ∇ Attach BVM, ETCO2 device (EasyCap or Filterline Adapter) and ventilate
     - Waveform Capnography is gold standard for confirming placement
       - **If you don't have a waveform with ventilation, the airway is not patent**
     - See below for EasyCap and Filterline Adapter placement
     - See End Tidal CO2 (ETCO2) Detection Skills Dictionary for more detailed information on ETCO2 placement and monitoring
   - ∇ Observe for chest rise
   - ∇ Auscultate for absence of epigastric sounds and presence of breath sounds
     - Breath Sounds alone, without the presence of waveform capnography, does not indicate a patent airway

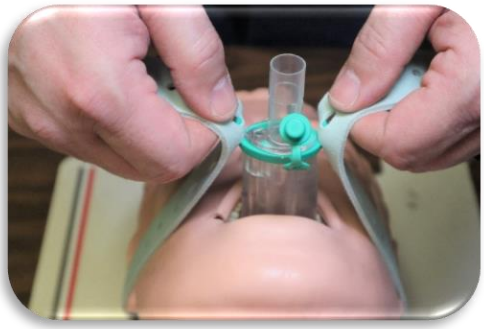
EasyCap Colorimetric Device Placement:

End-Tidal Capnography

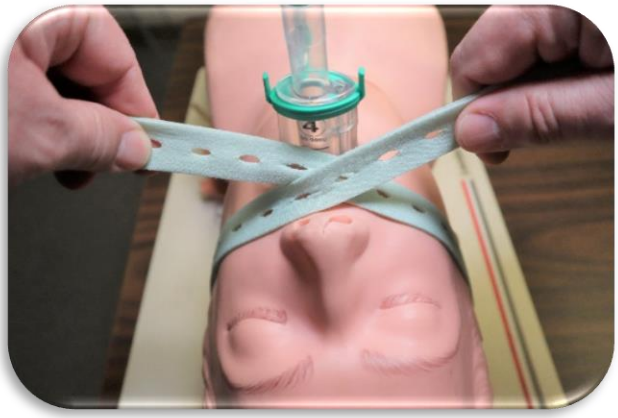
- ∇ Initializing (Zeroing) and applying the sampling device
  - There are 3 steps in initializing and applying the sampling device that may be done in any order
    - Plugging the sampling device into the monitor
    - Pressing the CO2 Soft Key to activate the sampling pump
    - Applying the sampling device (CapnoLine / FilterLine) to the patient
  - Contrary to previous teaching, applying the sampling device to the patient prior to completion of the zeroing process will not affect accuracy of readings.
  - Ventilate and observe for waveform and numerical reading
  - Waveform Capnography is the gold standard for airway confirmation
  - **If there is no ETCO2 waveform with ventilation, the ET Tube is not patent**

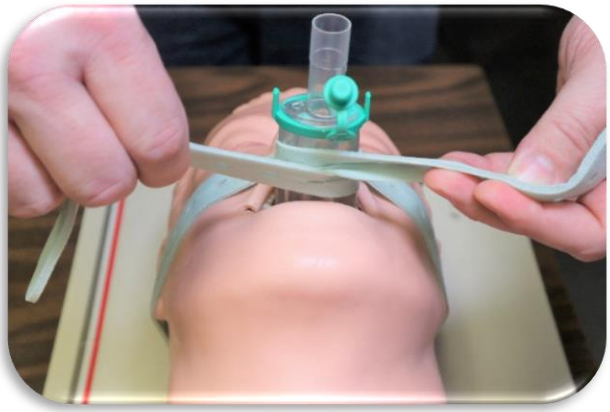


6. **Secure airway**
   - ∇ Secure the i-gel using the included elastic strap
     - Use of the Thomas Tube Holder to secure the i-gel is NOT approved
     - See Pediatric Section for information on securing pediatric i-gels
     - Straight Securing Method
       - Place the wide, center part of the strap behind the patient's head at the occiput.
       - Stretch each end of the strap up and insert a strap hole over the securing horn on each side of the device



- Cross Securing Method
  - If using the straight securing method allows too much side to side movement in the situation you may attempt the Cross Securing Method to maintain a better seal
  - Place the wide, center part of the strap behind the patient's head at the occiput
  - Stretch each end of the strap up and cross them across the i-gel either on the nose or chin side
  - Wrap each side once, around the opposite side of the i-gel and insert a strap hole over the securing horn on each side of the device





*****NOTE*****

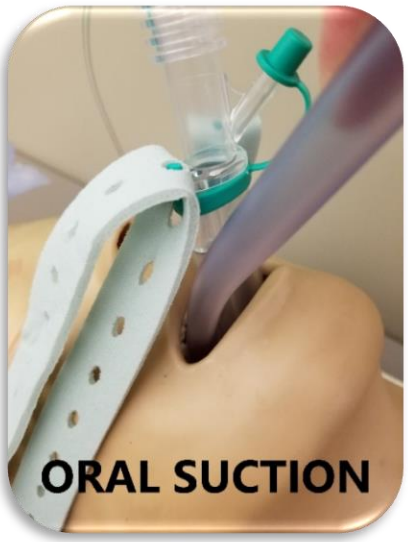
- **To perform the Cross Securing Method correctly, you must cross both ends of the strap at either the side closest to the top of the patient's head or the side closest to the patient's chin**
  - When completed correctly, both tails should point either towards the top of the patient's head or the patient's chin
  - If tails point in opposite directions when complete, it is likely the wrap was done incorrectly and a rotational force could be applied to the i-gel that will prevent it from sealing adequately against the glottis

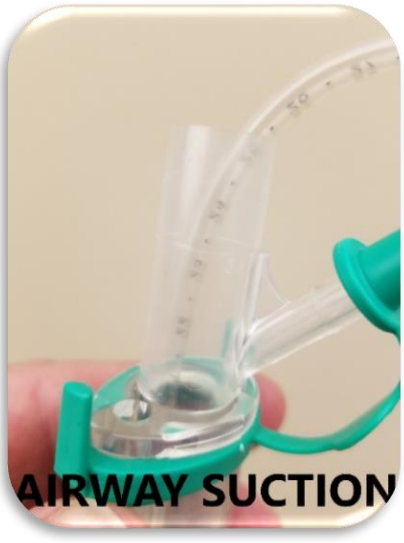
7. **Ventilate Patient**
   - Continuously monitor End-Tidal Waveforms to ensure proper seal, rate and volume
   - The apneic patient should be ventilated at 10 breaths per minute
     - Increase rate and/or volume of ventilation if ETCO2 Capnometry is >45mmHg
     - Decrease rate and/or volume of ventilation if ETCO2 Capnometry is <35mmHg
   - **If there is no End-Tidal waveform with ventilation, the i-gel is not patent**

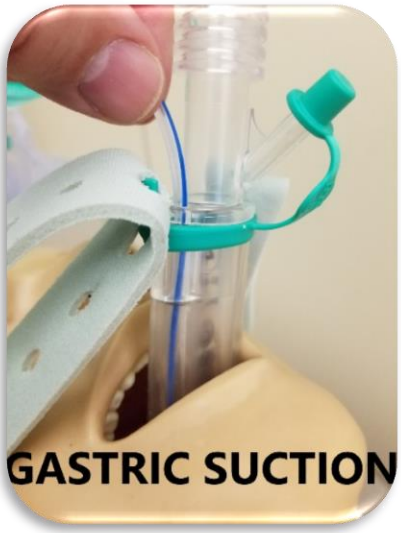
8. Suction PRN

- ∇ Oral Suctioning
  - Oral suctioning can be done around the i-gel for excessive secretions / emesis
- ∇ Airway Lumen Suctioning
  - Direct airway suctioning through the airway lumen of the i-gel may also be performed PRN.
  - Insert Suction cath up to max depth of approximately 22-23 cm on size 3-4-5
  - Disconnect the ETCO2 Filterline from the i-gel during airway lumen suctioning to make suctioning easier and avoid fouling the Filterline
- ∇ Gastric Suctioning
  - Gastric suctioning may be done to provide gastric decompression which may improve ventilation and reduce chance of aspiration
  - See i-gel® Gastric Suctioning section in Artificial Airway Suctioning for specific info on measuring and placing gastric suctioning catheters
  - Gastric suctioning should not be done continuously
    - If necessary, you can leave suction catheter inserted and apply suction intermittently
- ∇ See chart below for maximum suction catheter sizes

Adult i-gel® O2 Resus Suction Cath Size Chart		
i-gel® Size	**Airway Cath Size**	**Gastric Size**
3	14fr	12fr
4	14fr	12fr
5	14fr	14fr







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Pediatric Supraglottic Airway insertion i-gel® Anesthesia Model

1. **Knowledge Points**
   - ∇ This entry demonstrates use of the Pediatric i-gel® (Anesthesia model)
   - ∇ For Adult use, see Supraglottic Airway Insertion - Adult (i-gel® Resus)

2. **Prepare Equipment**
   - ∇ Assure oxygenation and ventilation is maintained during equipment preparation
   - ∇ Pediatric Sizing
     - Pediatric i-gels® are the anesthesia model, not the O2 Resus mode
     - Pediatric i-gel® colors DO NOT correlate with Length Based Tape sizing colors. Use Length Based Tape and Field Reference Guide to determine correct size of Pediatric i-gel®
     - If first attempted size does not fit, attempt a size up or down

	Description	Size	Weight
○	i-gel, large paediatric, supraglottic airway	2.5	25-35kg
●	i-gel, small paediatric, supraglottic airway	2	10-25kg
●	i-gel, infant, supraglottic airway	1.5	5-12kg
●	i-gel, neonate, supraglottic airway	1	2-5kg

   - ∇ Lubricate back, sides and front of cuff and place back in cradle
     - Generous lubrication is critical to prevent friction in the airway which can lead to bleeding
     - Do not allow a large bolus of lube to collect in the lumen of the i-gel or occlude the distal suction port

- ∇ Prepare Suction
  - Vomiting and fluids in the pharynx are possible when placing an airway and may present challenges to the airway seal and ventilation

3. Prepare Patient

- ∇ For pediatric patients with larger occiput, pad under the shoulder blades to place head in sniffing position

4. Insert Airway

- ∇ Grasp integral bite-block at midshaft, cuff facing patient's chin
  - Integral bite block and shaft are sturdy and can successfully guide airway. No fingers need enter mouth or between teeth
- ∇ With your other hand, open mouth by pushing chin down
  - Opening mouth facilitates passage of cuff through oropharynx

- ∇ Insert leading soft tip, gently advancing at midline toward hard palate
  - Some resistance may be felt as cuff passes tonsillar area of pharynx, but continue insertion
  - Stop when definitive resistance is felt
    - Tip of cuff should rest in upper esophageal opening
  - No portion of the cuff should be visible when looking in the mouth

5. Confirm Placement

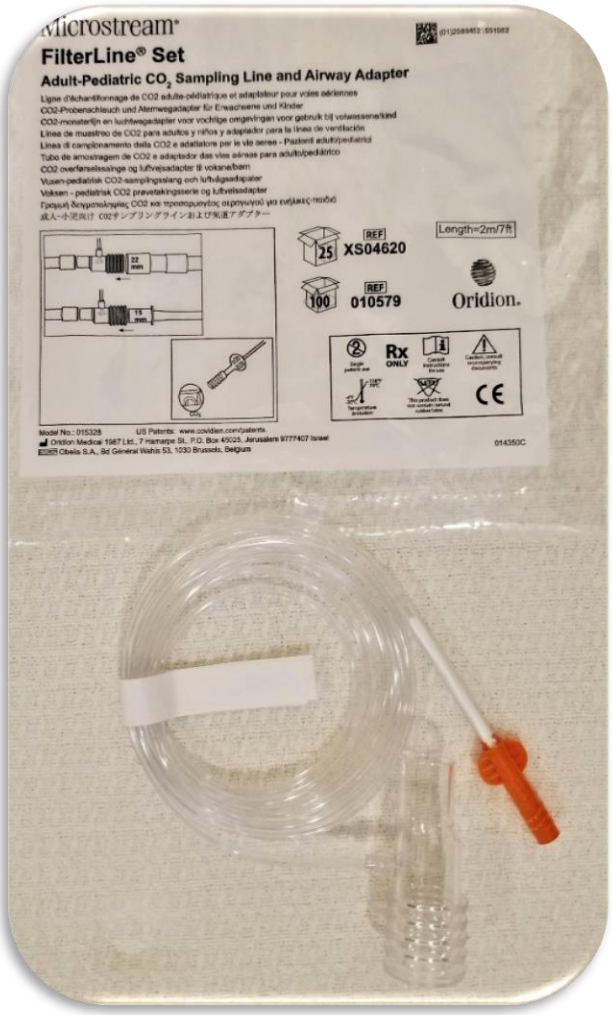
- ∇ Confirm with capnography
- ∇ **If you don't have a waveform with ventilation, the airway is not patent**
- ∇ See End Tidal CO2 (ETCO2) Detection Dictionary for more detailed information
- ∇ Patient must be ventilated with BVM to assess proper placement
- ∇ Attach BVM, ETCO2 device (EasyCap or Filterline Adapter) and ventilate
  - Waveform Capnography is gold standard for confirming placement
  - See FRG for proper selection of Filterline Adapter Size
- ∇ Observe for chest rise
- ∇ Auscultate for absence of epigastric sounds and presence of breath sounds
  - Breath Sounds alone, without the presence of waveform capnography, does not indicate a patent airway.

EasyCap Colorimetric Device Placement:

End-Tidal Capnography

- ∇ Initializing (Zeroing) and applying the sampling device
  - There are 3 steps in initializing and applying the sampling device that may be done in any order
    - Plugging the sampling device into the monitor
    - Pressing the CO2 Soft Key to activate the sampling pump
    - Applying the sampling device (CapnoLine / FilterLine) to the patient
  - Contrary to previous teaching, applying the sampling device to the patient prior to completion of the zeroing process will not affect accuracy of readings.
  - Ventilate and observe for waveform and numerical reading
  - Waveform Capnography is the gold standard for airway confirmation
  - **If there is no ETCO2 waveform with ventilation, the ET Tube is not patent**
  - Choose correct size Filterline based on patient size
    - See FRG for sizing based on Length Based Tape
    - Using the Adult/Pediatric Filterline on patients Yellow and smaller will result in false low readings or failure to read ETCO2 due to too much dead space in the Filterline.

Adult / Pediatric FilterLine



Length Based Tape Sizing	
White	15-18 kg
Blue	19-23 kg
Orange	24-29 kg
Green	30-36 kg

EMS Skills Dictionary

Infant / Neonate FilterLine

Length Based Tape Sizing	
Gray	3-4-5 kg
Pink	6-7 kg
Red	8-9 kg
Purple	10-11 kg
Yellow	12-14 kg

6. Secure Airway

- ∇ Use tape to wrap once around i-gel and adhere maxilla to maxilla
  - o Place center of length of tape with sticky side adhering to side of i-gel closest to feet
  - o Wrap one side around i-gel and adhere to opposite maxilla
  - o Wrap other side around i-gel and adhere to opposite maxilla

7. Ventilate patient

- ∇ Continuously monitor End-Tidal Waveforms to ensure proper seal, rate and volume
- ∇ The apneic patient should be ventilated at 10 breaths per minute
  - o Increase rate and/or volume of ventilation if ETCO2 Capnometry is >45mmHg
  - o Decrease rate and/or volume of ventilation if ETCO2 Capnometry is <35mmHg
- ∇ **If there is no End-Tidal waveform with ventilation, the i-gel® is not patent**

8. Suction PRN

- ∇ Oral Suctioning
  - Oral suctioning can be done around the i-gel for excessive secretions / emesis
- ∇ Airway Lumen Suctioning
  - Direct airway suctioning through the airway lumen of the i-gel may also be performed PRN.
  - Disconnect the ETCO2 Filterline from the i-gel during airway lumen suctioning to make suctioning easier and avoid fouling the Filterline.
- ∇ Gastric Suctioning
  - Gastric suctioning may be done to provide gastric decompression which may improve ventilation and reduce chance of aspiration
  - See i-gel® Gastric Suctioning section in Artificial Airway Suctioning for specific info on measuring and placing gastric suctioning catheters
  - Gastric suctioning should not be done continuously
    - If necessary, you can leave suction catheter inserted and apply suction intermittently.
- ∇ See chart below for maximum suction catheter sizes

Pediatric i-gel® Anesthesia Suction Cath Size Chart		
i-gel® Size	**Airway Cath Size**	**Gastric Size**
1	8	N/A
1.5	10fr	10fr
2	10fr	12fr
2.5	10fr	12fr

Endotracheal Intubation

1. **Prepare Equipment**
   - ∇ Assemble all equipment and have readily accessible
   - ∇ Check that suction is functioning
   - ∇ Connect laryngoscope blade to handle and check light / batteries are functional
   - ∇ Assure stylet is in endotracheal tube and shaped appropriately
   - ∇ Check for cuff leak by inflating with 10mL air
     - Attempt to minimize contamination by keeping ET Tube in packaging during check
     - Fully deflate cuff after leak check
     - Leave syringe attached to pilot balloon
   - ∇ Lubricate tube
   - ∇ Place tube in position where it can be retrieved easily without taking eyes off vocal cords once they are visualized

2. **Prepare Patient**
   - ∇ Preoxygenate patient with a pulse
   - ∇ Remove dentures which may become loose during insertion and be pushed into airway
   - ∇ Place patient in sniffing position unless maintaining Spinal Motion Restriction as necessary
     - Optimal positioning is obtained by aligning the ears with the sternal notch

3. Open the Airway

- ∇ Opening the airway in a Medical Patient
  - Open the mouth widely by performing cross finger scissor maneuver

- ∇ Opening the airway in the Trauma Patient
  - 2nd rescuer establishes manual stabilization from position to the side of the torso
  - Remove anterior portion of C-collar to assure mandibular mobility
  - Open mouth widely by performing cross finger scissor maneuver as demonstrated above

4. Visualize the vocal cords / glottic opening

- ∇ Hold laryngoscope in Left hand
- ∇ Insert laryngoscope in the Right side of mouth and move to midline, sweeping tongue to left with it
- ∇ Position the blade to visualize cords
  - Straight Blade
    - Advance blade observing for epiglottis
    - When visualized, place tip of blade under epiglottis
    - Keeping handle in a vertical position, push laryngoscope upward and away at a 45° angle, without rocking handle backward, directly lifting epiglottis until cords are seen
  - Curved Blade
    - Advance blade until it seats in vallecula
    - Keeping handle in a vertical position, push laryngoscope upward and away at a 45° angle, without rocking handle backward, indirectly lifting epiglottis until cords are seen

Straight Blade View

Curved Blade View

5. Insert Endotracheal Tube

- ∇ Advance tube gently through the cords into glottic opening, stopping when black markings pass through cords
- ∇ Take note of depth marking placement (Typically 19-23cm at incisors in adult patient)

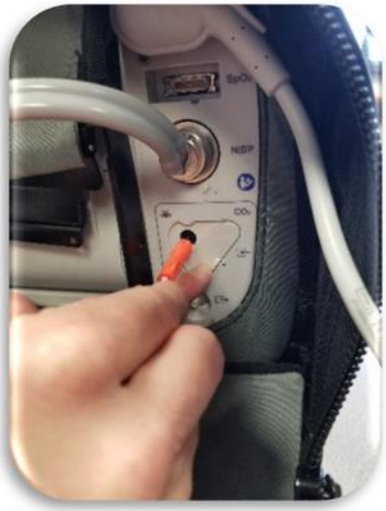
- ∇ Remove laryngoscope from mouth while holding tube in place
- ∇ Remove stylet while holding tube in place
- ∇ Inflate cuff with 10mL of air and remove syringe from pilot balloon

6. Confirm Placement

- ∇ Elapsed time from steps 2-5 should be less than 30 seconds
- ∇ Primary Confirmation is the use of ETCO2 Waveform Capnography
- ∇ Patient must be ventilated with BVM to assess proper placement
- ∇ Attach BVM, ETCO2 Filterline Adapter and ventilate
  - ○ Waveform Capnography is gold standard for confirming placement
    - **If you don't have a waveform with ventilation, the airway is not patent**
  - ○ See below for Filterline Adapter placement
  - ○ See FRG for correct Filterline Adapter selection in Pediatric Patient
  - ○ See ETCO2 Skills Dictionary for more detailed information on ETCO2 placement and monitoring
- ∇ Observe for chest rise
- ∇ Secondary Confirmation
  - ○ Auscultate for absence of epigastric sounds and presence of breath sounds
    - **Breath Sounds alone, without the presence of waveform capnography, does not indicate a patent airway**
    - Condensation in tube is not a reliable form of confirmation
      - ♦ Esophageal placement may still cause condensation in tube

End-Tidal Capnography

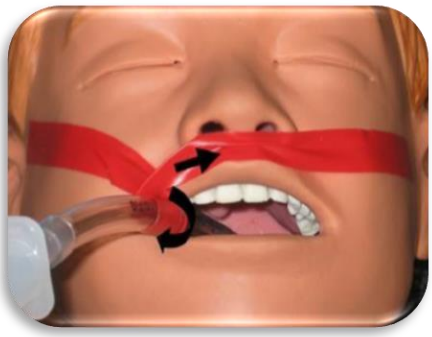
- ∇ Initializing (Zeroing) and applying the sampling device
  - There are 3 steps in initializing and applying the sampling device that may be done in any order
    - Plugging the sampling device into the monitor
    - Pressing the CO2 Soft Key to activate the sampling pump
    - Applying the sampling device (CapnoLine / FilterLine) to the patient
  - Contrary to previous teaching, applying the sampling device to the patient prior to completion of the zeroing process will not affect accuracy of readings.
  - Ventilate and observe for waveform and numerical reading
  - Waveform Capnography is the gold standard for airway confirmation
  - **If there is no ETCO2 waveform with ventilation, the ET Tube is not patent**

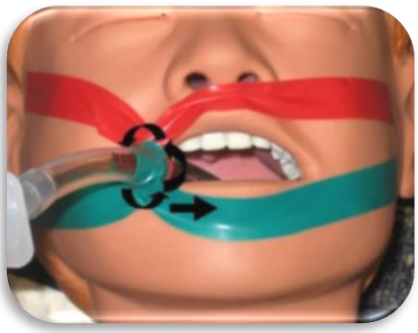


7. Secure the Tube

- ∇ Be sure tube is still at previously noted depth
- ∇ Re-secure C-Collar if Trauma Patient
- ∇ Adult Patient
  - Apply commercial ET Tube securing device

- ∇ Pediatric Patient
  - Use tape
  - Wrap center of piece of tape around ET Tube and tape maxilla to maxilla
  - A 2nd piece of tape can be used to wrap around opposite direction and secure to lower cheeks





8. Re-confirm Tube Placement

- ∇ Verify tube depth remains at previous position
  - Deflate cuff and adjust height PRN
- ∇ Verify continuation of waveform capnography
- ∇ Verification should be performed and documented every time the patient is moved
- ∇ **If there is no ETCO2 waveform with ventilation, the ET Tube is not patent**

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Percutaneous Airway Device (QuickTrach®)

1. **Prepare equipment**
   - ∇ Obtain Quicktrach puncture set
     - ∇ Prepare the device
     - ∇ The Quicktrach is a preassembled emergency percutaneous cricothyrotomy unit with a 10-ml syringe, padded neck strap and a flexible connecting tube that allows access for ventilation in the presence of acute respiratory distress with upper airway obstruction when less invasive airway procedures are unsuccessful

   - ∇ Obtain Bag-Valve Mask device
     - ∇ BVM shall be obtained to assist with ventilation once the Quick Trach is inserted.
   - ∇ Obtain an oxygen source
     - ∇ Oxygen tank, portable or ambulance fixed for supplemental oxygen to the BVM
     - ∇ Alcohol preps or Betadine swabs are adequate.

   - ∇ Ensure the 10ml syringe is securely attached to the Quicktrach catheter
     - ∇ The syringe provides a better hold on the equipment. Aligning the Catheter bevel with the fixation flange of the Quicktrach provides an easy reference for which way the bevel is facing. Conical needle tip guarantees the smallest necessary stoma and reduces bleeding.

- ∇ Position the cushioned neck band behind the patient's neck with straps undone
  - Pre-positioning the cushioned neck band will allow for a one handed securing technique once the Quicktrach has been inserted, thus ensuring one hand can stay on the device for stabilization.

2. Prepare the patient and identify the puncture site

- ∇ Place the patient supine
- ∇ Position yourself beside the patient's head
- ∇ Hyperextend the patient's head and neck
  - Hyperextension of the head stretches the skin of the neck and facilitates locating landmarks for the laryngeal structures and puncture site.

- ∇ Locate the cricothyroid membrane between the thyroid and cricoid cartilages
  - Use two fingers to steady the larynx while the opposite hands index finger locates the site of the puncture. The cricothyroid membrane represents an easily identifiable and relatively superficial access to the trachea in the anterior neck. The risk of damaging surrounding structures and causing excessive bleeding is minimized by using this site.

- ∇ Prepare the skin with antiseptic solution
- ∇ This device can be used in either hand

3. **Puncture the membrane**
   - ∇ Stabilize the trachea with the thumb and index finger
   - ∇ Insert the Quick Trach with bevel caudally into the midline of the cricothyroid membrane
     - Ensure a firm grip on the syringe as the insertion is made.
   - ∇ The needle is initially directed perpendicular to prevent unwanted movement of the intended puncture site
     - This angle is necessary to avoid accidental penetration of the posterior wall of the trachea.

4. **Aspirate free air and insert device**
   - ∇ Aspirate with the syringe as the needle is advanced into the trachea
     - Entrance into the trachea will be confirmed by the free aspiration of air into the syringe.
   - ∇ Once air is aspirated into the syringe, advance the Catheter caudad while holding the needle in position

   - ∇ Once the beveled tip is inserted into the cricothyroid ligament, begin to advance the device at a 45 degree angle until the stopper rests on the tissue

- ∇ Once the stopper meets the skin, REMOVE THE STOPPER, hold the steel needle and advance only the plastic cannula

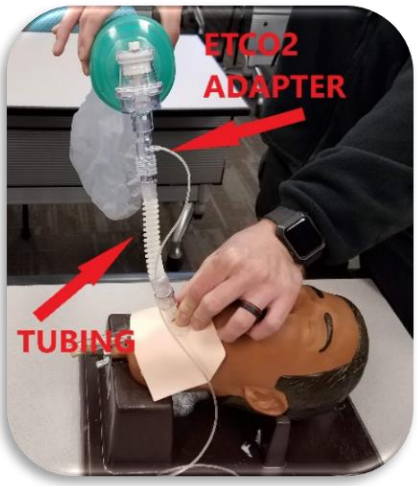
  - Withdraw the steel needle and advance only the plastic cannula, until the fixation flange lies on the skin.

5. Assemble and Confirm placement

5.1 Connect the Extension Tubing to the Quicktrach and connect the ETCO2 adapter and BVM to the other end.

5.2 Be very cautious about movement of the Quicktrach and causing further tracheal injury. Using the flexible extension tubing, connected directly to the hub on the Quicktrach may help minimize further injury.

5.3 Placing the ETCO2 adapter between the BVM and extension tubing may help minimize soiling of the ETCO2 adapter with blood in the airway from the procedure.



6. **Secure the fixation flange**
   - ∇ Use the pre-placed cushioned neck band
     - Using the pre-placed band, extend the hook and loop ends and insert them thru the plastic holder spaces on the Quick Trach cannula then double back onto itself for secure closure. Repeat on each end of the neck band.

7. **Ventilating the patient**
   - ∇ Watch for chest rise and fall
     - Adequate chest rise should be noticed, do not overinflate the lungs
     - Frequently check for ventilation of both lungs by auscultating the chest and observing for chest movement
   - ∇ The "Feel" of providing ventilations
     - It may feel more difficult and require more force to provide ventilation through the reduced lumen of the Quicktrach.
     - Be cautious and reassess breath sounds if there is an increase in the difficulty at any point. This could be an indicator of pneumothorax caused by inadequate exhalation time.
   - ∇ Prolonged exhalation time needs to be allowed due to the small lumen of the Quicktrach.
     - Inspiration to Exhalation time ratio should be approximately 1 second to 6 seconds.
     - Timing alone can be unreliable and chest rise may not easily be detected
     - Using ETCO2 is the most reliable indicator of adequate ventilation.
   - ∇ Due to the small lumen size of the Quicktrach, it may be difficult to achieve optimal levels of 35-45 mmHg.
     - If the ETCO2 levels are below 35 mm Hg, the provider should slow ventilation rate to reach this optimum range.
     - If the ETCO2 levels are above 45 mm Hg, the provider should increase ventilation rate to reach this optimum range but be cautious to continue to allow adequate exhalation time.

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Continuous Positive Airway Pressure (CPAP)

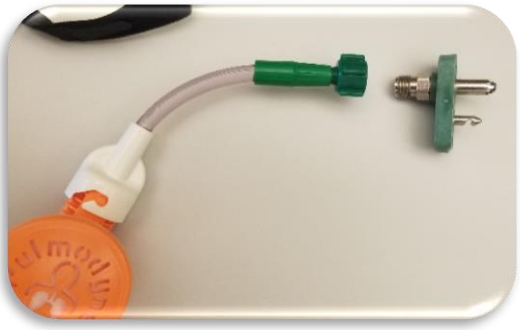
1. Assess need for CPAP

- ∇ Consider CPAP for patients with acute pulmonary edema, asthma, drowning, COPD, and/or pneumonia who show signs and symptoms of acute respiratory failure
  - Patients must meet inclusion criteria before CPAP is used
- ∇ Patient must have:
  - GCS > 8, RR > 8, B/P ≥ 100 mmHg
- ∇ Apply $ETCO_2$ nasal cannula
  - Perform continuous, non-invasive $ETCO_2$ monitoring on all patients who will be actively treated with medications.

2. Gather and Assemble equipment

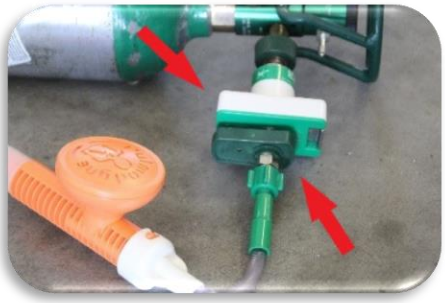
- ∇ Assemble the Mask and Tubing
  - Mask harness should be loose but connected with the hook and loop fasteners at the forehead.
  - Connect one side of the chin harness and leave the other side undone to make placement on the patient easier.
  - Connect tubing to mask port

∇ Connect the other end of the CPAP tubing (Orange generator and pigtail) to the quick connect adaptor



∇ Attach female quick connect coupler to 50 psi outlet on oxygen cylinder.

∇ Connect the quick connect adaptors when ready to begin gas flow.
- There is no need to set an oxygen flow rate.



- ∇ Alternatively, if your department does not have the quick connect adapters, you and screw the CPAP pigtail directly to the threaded outlet on the oxygen regulator

3. Coach patient

- ∇ Inform patient about noise, mask, expiratory resistance, and air flow.
  - o Patients are more likely to cooperate with CPAP if they are informed of what to expect. Proper coaching decreases patient anxiety and enhances patient compliance.

4. Hold mask near patient's face

- ∇ Leaving strap unsecured, hold mask under patient's chin for a few seconds to acclimate them to noise and air flow
  - o Patient will likely cooperate more fully if allowed to feel the mask and air flow before the mask is secured onto their face. Properly fitting equipment is important to attain effective CPAP mask seal.

5. Secure mask to patient's face using straps provided

- ∇ Apply the mask to the patient's face and adjust the straps so that the mask fits securely across the bridge of the patient's nose and above their chin
  - Mask fit creates adequate CPAP mask seal. Apply just tight enough so that mask makes a complete seal. Do not over tighten.
  - Respiratory distress patients, especially those requiring CPAP, should have ETCO2 monitoring. Using the CapnoLine ETCO2 Nasal Cannula under the CPAP mask is the preferred method for capturing ETCO2 with CPAP.
    - The cannula tubing causes very minimal to no leak with proper mask fit.
    - The cannula captures exhaled CO2 directly from the mouth and nose, providing the most accurate reading during CPAP.
    - Using the inline FilterLine adaptor may give an incorrectly low reading due to dilution from the oxygen flow of the CPAP.

- ∇ Check for air leaks around the mask
  - If air leaks are noted, readjust mask and/or straps to insure better fit.
  - Mask can be moved aside for administration of ASA or sublingual nitroglycerine if indicated
- ∇ If an effective fit is not possible with the medium mask, switch to the larger mask for a more efficient fit

6. Reassess and monitor patient

- ∇ Assess vitals and 1-5 Respiratory Assessment every 5 minutes
  - 1-5 scale coupled with vital signs and SpO_2 form a reliable picture of patient improvement.
  - Monitoring CPAP system ensures continuous airway flow and constant evaluation of clinical parameters

How hard is it for you to breathe?

1 2 3 4 5

(Not bad) (Very bad)

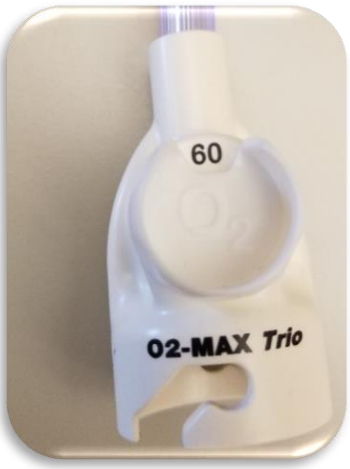
- ∇ Monitor oxygen supply closely

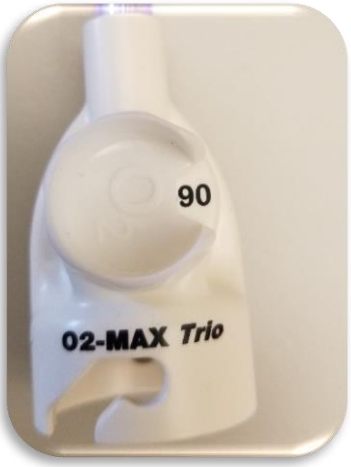
7. Switch to onboard oxygen supply ASAP once in ambulance

- ∇ Detach CPAP Tubing quick connect adaptor from the oxygen bottle quick connect adaptor and immediately attach the CPAP Tubing quick connect adaptor to high-pressure oxygen port in ambulance.
  - Use of onboard oxygen system minimizes chance of oxygen depletion and system failure. Ensure adequate oxygen remains in portable oxygen supply to ensure CPAP flow into the ED.

- ∇ If, at any time, gas flow is interrupted, for any reason, for more than the time it would take to unplug the quick connect from the oxygen cylinder and plug it into the wall outlet, the CPAP tubing should be disconnected from the mask, or the mask should be removed from the patient.
- ∇ If patient's SpO_2 is <94% upon arrival to ambulance, switch to Trio connector and set to 90% FiO_2.
  - Remove standard connector from orange generator and attach Trio

- ∇ Titrate Trio FiO_2 back down to 60% or 30% when able, based on need, to maintain SpO_2 <94%





8. Communicate patient status to ED

- ∇ Make early hospital contact.
  - Early hospital contact ensures that adequate resources are ready at the ED on patient arrival.

9. Adding a Nebulizer (when necessary)

- ∇ ***See also Medication Administration – Nebulized Delivery Skills Dictionary**
- ∇ Select medication
- ∇ Perform Medication Cross-Check
- ∇ Place medication in nebulizer cup
- ∇ Remove cap from bottom port on T-piece and attach nebulizer cup

- ∇ Connect nebulizer tubing to oxygen source and flow at 6-8 LPM
  - Same bottle can be used to run CPAP and Nebulizer if necessary, but will result in faster depletion.
  - Monitor oxygen supply closely

End Tidal CO2 (ETCO2) Detection

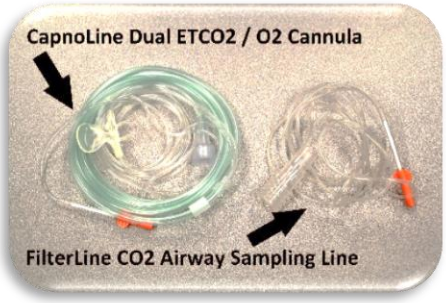
This Skills Dictionary entry covers the detection / measurement of End Tidal CO2 (ETCO2) using the following devices:

End Tidal Waveform Capnography using the Zoll X-Series Monitor
Easy Cap Colorimetric CO2 Detector

End Tidal Waveform Capnography (ZOLL®)

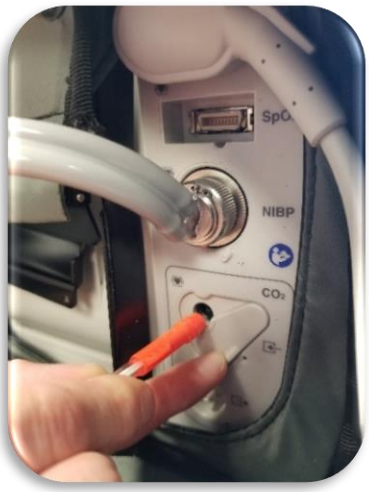
1. **Gather and prepare equipment**

∇ Gather appropriate ETCO2 sampling device – either the CapnoLine nasal cannula (adult or pediatric) or the FilterLine Airway Adaptor device.
- The CapnoLine Nasal Cannula and FilterLine Airway Adapter are for use by ALS providers, using a cardiac monitor.



∇ **When using the CapnoLine nasal cannula for spontaneously breathing patients:**
- The CapnoLine nasal cannula should be used to monitor the ETCO2 of patients without an advanced airway.
  - The CapnoLine nasal cannula is the preferred method for ETCO2 monitoring for patients receiving CPAP or BVM/Mask ventilation.

∇ **Initializing (Zeroing) and applying the sampling device**
- There are 3 steps in initializing and applying the sampling device that may be done in any order
  - Plugging the sampling device into the monitor
  - Pressing the CO2 Soft Key to activate the sampling pump
  - Applying the sampling device (CapnoLine / FilterLine) to the patient
- Contrary to previous teaching, applying the sampling device to the patient prior to completion of the zeroing process will not affect accuracy of readings.
- **To plug the sampling device into the monitor:**
  - Access the ETCO2 sampling port, inside the pocket, on the side of the monitor, on the left side of the screen.
  - Slide the access port cover down, insert the orange plug and twist clockwise (towards the front of the monitor) until it stops.



○ **Press the CO2 Soft Key on the Left side of the screen to activate the internal suction pump.**

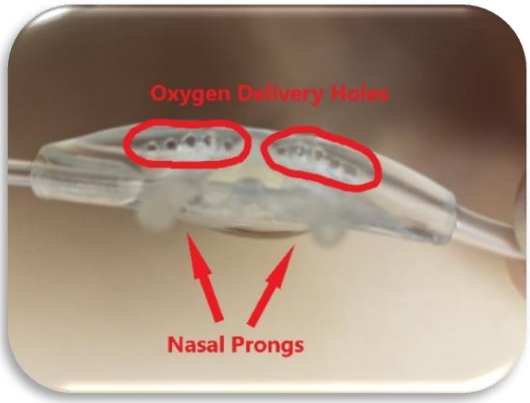
- Once the CO2 soft key has been activated, a green light will display in the box to indicate the pump is running

- Once the CO2 soft key has been activated, the Initialization (Zeroing) process will begin and the ETCO2 status will display as “Initializing”.
  - ***a.*** During the Initializing process, no sampling results will be available if the sampling device is already applied to the patient.
- When the monitor has completed the ETCO2 zeroing process, the EtCO2 box will display with a “Searching” message until it detects CO2

- **Apply the CapnoLine nasal cannula to the patient.**
  - Check that both nostrils are clear
  - Position the nasal CapnoLine on the face by inserting the tips into the nostrils

  - Pass the CapnoLine tubing over the ears, then slide the sleeve up the tubing toward the neck to a comfortable fit under the chin
  - Attach the green tubing end to an oxygen source and set at the appropriate oxygen level (If flowing oxygen)

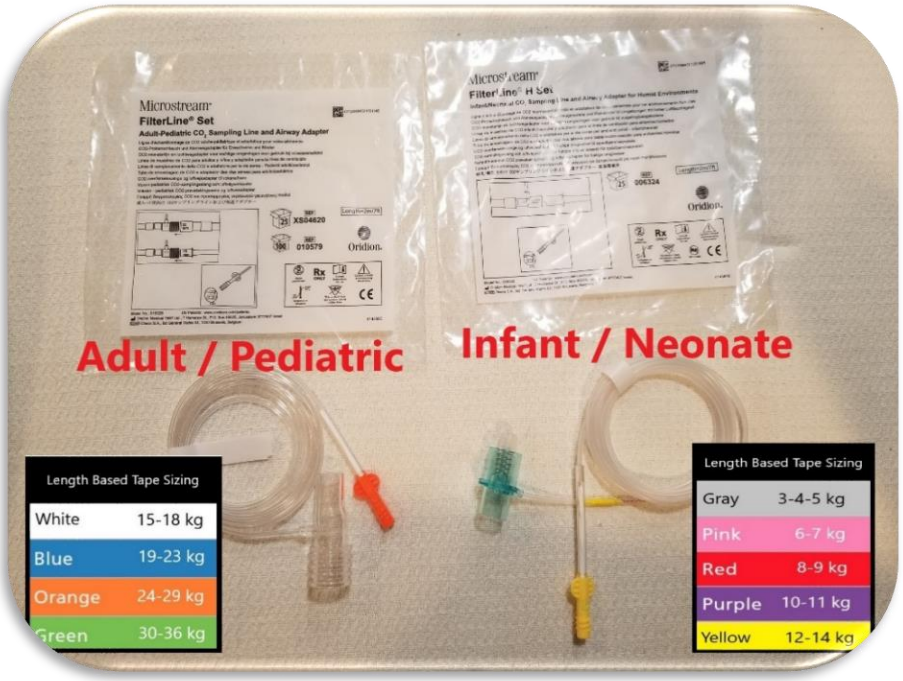
- The CapnoLine nasal cannula can be used solely to monitor ETCO2, or it can be used in conjunction with oxygen flow to provide supplemental oxygen support.
  - Exhaled CO2 is sampled using the nasal prongs and “oral scoop”.
  - The nasal prongs DO NOT provide oxygen flow.
  - Oxygen flow comes from a set of small holes just above the nasal prongs. (Picture below)



- **When monitoring ETCO2 while providing CPAP therapy or ventilations using a BVM** and mask, the CapnoLine nasal cannula provides the most accurate readings.
  - Especially during BVM and mask ventilation, poor mask seal can result in diluted and incorrect readings when using the FilterLine Airway Adapter. Because the CapnoLine nasal cannula samples from much closer to the mouth and nose, it provides more reliable readings when BVM mask seal is not consistent.
  - The tubing of the Capnoline nasal cannula should not create a significant enough leak, where it passes under the CPAP or BVM mask, to result in measurably diluted samples.
  - When monitoring ETCO2 with CPAP therapy, get a good baseline ETCO2 prior to applying CPAP
  - The flow of CPAP can dilute the ETCO2 sample, you should anticipate a possible 5-15mmHG drop in ETCO2 due to dilution when applying the CPAP. You can still evaluate trends based on the new lower, diluted reading.

∇ The pictures below show use of the CapnoLine nasal cannula under CPAP and BVM mask.

- **When using the FilterLine Airway Adapter device for ET or i-gel® airways:**
  - Choose the correct FilterLine Adapter
    - Adult patients use the Adult / Pediatric Filterline Adapter
    - Pediatric patients who measure White and Larger on a Length Based Tape also use the Adult / Pediatric FilterLine Adapter
    - Pediatric patients who measure Yellow and Smaller on a Length Based Tape use the Infant / Neonate FilterLine Adapter
    - See FRG for sizing based on Length Based Tape
    - Using the Adult/Pediatric Filterline on patients Yellow and smaller will result in false low readings or failure to read ETCO2 due to too much dead space in the Filterline



- **Initializing (Zeroing) and applying the sampling device**
  - There are 3 steps in initializing and applying the sampling device that may be done in any order
    - Plugging the sampling device into the monitor
    - Pressing the CO2 Soft Key to activate the sampling pump
    - Applying the sampling device (CapnoLine / FilterLine) to the patient
  - Contrary to previous teaching, applying the sampling device to the patient prior to completion of the zeroing process will not affect accuracy of readings.
  - **To plug the sampling device into the monitor:**
    - Access the ETCO2 sampling port, inside the pocket, on the side of the monitor, on the left side of the screen.
    - Slide the access port cover down, insert the orange plug and twist clockwise (towards the front of the monitor) until it stops.

  - **Press the CO2 Soft Key on the Left side of the screen to activate the internal suction pump.**
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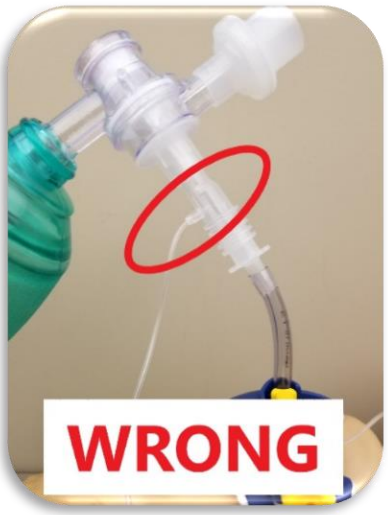
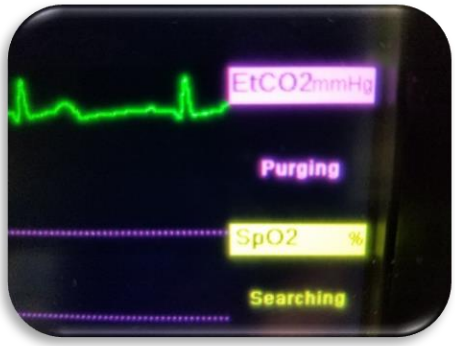
- Once the CO2 soft key has been activated, the Initialization (Zeroing) process will begin and the ETCO2 status will display as “Initializing”.
  a. During the Initializing process, no sampling results will be available if the sampling device is already applied to the patient.
- When the monitor has completed the ETCO2 zeroing process, the EtCO2 box will display with a “Searching” message until it detects CO2

- To minimize the risk of the sampling line becoming obstructed with airway secretions, the sampling line should never be in a dependent position**.**



- If the sampling line becomes too heavily contaminated with airway fluids, the monitor will go through a purging cycle and a message of “Purging” will replace the ETCO2 numeric value displayed on the screen.
  - If the message clears and remains clear, the Filterline tubing does not need to be replaced.
  - If the purging cycle does not relieve contamination, replace the Filterline tubing.
  - If you see contamination in the line but no message appears, and the wave form appears to display correctly, the Filterline tubing does not need to be changed.



  - Begin ventilations and within 2-4 ventilations the color on the device should change from purple to yellow if the advanced airway is appropriately placed in the airway

2. Measuring and interpreting $EtCO_2$

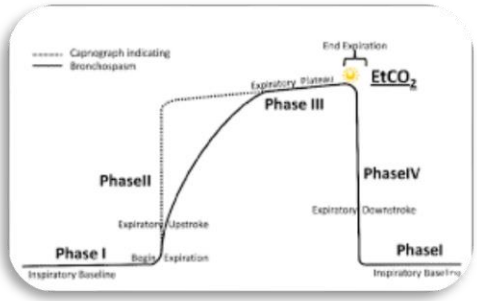
∇ The CO_2 waveform is automatically displayed in the configured Wave Sector of the monitor when the FilterLine is connected to the CO_2 Inlet port.

○ A normal $EtCO_2$ waveform should resemble a top hat or a rectangle with rounded corners

○ The measurement value (capnometry) for End-Tidal CO_2 (EtCO2) is displayed on the monitor as shown below.

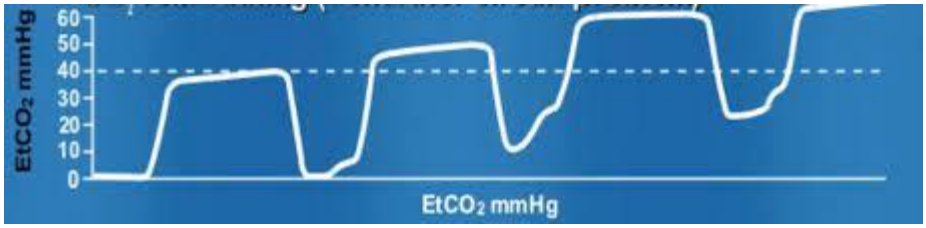
- ETCO2 value will be shown at the top of the box
- Breathing Rate (BR) will be shown in smaller numbers at the bottom of the box

○ A normal $EtCO_2$ level should be between 35-45 mmHg

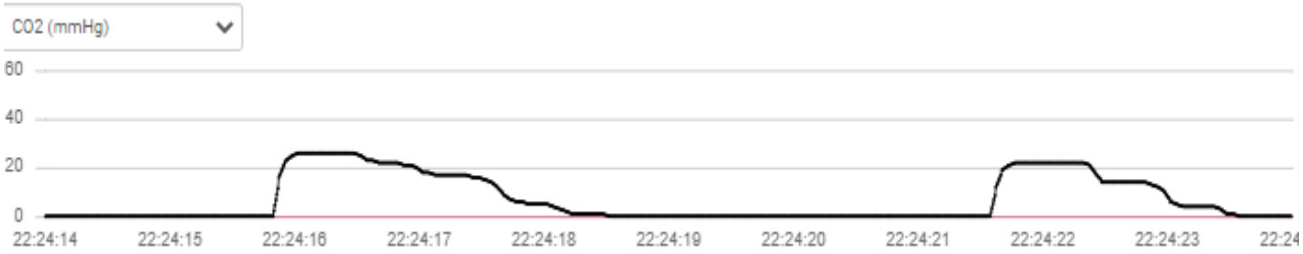


- An abnormal $EtCO_2$ wave form might look like the shapes below.
  - Obstructive (Shark Fin) Pattern
    - Indicates lower airway constriction often caused by an obstructive disease process such as COPD or Asthma.

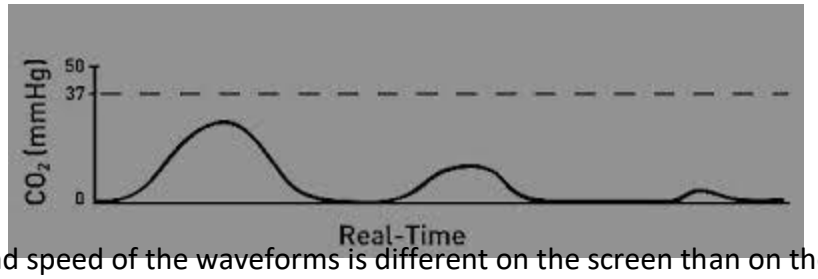
  - Breath Stacking (Rising / Elevated ETCO2 Baseline)
    - Indicates re-breathing of exhaled CO2, often caused by clinician not allowing adequate exhalation time during positive pressure ventilation



  - Downward Inspiratory Slope
    - Indicates mixing of fresh air and exhaled air during ventilation and may be caused by a leak in the glottic seal during positive pressure ventilation with inadequate volume being delivered



- Rounded Waveforms
  - Indicates mixing of fresh air and exhaled air during ventilation and exhalation and is caused by a leak during all phases of inhalation and exhalation with inadequate volume being



- The shape and speed of the waveforms is different on the screen than on the print-out.
  - When assessing shape of waveform to determine presence of bronchoconstriction, the print-out should be used, rather than relying on the shape of the waveform on the screen.
  - "The waveform on the screen usually doesn't look like the printout because most cardiac monitors' screens scroll at a rate of 25mm per second and typically display about three seconds of activity at a time. This works well for heart rates. But when a patient takes 12 breaths per minute, you wouldn't see a waveform on the scope. The screen section chosen to display the waveform is sped up about 10 times so the waveform is visible. But when the waveform is printed, it's printed real time on the paper and will be a lot wider than what you see on the scope. So I recommend that the paper capnogram be used to evaluate for airway issues, not the scrolling part on the screen. The scrolling part on the screen can be used to look at a square capnogram (for tube placement confirmation) or apnea (flat line). Everything else should be evaluated on the printout. It's the easiest and most accurate way to study the capnograph." - Bob Page

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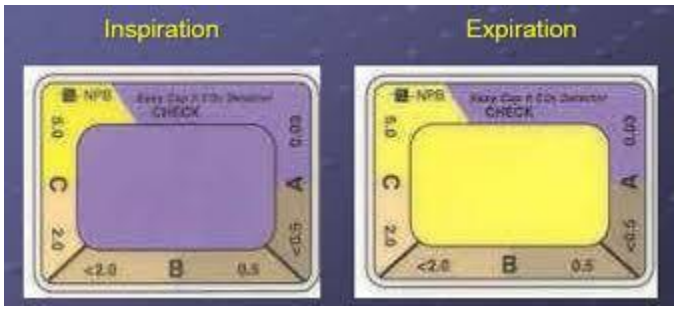
Colorimetric Easy Cap CO2 Detector

1. **Gather and assemble equipment**
   - ∇ The EasyCap colormetric device is for use by BLS providers or for ALS providers on a response vehicle without a cardiac monitor, when placing an advanced airway.
   - ∇ The center rectangle will change color with each Inspiration / Expiration cycle. Color determination should be made by identifying the color during exhalation.



   - ∇ When using the Easy Cap colormetric device:
     - ○ Remove device from package
     - ○ Attach bottom of device to advanced airway device
     - ○ Attach BVM to the other ventilation port.
2. **Measuring and interpreting EtCO2**
   - ∇ After placement, begin ventilation and watch for color change. A minimum of 6 ventilations should be provided prior to determining color change. This allows for washout of any residual CO2 in the esophagus with improper airway placement.
   - ∇ *Yellow – Color Range C*
     - ○ Yellow color indicates a properly placed airway in an adequately perfused patient.
   - ∇ *Tan / Brown / Grey – Color Range B*
     - ○ Colors in this range may be the result of a poorly perfusing patient, or an improperly placed airway. Patient assessment and clinical judgement should be used to determine the cause.
       - Possible causes include:
         - An improperly seated / incorrect size supraglottic airway could be allowing exhaled gas to go around airway
         - Esophageal intubation with residual CO2 (Waveform Capnography should be used on intubated patients)
         - Prolonged patient down time
       - Interventions:
         - Replace supraglottic airway with another size
         - Verify ET tube is through vocal cords (Waveform Capnography should be used on intubated patients)
         - Reassess perfusion, CPR effectiveness, patient down time

- ∇ *Purple – Color Range A*
  - ○ Purple color may be the result of a non-perfusing patient or an improperly placed airway. Patient assessment and clinical judgement should be used to determine the cause.
    - Possible causes include:
      - Esophageal intubation (Waveform Capnography should be used on intubated patients)
      - An improperly seated / incorrect size supraglottic airway could be allowing exhaled gas to go around airway
      - Very prolonged patient down time
    - Interventions:
      - Replace supraglottic airway with another size
      - Verify ET tube is through vocal cords (Waveform Capnography should be used on intubated patients)
      - Reassess perfusion, CPR effectiveness, patient down time

Magill Forceps Use

1. Prepare equipment

- ∇ Gather laryngoscope blade and handle, check light
- ∇ Select appropriate size Magills forceps
- ∇ Check suction and have standing by

2. Insert Laryngoscope*

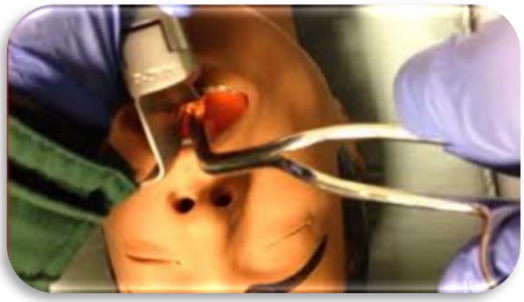
- ∇ **EMT and AEMT Providers are not authorized to perform direct laryngoscopy during the FBAO removal procedure. These providers are authorized to use the Magill Forceps to remove ONLY foreign bodies that are visible with opening the mouth and positioning the airway. Rather than inserting the laryngoscope, the EMT and AEMT Providers will skip to Step 3, below.*
- ∇ Put head in sniffing position (if not contraindicated)

- ∇ Insert blade in right side of mouth and sweep left
- ∇ Do not pry, keep off the teeth
- ∇ Attempt to visualize obstruction while performing direct laryngoscopy

3. Insert forceps and remove obstruction

- ∇ Hold Magills forceps with right hand

- ∇ Insert Magills forceps and grasp obstruction



- ∇ Remove obstruction

4. Assess patient's condition

- ∇ Visualize to confirm entire obstruction removed
- ∇ Check for breathing
- ∇ Auscultate breath sounds
- ∇ Obtain vital signs

5. Start oxygen therapy or ventilatory assistance if needed

- ∇ While maintaining face-to-mask seal with one hand, squeeze bag slowly, delivering a ventilation (evidenced by chest rise) over 1-2 seconds (ventilation volume may vary depending on age, clinical situation, and $ETCO_2$). Completely release bag and allow for full refill between ventilations.

Use 2 fingers to ventilate

- ∇ If the ETCO2 levels are below 35-45 mm Hg, the provider should slow ventilation rate to reach this optimum range.
- ∇ If the ETCO2 levels are above 45 mm Hg, the provider should increase ventilation rate to reach this optimum range.

Suctioning

This entry includes an Introduction for all methods and Oral Suctioning, Nasal Suctioning, Stomal / Tracheostomy Suctioning and Artificial Airway Suctioning

Introduction

1. **Turn the patient onto his/her side if able**
   - ∇ Log roll technique
     - Turn the patient onto his/her side with the head down to facilitate drainage of blood, vomitus, or other secretions out of the patient's mouth rather than down the throat

     - If mechanism of injury indicates a possible spinal injury, maintain and protect spinal integrity within reason

2. **Open the patient's mouth if necessary**
   - ∇ Use appropriate manual airway technique
     - Crossed-finger technique

     - Tongue-jaw-lift

3. Finger sweep if necessary

- ∇ Use the gloved index finger of other hand to sweep the mouth
  - Facilitates clearing the airway of foreign material that may be too large to be handled by the suction equipment - never let the obtaining of equipment delay patient care.
  - The airway must be cleared immediately to prevent aspiration

4. Select appropriate suction tip

- ∇ Rigid (tonsil) tip (Yankauer)
  - This tip is preferred for suctioning the pharynx as it is less likely to become clogged and the rounded tip is less likely to be traumatic to the soft tissue
- ∇ Flexible catheters - A variety of sizes are available and may be tolerated better by a conscious or semi-conscious patient, patients with a stoma or suctioning the nasopharynx
  - Suctioning a patient with clenched teeth can also be accomplished easier with this type of tip because it can be placed along the teeth back into the mouth or nasally
- ∇ Suction tubing
  - At times the largest flexible catheter or the Yankauer tip will not able to suction particulate matter from the airway. The suction tubing itself without a suction tip on it can be utilized to suction thicker, particulate secretions from airway if needed.

Oropharyngeal Suctioning

1. **Measure the tip**
   - ∇ Measure the Yankauer suction tip from the tip of the patients earlobe to the corner of his/her mouth
     - Measuring the tip prevents the suction tip from being placed too deep into the pharynx causing soft tissue damage. In a conscious or semi-conscious patient this could stimulate vomiting.

2. **Insert the tip with suction not applied (general rule for all suction techniques)**
     - Prevents suction tip from attaching to the soft tissue when inserting the tip. The tonsil tip should be inserted with its convex side along the roof of the mouth until the pharynx has been reached.

3. **Perform oropharyngeal suctioning**
   - ∇ Apply suction to the pharynx and dependent buccal area
     - The suction tip must be continuously moved to prevent the catheter from attaching to the soft tissue. Try to limit suctioning to 15 sec. A complication of suctioning is hypoxia. After the airway is cleared supplemental oxygen must be administered to help prevent or counteract hypoxia

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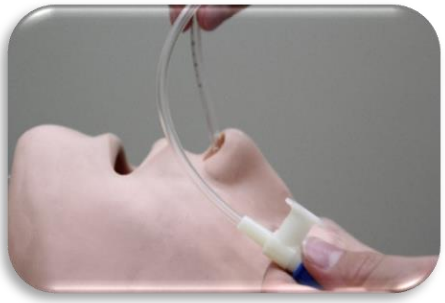
Nasopharyngeal Suctioning

1. Nasopharyngeal suctioning

- ∇ Measure the tip of the same way as for a nasopharyngeal airway
  - See nasopharyngeal airway skill criteria
- ∇ Moisten tip with water or a water soluble lubricant
  - A flexible tip must be used for this type of suctioning. Select one small enough to fit into the nostril. A rigid tip is too large to be inserted into the nostril and would cause extensive damage to the nasal mucosa. Moistening and/or apply a water soluble lubricant to the tip lubricates the catheter for easier insertion
- ∇ Insert the tip gently through one of the nostrils using a slight downward slant to the back of the throat with suction not applied
  - Application of suction while inserting the tip into the pharynx increases the risk of damage to the pharyngeal mucosa. This procedure can be done with a nasal airway in place.



- ∇ Apply suction intermittently
  - Suction until the airway is clear, limiting suctioning to no more than 15 seconds and administer supplemental oxygen to counteract or prevent hypoxia. Intermittent suctioning and rotating of the catheter between the thumb and forefinger prevents injury to the lining of the pharynx.

2. Flush tip and tubing with water as needed

- ∇ Place suction tip in water with suction applied and flush the catheter and tubing as necessary
  - To prevent clogging of the tubing after suctioning is accomplished flush all emesis from tip and tubing into collection bottles. This contains the emesis for easier disposal and infection control

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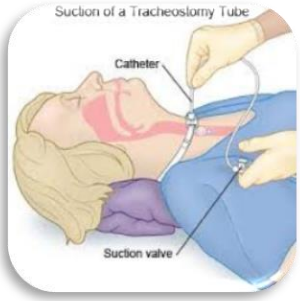
Stoma / Tracheostomy Suctioning

1. Stoma/tracheostomy suctioning

- ∇ Remove all coverings
  - o Allows for visualization and access to stoma

- ∇ Clear the stoma of any foreign matter
  - o The airway must be cleared to prevent aspiration
- ∇ This is a sterile procedure and every precaution should be taken to keep the suction catheter tip sterile
  - o A sterile surface becomes contaminated as soon as the sterile surface comes in contact with anything, surface or object, considered not sterile. Sterile objects may touch other sterile objects and remain sterile. If you are unsure about the sterility of an object, consider it contaminated.
- ∇ Moisten tip with sterile water and/or apply a water soluble lubricant
  - o A flexible tip must also be used for this type of suctioning. Select one small enough to get through the stoma. A rigid tip is too large to be inserted and would cause extensive soft tissue damage
  - o Moistening and/or application of water soluble lubricant to the tip lubricates it for easier insertion

- ∇ Insert tip gently. Approximately 2-3 inches through the stoma
  - o Suction until the airway is clear, limiting suctioning to no more than 15 seconds. Administer supplemental oxygen to counteract or prevent hypoxia. Intermittent suctioning and rotating of the tip between the thumb and forefinger prevents injury to the soft tissue of the lower airways



- ∇ Apply intermittent suctioning as the tip is slowly withdrawn

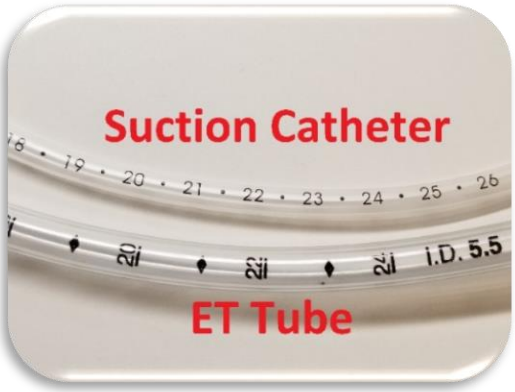
2. Flush tip and tubing with water as needed

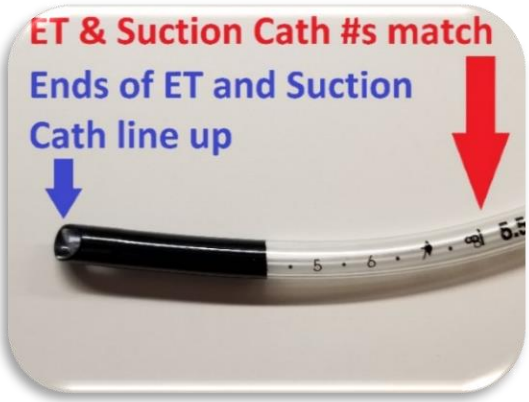
- ∇ Place suction tip in water with suction applied and flush the catheter and tubing as necessary
  - To prevent clogging of the tubing after suctioning is accomplished flush all emesis from tip and tubing into collection bottles. This contains the emesis for easier disposal and infection control

Artificial Airway Suctioning

1. **Selecting Suction Catheter Size**
   - ∇ Endotracheal Tube Suctioning
     - Don't use a suction catheter size that takes up more than 50% of the airway.
     - General rule of thumb is ET Size x2 = Suction Cath Size
       - Do Not round up.
       - See chart below for further assistance in selecting correct suction catheter size
     - Determine proper suction tube insertion depth by matching top depth number on ET tube to same depth number on suction catheter during insertion (See pictures below for example)
       - This will place the tip of the catheter just at the end of the ET Tube. You may advance an additional 1-2 cm but doing so could cause trauma to the carina and bleeding in the airway.
   - ∇ ET Suction Catheter Sizing Chart

ET Suction Cath Size Chart	
ET Size	**Suction Size**
2.5	6
3.0	6
3.5	6
4.0	8
4.5	8
5.0	10
5.5	10
6.0	10
7.0	14
7.5	14
8.0	14





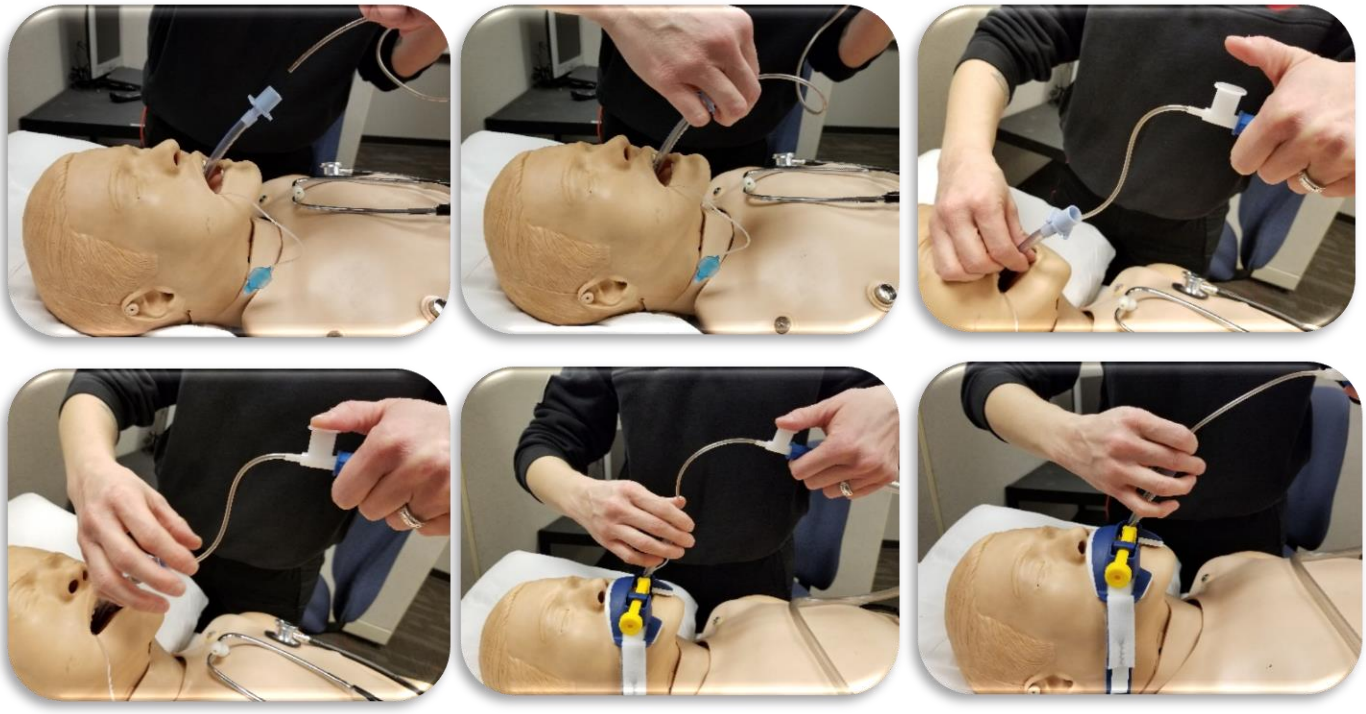
- ∇ I-gel®
  - Airway Lumen Suctioning
    - See chart below for Maximum Airway Suction Catheter size
    - Insert suction up to max depth of approximately 22-23cm on adult size (3-4-5) i-gel®
  - Gastric Suctioning
    - See chart below for Maximum Gastric Suction Catheter size
    - See below for determining insertion length
  - i-gel® Suction Catheter Sizing Chart
    -

Adult i-gel® O2 Resus Suction Cath Size Chart		
i-gel® Size	**Airway Cath Size**	**Gastric Size**
3	14fr	12fr
4	14fr	12fr
5	14fr	14fr

Pediatric i-gel® Anesthesia Suction Cath Size Chart		
i-gel® Size	**Airway Cath Size**	**Gastric Size**
1	8	N/A
1.5	10fr	10fr
2	10fr	12fr
2.5	10fr	12fr

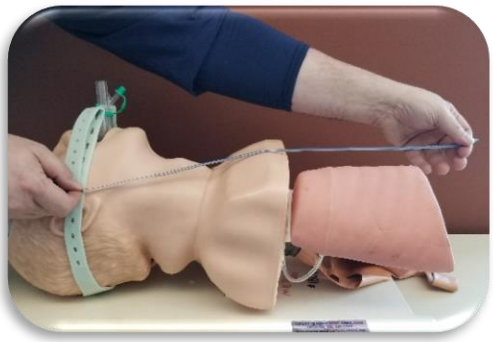
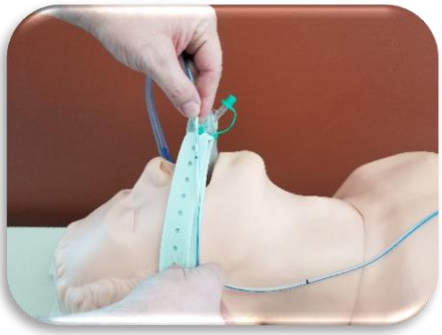
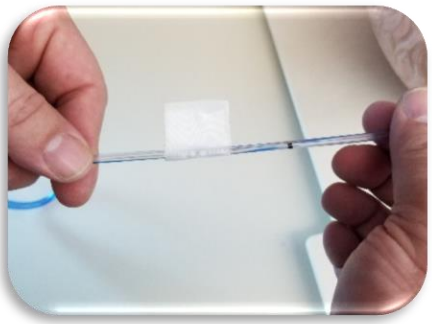
2. Performing Tracheal / Airway Lumen Suctioning (i-gel® or ET Tube)

- ∇ Pre-oxygenation may be necessary
- ∇ See chart above to select correct suction catheter size
- ∇ Select correct suction pressure
  - Adults should typically be set between 80-120 mmHg
  - Pediatrics should typically be set between 60-80 mmHg
  - Sometimes higher settings may be necessary for particularly thick / tenacious materials
  - If device only has "High" and "Low" settings, use High for adults and Low for pediatrics
- ∇ Connect suction catheter to suction device
- ∇ Insert suction catheter into airway to correct depth as described above
  - Insertion should be done without applying suction
- ∇ Occlude Chimney Port / Suction Port to apply suction and slowly remove suction catheter from airway while applying suction
  - It may be helpful to swirl the suction catheter around in the airway during removal
  - Each airway suction pass / attempt should take no more than 10-15 seconds
  - If multiple passes are required to clear airway sufficiently, re-attach BVM and provide some ventilations / oxygenation for 10-15 seconds between passes
- ∇ The pictures below demonstrate airway lumen suctioning on an Endotracheal Tube, but the procedure is the same for suctioning ET Tubes or i-gels®



3. Performing Gastric Decompression (i-gel®)

- ∇ Gastric suctioning may be done to provide gastric decompression which may improve ventilation and reduce chance of aspiration
- ∇ See chart above to select correct suction catheter size
- ∇ Nasogastric suction catheter or Nasopharyngeal suction catheter may be used
  - ○ In adult patients, using a nasopharyngeal suction catheter may not reach all the way into the stomach
- ∇ Measure insertion depth for Gastric Suction Catheter by placing distal tip at patient's navel, stretching tubing to airway gastric port, then to ear lobe
  - ○ Place small piece of tape at this position as insertion stop

- ∇ Lubricate gastric tube or place bolus of lube over gastric suctioning port
- ∇ Advance gastric tube into and through gastric suctioning port until reaching tape stop
  - ○ Do not turn on suction while advancing the catheter

- ∇ Once in place, gastric suctioning should not be done continuously
- ∇ If necessary, you can leave suction catheter inserted and apply suction intermittently

Automated External Defibrillator (AED) Use

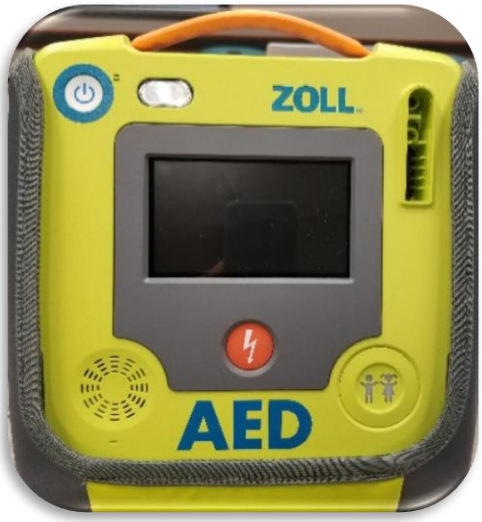
This Skills Dictionary entry covers use of the following devices:

ZOLL AED 3

ZOLL X-Series Monitor / Defibrillator in AED Mode

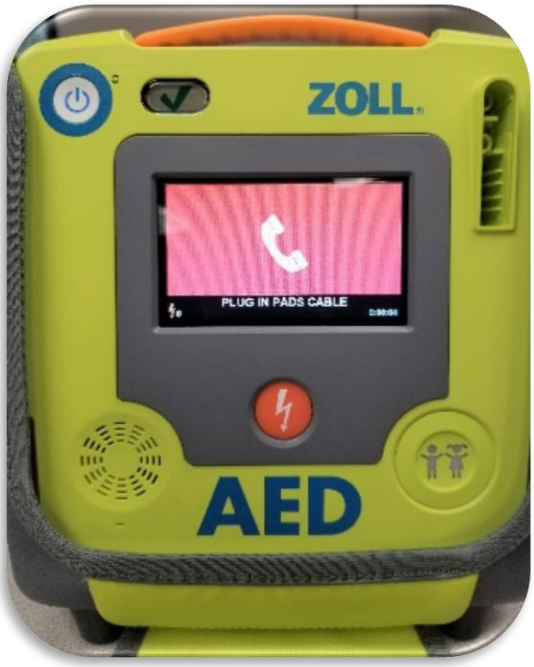
ZOLL AED 3

1. **Knowledge Points**
   - ∇ This Dictionary focuses on the use of the ZOLL AED 3. Other AEDs will have typically similar functions
   - ∇ For use of the ZOLL X-Series Monitor/Defibrillator as an AED, see Automated External Defibrillator (ZOLL X-Series)
2. **Open case / expose AED**
   - ∇ Depending on the manufacturer, some AEDs power on automatically when case is opened
   - ∇ If AED does not power on automatically, proceed to next step.
   - ∇ Once AED powers on, follow the auditory directions and directions on screen



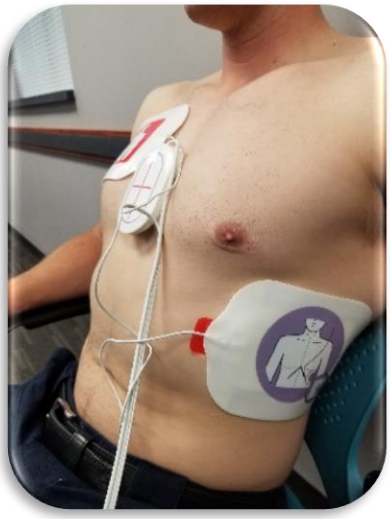
3. **Power on AED – Press Power Button**
   - ∇ AEDs go through brief self-check when powered on and will display results prior to beginning directions
   - ∇ Once AED powers on, follow the auditory directions and directions on screen
   - ∇ Those directions are detailed in the following steps

4. **Plug in Pads Cable**
   - ∇ If your department stores the AED with pads already plugged in, the AED will skip this step
   - ∇ If Pediatric pads are plugged in, the Child Selector Button will illuminate, and the AED will automatically attenuate the doses delivered for pediatric patients
     - If you are using Universal pads or Adult pads on a pediatric patient, you will need to manually press the Child Selector Button.

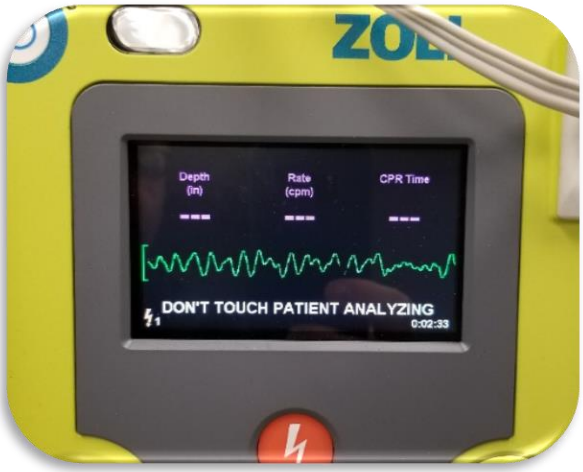


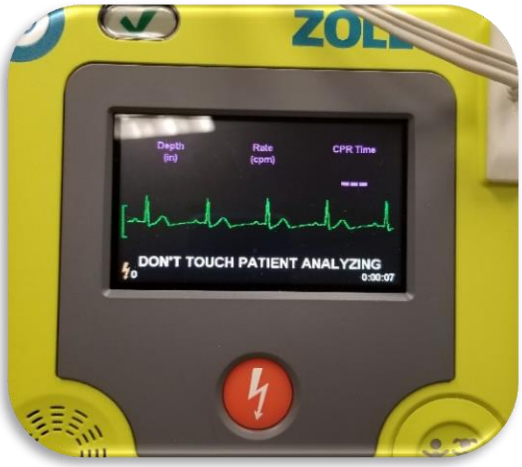
5. **Expose Bare Chest**
   - ∇ Prepare skin as necessary
   - ∇ Not all patients will require skin preparation prior to application of therapy patches
   - ∇ Dry the chest if wet or diaphoretic
   - ∇ Clip or shave hair as needed to allow proper pad contact with skin
     - ○ If razor/clippers are not available, but there are more than one set of pads available, you may remove hair by applying a set of pads to the patient's chest and then rapidly pulling them off. Discard this set of pads and apply a new set to begin therapy.

6. **Attach Pads**
   - ∇ The AED will remind you to open the pad package
   - ∇ The Anterior-Lateral pad position is the preferred placement for Defibrillation
     - A-L position is preferred because it causes the least interference with other lifesaving interventions such as CPR.
     - Place the Anterior pad by adhering the CPR sensor on the bottom half of the sternum, aligned with the sternal notch and applying the anterior pad on the patient's upper right torso.
     - Place the Lateral pad so the center of the conduction area is at the V6 position.
   - ∇ Once pads are placed, the AED will automatically proceed to analyzing the rhythm
   - ∇ Once pads are placed you will be able to see rhythm on screen



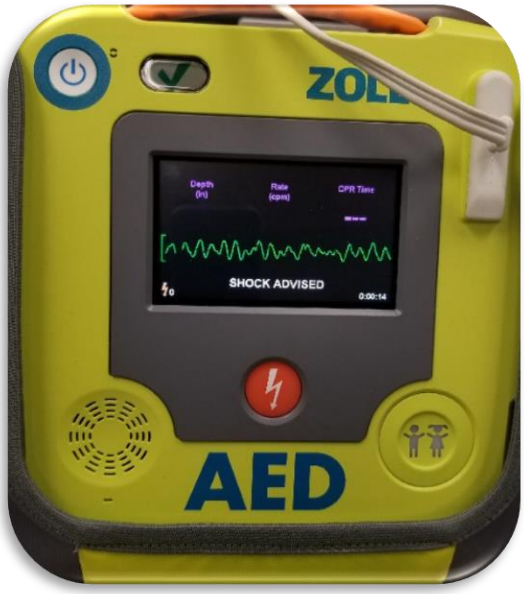
7. **Analyze Rhythm**
   - ∇ The AED will automatically begin analyzing the rhythm when the pads are placed on the patient
   - ∇ The AED will give auditory and on-screen directions to not touch the patient while analyzing
   - ∇ You will be able to see the rhythm on screen during AED analysis
   - ∇ The AED operator should also announce and visually ensure that no other providers are touching the patient during analysis

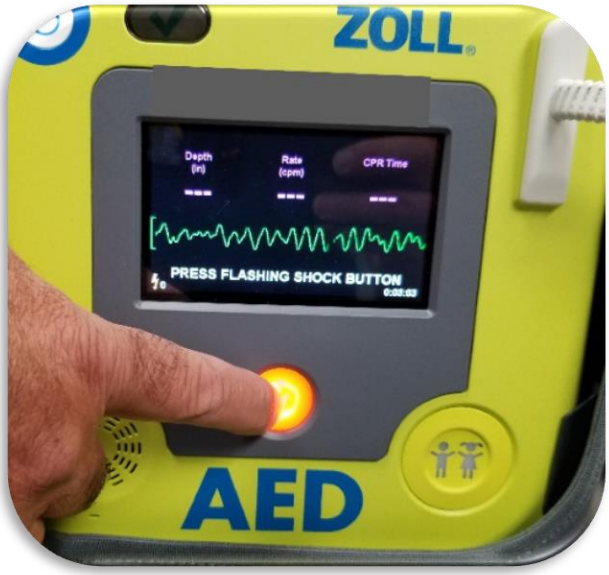




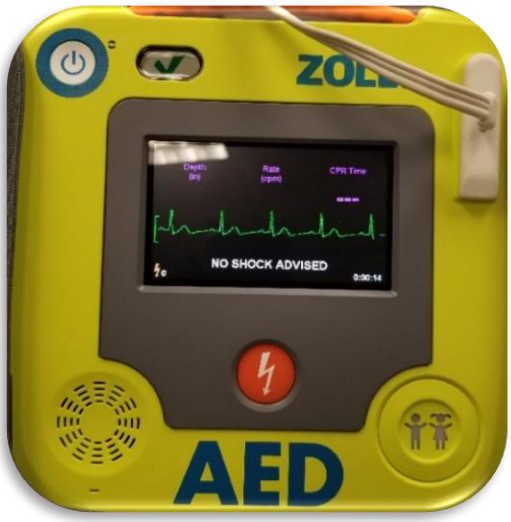
8. **Shock or No-Shock Determination**
   - ∇ Following analysis, the AED will determine if a defibrillation shock is advised or not advised.
   - ∇ SHOCK ADVISED
     - o If the AED determines the rhythm is shockable, it will give auditory and on-screen directions of "Shock Advised" and begin to charge the defibrillator to the preset amount of 200 Joules.
     - o The AED will also give auditory and on-screen directions of "Stand Clear" or "Do Not Touch Patient".
     - o While CPR may be performed during charging, it is imperative the operator of the AED announce and visually ensure that no other providers are touching the patient when delivering the defibrillation shock.
     - o Once fully charged, shock button will light up and/or flash and the AED will give auditory and on-screen directions to "Press Shock" to deliver the defibrillation shock.
     - o Once defibrillation has been delivered, the AED will give auditory and on-screen directions to "Begin CPR" and the metronome will begin at 105 beats per minute.

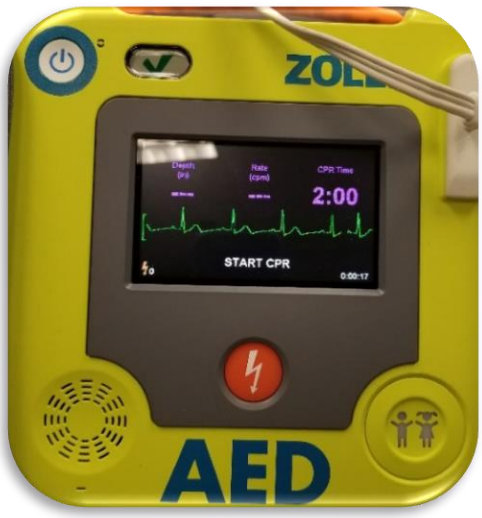
EMS Skills Dictionary



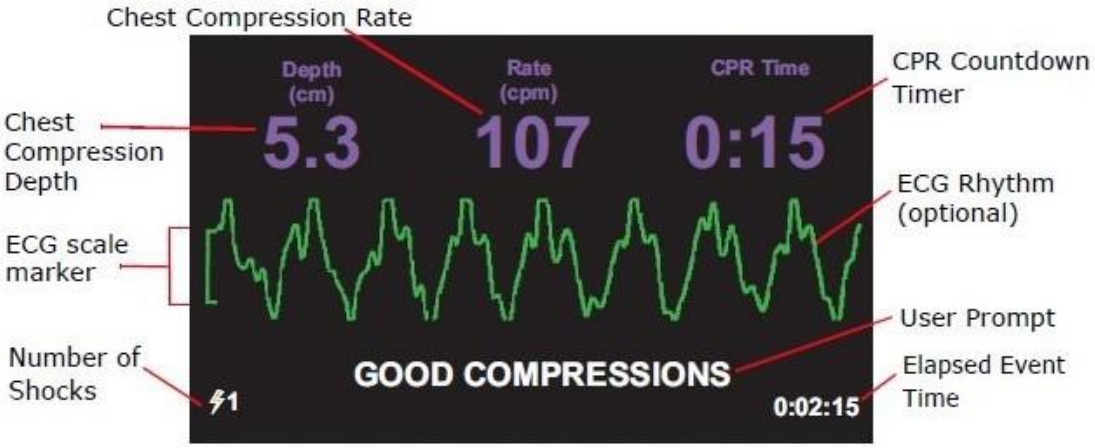


- NO SHOCK ADVISED
  - If the AED determines the rhythm is non-shockable, it will give auditory and on-screen directions of "No Shock Advised" and to "Begin CPR". The metronome will begin at 105 beats per minute.





- Performing CPR and CPR Feedback
  - The AED will continue with the metronome at 105 beats per minute
  - The AED will display the following information on screen during CPR
    - Cardiac rhythm
    - Number of shocks delivered
    - CPR countdown timer to keep track of 2 minute intervals
    - Elapsed time of event
    - CPR Feedback information
      - CPR Feedback information may include auditory and on-screen prompts regarding rate and depth of compressions depending on device and type of defibrillation patches used.
  - At the end of every 2 minute cycle, the AED will provide auditory and on-screen instructions to "Stop CPR" and the AED will cycle back through the process of analyzing the rhythm.
    - If the AED detects a shockable rhythm, it will repeat the instructions to charge and shock the patient.
    - If the AED detects a non-shockable rhythm, it will provide auditory and on-screen instructions to "Check Pulse" before continuing prompts to continue CPR.



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ZOLL X-Series Monitor / Defibrillator in AED Mode

1. **Knowledge Points**
   - ∇ ***CAUTION***
   - ∇ The ZOLL X-Series monitors in use by the JOCO EMS System power on in Manual Mode.
     - *This requires great attention and care from the BLS Provider to operate the monitor correctly, safely and within their scope of practice.*

2. **Power on ZOLL X-Series Monitor – Press Power Button**
   - ∇ The monitor will go through brief self-check when powered on and will display results prior to beginning directions

3. Patient Preparation

- ∇ These steps may be done before or after pushing the Analyze button for AED use. If done after pushing Analyze, the AED will guide you through these steps.
- ∇ ***CAUTION*** the monitor will remain in Manual Mode until the Analyze Button is pushed. It is recommended that BLS Clinicians push the Analyze Button immediately after the monitor self-check is completed.
- ∇ CPR Should be performed while simultaneously performing the following steps.
  - **Push Analyze Button**
    - Pushing the Analyze Button places the X-Series monitor in AED Mode.
    - Once in AED Mode, the monitor will prompt you through attaching the pads, defibrillation when necessary, and CPR.

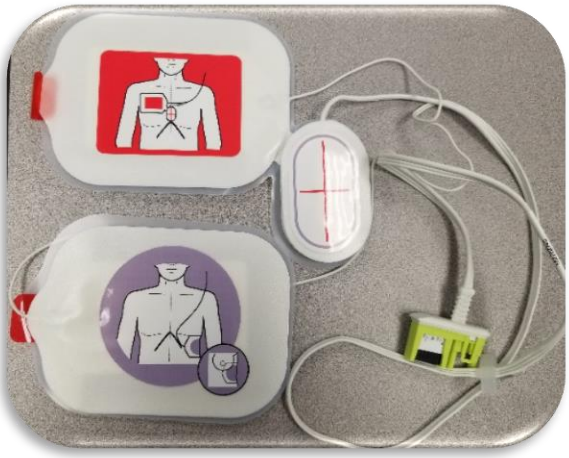
- **Expose Bare Chest**
  - Prepare skin as necessary
  - Not all patients will require skin preparation prior to application of therapy patches
  - Dry the chest if wet or diaphoretic
  - Clip or shave hair as needed to allow proper pad contact with skin
    - ♦ If razor/clippers are not available, but there are more than one set of pads available, you may remove hair by applying a set of pads to the patient's chest and then rapidly pulling them off. Discard this set of pads and apply a new set to begin therapy.

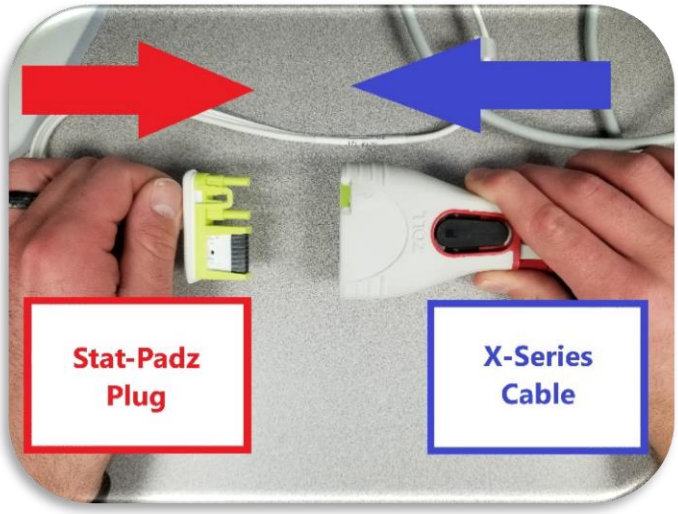
- **Attach Pads**
  - Using the ZOLL X-Series, it's likely always kept ready for use with the Adult pads kept plugged in
  - If your department stores the X-Series with pads already plugged in, skip this step
  - If your department does not store the X-Series with pads already plugged in, the monitor will display "ATTACH PADS". See picture below.
  - If your department does not store the X-Series with pads already plugged in, see pictures below for steps to plug in pads.
  - Adult pads require an adaptor that is typically left connected to the One-Step (defibrillator) cable
  - Pediatric pads require the removal of the Adult adapter. See Pediatric Considerations Section at end of this entry.

EMS Skills Dictionary

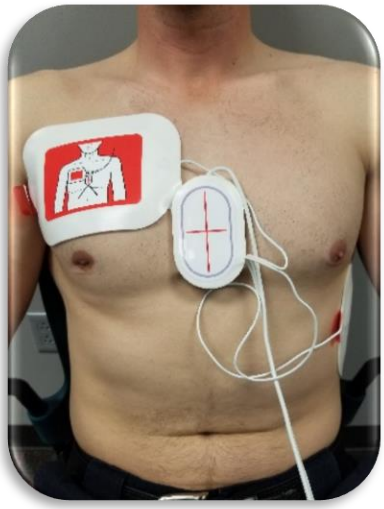
ATTACH PADS MESSAGE

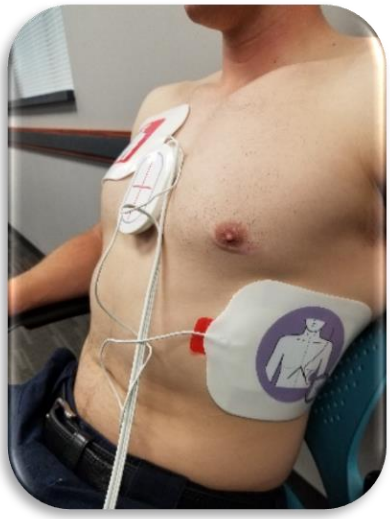
ADULT PADS CONNECTION





4. **Place Pads on Patient**
   - ∇ The Anterior-Lateral pad position is the preferred placement for Adult Defibrillation
     - A-L position is preferred because it causes the least interference with other lifesaving interventions such as CPR.
     - Place the Anterior pad by adhering the CPR sensor on the bottom half of the sternum, aligned with the sternal notch and applying the anterior pad on the patient's upper right torso.
     - Place the Lateral pad so the center of the conduction area is at the V6 position.
     - For Pediatric Pad placement, see Pediatric Considerations section.
   - ∇ If the Analyze Button has been pushed, once pads are placed, the monitor will automatically proceed to analyzing the rhythm (See next step)
   - ∇ Once pads are placed you will be able to see rhythm on screen





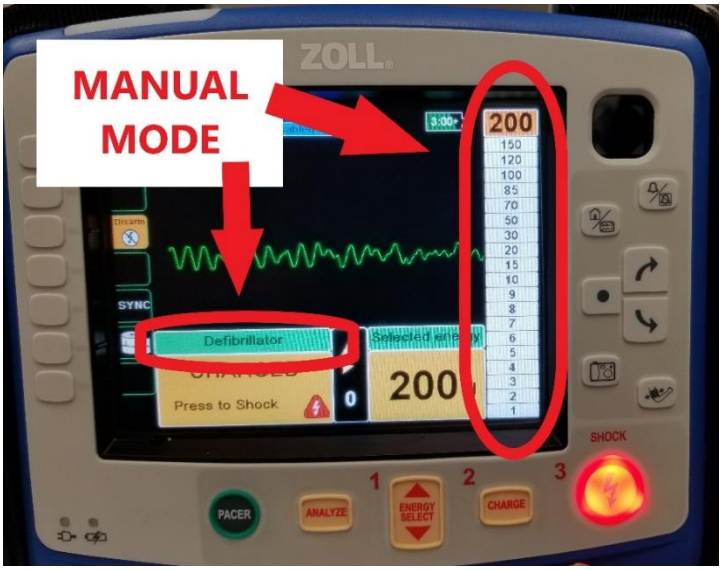
(Pictures are for placement reference only. Patients should be placed supine for CPR and Defibrillation)

5. **Analyze Rhythm**
   - ∇ If you have not already pushed the Analyze Button, do so now.
   - ∇ ***BLS Clinicians – you must push the Analyze Button to enter AED Mode
   - ∇ In AED Mode (after pushing the Analyze Button), the monitor will automatically begin analyzing the rhythm when the pads are placed on the patient.
   - ∇ The AED will give auditory and on-screen directions to not touch the patient while analyzing
   - ∇ You will be able to see the rhythm on screen during AED analysis
   - ∇ The AED operator should also announce and visually ensure that no other providers are touching the patient during analysis

6. **Shock or No-Shock Determination**
   - ∇ Following analysis, the AED will determine if a defibrillation shock is advised or not advised.
   - ∇ SHOCK ADVISED
     - If the AED determines the rhythm is shockable, it will give auditory and on-screen directions of "Shock Advised" and begin to charge the defibrillator to the preset amount of 200 Joules.
     - The AED will also give auditory and on-screen directions of "Stand Clear" or "Do Not Touch Patient".
     - ***Note: The monitor does NOT make a noise when charging in AED Mode.
     - *** If you hear a charging noise when charging YOU ARE NOT IN AED MODE and must PUSH ANALYZE BUTTON TO ENTER AED MODE
     - While CPR may be performed during charging, it is imperative the operator of the AED announce and visually ensure that no other providers are touching the patient when delivering the defibrillation shock.
     - Once fully charged, shock button will light up and/or flash and the AED will give auditory and on-screen directions to "Press Shock" to deliver the defibrillation shock.
     - Once defibrillation has been delivered, the AED will give auditory and on-screen directions to "Perform CPR" and the metronome will begin at 105 beats per minute once several compressions have been detected by the monitor.
       - If internal metronome has been deactivated, activate external metronome at 105 beats per minute

WARNING

- When in AED Mode, you DO NOT need to push the Charge button. Ever.
  - If you have to push the "Charge" button to get the machine to charge, you are NOT IN AED MODE. Push the ANALYZE BUTTON to enter AED Mode.
- When in Manual Mode, the monitor displays a Charging Bar on the Right side of the screen and says "Defibrillator" in a Green and Yellow block on the Lower Left of the screen when charged.
- When operating in AED Mode, the monitor DOES NOT display the Charging Bar and DOES NOT say "Defibrillator".
- If you see these things, YOU ARE IN MANUAL MODE
- BLS CLINCIANS – DO NOT PUSH THE SHOCK BUTTON IN MANUAL MODE
  - Push the ANALYZE BUTTON to enter AED Mode



- ∇ NO SHOCK ADVISED
  - If the AED determines the rhythm is non-shockable, it will give auditory and on-screen directions of "No Shock Advised" and to "Perform CPR". The metronome will begin at 105 beats per minute once several compressions have been detected by the monitor.
    - If internal metronome has been deactivated, activate external metronome at 105 beats per minute

7. Performing CPR and CPR Feedback

- ∇ The AED will continue with the metronome at 105 beats per minute
  - If internal metronome has been deactivated, activate external metronome at 105 beats per minute
- ∇ The AED will display the following information on screen during CPR
  - Cardiac rhythm
  - Number of shocks delivered
  - CPR countdown timer to keep track of 2 minute intervals
  - Elapsed time of event
  - CPR Feedback information
    - CPR Feedback information may include auditory and on-screen prompts regarding rate and depth of compressions depending on device and type of defibrillation patches used.
- ∇ At the end of every 2 minute cycle, the AED will provide auditory and on-screen instructions to "Stop CPR, Stand Clear" and the AED will cycle back through the process of analyzing the rhythm.
  - If the AED detects a shockable rhythm, it will repeat the instructions to charge and shock the patient.
  - If the AED detects a non-shockable rhythm, it will provide auditory and on-screen instructions to "Check Pulse" before continuing prompts to continue CPR.

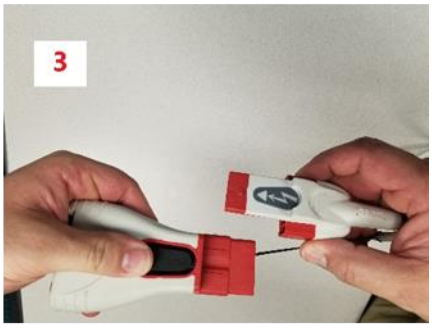
ALS PROVIDERS ONLY

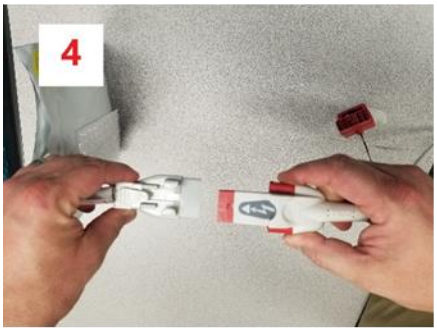
- To exit AED Mode and enter Manual Mode, press any of the buttons listed below
  - Energy Select Button
    - ♦ Dumps any existing charge, Exits AED Mode and opens screen to select an energy level and charge for a Manual Defibrillation
  - Charge Button
    - ♦ Dumps any existing charge, Exits AED Mode and opens screen to select an energy level and charge for a Manual Defibrillation
  - EXIT Soft Key
    - ♦ Dumps any existing charge, Exits AED Mode and opens basic monitoring screen

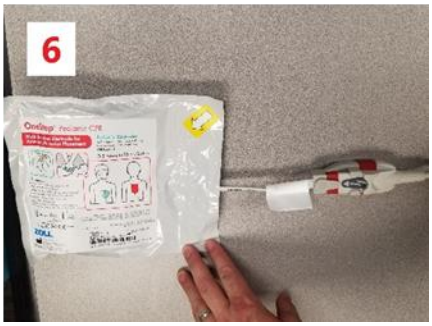
Pediatric Considerations

1. Using Pediatric One Step Defibrillation Patches

- ∇ The Pediatric One Step Patches are only to be used with children under 55lbs / 24kg (Blue and under on Length Based Tape / Field Reference Guide)
- ∇ Attaching the Pediatric One Step pads to the One Step Cable will require the removal of the Adult Stat-Padz Adaptor if it is attached. See steps below for removal of adaptor and connection of pads.
- ∇ The Anterior – Posterior placement is the only acceptable placement when using Pediatric One Step patches.
- ∇ Attaching Pediatric One Step pads will automatically place the ZOLL X-Series in Pediatric Mode, which will cause a lower pre-set defibrillation energy setting to be used.

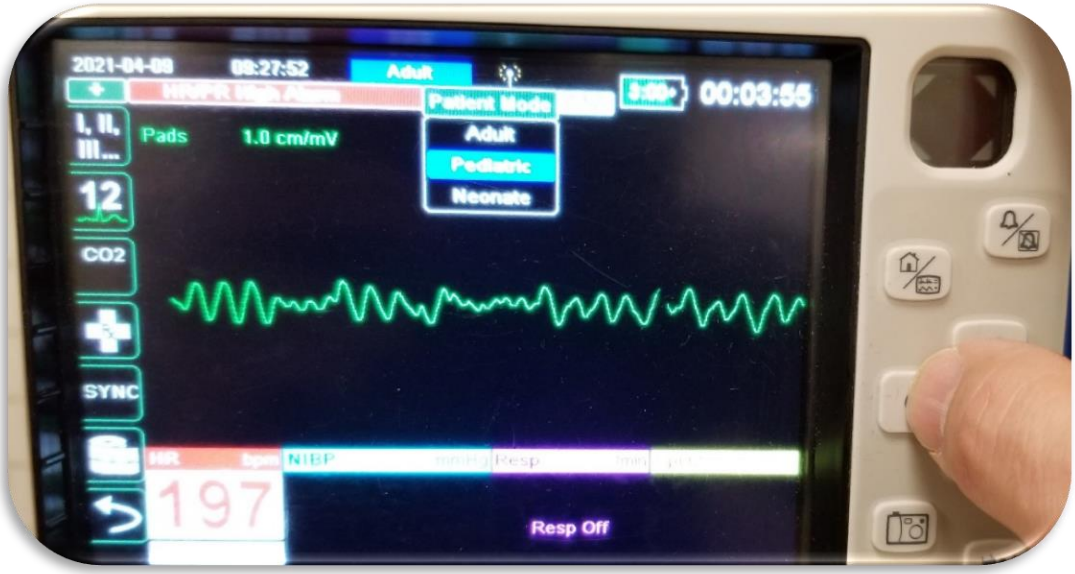




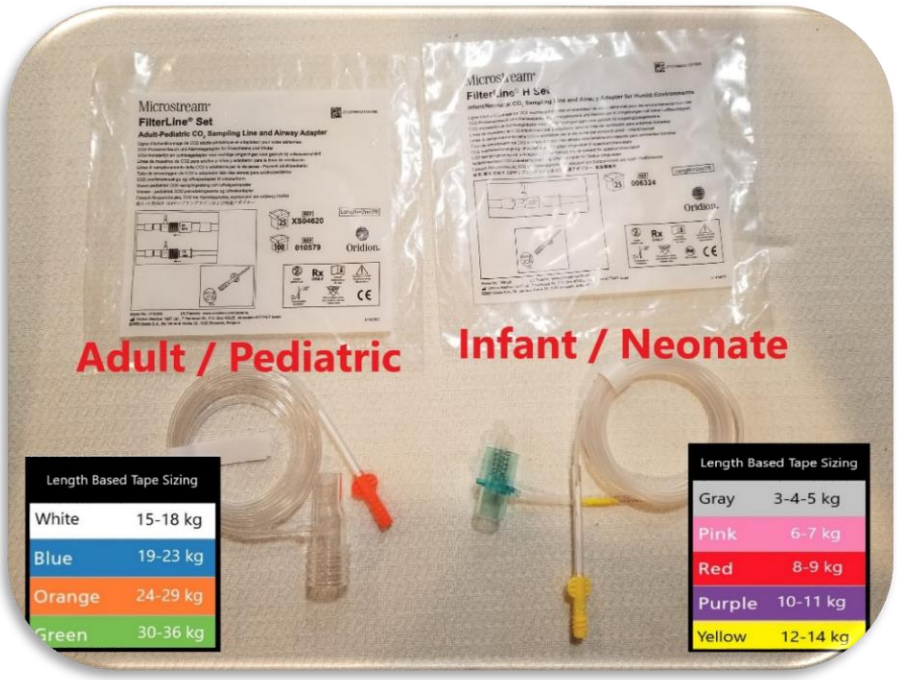


- If you are using Adult Stat-Padz Defibrillation patches, see directions below for manually placing the ZOLL X-Series in Pediatric Mode.
  - The Patient Age Mode setting is located in the top, center of the screen. Available selections are “Adult”, “Pediatric” and “Neonate”.

  - Use the Navigation Keys to the Right of the screen to scroll through the display to highlight and select the Patient Mode.
  - Use the Navigation Keys to select Pediatric.

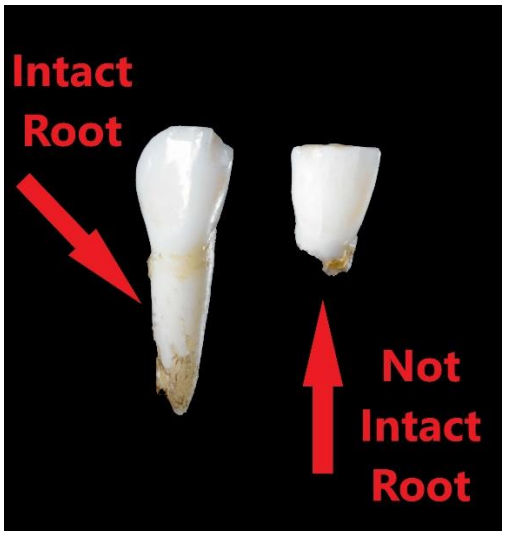


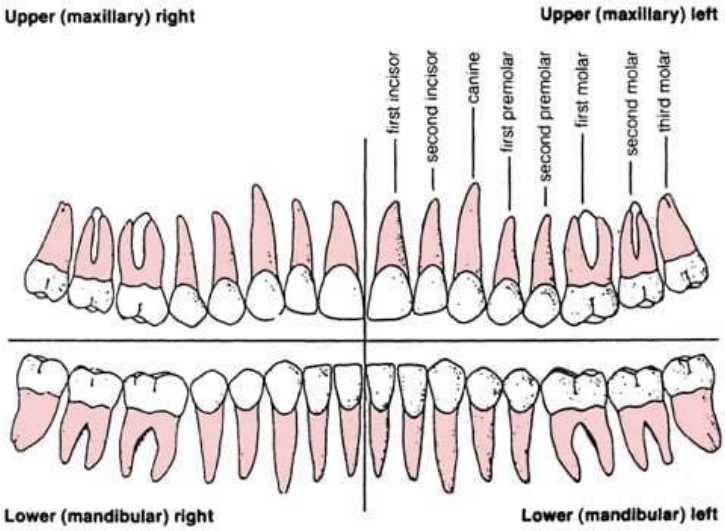
2. ETCO2 Monitoring

- ∇ See below for selecting the correct Filterline Adapter in Pediatric Patients:
  - Infant / Neonate Adapter
    - Endotracheal Tube size 4.5 and Below
    - FRG / Length Based Tape colors Yellow, Purple, Red, Pink, Grey
  - Adult / Pediatric Adapter
    - Endotracheal Tube size 5.0 and Above
    - FRG / Length Based Tape colors Blue, Orange, Green
  - 

Avulsed Tooth Management

1. **Determine duration of time tooth has been out of mouth and if patient would like you to attempt re-insertion**
   - Re-insertion can only be done on tooth that has intact root connected





   - For best results, elapsed time should be no more than 30 minutes
   - Rinse tooth gently with tap water or Normal Saline
     - Do not scrub or rub root area with gauze
     - Handle the tooth only by the crown area

   - If patient does not want EMS provider to attempt re-insertion but would like attempt by provider in ED or dentist office, place tooth in media listed below in preferred order:
     - Container of cold white milk
       - Do not use flavored milk
       - Do not use alternative milk (i.e. soy, almond, etc)
     - Container of patient's saliva
     - Container of normal saline
     - Container of tap water

- If patient would like provider to attempt re-insertion, continue to next steps

2. **Irrigate socket**
   - There is likely to be moderate to heavy bleeding and / or the beginning of clot formation.
     - Irrigate the socket gently with normal saline
     - Having the patient swish and spit normal saline or tap water is also acceptable
     - Use gauze pad to wipe away clot if necessary
3. **Position patient**
   - High Fowler's is best to minimize possibility of swallowing tooth or causing airway obstruction if tooth is dropped during re-insertion attempt
4. **Orient tooth**
   - Crown in proper direction
   - Front facing out
   - Do not handle tooth by the roots
5. **Replace tooth into socket**
   - Attempt to approximate level to height of surrounding teeth
   - Anesthesia is typically not necessary as pain-carrying nerve fibers are often displaced and damaged when tooth is knocked out
   - Use gentle pressure only, if resistance is met, place tooth in storage media and transport

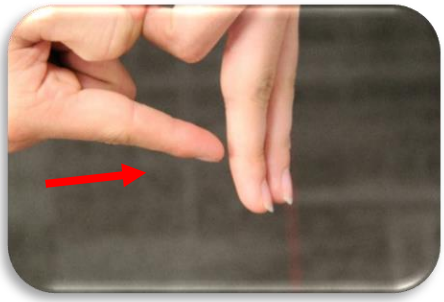
6. **Stabilize tooth**
   - Place folded gauze pad over tooth and have patient bite down gently to stabilize tooth during transport

7. **Monitor closely for airway obstruction**

Blood Glucose Analysis

1. **Assemble equipment**
   - ∇ Gather glucometer, test strip, lancet device, cleansing prep, and bandage or 4x4's

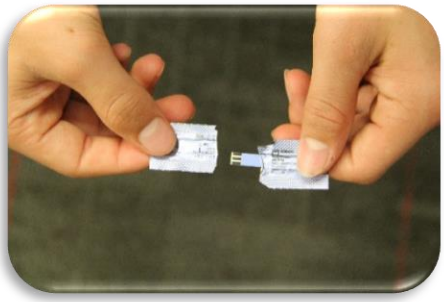
2. **Ready fingerstick site**
   - ∇ Choose medial or lateral aspect of distal ring or middle finger
     - o Less callused area, more comfortable for the patient



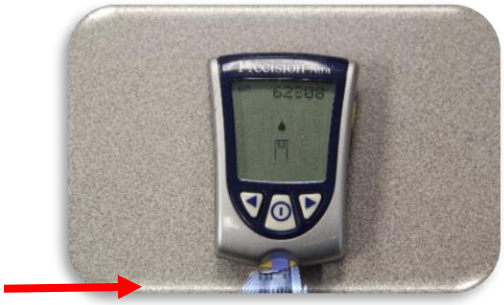
   - ∇ Cleanse site thoroughly with alcohol prep
     - o Decreases chance of infection and inaccurate readings from other sources (i.e. candy, food, etc.)
   - ∇ Allow site to dry thoroughly before finger stick
     - o Alcohol left wet on the skin will mix with the specimen and can cause inaccurate high readings

3. **Ready glucometer and testing strip**
   - ∇ Place glucometer on flat surface
   - ∇ Open testing strip sheath by tearing at arrows and removing short end of sheath to expose "bar codes"

- ∇ Grasp sides of electrode and pull strip half out of foil packet
  - Leaving foil on test site area precludes contamination of test strip. Do not use if bar code area is bent, scratched or damaged in any way.

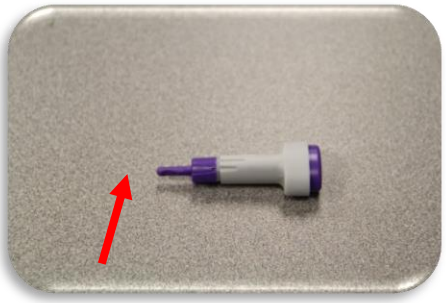


- ∇ With test strip still in foil packet insert bar code end face up into the glucometer. Gently push until it stops.

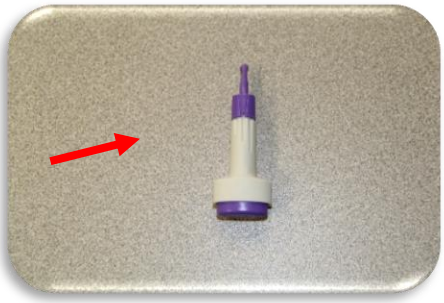


4. Obtain specimen

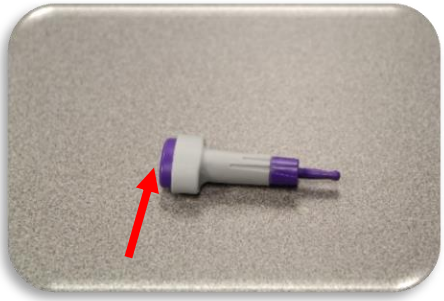
- ∇ Twist the plastic purple collar of lancet to dial needle depth (length marks on stem of lancet)



Shortest needle length

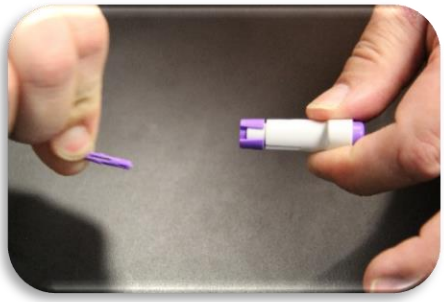


Regular needle length

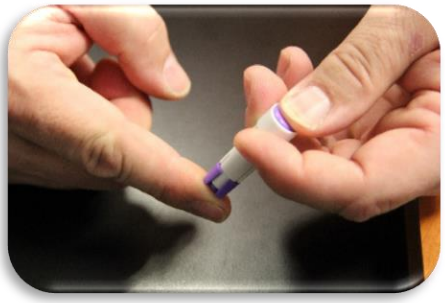


Longest needle length

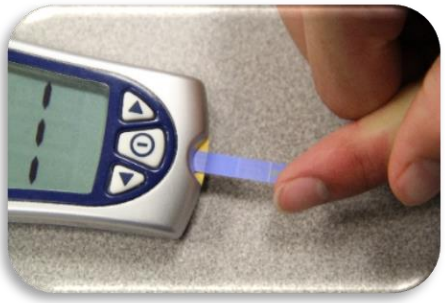
- ∇ Remove guard off end of lancet device, assuring to keep fingers away from lancet end



- ∇ Place the lancet device firmly against the cleansed and dried site
  - The lancet device should be held against the site firmly so that all of the force of the device is directed into the site.
  - Supporting the finger assure stability for the stick and helps to keep the digit firmly against the lancet when it springs out.
- ∇ Depress lancet device button on opposite end
  - This action advances the lancet to cause puncture. Lancet is drawn back into the sheath.

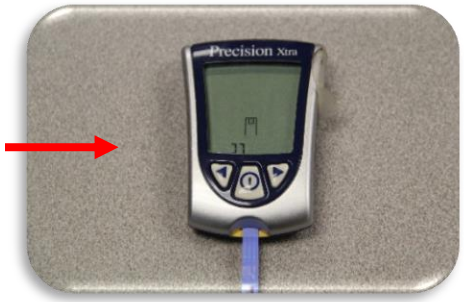


- ∇ With hand remaining dependent, gently milk the finger in downward strokes. Do not squeeze site
  - Squeezing site can cause an increase in serous fluid and cause inaccurate readings
- ∇ Obtain a large drop for sample purposes
- ∇ Remove foil cover over electrode to expose test site
- ∇ Firmly press the drop of blood on finger into the oval test site area
  - The device is designed to measure glucose in a predictable volume of blood. This is the volume normally found in a hanging drop. Enough blood must be infused into the white area for the unit to begin testing.



- ∇ If this action fails, remove the strip and insert a new one and try again
- ∇ Clean puncture site with 4x4's. May need to apply Band-Aid to stop any continued hemorrhage

5. **Read results**
   - ∇ Wait for the glucometer to countdown 20 seconds, which is visible on screen, following placement of the specimen on the test strip.



   - ∇ Observe the reading that appears.
   - ∇ If display does not appear, discard strip and use a new strip and a new puncture site.
   - ∇ Compare test readings to patient's presentation.
     - If reading is low, does this coincide with the patient's condition? And the same with high readings. Administration of glucose agents should not be determined on the basis of a glucometer reading only.

6. **Dispose of sharps and strips**
   - ∇ Dispose of lancet in approved sharps containers only. Dispose of test strip and placing in waste bin.

Cardiac Compressions

This entry covers Adult, Child, Infant and Neonate Compressions

Adult Compressions

1. **Determine correct hand position.**
   - ∇ Hand placement should include both hands (one on top of the other) being placed the lower ½ of the sternum
     - Hands can also be placed two fingers above the xiphoid process
     - Use the QCPR device if available

2. **Begin Compressions**
   - ∇ Compression rate should be at least 100 compressions/min
     - Use of a metronome is required when available (105/minute)
     - Advanced airways should be placed immediately and a ventilation should be provided every 10th compression
   - ∇ Compression depth should be at least two inches in depth
     - Larger adult chests may require a depth of more than two inches
   - ∇ Allow for complete recoil with each compression
     - Do not lean on the patient's chest between compressions as this does not allow for complete filling of the heart.

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Child Compressions

1. **Determine correct hand position.**
   - ∇ Hand placement should include one or both hands (one on top of the other) being placed the lower ½ of the sternum (dependent on patient and rescuer size)

2. **Begin compressions**
   - ∇ Compression rate should be at least 100-120 compressions/min
     - ○ Use of a metronome is required when available (105/minute)
     - ○ If there is one rescuer available, 30 compressions : 2 ventilations should be performed
     - ○ If there are two rescuers available, 15 compressions : 2 ventilations should be performed
     - ○ Once an advanced airway is in place, a ventilation should be provided every 10th compression
   - ∇ Compression depth should be about two inches in depth or 1/3 the depth of the chest
   - ∇ Allow for complete recoil with each compression
     - ○ Do not lean on the patient's chest between compressions as this does not allow for complete filling of the heart.

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Infant Compressions

1. **Determine correct hand position.**
   - ∇ 1-Rescuer – Place 2 fingers on the sternum just below the nipple line
   - ∇ 2-Rescuer - Place both thumbs on the sternum below the nipple line and encircle the hands around the back of the patient for support during compressions

2. **Begin compressions**
   - ∇ Compression rate should be at least 100-120 compressions/min
     - ○ Use of a metronome is required when available (105/minute)
     - ○ If there is one rescuer available, 30 compressions : 2 ventilations should be performed
     - ○ If there are two rescuers available, 15 compressions : 2 ventilations should be performed
     - ○ Once an advanced airway is in place, a ventilation should be provided every 10th compression
   - ∇ Compression depth should be at least 1 ½ inches or 1/3 the depth of the chest
   - ∇ Allow for complete recoil with each compression
     - ○ Do not lean on the patient's chest between compressions as this does not allow for complete filling of the heart.

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Neonate / Newly Born Compressions

1. **Determine correct hand position.**
   - ∇ 1-Rescuer - Place 2 fingers on the sternum just below the nipple line
   - ∇ 2-Rescuer - Place both thumbs on the sternum below the nipple line and encircle the hands around the back of the patient for support during compressions

2. **Begin compressions**
   - ∇ Compression rate should be at least 100-120 compressions/min
     - ○ Use of a metronome is required when available (105/minute)
     - ○ Rescuers should perform 3 compressions : 1 ventilation
     - ○ Compression depth should be 1/3 the depth of the chest
   - ∇ Allow for complete recoil with each compression
     - ○ Do not lean on the patient's chest between compressions as this does not allow for complete filling of the heart.

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Childbirth

Delivery – Shoulder Dystocia

Shoulder dystocia occurs during childbirth. After delivery of the infant's head, the anterior shoulder gets caught on the mother's pubic bone. This may result in the baby's head "turtling" or pulling back into the vagina. Shoulder dystocia is an obstetric emergency that occurs in about 1% of vaginal deliveries. If the body of the infant does not deliver within 1 minute of head presentation, Shoulder Dystocia is the likely cause.

Relieving shoulder dystocia requires multiple providers. Call for additional units if necessary but if unable to be resolved after 2 minutes, do not delay transport.

Risk factors for Shoulder Dystocia include:

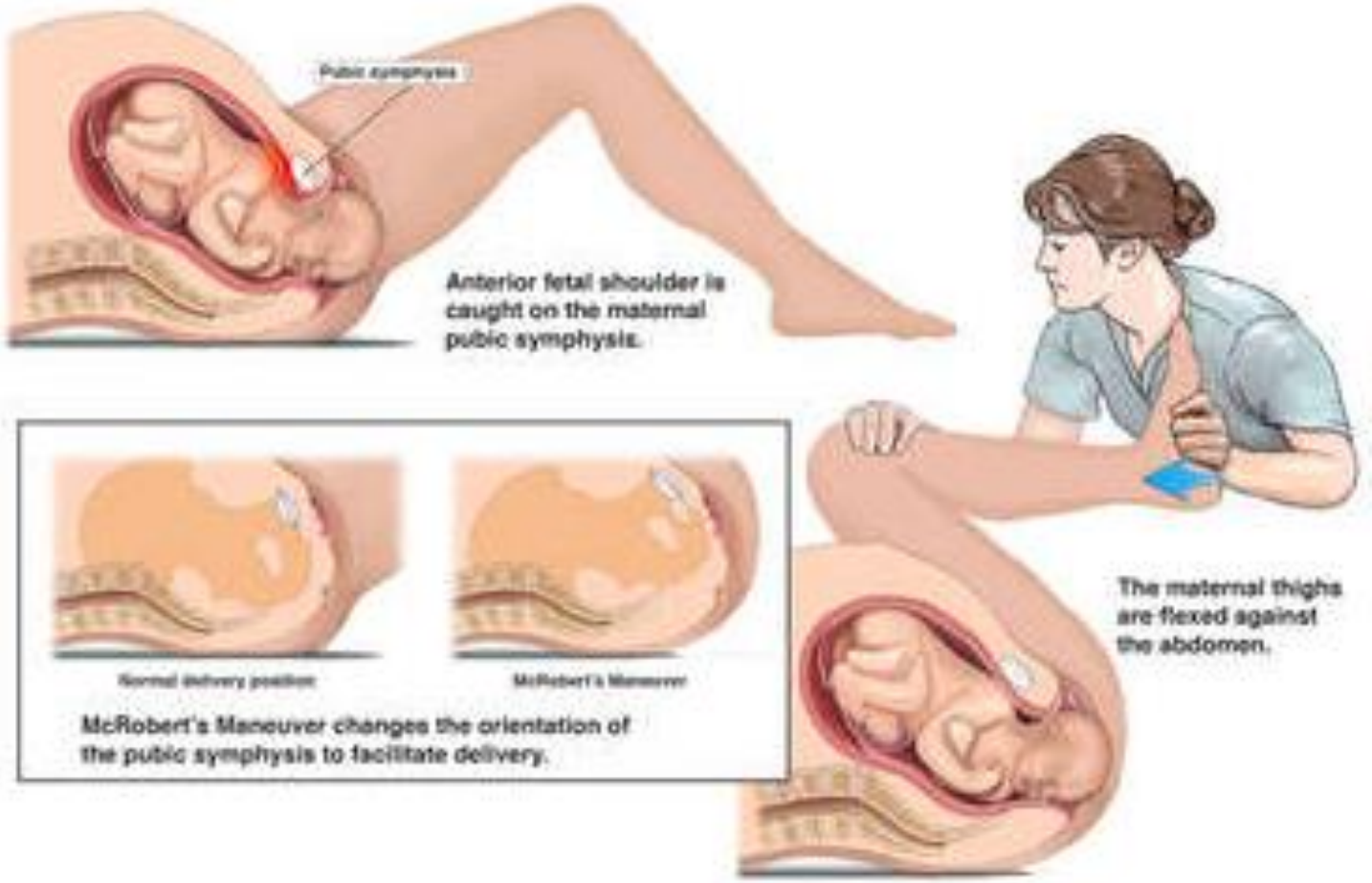
- Maternal Age > 35
- Short in stature
- Small or abnormal pelvis
- > 42 weeks gestation
- Estimated fetal weight ≥ 10 lbs
- Maternal diabetes (2-4x increased risk)

There are two primary techniques to alleviate Shoulder Dystocia and *they are to be applied simultaneously* for maximum results:

- McRoberts' Maneuver
- Suprapubic Pressure

Shoulder Dystocia is a Time Critical Medical Emergency **- No more than 2 minutes should be spent attempting the McRoberts' Maneuver and Suprapubic Pressure before transporting to the hospital for definitive care.**

1. **McRoberts' Maneuver**
   - ▽ The mother's legs should be bent at the knees and pulled as far apart as possible
   - ▽ The mother's knees should be pressed as far as possible into her chest / pulled back toward her shoulders.
     - This may be done by having a provider on each leg (preferred) or by having the mother perform the maneuver
   - ▽ This position causes the pubic bone to rotate towards the mother's head and position it slightly higher and more horizontal, to allow passage of the baby.
   - ▽ DO NOT pull on the baby's head. Excessive downward traction of the baby's head could cause injury to the brachial plexus, causing weakness / paralysis of the baby's arm.

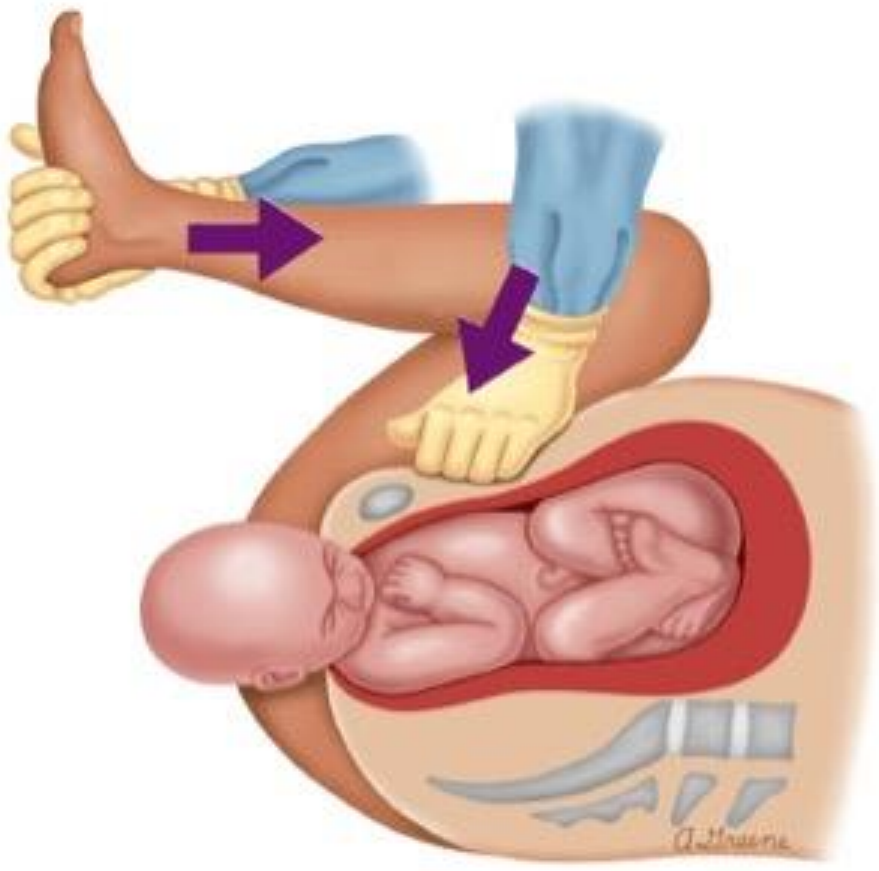


2. Suprapubic Pressure

▽ While initiating the McRoberts's Maneuver, another provider should position themselves to the side of the mother and palpate immediately superior to the symphysis pubis, to locate the anterior shoulder of the infant.

▽ Once locating the anterior shoulder, the provider will place the heel of their hand over the infant's anterior shoulder and apply pressure downward and laterally, towards the baby's face.

- Pressure from this angle pushes the shoulders together towards the front of the baby, causing the width of the baby's shoulders to decrease. If successful, the baby will rotate face down and be delivered.
- Initially the pressure is applied continuously downward and towards the baby's face, causing the shoulder to adduct and pass under the symphysis.
- If continuous pressure is unsuccessful, the provider can apply a rocking motion while applying pressure to dislodge the shoulder, similar to performing CPR (but without the force or speed of CPR compressions).
  - DO NOT apply fundal pressure as this only worsens the impaction and potentially cause injury to the infant or mother.
- **If the combined efforts have been unsuccessful after attempting for 2 minutes, immediately transport to the hospital for definitive care.**



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Defibrillation (ZOLL®)

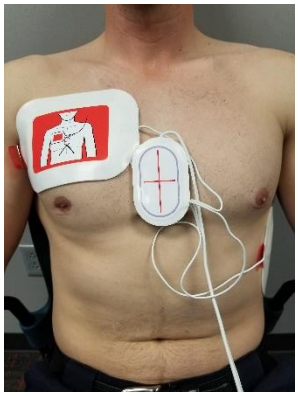
This entry covers Standard / Single Defibrillation and Double Sequential Defibrillation

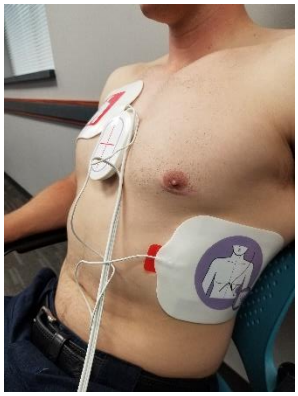
*These entries assume the monitor is powered on.

Standard / Single Defibrillation

1. **Prepare the patient for Defibrillation**
   - ▽ Remove all clothing covering the patient's chest
   - ▽ Wipe and dry the areas where pads will be placed
   - ▽ Clip or shave chest hair if it will interfere with adherence of the pads to the chest

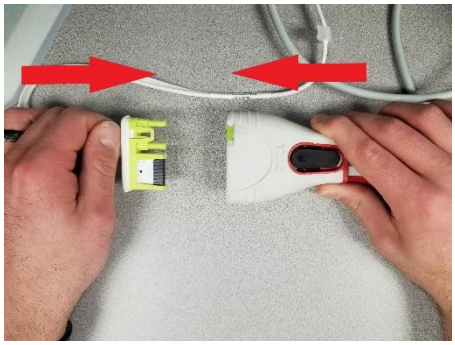
2. **Apply the Hands-Free therapy electrodes**
   - ▽ The Anterior-Lateral pad position is the preferred placement for Defibrillation
     - A-L position is preferred because it causes the least interference with other lifesaving interventions such as CPR.
       - If the patient has already had the therapy electrodes placed in the Anterior-Posterior configuration prior to developing cardiac arrest and the need for defibrillation, there is no need to change the configuration of the electrodes to the Anterior-Lateral position.
       - The Anterior-Posterior position is more effective in Transcutaneous Pacing and Synchronized Cardioversion. If the patient experiences ROSC followed by indications for either of those therapies, consider changing the pad position.
     - Place the Anterior pad by adhering the CPR sensor on the bottom half of the sternum, aligned with the sternal notch and applying the anterior pad on the patient's upper right torso.
     - Place the Lateral pad so the center of the conduction area is at the V6 position.

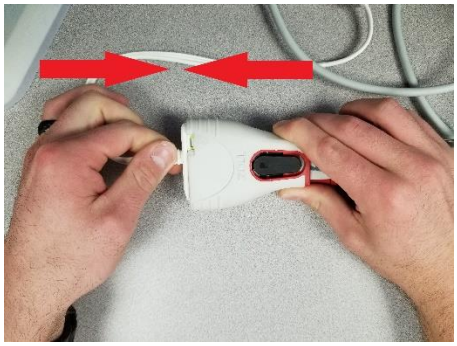




- For A-L placement, it is not necessary to separate the CPR device from the Anterior pad, but separating them may make it easier to reposition the pads as necessary, and minimize artifact in the See-Thru CPR function.

▽ Connect therapy electrodes to therapy cable if not already done.



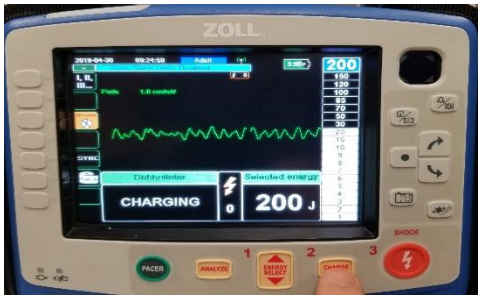


3. Charge the defibrillator

▽ *During CPR, the defibrillator should be charged near the end of the CPR cycle to minimize the peri-shock pause.*

▽ Push the Charge button.

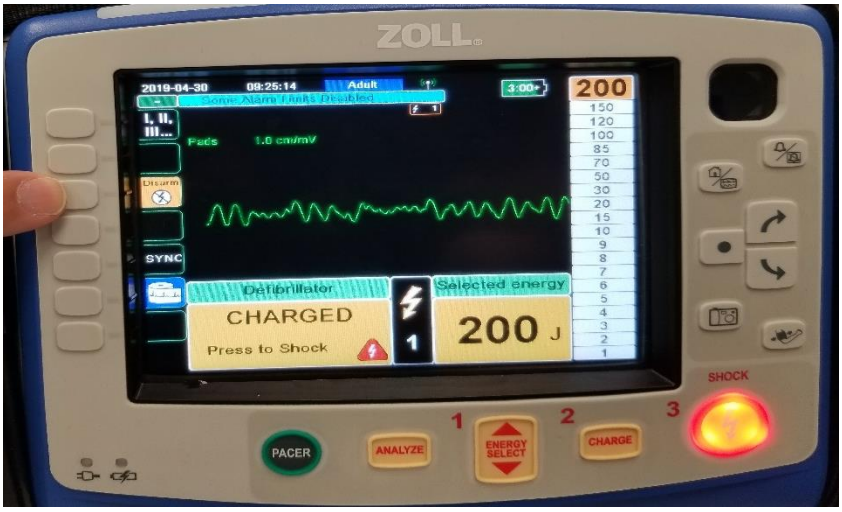
- An energy bar will appear on the right of the screen to show charging progress.
- The defibrillator will charge to the preset energy level of 200 Joules.
  - Ensure the preset level is the desired level. For pediatric patients who require a lower energy level, prior to charging, you may use the Energy Select button to change dosage if necessary. Changing the energy level after charging will dump the energy and the Charge button will need to be pushed again to charge to the new desired energy level.



4. Verify presence of shockable rhythm

▽ After charging, if the patient's condition no longer warrants defibrillation, or you need to dump the charge for any reason, use ONLY the "Disarm" quick access key illustrated below.

- *NOTE* using the "Energy Select" key to disarm the charge will cause subsequent charges to charge to a lower level and if not noticed, will result in defibrillations delivered at a lower level.
- If the defibrillator is not discharged within 60 seconds after reaching selected energy level, the unit automatically disarms itself.



5. Deliver Shock

▽ ***Warn all persons in attendance of the patient to STAND CLEAR prior to discharge***

▽ Press and hold the "SHOCK" button until energy is delivered.

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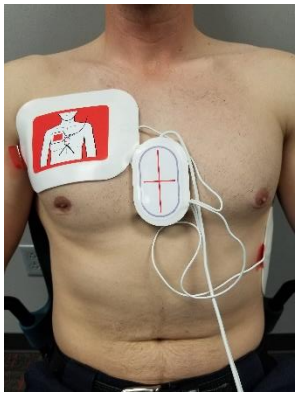
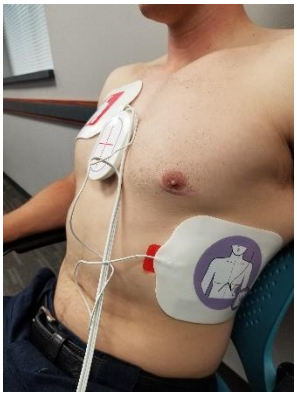
Double Sequential Defibrillation

1. ***This entry assumes the patient is already connected to one defibrillator with the therapy patches applied in the Anterior – Lateral (A-L) Position and a minimum of 5 single defibrillations have been performed with refractory VF/VT.**





2. **Apply 2nd set of therapy patches in the Anterior – Posterior (A-P) Position**

▽ Begin removing the CPR feedback device from the new anterior pad.

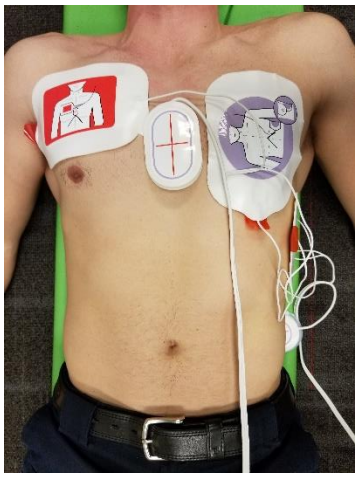
- This is done by tearing the foam and plastic backing. Leave the plastic backing attached to the foam pad.
- The 2nd CPR feedback device will not be used, and should be placed somewhere beside the patient where it will not be able to detect vertical movement.
- If the unused CPR feedback device detects vertical movement, it may trigger the 2nd monitor to begin giving audible CPR feedback cues.

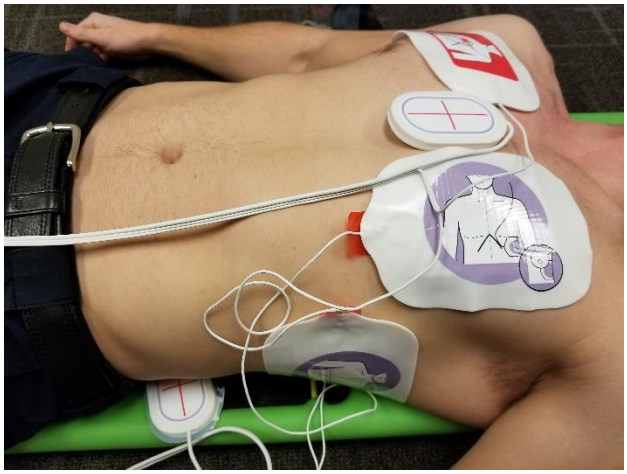
▽ *Place 2nd Anterior Pad

- For the A-P application, the 2nd Anterior pad will be placed on the patients back, Left of the spine, just below the scapula, at the heart level.
- Recalling the phrase “Red to Bed” may be helpful in remembering to place the 2nd Anterior pad in the correct position for DSD.

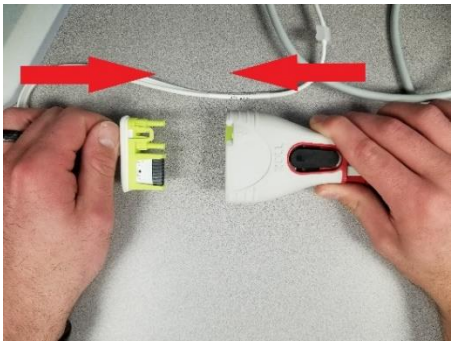
▽ Place 2nd Lateral Pad

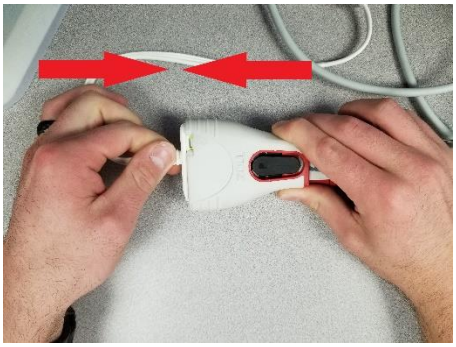
- The 2nd Lateral Pad will need to be placed on the Left Anterior chest, over the heart.
- It may need to be placed vertically so as not to overlap with 1st Lateral Pad.
  - Overlap of the adhesive edges is allowable but do not allow any of the conductive area of a pad to overlap any of the adhesive or conductive area of another pad.
- Avoid placing the conductive area of the pad over the patient's nipple when possible.





3. Connect 2nd set of therapy electrodes to 2nd therapy cable of 2nd defibrillator if not already done.





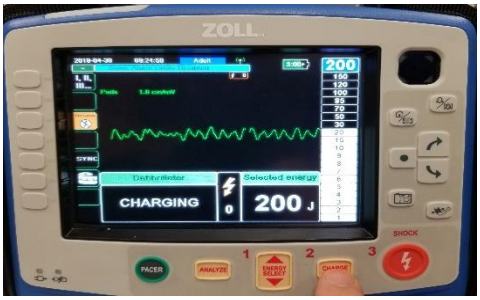
4. Position defibrillators so they can be read and used by a single provider

5. Charge BOTH defibrillators

▽ *During CPR, the defibrillator should be charged near the end of the CPR cycle to minimize the peri-shock pause.*

▽ Push the Charge button.

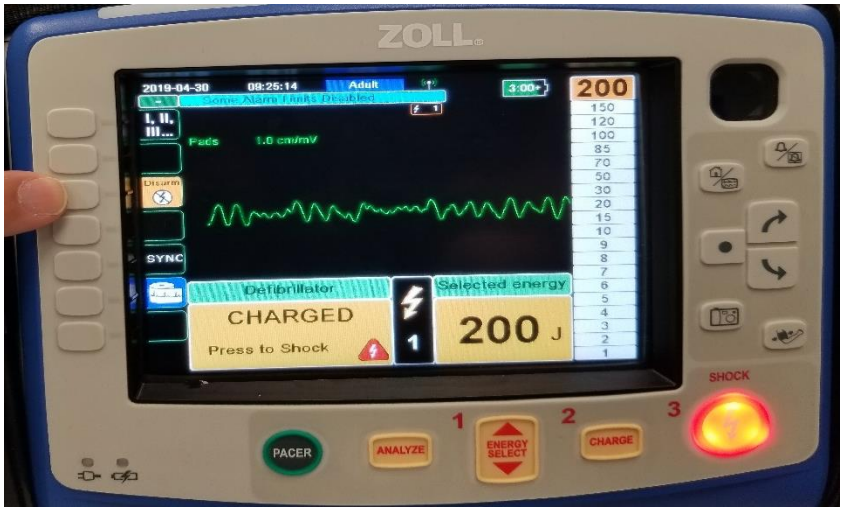
- An energy bar will appear on the right of the screen to show charging progress.
- The defibrillator will charge to the preset energy level of 200 Joules.
  - Ensure the preset level is the desired level. For pediatric patients who require lower energy level, prior to charging, you may use the Energy Select button to change dosage if necessary. Changing the energy level after charging will dump the energy and the Charge button will need to be pushed again to charge to the new desired energy level.



6. Verify presence of shockable rhythm

▽ After charging, if the patient's condition no longer warrants defibrillation, or you need to dump the charge for any reason, use ONLY the "Disarm" quick access key illustrated below.

- *NOTE* using the "Energy Select" key to disarm the charge will cause subsequent charges to charge to a lower level and if not noticed, will result in defibrillations delivered at a lower level.
- If the defibrillator is not discharged within 60 seconds after reaching selected energy level, the unit automatically disarms itself.



7. Deliver the Dual Sequential Shock

▽ ***Warn all persons in attendance of the patient to STAND CLEAR prior to discharge***

▽ Position hands so you ONE provider has a finger on each shock button.

▽ Press and hold the "SHOCK" button on Defibrillator #1 until energy is delivered.

▽ Count "One – One Thousand"

▽ Press and hold the "SHOCK" button on Defibrillator #2 until energy is delivered.

8. Transport Considerations

▽ If ROSC is achieved using DSD, consider transporting the patient with both defibrillators.

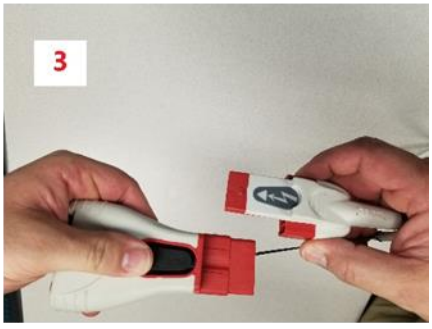
▽ For ePCR recordkeeping, further therapies following ROSC such as pacing, should be done using the Transport Agency's monitor / defibrillator.

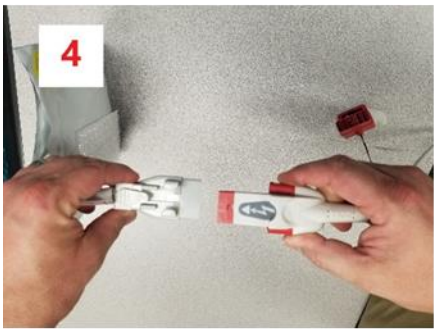
- If the Transport Agency's defibrillator was used as Defibrillator #1, with therapy electrodes placed in the Anterior – Lateral position, consider unplugging the A-L electrodes and plugging the Anterior – Posterior electrodes into the Transport Agency defibrillator.

Pediatric Considerations

1. Pediatric Defibrillation

- ∇ Defibrillation steps for pediatric patients is identical to adult patients.
- ∇ See Weight Based Pediatric Drug Chart in Johnson County EMS Field Reference Guide for Defibrillation Joule settings
- ∇ The Pediatric One Step Patches are only to be used with children under 55lbs / 24kg (Blue and under on Length Based Tape / Field Reference Guide)
- ∇ Attaching the Pediatric One Step pads to the One Step Cable will require the removal of the Adult Stat-Padz Adaptor if it is attached. See steps below for removal of adaptor and connection of pads.
- ∇ The Anterior – Posterior placement is the only acceptable placement when using Pediatric One Step patches.





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Hemorrhage Control

This entry covers Basic Wound Care, Tourniquet Application and Wound Packing

Basic Wound Care

1. **Apply direct pressure immediately to wound**
   - ∇ Use firm, even pressure with hand to control bleeding
     - Direct pressure is effective at controlling minor to moderate bleeding

2. **Apply dressing to wound**
   - ∇ Use sterile dressings when possible
     - Sterile dressings can help prevent infection
   - ∇ If dressing becomes saturated, apply additional dressings and maintain pressure
     - Do not remove dressing. Place additional dressings on and maintain pressure
     - Removal of dressing interferes with the body's ability to clot, crucial to bleeding control

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Tourniquet Application

1. Apply tourniquet

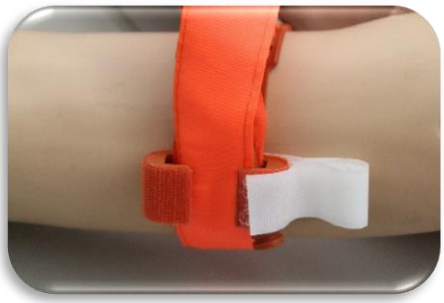
- ∇ Prepare tourniquet for application
  - Tourniquet components:

  - Apply tourniquet to injured limb 1-2" or 3 fingers above injury site, avoiding joints. Insert injured limb through tourniquet loop (if already through the buckle and able), proximal to bleeding site or unlatch the strap of the tourniquet and place around limb and pass tip of strap through buckle.

- ∇ Pull band very tight and securely fasten back on itself
  - Pull tourniquet tightly and Velcro back onto itself
    - Tourniquets are designed to cut off blood flow and must, therefore, be very tight
    - Tourniquets should be applied to bare skin, not over clothing
    - Should be tight enough that you cannot fit fingers between TQ and limb prior to turning windlass
    - If one tourniquet is not sufficient to stop the blood loss, then a second tourniquet can be applied

- ∇ Twist the rod until bleeding has stopped and distal pulse is occluded
  - Monitor bleeding and palpate distal pulse to ensure effectiveness
    - Distal pulses (radial, pedal) should not be palpable after application
- ∇ Place rod inside clip and lock into place

- ∇ Reassess bleeding and pulse
  - Monitor bleeding and palpate for absence of distal pulse to ensure continued effectiveness
    - Securing the rod or movement of the extremity may cause loosening of TQ
    - It is okay to reposition if necessary to ensure effective application
- ∇ Place remainder of band over the rod, secure with white 'time' strap



- ∇ Record time of application on white Velcro strap
  - Tourniquets are time-sensitive and must be kept visible to other healthcare providers

Wound Packing

1. **Prepare wound site for packing and pressure bandage**
   - ∇ Expose the injury by opening or cutting away the clothing
   - ∇ If possible, remove excess blood and or debris from the wound while preserving any clots in the wound that may have formed
   - ∇ Locate the source of the most active bleeding
2. **Gather equipment for wound packing**
   - ∇ Remove the gauze or hemostatic gauze from its package
   - ∇ Pack hemostatic gauze or gauze roll tightly into the wound directly over the site of the most active bleeding

     - o Multiple gauze rolls may be required to control the hemorrhage
     - o Gauze may be re-packed or adjusted in the wound to ensure proper placement
3. **Direct Pressure and pressure bandages**
   - ∇ Apply direct pressure quickly with enough force to stop the bleeding
   - ∇ Reassess for bleeding control
     - o Additional gauze may be added as necessary to stop any continued bleeding
   - ∇ Leave gauze in place and secure with a pressure dressing

4. **Document appropriately in report**
   - ∇ Time of tourniquet application should be noted in the patient report
   - ∇ If a wound is packed, a description of material used and estimate or known quantity of packing material used should be listed on the report

5. **Monitor and treat for S/S of shock**
   - ∇ Provider should verbalize recognition of shock and demonstrate the treatment of shock (S/S of shock, oxygen application, supine position, and temperature maintenance)
   - ∇ Verbalize need for immediate transport
     - o Shock patients require rapid transport to trauma facility

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Intraosseous Needle Insertion (EZ-IO®)

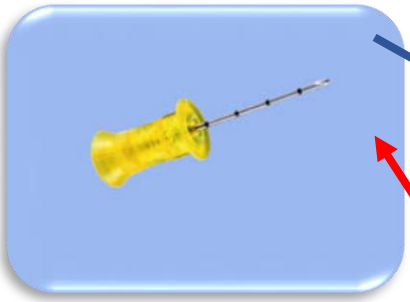
This entry covers insertion of the EZ-IO® needle in the Proximal Tibia, Distal Tibia and Proxomal Humerus and the infusion of Lidocaine for Pain Management in the Conscious Patient

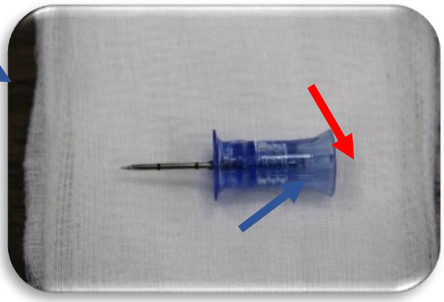
1. Prepare equipment

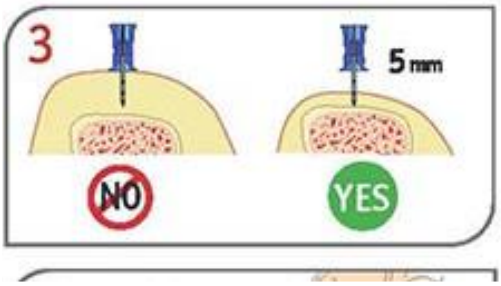
- ∇ Gather appropriately sized needle for patient
  - Appropriate size IO needle
    - 15ga 25 mm >39kg or 15mm IO needle < or =39kg, or 45mm needles
    - Needle size selection is based on tissue depth overlying the insertion site - always use 45mm needle for proximal humerus. Assess tissue depth using thumb or finger to get a rough estimate of tissue depth.
  - Extension set
  - 2- 10 cc syringes one with 10 cc of NS (5cc for pediatric)
  - 4X4's
  - 2% Lidocaine
  - Alcohol preps
  - Tape

- ∇ Ensure that the needle set is seated securely in drill head

- The markings on the needles have a meaning. The top mark (closest to hub – red arrows) must be visible when the needle is inserted in the skin and touching the bone. If it is not, the needle is too small. For the 30 and 45mm needles, if the most distal mark (by the tip of the needle – blue arrows) is still visible when in the skin and against the bone, the needle is too large.







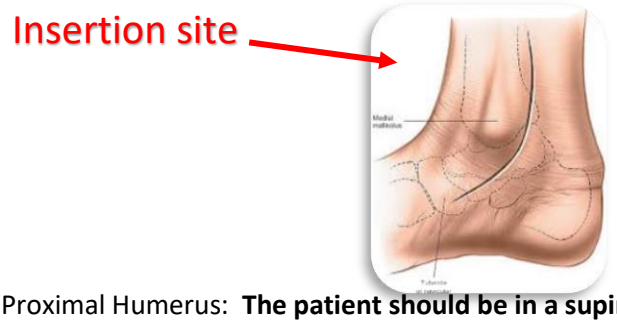
- Assemble IV solution, tubing
- Flush extension set

2. Locate and prepare site for insertion

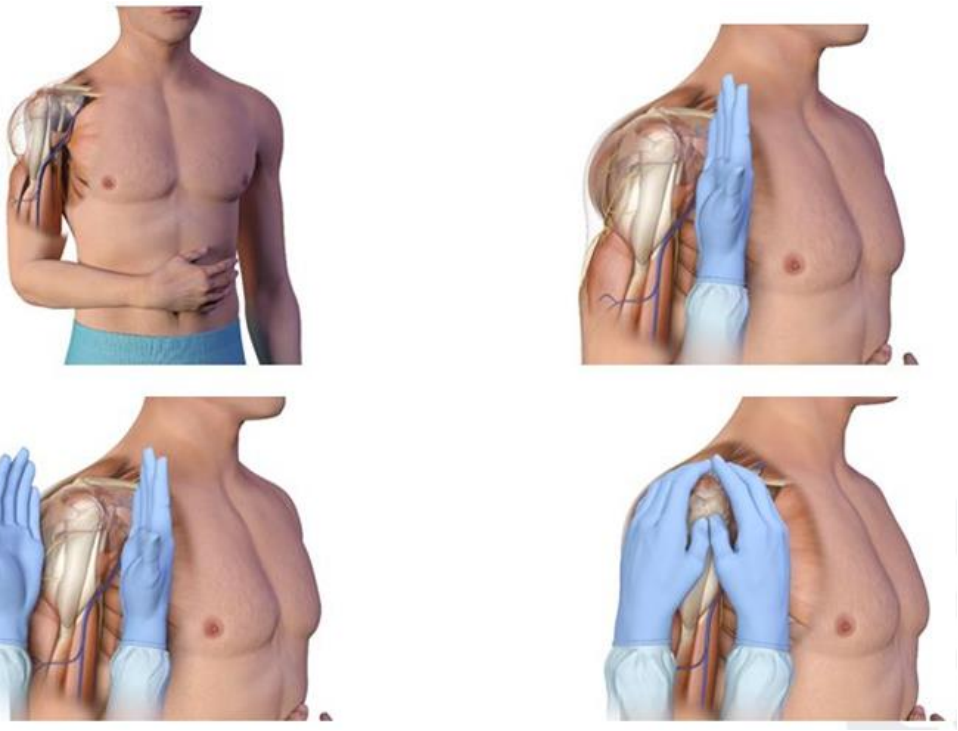
- Select appropriate site
  - Acceptable sites include the proximal humerus, distal tibia, and proximal tibia
- Know the contraindications for establishing an IO
  - Fracture in that extremity
  - Infection at site
  - Burn at site
  - Osteogenesis imperfecta
  - Osteopenia / Osteopetrosis
  - Previous attempt at same site

- For Proximal tibia: Locate tibial tuberosity. Space off 1 – 2 finger widths below the tuberosity. Move medially to the flat tibial plateau.

- For Distal tibia: Locate the medial malleolus and the insertion site is one finger width proximal to it



- For Proximal Humerus: **The patient should be in a supine position A/B 1. Expose shoulder and adduct humerus (place the patient's arm against the patient's body) resting the elbow on the stretcher or ground. Forearm resting on the abdomen** (With the patient in this position you may immediately note the humeral head on the anterior-superior aspect of the upper arm or anteriorlateral shoulder) **A Palpate and identify the mid-shaft humerus and continue palpating toward the proximal aspect or humeral head.** As you near the shoulder you will note a small protrusion. This is the base of the greater tubercle insertion site. **With the opposite hand you may consider "pinching" the anterior and inferior aspects of the humeral head while confirming the identification of the greater tubercle**. This will ensure that you have identified the midline of the humerus itself. **Alternatively: B Identify two land marks on the lateral shoulder consisting of the acromion and the coracoid process.** This can be accomplished by placing one hand on the lateral superior aspect of the patient's shoulder and palpating for the protrusions. Identifying the coracoid process and the acromion can also be accomplished by "walking" your index and middle finger along the clavicle to the shoulder's lateral end. **B Identify the greater tubercle insertion site approximately two finger widths inferior to the coracoid process and the acromion.** One can envision the location of this site by creating a "T" - the upper portion of the letter connecting the coracoid process and the acromion while the "leg" reaches inferiorly and slightly anteriorly - approximately two finger widths along the midline between the two structures. **Do not attempt insertion medial to the greater tubercle!**



- ∇ Cleanse insertion site.

6. Insert needle

- ∇ Control patient's movement prior to and during needle set insertion
- ∇ Position driver at insertion site with needle set at a 90 degree angle to the bone
- ∇ Gently push needle set until tip touches the bone
- ∇ Ensure that at least 5mm of catheter is visible (the black lines on the IO needle are 5mm apart)
  - One black line should be showing when needle is placed properly

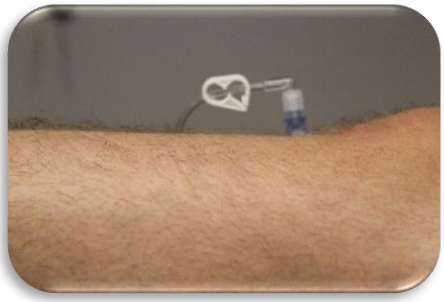
- ∇ Penetrate bone cortex by squeezing the driver's trigger and applying **gentle, steady downward** pressure. If too much pressure is applied driver may stall- allow drill to do the work
- ∇ Release driver's trigger and stop insertion when sudden give or pop is felt upon entry into medullary space
- ∇ Remove driver and stylet

7. Verify needle location and flush

- ∇ Observe that the needle will stand without support
- ∇ Attempt to aspirate blood or marrow
- ∇ Attach prefilled saline extension set (for the unconscious patient.)
  - For the conscious patient, see next section for Lidocaine administration)

8. Attach and anchor IV tubing

- ∇ Attach IV tubing and open flow clamp



- ∇ Observe the drip chamber for IV flow
  - If acceptable flow rate is observed move on to next step
  - If no flow or slow consider: infiltration or pressure infusion or syringe for fluid bolus or viscous drug administration
- ∇ Check surrounding tissue and tissue opposite insertion site for signs of infiltration
- ∇ Adjust rate
- ∇ Tape needle in place
- ∇ Loop the IV tubing before taping it down so that it does not kink
- ∇ Further secure with a bulky dressing

***For information on administering Lidocaine to a conscious patient for IO Administration pain management, see Medication Administration – IO Analgesia (Lidocaine)**

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Medication Administration

This entry includes information on techniques of administration such as IV Push, IV Drip Infusion, Auto Injector, Nasal Atomizer, Nebulization, and specific medications in those categories.

Auto Injector

1. **Assemble equipment**
   - ∇ Obtain appropriate auto-injector and medication and follow manufacturer's guidelines

2. **Medication Verification / Cross Check**
   - ∇ Verify right patient
   - ∇ Verify the medication name and concentration
   - ∇ Verify the right indication for administering med
   - ∇ Are there any contraindications for administering this medication?
     - Confirm patient is not allergic to medication to be administered
     - Are the patient's vital signs appropriate
     - Is the medication in date?
   - ∇ What is the appropriate route for administering this medication?
   - ∇ What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. **Prepare patient and medication**
   - ∇ Advise patient of procedures
   - ∇ Remove safety cap from the auto-injector
     - Assure that fingers are kept away from the needle end of the auto-injector (follow manufacturer's guidelines)

4. **Administer medication**
   - ∇ Locate site for injection
     - Injection site should be the lateral thigh between the hip and knee
     - Can be administered over single layer of clothing (thin material) if unable to bare thigh

- ∇ Place the auto-injector against the outer thigh (one layer of clothing only) and firmly push the injector until a click is heard

Bare thigh is preferred

- ∇ Hold in place for 5 sec
- ∇ Dispose of auto-injector into a sharps box

- ∇ Rub injection site for 5 sec

5. Reassess patient

- ∇ Reassess patient status after the medication has been administered for improvement and document

IO Analgesia (Lidocaine Administration)

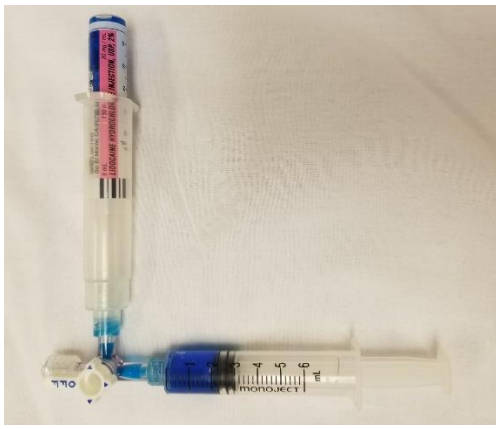
***This dictionary entry assumes a patent intraosseous infusion device has already been appropriately placed. For instructions on inserting an intraosseous infusion device, see Skills Dictionary "Intraosseous Insertion EZ-IO"**

***Prior to administration of any medication, confirm your dose in the Field Reference Guide and complete the Medication Cross-Check with another provider**

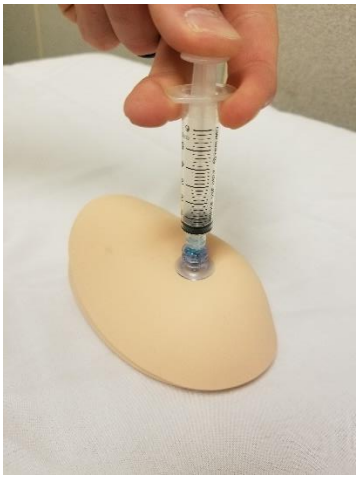
*Medications in this skills dictionary entry are simulated with colored fluids for easier visualization

1. Gather equipment for procedure

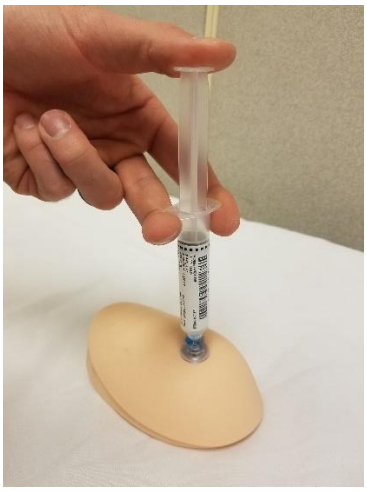
2. Assemble stopcock, Lidocaine syringe and receiving syringe and transfer 2mL of Lidocaine to receiving syringe
   - For complete instructions on performing syringe to syringe transfer technique, see Skills Dictionary Medication Administration – Syringe to Syringe Transfer
   - For the following examples, colored water is used to easier visualize the doses

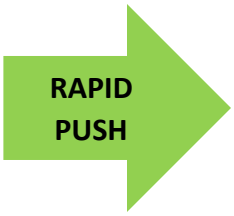


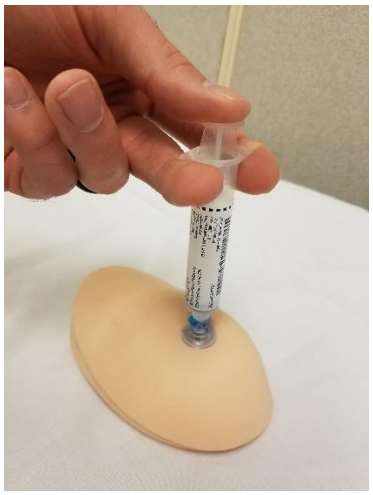
3. Connect receiving syringe to IO hub and slow push 2mL Lidocaine over 2 minutes



4. Attach 10mL flush and push rapidly

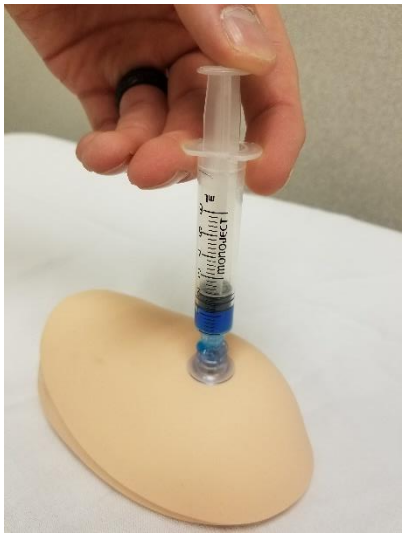


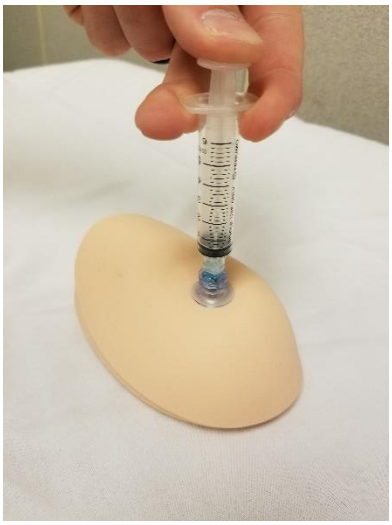




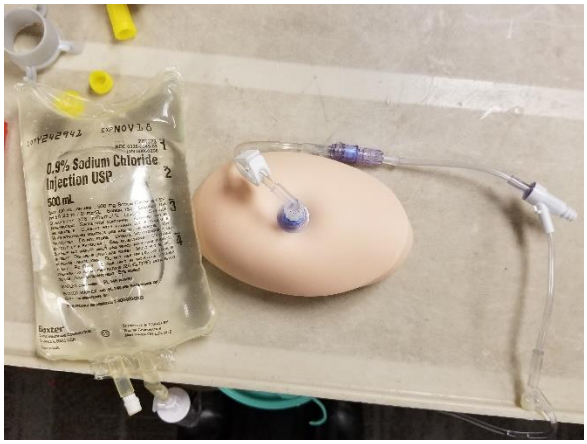
5. Transfer 1mL Lidocaine to receiving syringe

6. Slow push 1mL Lidocaine over 1 minute





7. Connect appropriately flushed extension tubing and/or IV administration set and continue fluid administration as indicated.
   - See Skills Dictionary "Intraosseous Infusion – EZIO" for information on intraosseous fluid administration



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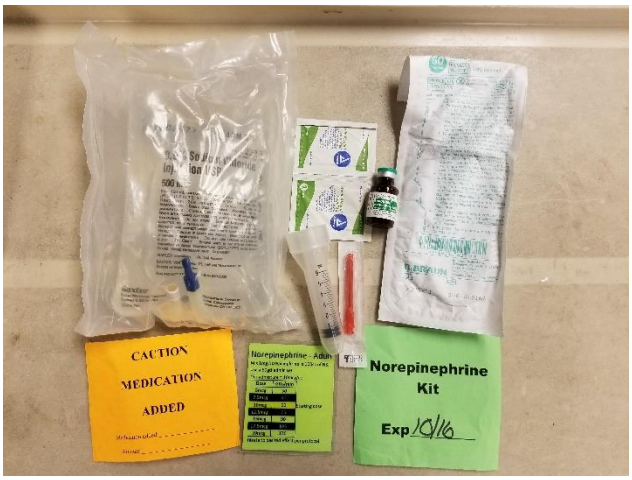
IV Admixture Infusion – Norepinephrine

1. **Knowledge Points**
   a. Admixture examples include Norepinephrine and Hydroxocobalamin
   b. Admixtures should not be hung as a "piggy-back" on another infusion of fluid or medication. Admixtures should have their own dedicated IV access point.
   c. The following example is pictured using Norepinephrine but the process should be followed for any admixture medication.
   d. Refer to JOCO EMS System Field Reference Guide for mixing and dosing information of specific medications for all admixture delivery.
   e. Drip rate is gravity dependent and may change if the bag or the patient is raised or lowered after the drip rate is set. Frequently evaluate for rate change and recalibrate with metronome if needed.
2. **Preparation**
   a. Gather all necessary equipment (medication, needles, syringes, fluid bags, drip sets, alcohol pads, medication labels, etc)

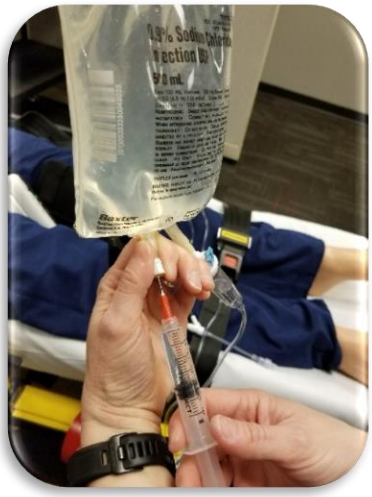


   b. Perform Medication Verification / Cross Check
      i. Verify right patient
      ii. Verify the medication name and concentration
      iii. Verify the right indication for administering med
      iv. Are there any contraindications for administering this medication?
         1. Confirm patient is not allergic to medication to be administered
         2. Are the patient's vital signs appropriate
         3. Is the medication in date?
      v. What is the appropriate route for administering this medication?
      vi. What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. Admixture Set-Up

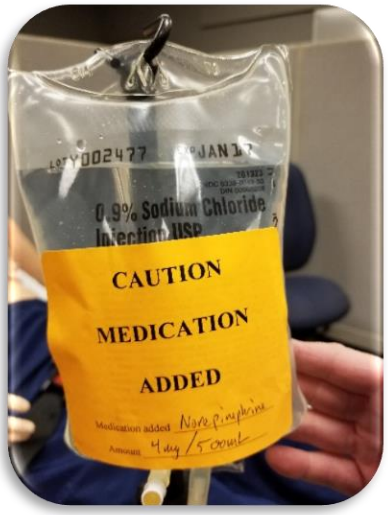
a. Using sterile technique, draw up medication from vial

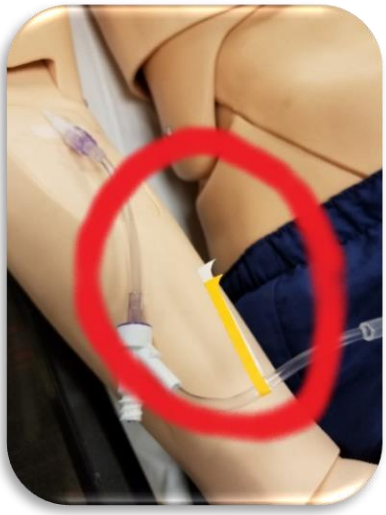
b. Using sterile technique, inject medication into Normal Saline 0.9% bag



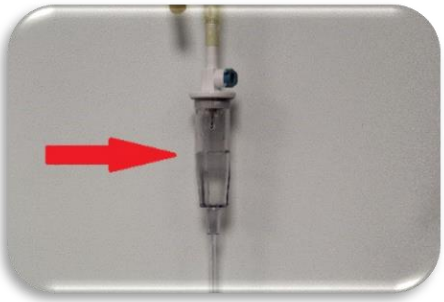
c. Fill out and apply medication label to bag

    i. Since there is a chance you may have more than one active IV line on a patient, it is a good practice to consider using the remaining edge of the medication label to "flag" the IV tubing, near the hub, that contains the medication





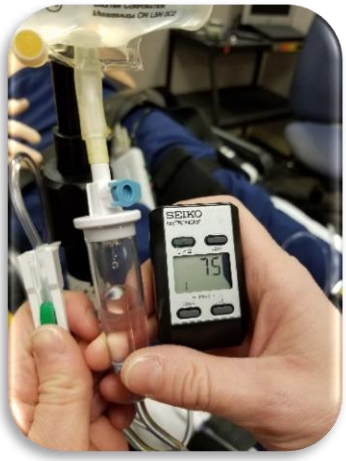
d. Mix bag well by rocking bag back and forth
e. Connect appropriate drip set to bag, fill drip chamber ½ way and flush tubing with infusion mixture



f. Using sterile technique, connect tubing to saline lock / extension set on patient.

4. Infusion

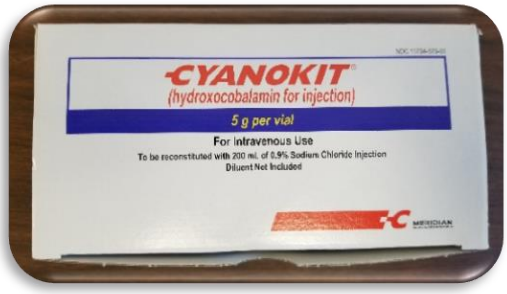
a. Begin infusion and set drip rate to applicable rate based on JOCO EMS System Field Resource Guide
    i. Use Metronome to set drip rate



b. Reassess patient
    i. Observe for both desired and adverse effects
c. Document Infusion
    i. Document drug name, mixture, dose / rate, delivery method and any change in patient status from infusion

IV Admixture Infusion – Hydroxocobalamin (Cyanokit)

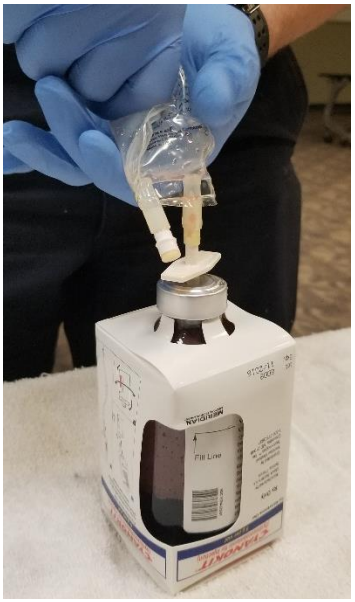
1. **Knowledge Points**
    a. Admixtures such as Hydroxocobalamin should not be hung as a "piggy-back" on another infusion of fluid or medication. Admixtures should have their own dedicated IV access point.
    b. Use only the included vented, 10gtt/mL administration line.
        i. The gtts/min doses listed in the JoCo EMS Field Guide will only be correct if using a 10gtt drip set.
    c. Do not administer other medications through the Hydroxocobalamin admixture IV line.
        i. Dopamine and Fentanyl have a known physical incompatibility with Hydroxocobalamin resulting in particulate formation when mixed. Other medications may result in similar particulate formation.
        ii. Physical and chemical incompatibility has also been noted with Sodium Nitrite and Sodium Thiosulfate.
    d. Hypertension reported greater than 180/110 is common after administration of Hydroxocobalamin.
    e. Refer to JOCO EMS System Field Reference Guide for mixing and dosing information of specific medications for all admixture delivery.
        i. Adult (and Pediatrics > 36kg) dosing is 1 full vial (200mL) over 15 minutes @ 133 gtts/min
        ii. Pediatrics 19-36kg dosing is ½ vial (100mL) over 15 minutes @ 67 gtts/min
        iii. Pediatrics up to 18kg dosing is ¼ vial (50mL) over 15 minutes @ 33 gtts/min
        iv. Drip rates are calculated using a 10gtt set. Prior to administration, ensure you are using a 10gtt set.
    f. Drip rate is gravity dependent and may change if the bag or the patient is raised or lowered after the drip rate is set. Frequently evaluate for rate change and recalibrate with metronome if needed.
2. **Preparation**
    a. Gather all necessary equipment (medication, needles, syringes, fluid bags, drip sets, alcohol pads, medication labels, etc)



d. Perform Medication Verification / Cross Check
    i. Verify right patient
    ii. Verify the medication name and concentration
    iii. Verify the right indication for administering med
    iv. Are there any contraindications for administering this medication?
        1. Confirm patient is not allergic to medication to be administered
        2. Are the patient's vital signs appropriate
        3. Is the medication in date?
    v. What is the appropriate route for administering this medication?
    vi. What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

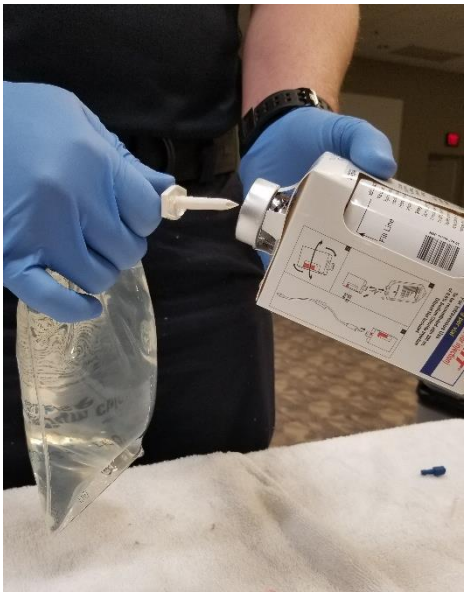
5. Admixture Set-Up

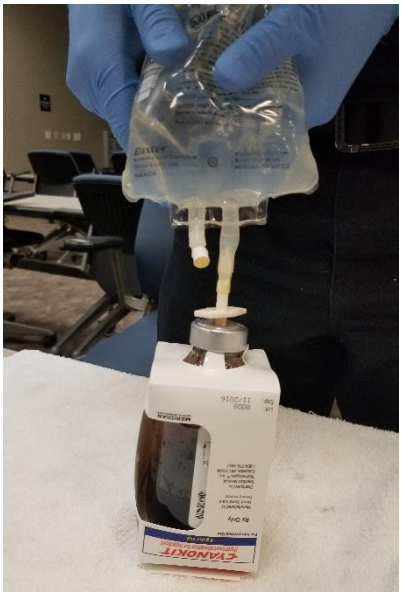
a. Using sterile technique, reconstitute the Hydroxocobalamin by filling the vial with 200mL of 0.9% Sodium Chloride.
    i. Filling the vial can be done either with two (2) 100mL bags or by using a portion of a larger volume such as a 500mL bag
b. Filling with two (2) 100mL bags method:
    i. Using the Transfer Spike, connect first 100mL fluid bag to medication vial and squeeze in the contents.
    ii. Disconnect the first bag from the transfer spike, attach the 2nd 100mL bag to the spike and squeeze in the contents.



a. Filling with single (≥ 500mL) bag method:

iii. Using the Transfer Spike, connect the fluid bag to the medication vial and squeeze in 200mL of fluid.

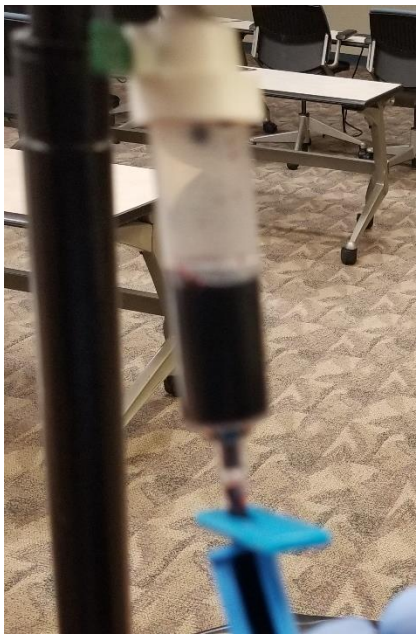




iv. With the vial sitting vertically, on a level surface, with the injection port pointing up, the 200mL of fluid should come to the level of the "Fill Line" printed on the vial label.

c. Mix bag well by rocking bag back and forth or swirling in a circular motion.
    i. DO NOT SHAKE! Shaking will result in the formation of bubbles in the medication that will result in it being unusable.

d. Connect appropriate drip set to bag, fill drip chamber ½ way and flush tubing with infusion mixture.
    i. Drip rates listed in Protocols are based on a 10gtt administration set. Prior to administration, ensure you are using a 10gtt set.



e. Using sterile technique, connect tubing to saline lock / extension set on patient.
    i. Admixtures such as Hydroxocobalamin should not be hung as a “piggy-back” on another infusion of fluid or medication. Admixtures should have their own dedicated IV access point.

6. Infusion

a. Begin infusion and set drip rate to applicable rate based on JOCO EMS System Field Resource Guide
   i. Prior to administration to Pediatric patient 19-36kg, consider discarding 100mL of mixed solution to prevent over administration of medication.
   ii. Prior to administration to Pediatric patient under 19kg, consider discarding 150mL of mixed solution to prevent over administration of medication.

   iii. Use Metronome to set drip rate
      1. Adult (and Pediatrics > 36kg)
         a. 1 full vial (200mL) over 15 minutes @ 133 gtts/min
      2. Pediatrics 19-36kg
         a. ½ vial (100mL) over 15 minutes @ 67 gtts/min
      3. Pediatrics up to 18kg
         a. ¼ vial (50mL) over 15 minutes @ 33 gtts/min
      4. Drip rates are calculated using a 10gtt set. Prior to administration, ensure you are using a 10gtt set.

b. Reassess patient
   i. Observe for both desired and adverse effects

c. Document Infusion
   i. Document drug name, mixture, dose / rate, delivery method and any change in patient status from infusion

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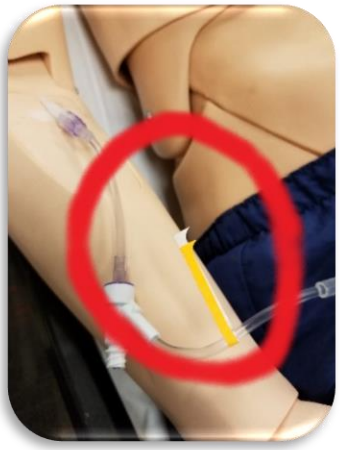
IV Pre-Mixed Infusion – D10

1. **Knowledge Points**
   a. Pre-Mixed medication infusion examples include D10
   b. Pre-Mixed medication infusions should not be hung as a "piggy-back" on another infusion of fluid or medication. Pre-Mixed medications should have their own dedicated IV access point.
   c. The following example is pictured using D10 but the process should be followed for any pre-mixed medication.
   d. Refer to JOCO EMS System Field Reference Guide for dosing information of all pre-mixed medication infusions
2. **Preparation**
   a. Gather all necessary equipment (medication, needles, syringes, fluid bags, drip sets, alcohol pads, medication labels, etc)
   b. Fill out and apply medication label to bag
      i. Since there is a chance you may have more than one active IV line on a patient, it is a good practice to consider using the remaining edge of the medication label to "flag" the IV tubing, near the hub, that contains the medication
      ii. While you are not actually adding anything to the bag of fluid, using a medication label



is a good practice to remind other providers that there is a medication in that bag that is flowed at a prescribed rate.

c. Perform Medication Verification / Cross Check
    i. Verify right patient
    ii. Verify the medication name and concentration
    iii. Verify the right indication for administering med
    iv. Are there any contraindications for administering this medication?
        1. Confirm patient is not allergic to medication to be administered
        2. Are the patient's vital signs appropriate
        3. Is the medication in date?
    v. What is the appropriate route for administering this medication?
    vi. What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)
d. Using sterile technique, connect tubing to saline lock / extension set on patient.

3. Infusion

a. Begin infusion and set drip rate to applicable rate based on JOCO EMS System Field Resource Guide
    i. Use Metronome to set drip rate

b. Reassess patient
    i. Observe for both desired and adverse effects
c. Document Infusion
    i. Document drug name, mixture, dose / rate, delivery method and any change in patient status from infusion.

IV Push – Rapid (Adenosine Administration)

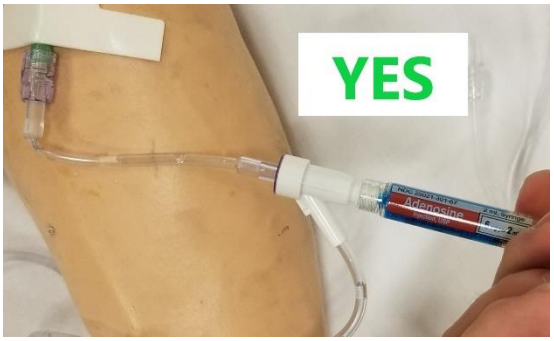
***Prior to administration of any medication, confirm your dose in the Field Reference Guide and complete the Medication Cross-Check with another provider**

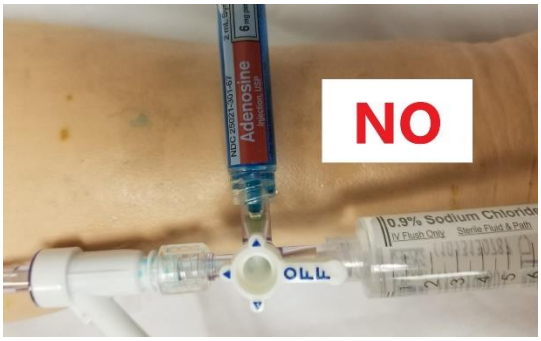
*Medications in this skills dictionary entry are simulated with colored fluids for easier visualization

1. Establish a patent intravenous line
   - Placement should be as close to heart as possible
   - Use of at least 18ga IV catheter recommended

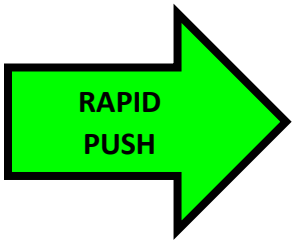
2. Attach bag of IV fluid and run drip rate at Wide Open

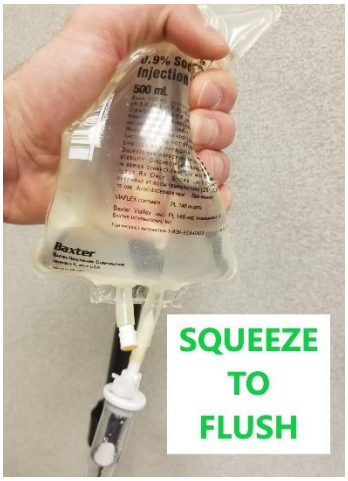
3. Remove air from Adenosine and connect directly to IV tubing port most proximal to the patient
   - Do not use stopcock





4. With fluid running Wide Open, rapidly inject Adenosine over 1-2 seconds
   - Do not pinch tubing during administration of Adenosine
   - After pushing Adenosine consider squeezing IV bag for up to 10 seconds to assist with delivery of medication





5. Slow drip rate to maintain IV patency

EMS Skills Dictionary

Syringe to Syringe Transfer

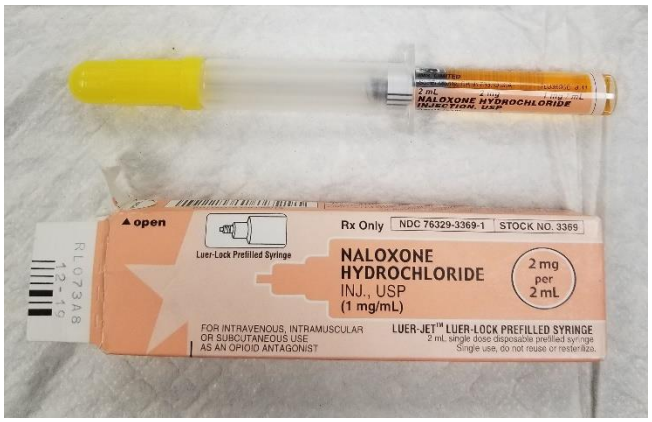
***Prior to administration of any medication, confirm your dose in the Field Reference Guide and complete the Medication Cross-Check with another provider**

*Medications in this skills dictionary entry are simulated with colored fluids for easier visualization

1. Make sure stopcock lever is pointed to the “male” port to turn shut off that port

2. Assemble and flush prefilled medication syringe

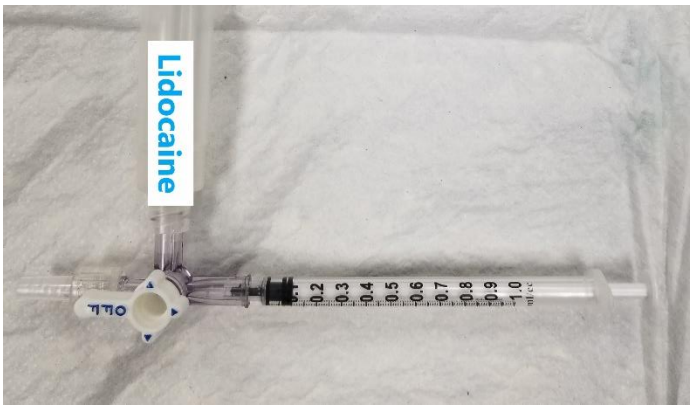
- For the following examples, colored water is used to easier visualize the doses

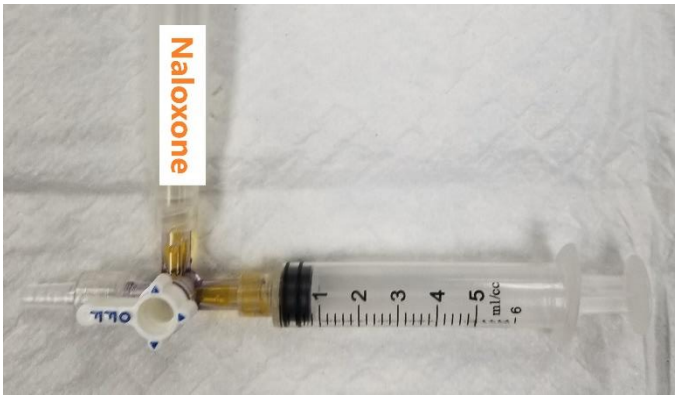


3. Attach medication syringe to one of the “female” ports on the stopcock and flush stopcock

- For the following examples, colored water is used to easier visualize the doses
- Child weight / volume examples shown are:
  - Naloxone Orange 19-23kg 2mL
  - Lidocaine Grey 5kg 0.25mL

4. Attach empty receiving syringe to other "female" port





5. Slowly push medication from medication syringe into the receiving syringe until proper dose is achieved

6. Remove receiving syringe and administer to patient

7. Special Notes

- Use separate stopcocks for separate medications
  - i.e. during a code, use one stopcock for epinephrine and a different stopcock for lidocaine
- When multiple medications are being drawn up, LABEL THE SYRINGES
- Never place the stopcock in the patient's IV line to do the transfer
  - There's too much risk of having the stopcock turned the wrong way and injecting an overdose
- Care should be taken to not contaminate any of the hubs of the stopcock and syringes. Clean with isopropyl alcohol pads prn.

Nasal Atomization

This entry covers use of Pre-Packaged Nasal Atomizer and the Mucosal Atomization Device (MAD™)

Nasal Atomization of medication can be done in varying ways, depending on the level of the Credentialed Provider:

- **Pre-Packaged nasal atomizer is approved for all Credential levels**
- **Use of Mucosal Atomization Device (MAD) and syringe is approved for *ONLY* Paramedic Credentialed Providers.**

Pre-Packaged Nasal Atomizer

1. **Prepare equipment**
   - Obtain Pre-Packaged medication atomizer

2. **Medication Verification / Cross Check**
   - Verify right patient
   - Verify the medication name and concentration
   - Verify the right indication for administering med
   - Are there any contraindications for administering this medication?
     - Confirm patient is not allergic to medication to be administered
     - Are the patient's vital signs appropriate
     - Is the medication in date?
   - What is the appropriate route for administering this medication?
   - What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. **Ready nares and position patient**
   - Make sure nare to be utilized is clear
     - Have patient blow nose if possible
     - Put finger against opposite nare and ensure air movement in chosen nare

- ∇ Works best with patient in supine position
- ∇ If patient is alert, explain the procedure to them

4. Administer medication

- ∇ Insert device tip firmly into nare and push the plunger briskly
  - ○ Try to administer medication during inhalation if possible

  - ○ If using MAD device, ensure device is securely fastened to syringe to prevent air leaks and maximize atomization of medication
  - ○ Maximum volume amount to be administered:
    - Adult 1mL/nare max
    - Pediatric 0.5mL/nare max
  - ○ Try to administer medication during inhalation
- ∇ Remove device from nare

5. Reassess patient

- ∇ Observe for desired effects and side effects
- ∇ Document administration and effects in patient report

Mucosal Atomization Device (MAD™)

1. **Prepare Equipment**
   - ∇ Obtain all equipment

2. **Medication Verification / Cross Check**
   - ∇ Verify right patient
   - ∇ Verify the medication name and concentration
   - ∇ Verify the right indication for administering med
   - ∇ Are there any contraindications for administering this medication?
     - o Confirm patient is not allergic to medication to be administered
     - o Are the patient's vital signs appropriate
     - o Is the medication in date?
   - ∇ What is the appropriate route for administering this medication?
   - ∇ What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)
3. **Ready nares and position patient**
4. **Administer Medication**
   - ∇ Ensure MAD device is securely fastened to syringe to prevent air leaks and maximize atomization of medication
   - ∇ Insert device tip firmly into nare and push the plunger briskly

   - ∇ Try to administer medication during inhalation if possible
   - ∇ Maximum volume amount to be administered:
     - o Adult 1mL/nare max
     - o Pediatric 0.5mL/nare max
   - ∇ Remove device from nare
5. **Reassess patient**
   - ∇ Observe for desired effects and side effects
   - ∇ Document administration and effects in patient report

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Nebulized Medication Delivery

This Skills Dictionary entry covers Nebulized Medication Delivery via the following adjuncts:

Mouthpiece and Aerosol Mask
BVM and Advanced Airways
CPAP

Via Mouthpiece and Aerosol Mask

1. **Gather equipment**
   - ∇ Assemble the equipment needed to provide medication to a patient via nebulizer
   - ∇ Determine which device (mouthpiece or facemask) is best suited for patient condition to administer medication

2. **Medication Verification / Cross Check**
   - ∇ Verify right patient
   - ∇ Verify the medication name and concentration
   - ∇ Verify the right indication for administering med
   - ∇ Are there any contraindications for administering this medication?
     - Confirm patient is not allergic to medication to be administered
     - Are the patient's vital signs appropriate
     - Is the medication in date?
   - ∇ What is the appropriate route for administering this medication?
   - ∇ What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. **Prepare medication**
   - ∇ Pour medicine to be administered into the nebulizer reservoir
   - ∇ Medicine can be placed with cap removed or through the top of cap

- ∇ Attach nebulizer reservoir to “T” piece
- ∇ Assemble the nebulizer with either the T-piece, mouthpiece and corrugated tubing, or the mask as determined by patient condition

- ∇ Connect oxygen tubing to bottom of the nebulizer reservoir

4. Prepare patient

- ∇ Place patient in sitting position or position of comfort
- ∇ Instruct patient on how to hold nebulizer
- ∇ Instruct patient to place mouthpiece in mouth and breathe through mouth or breath normally if using the facemask

5. Administer medication

- ∇ Connect oxygen tubing to flow meter and set at 6 – 8 LPM

- ∇ Monitor breath sounds at about the halfway point of administration (@ 5 – 7 minutes)
- ∇ Administration is complete when the nebulizer reservoir is empty

6. Reassess patient

- ∇ Listen to breath sounds and note improvement or need for further intervention

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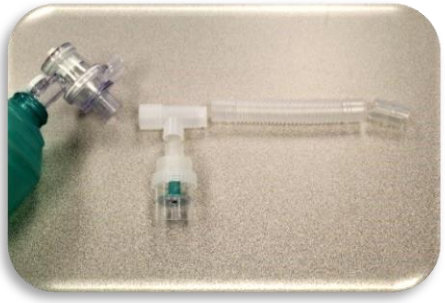
Via BVM Mask and Advanced Airway

1. **Prepare equipment**
   - ∇ Gather equipment needed to nebulize medication with a BVM
     - Nebulizer, T-Piece, Corrugated Tubing (All come from packaged nebulizer kit)
     - 15mm to 15mm adapter



   - ∇ Connect ET adapter and "T" piece to either end of corrugated tubing
     - The T-Piece and Corrugated Tubing are assembled in the same manner as if delivering via the mouthpiece, but the mouthpiece is not attached.
     - The 15mm to 15mm adapter is attached to the end of the corrugated tubing opposite of the T-piece

2. **Medication Verification / Cross Check**
   - ∇ Verify right patient
   - ∇ Verify the medication name and concentration
   - ∇ Verify the right indication for administering med
   - ∇ Are there any contraindications for administering this medication?
     - Confirm patient is not allergic to medication to be administered
     - Are the patient's vital signs appropriate
     - Is the medication in date?
   - ∇ What is the appropriate route for administering this medication?
   - ∇ What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. Prepare medication

- ∇ Pour medicine to be administered into the nebulizer reservoir
  - Medicine can be placed with cap removed or through the top of cap

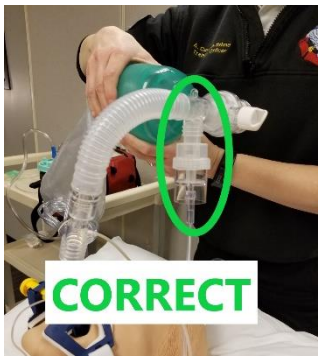
- ∇ Connect oxygen tubing to oxygen source and bottom of the nebulizer reservoir and set flow meter to 6 – 8 LPM
  - Separate oxygen sources for BVM and Nebulizer may be necessary

- ∇ Attach nebulizer reservoir and BVM to “T” piece

4. Administer medication

- ∇ Attach ET adapter to BVM Mask or Advanced Airway
  - The same 15mm to 15mm adapter will attach to either a BVM Mask, ET Tube or iGEL, and will also attach to the FilterLine ETCO2 adapter

- ∇ The nebulizer cup must remain vertical for effective medication delivery



- ∇ Ventilate the patient
- ∇ Monitor breath sounds at about the halfway point of administration (@ 5 – 7 minutes)
- ∇ Administration is complete when the nebulizer reservoir is empty

5. Reassess patient

- ∇ Listen to breath sounds and note improvement or need for further intervention

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Via Continuous Positive Airway Pressure (CPAP)

For further information on using Continuous Positive Airway Pressure (CPAP), see Continuous Positive Airway Pressure entry.

1. **Gather equipment**
   - ∇ Assemble the equipment needed to provide medication to a patient via nebulizer and CPAP
   - ∇ ***For CPAP set-up See CPAP Skills Dictionary**

2. **Medication Verification / Cross Check**
   - ∇ Verify right patient
   - ∇ Verify the medication name and concentration
   - ∇ Verify the right indication for administering med
   - ∇ Are there any contraindications for administering this medication?
     - Confirm patient is not allergic to medication to be administered
     - Are the patient's vital signs appropriate
     - Is the medication in date?
   - ∇ What is the appropriate route for administering this medication?
   - ∇ What is the right dose and volume of medication to be administered? (For pediatric patients, verify the volume only)

3. **Prepare medication**
   - ∇ Pour medicine to be administered into the nebulizer reservoir
     - Medicine can be placed with cap removed or through the top of cap

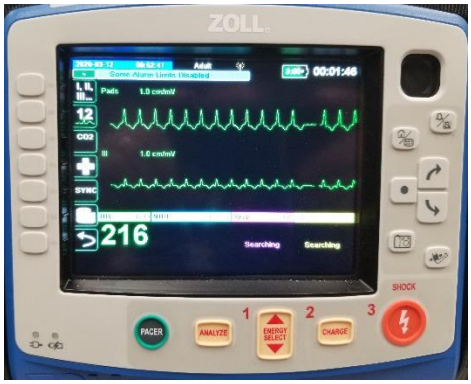
4. Connect to CPAP

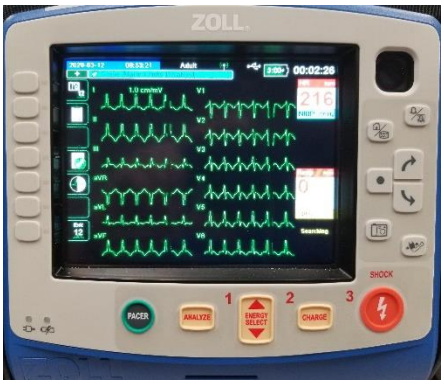
- ∇ Connect oxygen tubing to oxygen source and bottom of the nebulizer reservoir and set flow meter to 6 – 8 LPM
  - Same bottle may be used to run CPAP and Nebulizer if necessary, but will result in much faster oxygen depletion.
  - Monitor oxygen supply closely.

- ∇ Remove cap from bottom port on T-Piece and attach nebulizer cup

Modified Valsalva Maneuver

1. **Attach 4-Lead electrodes and cables**
   - Attaching the 12-Lead electrodes and cables is also suggested and may be beneficial in diagnosing Supraventricular Tachycardia prior to performing the Modified Valsalva Maneuver.
   - See 12-Lead Skills Dictionary for instructions on placement



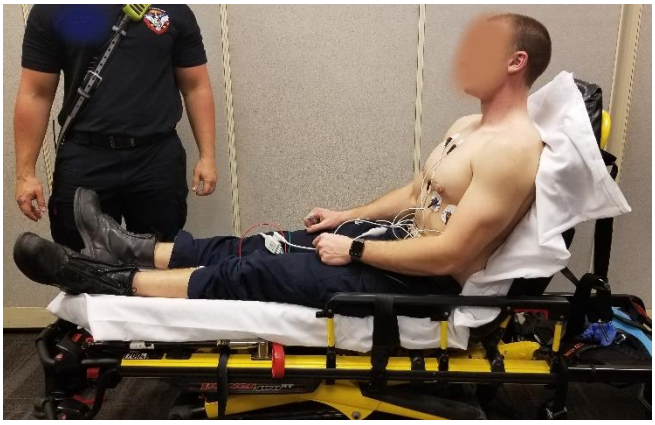


2. **Place patient in Semi-Fowlers position**

3. **Have patient blow into 10mL syringe for 15 seconds**
   - It is suggested to move the plunger slightly back and forth to loosen the seal prior to performing maneuver
   - Instruct the patient to hold the syringe with the tip in their mouth and blow hard enough to attempt to move the plunger
   - Instruct the patient to blow for 15 seconds while the provider times them or counts out loud "one-one thousand, two-one thousand, etc"

4. **Lay patient supine and perform passive leg raise for 15 seconds**
   - Lean the patient's head and torso into the supine position
   - The provider should then lift the patient's legs to a 45 degree angle
     - Do not bed the patient's legs at the knees.
     - The provider should bear the weight of the legs
     - Elevating the foot of the cot does not provide enough elevation alone

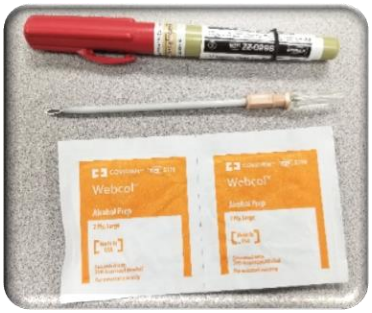
5. **Lower patient's legs and elevate head back to semi-fowlers position for 30 seconds**
   - Continue to monitor patient and ECG for 30 seconds after returning to Semi-Fowlers position, before attempting again or providing further therapy (unless the patient becomes unstable)



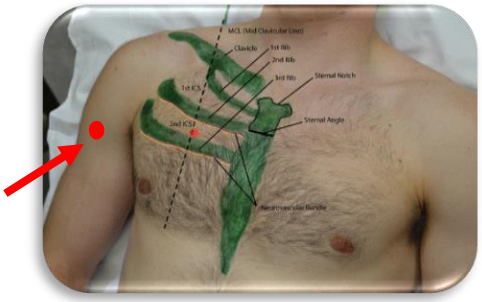
6. **Re-evaluate patient after 30 seconds**
   - Evaluate ECG rhythm and re-assess patient to determine efficacy of Modified Valsalva Maneuver and / or need for further therapy for continued tachycardia.

Needle (Chest) Decompression

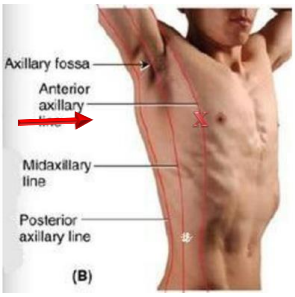
1. **Assemble equipment**
   - ∇ Gather chest decompression needle (3.25 in 10 gauge) and antiseptic prep



2. **Locate and prepare appropriate puncture site**
   - ∇ There are two possible sites for performing a chest needle decompression.
     - ○ One site is the 2nd intercostal space (ICS) midclavicular line. With your fingers, feel down the ribs until you meet the 3rd rib. Locate the middle of the clavicle and position your finger over the top of the 3rd rib in the 2nd ICS. This is the site to insert your needle.
       - Counting ribs may be difficult in a patient suffering chest injuries. The second rib attaches to the sternum at the level of the angle of Louis or sternal angle. Palpate the sternum for this landmark and then move laterally to find the second rib.



     - ○ The other potential site for chest needle decompression is the 4th or 5th ICS between the mid and anterior axillary line with arm over their head. Palpate down the ribs and slide your fingertip over to the anterior axillary line to location this puncture site.
       - This is typically about the nipple line in younger healthy males.



- ∇ Prepare the skin with alcohol or betadine
    - As the lung is compressed toward the mediastinum it will be out of the way of a needle inserted high into the chest wall or on the lateral side. Insertion along the midclavicular line also aids in avoiding the compressed lung and the internal mammary artery which passes close to the sternum.

3. Insert catheter

- ∇ Position catheter/stylet at the top of the rib perpendicularly to the chest wall

- ∇ Advance the catheter/stylet over the top of the rib into the intercostal space
    - ○ Intercostal arteries travel along the inferior border of ribs.

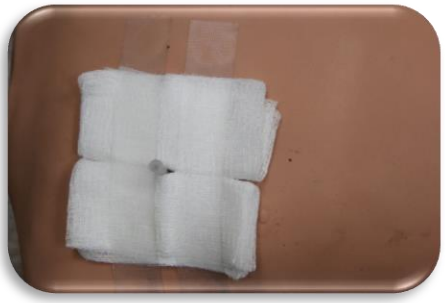
- ∇ A “pop” should be felt when the pleural space is accessed
- ∇ Advance the catheter while holding the stylet stationary

- ∇ Remove Stylet

- ∇ Listen for a “hiss” of trapped air which verifies existence of pneumothorax

4. Consider securing the catheter

- ∇ Consider securing the catheter



5. Assess patient and check for relief of tension pneumothorax

- ∇ Auscultate lungs
  - o Although breath sounds may not return to the affected side they may improve on the opposite side if this side was compressed by the tension pneumothorax.
- ∇ Check vital signs
  - o Circulation should improve with relief of a tension pneumothorax.

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Synchronized Cardioversion (ZOLL®)

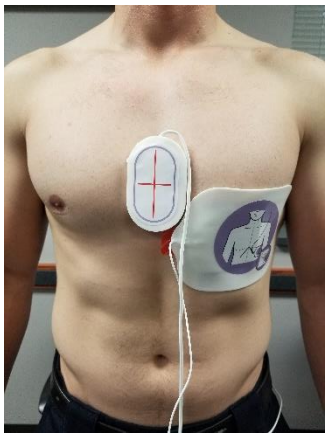
This entry contains information on using the ZOLL® X-Series monitor to perform Synchronized Cardioversion for Adult and Pediatric patients

Adult Synchronized Cardioversion

*This entry assumes the 4-Lead ECG Monitoring Electrodes are already attached and the monitor is powered on.

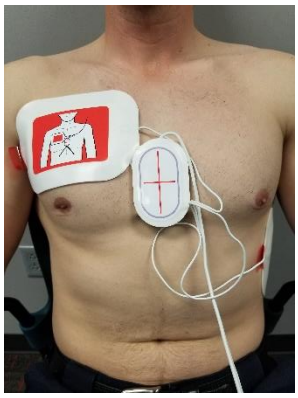
1. **Prepare the patient for cardioversion**
   - ▽ Explain the process to the patient
   - ▽ Consider Sedation
   - ▽ Remove all clothing covering the patient's chest
   - ▽ Wipe and dry the areas where pads will be placed
   - ▽ Clip or shave chest hair if it will interfere with adherence of the pads to the chest

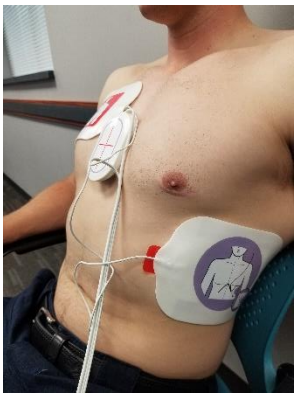
2. **Apply the hands-Free therapy electrodes**
   - ▽ *The Anterior-Posterior pad position is the PREFERRED placement for Synchronized Cardioversion*
     - A-P position is preferred because it decreases capture thresholds and as a result may increase patient tolerance.
     - Zoll Brand (and Zoll compatible) defibrillation electrodes come from the package with the CPR device attached to the Anterior pad. Separate the CPR device from the pad and *place the Anterior pad on the BACK of the patient,* Left of the spine, just below the scapula, at the heart level.
     - Place the Lateral pad over the cardiac apex with the center of the pad at the V4 position, 4th intercostal space at the mid-clavicular line.
       - On a male patient, the nipple may be placed under the adhesive area of the pad. Try to avoid placing nipple under conduction area.
       - On a female patient, place the pad UNDER the breast.
     - Place the CPR device on the bottom half of the sternum, aligned with the sternal notch.



▽ The Anterior-Lateral placement of electrodes is not recommended for Synchronized Cardioversion due to increased capture thresholds and decreased patient tolerance.

- If patient anatomy or circumstances of the call prevent placement of pads in the preferred Anterior-Posterior configuration, you may use the Anterior-Lateral configuration.
  - For A-L placement, it is not necessary to separate the CPR device from the Anterior pad, but separating them may make it easier to reposition the pads as necessary, and minimize artifact in the See-Thru CPR function.
- Place the Anterior pad by adhering the CPR sensor on the bottom half of the sternum, aligned with the sternal notch and applying the anterior pad on the patient's upper right torso.
- Place the Lateral pad so the center of the conduction area is at the V6 position.





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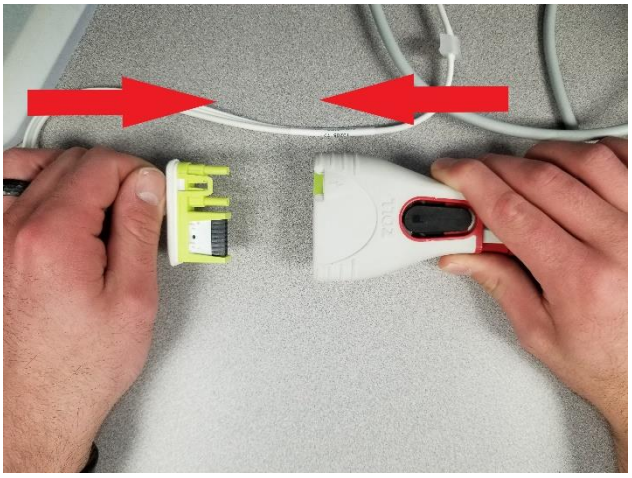
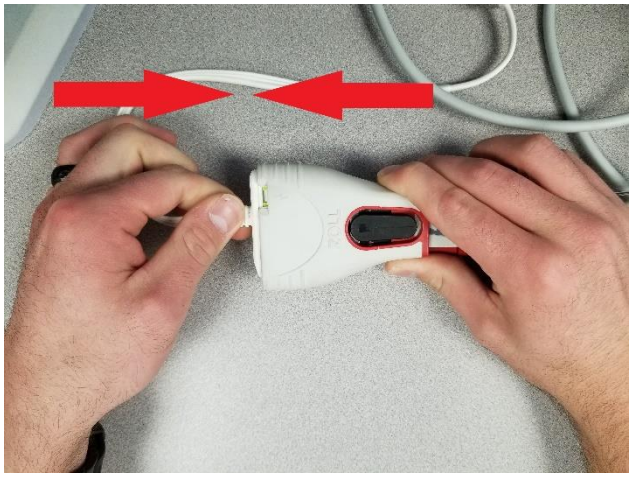




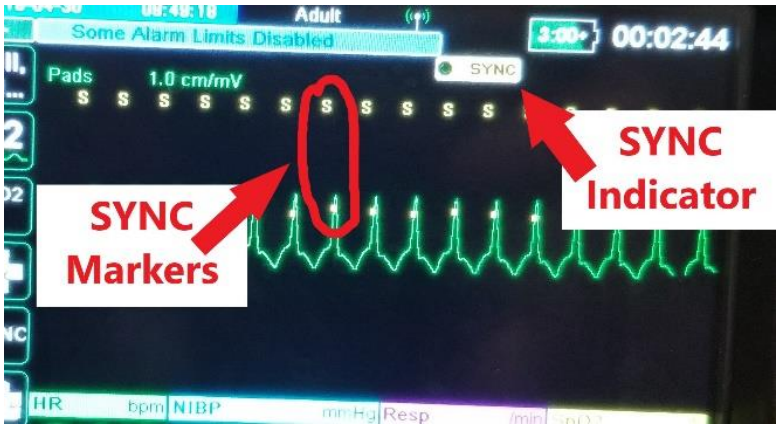
3. Activate SYNC Mode

▽ Press the Sync quick access key on the front panel. The system will now be in SYNC mode.

4. Ensure sensing of the QRS

▽ A sync marker (S) appears on the monitor above each detected R-wave to indicate where discharge will occur, and a Sync Indicator appears at the top of the display screen.

- If the marker does not appear over the R wave, select a different ECG lead. If the sync marker doesn't display, the defibrillator will not charge.



5. Charge the defibrillator

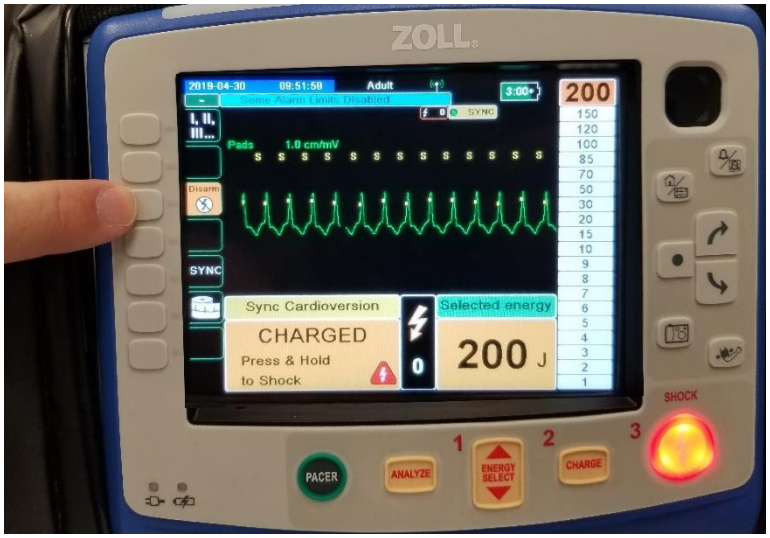
▽ Push the Charge button.

- An energy bar will appear on the right of the screen to show charging progress.
- The defibrillator will charge to the preset energy level of 200 Joules.
  - Ensure the preset level is the desired level. For pediatric patients who require a lower energy level, prior to charging, you may use the Energy Select button to change dosage if necessary. Changing the energy level after charging will dump the energy and the Charge button will need to be pushed again to charge to the new desired energy level.

6. Re-verify presence of shockable rhythm

▽ After charging, if the patient's condition no longer warrants defibrillation, or you need to dump the charge for any reason, use ONLY the "Disarm" quick access key illustrated below.

- *NOTE* using the "Energy Select" key to disarm the charge will cause subsequent charges to charge to a lower level and if not noticed, will result in defibrillations delivered at a lower level.
- If the defibrillator is not discharged within 60 seconds after reaching selected energy level, the unit automatically disarms itself.

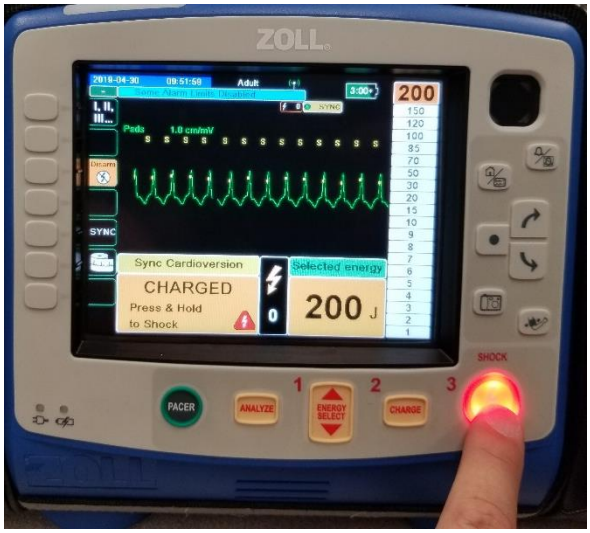


7. Deliver Shock

▽ ***Warn all persons in attendance of the patient to STAND CLEAR prior to discharge***

▽ Press and HOLD the Shock button until the energy is delivered.

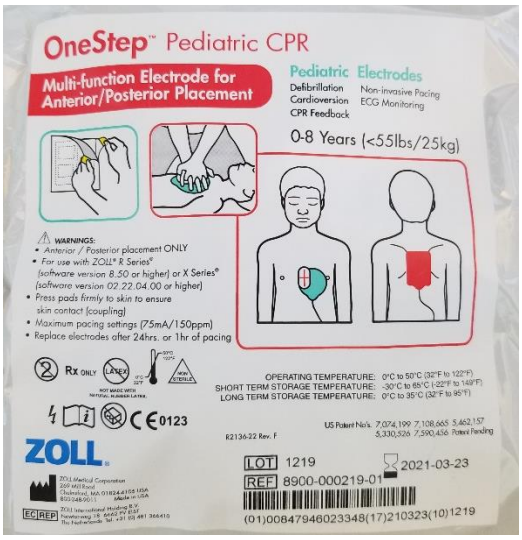
▽ Once energy is delivered, the machine will automatically exit Sync mode and the Sync button will need to be pressed again to deliver another Synchronized Cardioversion.

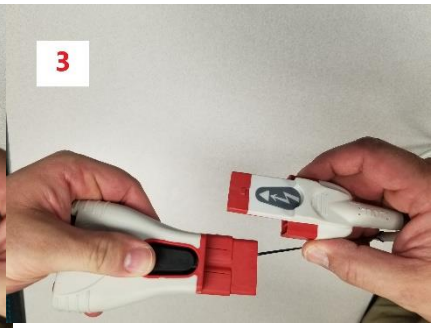


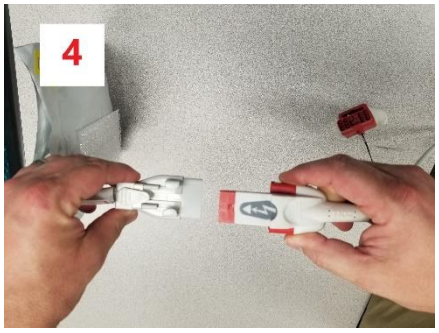
Pediatric Considerations

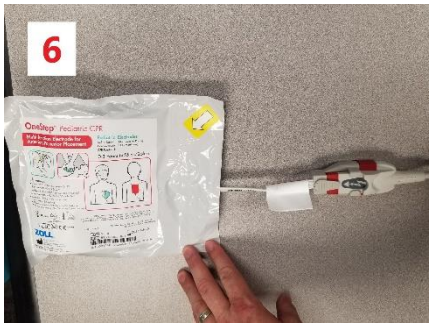
1. Pediatric Cardioversion

- ▽ Cardioversion steps for pediatric patients is identical to adult patients.
- ▽ See Weight Based Pediatric Drug Chart in Johnson County EMS Field Reference Guide for Cardioversion Joule settings
- ▽ The Pediatric One Step Patches are only to be used with children under 55lbs / 24kg (Blue and under on Length Based Tape / Field Reference Guide)
- ▽ Attaching the Pediatric One Step pads to the One Step Cable will require the removal of the Adult Stat-Padz Adaptor if it is attached. See steps below for removal of adaptor and connection of pads.
- ▽ The Anterior – Posterior placement is the only acceptable placement when using Pediatric One Step patches.









Transcutaneous Pacing (ZOLL®)

*This entry assumes the 4-Lead ECG Monitoring Electrodes are already attached and the monitor is powered on.

1. **Prepare the patient for Transcutaneous Pacing**
   - ▽ Explain the process to the patient
   - ▽ Consider Sedation
   - ▽ Remove all clothing covering the patient's chest
   - ▽ Wipe and dry the areas where pads will be placed
   - ▽ Clip or shave chest hair if it will interfere with adherence of the pads to the chest

2. **Apply the hands-Free therapy electrodes**
   - ▽ *The Anterior-Posterior pad position is the PREFERRED placement for Transcutaneous Pacing*
     - A-P position is preferred because it decreases capture thresholds and as a result may increase patient tolerance.
     - Zoll Brand (and Zoll compatible) defibrillation electrodes come from the package with the CPR device attached to the Anterior pad. Separate the CPR device from the pad and *place the Anterior pad on the BACK of the patient,* Left of the spine, just below the scapula, at the heart level.
     - Place the Lateral pad over the cardiac apex with the center of the pad at the V4 position, 4th intercostal space at the mid-clavicular line.
       - On a male patient, the nipple may be placed under the adhesive area of the pad. Try to avoid placing nipple under conduction area.
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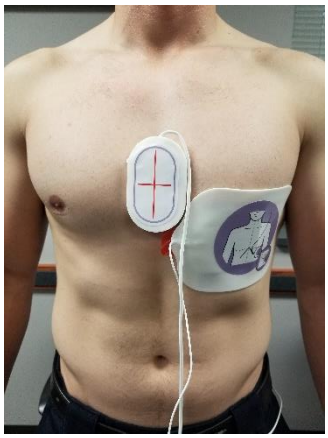

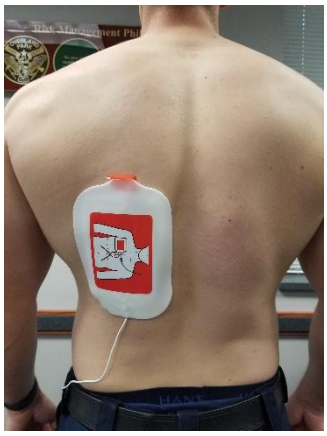

▽ The Anterior-Lateral placement of electrodes is not recommended for Transcutaneous Pacing due to increased capture thresholds and decreased patient tolerance.

- If patient anatomy or circumstances of the call prevent placement of pads in the preferred Anterior-Posterior configuration, you may use the Anterior-Lateral configuration.
  - For A-L placement, it is not necessary to separate the CPR device from the Anterior pad, but separating them may make it easier to reposition the pads as necessary, and minimize artifact in the See-Thru CPR function.
- Place the Anterior pad by adhering the CPR sensor on the bottom half of the sternum, aligned with the sternal notch and applying the anterior pad on the patient's upper right torso.
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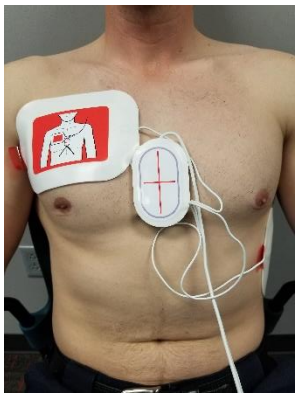
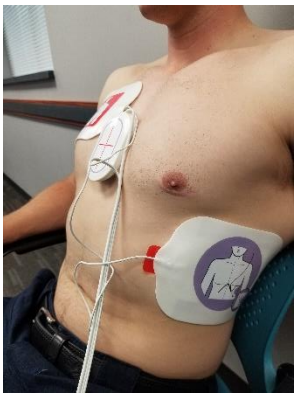
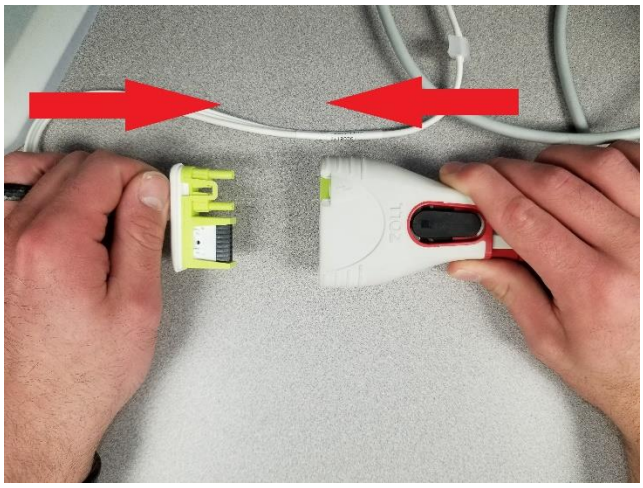
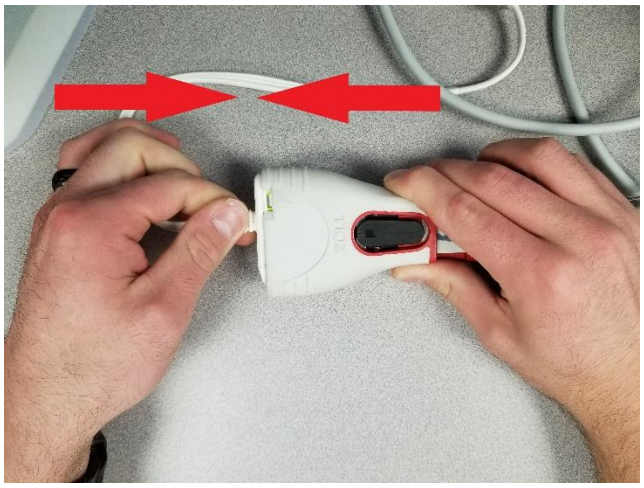




▽ Connect electrodes to therapy cable if not already done.





3. Select display lead

▽ To provide the most reliable electrical sensing and capture, the 4-Lead ECG electrodes should be used in conjunction with the hands-free therapy electrodes.

▽ Press the Lead Select quick access key to select either Lead I, II or III to display the view with the highest QRS amplitude.

4. Press Pacer button to open Pacer menu

▽ Pacer should default to Demand Pacing Mode at a Rate of 70 and 30 mA

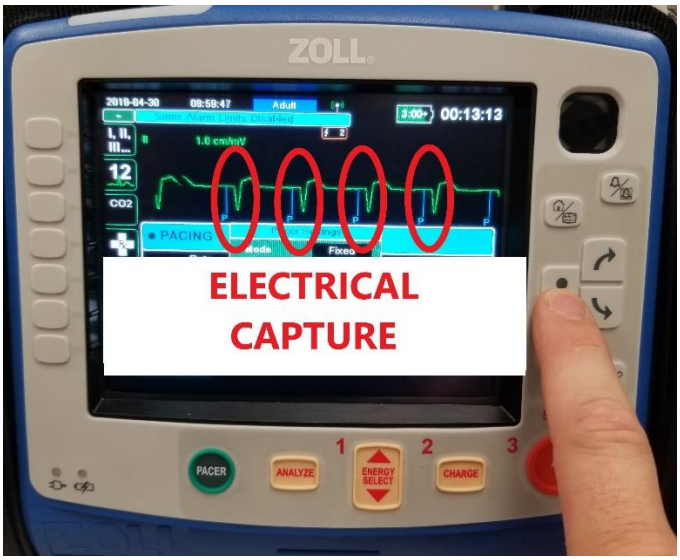
▽ If adjustments need to be made to Mode, Rate, or mA, use the Arrow Navigation buttons

- If there is a circumstance that prevents using the 4-Lead ECG electrodes or interferes with sensing, pacing may be done in Fixed Mode if there is no alternative available.
- The steps for performing Fixed Mode Pacing are the same.

5. Start Pacing

▽ Use the Arrow Navigation buttons and select “Start Pacer”

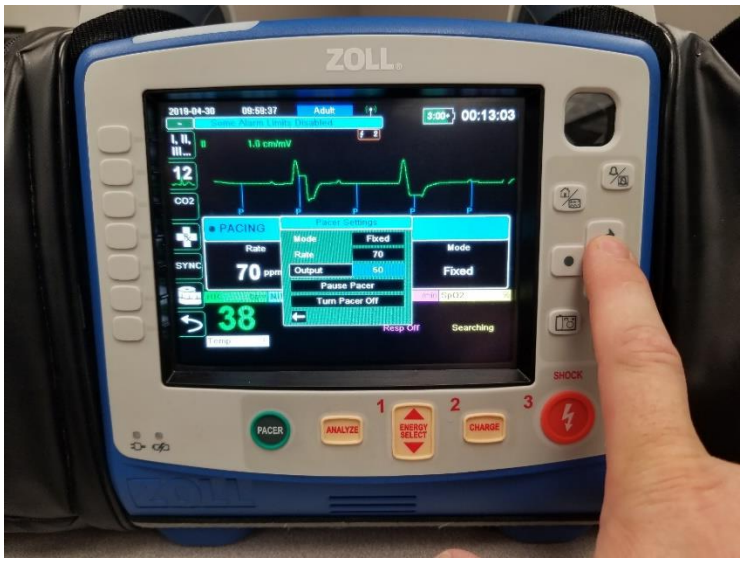
▽ Observe for presence of Pacer Spikes and Electrical Capture



6. Adjust Pacer Output

▽ Use the Arrow Navigation buttons to increase pacer output until electrical capture is obtained.

- The amount of energy in takes to obtain capture is called the Capture Threshold
- Energy adjustment is done in 10mA increases and 5mA decreases.
- Electrical Capture results in a Pacer Spike immediately producing a QRS.
  - Electrical Capture typically produces a widened QRS complex and suppression of the intrinsic QRS complex shape.
- Once Capture Threshold is achieved, increase energy output by 10%



7. Verify Mechanical Capture

▽ Mechanical Capture is assessed by palpation of the peripheral pulse.

- To avoid mistaking muscular response to pacing stimuli for arterial pulsations, use ONLY the following locations for palpating pulse during pacing:
  - Femoral Artery (Left or Right)
  - Right Brachial Artery
  - Right Radial Artery

Pediatric Considerations

1. Pediatric Transcutaneous Pacing

▽ Transcutaneous Pacing steps for pediatric patients is identical to adult patients.

▽ See "Pacing Chart" in Johnson County EMS Field Reference Guide for starting Rate and mA levels.

▽ The Pediatric One Step Patches are only to be used with children under 55lbs / 24kg (Blue and under on Length Based Tape / Field Reference Guide)

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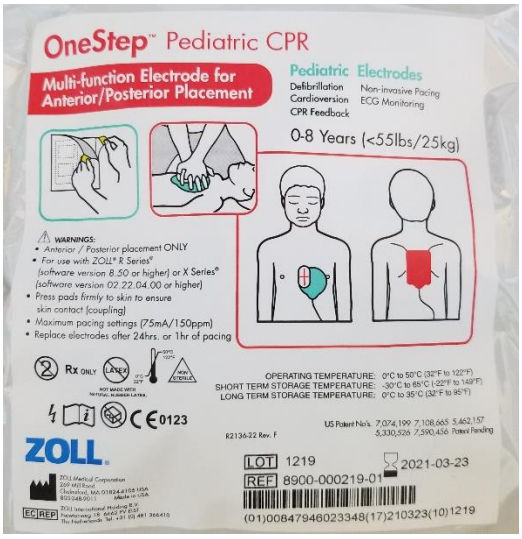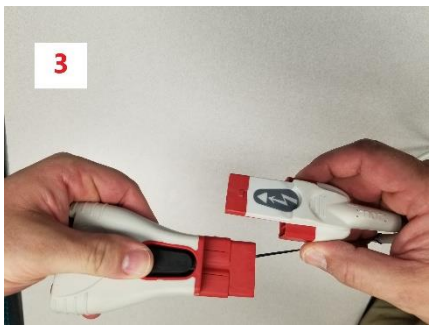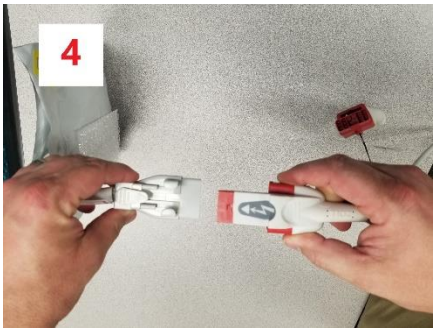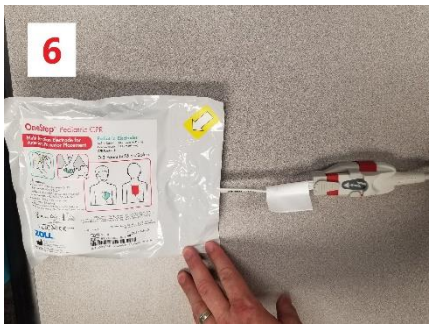
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