Procedures

Airway Management / General - 30.010

PURPOSE:
Proper airway management is the first priority of the EMS Provider/Paramedic.

INDICATIONS:
A. Airway control and protection.
B. Inadequate ventilation and/or oxygenation.

Oxygenation, Maintenance of Airway and Ventilation:

A. Supplemental oxygen:
    1. A Nasal cannula is useful for small amounts of supplemental oxygen.
    2. Partial Rebreather masks (PRB) are recommended when higher flow and concentrations of oxygen need to be delivered.
    3. "Blow-by" oxygen should be used for infants and toddlers.

B. Nasopharyngeal Airways (NPA) or Oropharyngeal Airways (OPA) should be used for patients who are unable to maintain their own airway.

C. A Bag-Valve-Mask (BVM) should be used when inadequate ventilation is present.

D. CPAP//BiPAP should be considered for MEDICAL patients complaining of moderate to severe respiratory distress meeting ALL the criteria described in the Continuous Positive Airway Pressure (CPAP) procedure.

E. Continuous End-tidal CO_2 shall be utilized on all intubated patients.

F. PEEP valve should be considered when ventilating a patient with COPD or emphysema to maintain alveolar inflation during exhalation.

NOTES & PRECAUTIONS:
In trauma patients, airway maintenance with cervical spine control is the primary concern. If unable to establish or maintain an airway, transport the patient to the closest hospital. This includes patients entered into the Trauma System.

AICD Deactivation – 30.020

DEFINITION:
An AICD is an implanted defibrillator device that consists of a lead system that senses cardiac activity, logic circuitry to analyze sensed signals, a power supply for device function and generating high voltage, and a capacitor that stores and delivers shocks. This device activates when brady and/or tachyarrhythmias are detected within programmed parameters.

INDICATIONS:
Consider application of a magnet to deactivate an implanted cardioverter defibrillator that is firing inappropriately. **Call OLMC prior to application**. Inhibition of AICD devices should be considered when continuous ECG monitoring verifies malfunction and ACLS is readily available.

PROCEDURE:
A. Contact OLMC.
B. Monitor ECG and verify sinus rhythm AND inappropriate defibrillator discharge.
C. Locate the position of the AICD device.
D. Place doughnut magnet directly over the device.
E. After proper positioning and AICD deactivation, tape magnet securely in place and transport.

NOTES & PRECAUTIONS:
A. It is very important to make the correct diagnosis before utilizing this protocol. Be sure that the ECG is showing a normal sinus rhythm without ectopy AND indications of recurrent AICD discharges.
B. Some AICD devices will emit varying beeping or continuous tones when magnets are applied, other will not. Disregard these tones.
C. If the magnet placement is successful in overriding the pulse generation of the AICD, **DO NOT REMOVE THE MAGNET**. Some units will return to normal operation after removal from the magnetic field.
D. Magnets should be stored so as not to come into contact with magnetic sensitive materials (e.g., monitor screens, tapes, credit cards, magnetic door entry cards, and other electronic equipment).
E. A small percentage of AICDs are impervious to magnetic fields (AICD recipients who normally work around magnetic fields have these special units). These will not be deactivated with the doughnut magnet. In such cases, advise OLMC and transport.
F. Consider use of the AICD magnet in deactivating cardiac pacemaker malfunctions. Application of a magnet to a pacemaker changes the pacing to asynchronous mode but will not turn off the pacemaker. Call OLMC prior to application.
G. Identification information of the AICD type, date implanted, and location of implantation should accompany the patient to the hospital. This information is typically found on a wallet card that the patient has.

Behavioral Health Emergencies (Transports to Unity Center) – 30.025

Purpose:
To establish criteria for EMS assessment, triage, and treatment of patients with potential behavioral/mental health emergencies who may be transported directly to the Unity Center for Behavioral Health (UCBH).

Definition:
Behavioral health encompasses behavioral factors in chronic illness care, care of physical symptoms associated with stress rather than diseases, and health behaviors, as well as mental health and substance abuse conditions and diagnoses.

Inclusion Criteria:

A. Voluntary patient or patient on police or mental health director hold.
B. 911 call or police request.
C. Age between 18 - 70 years.
D. Mental health complaint (e.g., depression, psychosis, suicidal or homicidal ideation), substance abuse or behavioral disorder with no acute medical or traumatic condition requiring treatment.
E. Alert and oriented to person, place, and time.
F. No evidence of trauma other than minor abrasions.
G. Able to perform activities of daily living independently (e.g., ambulate, bathe, toileting, eat, and drink).
H. If CBG is obtained, between 60 and 300 mg/dl.

Vital Signs:

A. HR 60 - 130 bpm
B. O_2 sat > 90%
C. Systolic BP 90 - 200mmHg
D. Diastolic BP < 110 mmHg
E. Temperature between 96.0° F and 100.4° F (38° C), if taken

Exclusion Criteria:

A. Possible drug overdose or acute intoxication impairing ability to ambulate or perform activities of daily living.
B. Acute medical or traumatic condition including altered level of consciousness, chest or abdominal pain, significant bleeding, respiratory distress, or other acute illness or injury.
C. Patients with abnormal vital signs or physical findings.
D. Patients who require pharmacological sedation (olanzapine ODT or IM haloperidol or droperidol alone **IS NOT** an exclusion).
E. Signs/symptoms of acute drug/alcohol withdrawal (e.g., tachycardia, hypertension, tremors, visual hallucinations).
F. Patients with central or peripheral IV lines.
G. Patients requiring gastric or nasogastric tube feedings.
H. Patients requiring dialysis.
I. Pregnancy greater than 20 weeks.
J. Patients requiring CPAP or BiPAP for treatment of acute respiratory failure.
K. Patients that require continuous supplemental oxygen; tracheostomies, or that require any type of services administered by RT such as nebulization.

Behavioral Health Emergencies (Transports to Unity Center) – 30.025

Procedure:

A. Assess and assure scene safety.
B. If police or Crisis Intervention Team (CIT) is on scene, EMS assessment and intervention should not be delayed, however, police or the CIT may need to diffuse the situation in order to allow for EMS to safely assess the patient. EMS crews should get an initial report from the officer before approaching the patient. If EMS is first on scene, give an initial report to officer.
C. Approach the patient in a calm, slow, reassuring, and honest manner. Multiple people attempting to intervene may increase the patient's confusion and agitation.
D. Consider offering olanzapine ODT 10 mg for agitation.
E. Protect the patient, bystanders, and rescuers from injury. Consider restraint and follow Agitated Patient protocol, if indicated.
F. Obtain history, physical, and mental status examination.
G. Assess and treat any medical conditions per EMS protocol and then determine if patient is eligible for transport to UCBH.
H. All patients will be assessed and evaluated by EMS regardless of transport status.

Specific Precautions:

A. Red Flags that this might **not** be a psychiatric condition:
    1. Waxing and waning level of consciousness.
    2. Abnormal vital signs.
    3. Dilated or pinpoint pupils.
    4. First psychotic episode over the age of 30.
    5. Acute onset over hours/days (consider substance abuse).
B. Psychiatric signs/symptoms:
    1. Mood disorder: Depression, mania, suicide ideation, anxiety.
    2. Thought disorder: Hallucinations, pressured speech, racing thoughts, grandiose or paranoid ideation, delusions.
C. Medical illnesses including hypoglycemia, hypoxia, stroke, head injury, or CNS infection may mimic psychiatric illness. Do not assume the patient's condition is purely psychiatric.

Continuous Positive Airway Pressure – 30.032

DEFINITION:
Continuous Positive Airway Pressure (CPAP) has been shown to rapidly improve vital signs, gas exchange, and to decrease the work of breathing, the sense of dyspnea, and the need for endotracheal intubation in patients who suffer from shortness of breath secondary to CHF/Pulmonary edema, COPD, or asthma. In patients with CHF, CPAP improves hemodynamics by reducing preload and afterload.

INDICATIONS:
Medical patients complaining of moderate to severe respiratory distress meeting **ALL** the following criteria:

A. Is awake, oriented and has the ability to maintain an open airway.
B. Has signs and symptoms consistent with either CHF/pulmonary edema, COPD, or asthma.
C. Has a systolic blood pressure above 90 mmHg.
D. Is over 12 years old and is able to fit the CPAP mask.

CONTRAINDICATIONS:

A. Respiratory arrest.
B. Non-cooperative patient.
C. Suspected pneumothorax.
D. Hemodynamically unstable.
E. Inability to maintain mask seal.
F. Active vomiting.

PROCEDURE:

A. EXPLAIN and COACH THE PATIENT ON THE PROCEDURE.
B. Ensure adequate oxygen supply to ventilation device.
C. Place the patient on continuous pulse oximetery and end-tidal CO_2.
D. Turn on device. Set device to minimum flow (2 - 5 cmH_2O).
E. Place the CPAP over the patient's mouth and nose (consider having the patient hold the mask against their face initially to reduce anxiety).
F. Secure the mask with the provided straps.
G. Check for air leaks.
H. Monitor and document the patient's respiratory response to the treatment.
I. Continue to coach patient to keep mask in place and readjust as needed to a maximum of 10 cmH_2O.
J. IF RESPIRATORY STATUS DETERIORATES, REMOVE THE DEVICE AND CONSIDER BAG VALVE MASK VENTILATION AND/OR ENDOTRACHEAL INTUBATION.

REMOVAL PROCEDURE:
CPAP therapy needs to be continuous and should not be removed unless the patient cannot tolerate the mask or experiences continued or worsening respiratory failure.

Continuous Positive Airway Pressure – 30.032

SPECIAL NOTES:

A. If unable to maintain oxygen saturation > 90%, administer positive airway pressure via BVM and PEEP valve.
B. Contact the receiving hospital as soon as possible that a patient with CPAP is enroute to their hospital so they can be prepared for the patient.
C. Reassessment of the patient's status is critical, and documentation should be performed every 5 - 10 minutes until patient is stable.
D. CPAP mask may be removed temporarily to administer nitroglycerin.
E. Suctioning of secretions may be required on some patients.
F. Watch for gastric distention and/or nausea.
G. The CPAP monometers should be used to determine and adjust CPAP pressures as this will vary depending on the device used and whether nebulization is occurring simultaneously.
H. Monitor mean arterial blood pressure closely in all patients with CPAP.

Double Sequential External Defibrillation – 30.034

PURPOSE:
To define the procedure for performing Double Sequential External Defibrillation (DSED) for refractory ventricular fibrillation.

INDICATIONS (Must meet all indications):

A. ≥ 18 years of age.
B. Persistent Ventricular Fibrillation/Pulseless Ventricular Tachycardia after 3 defibrillation attempts.

PROCEDURE:

A. Prepare the sites for placement of external defibrillation pads by drying the sites and minimizing interference of hair or other obstacles to good pad adhesion.
B. Apply one set of external defibrillation pads in anterior-posterior location. Apply the other set of external defibrillation pads in the anterior-lateral location. **Pads must be placed anterior-lateral and anterior-posterior while assuring they do not contact.** If using LUCAS, ensure that the defibrillation pads and wires are not underneath the suction cup.

1. Anterior-Posterior (A-P) Placement (Figure 1):
    a. Place the ♥ or ✚ therapy electrode over the left precordium. The upper edge of the electrode should be just below the nipple line. Avoid placement over the nipple or the bony prominence of the sternum, if possible.
    b. Place the other pad on the posterior side of the patient below the scapula. Do not place the pad over the bony prominences of the spine or scapula.
2. Anterior-Lateral (A-L) Placement (Figure 2):
    a. Place the ♥ or ✚ therapy electrode lateral to the patient's left nipple between the mid and posterior axillary line.
    b. Place the other therapy electrode on the patient's upper right torso, lateral to the sternum and below the clavicle.

Fig. 1

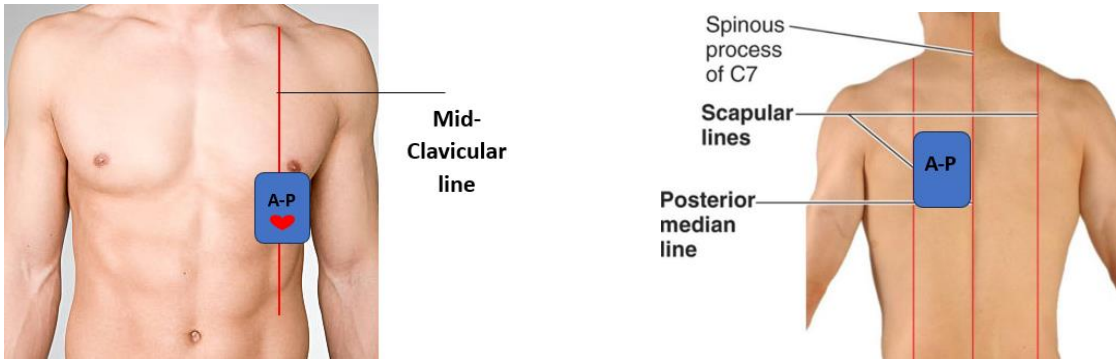
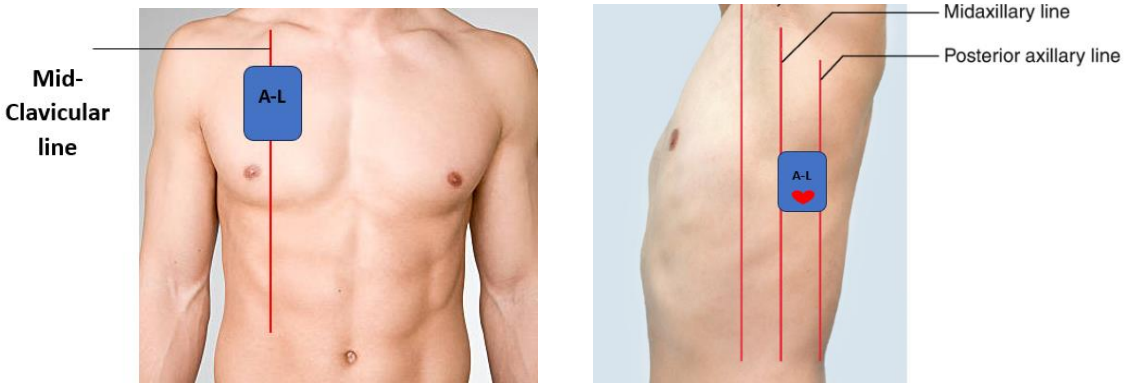


Fig. 2



C. Positon both defibrillators so they are accessible to a single operator.
D. Select the maximum energy for both defibrillators (e.g. Stryker-Physio Control LP15- 360J or Zoll 200J). When documenting DSED, the combined energy will be 720J if using 2 LP15's, 400 if using 2 Zoll's, or 560 if using 1 of each.
E. Charge both devices 15 seconds in advance of the anticipated break in CPR. Assure chest compressions continue while the devices are charging.
F. At the prescribed time in the CPR cycle, discontinue compressions and analyze the rhythm.
G. If a shock is indicated, assure all providers are clear from the patient and have a <u>single provider</u> deliver DSED by depressing the A-L defibrillator first then the A-P defibrillator as quickly as possible.
H. Immediately resume chest compressions.
I. Repeat the DSED steps for each subsequent shock until change in rhythm or ROSC.
J. Ideally, DSED should be performed after the intial dose of an antidysrhythmic (amiodarone or lidocaine) has been administered. In cases of delayed vascular access, DSED should still be performed after the 3rd unsuccessful defibrillation.
K. Following use of DSED, it is recommended that a test load shock be performed on both defibrillators that were used.

Emergency Cricothyrotomy – 30.035

INDICATIONS:
This technique is to be used only when other attempts to establish an airway have been unsuccessful (i.e., you are unable to oxygenate or ventilate using BVM) and respiratory failure exists. Such conditions are most likely to be found with foreign-body obstruction, facial and laryngeal trauma, inhalation, thermal, or caustic injury to the upper airway, angioedema, upper airway bleeding, epiglottitis, and severe croup.

PROCEDURE:
Place the patient in a supine position with support under the shoulders and mild hyperextension of the neck. Palpate the neck in the midline and locate the slight depression just below the notch of the thyroid cartilage. This is the position of the cricothyroid membrane.

Surgical Cricothyrotomy (Patients > 40 kg)

A. Cleanse the site with antiseptic.
B. Using your non-dominant hand (thumb and middle finger), stabilize the trachea. Your index finger is used to maintain location of the cricothyroid membrane throughout the procedure.
C. Locate the cricothyroid membrane.
D. Make a vertical incision through the skin. **NOTE**: There may be significant bleeding; consider use of combat gauze to control bleeding.
E. Make a horizontal incision through the cricothyroid membrane large enough to pass the tube.
F. Follow insertion instructions for commercial device being used or follow agency specific guidelines including use of gum elastic bougie.
G. Secure device.
H. Attach end-tidal CO_2 adapter and BVM.
I. Consider sedation if necessary.

Needle Cricothyrotomy – (pediatric patients 12 years and younger).

A. Assemble equipment: 14g or 16g angiocath, 3 cc syringe, 3.0 ETT adapter, oxygen, BVM.
B. Place the patient in a supine position with support under the shoulders and mild hyperextension of the neck unless C-Spine injury is suspected.
C. Palpate the neck in the midline and locate the slight depression just below the notch of the thyroid cartilage. This is the position of the cricothyroid membrane.
D. Prepare the area with antiseptic solution.
E. Stabilize the airway between thumb and forefingers.

F. Insert the needle with catheter into the cricothyroid membrane at a 30-degree angle caudally (toward the patient's feet).

G. When the needle is through the membrane. Stop and aspirate for air to ensure tracheal entry.

H. Advance the catheter over the needle and then remove the needle.

I. Attach the 3.0 ETT adapter to the hub of the catheter and begin ventilations with the BVM.

J. Secure the cannula with tape after confirming correct placement by auscultation for breath sounds (5-point check). Observe for kinking of cannula.

K. Consider sedation if necessary.

NOTES & PRECAUTIONS:

A. Hazards in performing this procedure are primarily those of damage to nearby structures; major vessels to either side of the midline, to the vocal cords if the puncture is made too high, or a through and through injury of the trachea if the puncture is made too deeply. The latter is more commonly seen in infants and children whose tracheas may be deceptively narrow.

B. Palpation of the cricothyroid membrane is very difficult in the infant and young child. The key to success is immobilization of the trachea throughout the procedure.

C. Needle cricothyrotomy is only a temporizing measure providing oxygenation not adequate ventilation.

Endotracheal Intubation – 30.040

INDICATIONS:

A. Airway obstruction
B. Need for airway protection
C. Respiratory failure

PROCEDURE:

Cardiac Arrest Patients:

A. Patients in cardiac arrest can typically be intubated without the use of an induction agent and paralytics. Pre-oxygenation and apneic oxygenation are not indicated.
B. Assemble and check all equipment:
    1. Cardiac monitor
    2. Suction
    3. $EtCO_2$
    4. Pulse Oximeter
    5. O_2 tank w/regulator
    6. Mask and BVM
    7. Intubation equipment (VL, DL)
    8. Backup devices ready: Bougie, supraglottic airway, surgical airway (cric kit)
C. Intubate in a controlled, but timely manner. (Consider use of a supraglottic airway to minimize CPR interruptions or when ALS resources are limited.)
D. Use of the bougie is encouraged for endotracheal intubation to facilitate first pass success.
E. Verify placement of ET tube using waveform capnography and a careful five-point check. Monitor waveform capnography continuously during transport.
F. Secure the tube utilizing ETT securing device. Record ET Tube depth at the teeth or gum line. Good depth target is 21 cm for women, and 23 cm for men at the teeth.
G. Avoid interruptions to CPR when securing a patient's airway. Once secured, deliver 1 breath every 6 secs. (10 breaths/min) asynchronous with compressions. About 1 second per breath, with visible chest rise. Optional method: 30:2 compression/ventilation ratio with advanced airway until ROSC.
H. Ventilate and monitor patient's vital signs including SpO_2.
I. If signs of "CPR Induced Consciousness" are present, administer up to 2.5 mg of midazolam IV/IO **or** lorazepam 1 mg IV/IO **and** 50 mcg of fentanyl. May repeat as needed every 5 - 10 minutes. Maximum total dose of lorazepam is 4 mg.
J. Consider orogastric tube placement.

Drug Assisted Airway Management (DAAM) in Perfusing Patients:

A. Assemble and check equipment:
    1. Two O_2 tanks w/regulators
    2. Nasal cannula
    3. Mask and BVM
    4. $EtCO_2$
    5. Intubation equipment (VL, DL)
    6. Suction
    7. Backup devices ready: Bougie, supraglottic airway, surgical airway (cric kit)
B. Attach pulse oximeter, cardiac monitor, BP cuff, and waveform capnography.
C. Establish 2 IVs or IOs, if not already done.
D. Verbalize missed airway plan to the entire team and verify/mark surgical airway landmarks.

Endotracheal Intubation – 30.040

E. Physiologically optimize patient prior to intubation with a MAP > 65 mmHg (systolic BP > 100 mmHg), SpO_2 ≥ 94% for at least 3 minutes, and aggressive treatment of underlying conditions.

F. Treat hypotension with fluids as well as Push Dose epinephrine 10 mcg every 1 - 5 minutes, with goal for a MAP > 65 mmHg (SBP ≥ 100 mmHg).

G. Place nasal cannula and administer oxygen at 15 lpm. Continue apneic oxygenation during procedure.

Difficulty achieving SpO_2 ≥ 94% for at least 3 minutes due to physiological conditions or preferred induction option based on paramedic discretion or medical director preference.

Yes → **Delayed Sequence Intubation procedure**

No → **Rapid Sequence Intubation procedure**

Administer Induction Agent:
Ketamine 1 - 2 mg/kg IV/IO slow push over 60 seconds for sedation and analgesia prior to paralysis

Positioning:
Ensure patient is positioned ear to sternal notch with head of bed/backboard elevated ≥ 15°. Maintain apneic O_2 via NC at 15 lpm throughout

Preoxygenation:
-If patient is **breathing adequately**, Hold BVM (**NO VENTILATIONS)** using 25 lpm of oxygen and NPA/OPA with two-handed mask seal **and PEEP @ 10.** Increase PEEP if unable to achieve SpO_2 ≥ 94%
-If patient is **breathing inadequately**, **VENTILATE** with BVM using 25 lpm of oxygen and OPA/NPA with two-handed mask seal **and PEEP @ 10.** Increase PEEP if unable to achieve SpO_2 ≥ 94%

Denitrogenation
Upon reaching SpO2 ≥ 94%, **begin 3-minute countdown** to allow for complete denitrogenation.
See letter H below

Paralysis
Administer one of the following paralytics:
- Succinylcholine
  - ≥ 6 years or > 20 kg - 1.5 mg/kg IV/IO
  - < 6 years or < 20 kg - 2 mg/kg IV/IO **OR**
- Rocuronium 1.2 mg/kg IV/IO **OR**
- Vecuronium 0.1 mg/kg IV/IO

Positioning:
Ensure patient is positioned ear to sternal notch with head of bed/backboard elevated ≥ 15°.
Maintain apneic O_2 via NC at 15 lpm throughout

Preoxygenation:
-If **breathing adequately**, administer oxygen via NRB at 25 lpm
-If **breathing inadequately**, use a BVM at 25 lpm with OPA/NPA. Perform two-person BVM ventilations with two-handed thumbs-down seal on mask

Administer Induction Agent:
- Etomidate 0.3 mg/kg IV/O **OR**
- Ketamine 1 - 2 mg/kg IV/IO slow push over 60 seconds **OR**
- Midazolam 0.2 mg/kg IV/IO (least desirable option)
  -If systolic BP ≥ 100 mmHg- max dose 10 mg
  -If systolic BP < 100 mmHg- max dose 5 mg

Paralysis
Immediately following induction agent, administer one of the following paralytics:
- Succinylcholine
  - ≥ 6 years or > 20 kg - 1.5 mg/kg IV/IO
  - < 6 years or under 20 kg - 2 mg/kg IV/IO **OR**
- Rocuronium 1.2 mg/kg IV/IO **OR**
- Vecuronium 0.1 mg/kg IV/IO

H. If unable to achieve SpO_2 ≥ 94%, consider failed airway plan, including use of a supraglottic airway.

I. Perform intubation approximately 60 seconds after succinylcholine or rocuronium, and 2 - 3 minutes after vecuronium.

J. Use of the bougie is encouraged to facilitate first pass success.

K. If SpO_2 drops to < 94% during intubation attempt, ventilate with BVM using 100% oxygen before next attempt.

L. If intubation unsuccessful, consider use of BVM and/or backup supraglottic airway device.

M. If unable to ventilate with BVM or backup airway, proceed to surgical airway (cricothyrotomy).

N. If bradycardia occurs, first ensure adequate ventilation, and if persistent, administer atropine 0.5 mg IV/IO (Pediatric patients: 0.02 mg/kg IV/IO. Minimum dose 0.1 mg. Do not exceed adult dose.)

O. Verify placement of ET tube using waveform $EtCO_2$ and five-point check.

P. Continue cardiac, waveform $EtCO_2$, and pulse oximetry monitoring at all times.

Q. Following intubation, titrate PEEP down to lowest setting to maintain SpO_2 ≥ 94%.

R. Insert an oral airway or compatible bite-block device if needed.

S. Secure the endotracheal tube and record the depth at the teeth/gums.

T. Recheck and document ET tube placement after every patient movement or change in vital signs. For sudden hypoxia, consider DOPE:
   1. **D**islodgement
   2. **O**bstruction
   3. **P**neumothorax
   4. **E**quipment

U. After successful airway placement, administer fentanyl **PLUS** midazolam/lorazepam, **OR** ketamine for analgesia and sedation:
   1. Fentanyl and midazolam/lorazepam:
      a. Fentanyl 50 - 100 mcg IV/IO if SBP ≥ 100 mmHg (MAP > 65 mmHg), repeat every 15 minutes as necessary to maintain analgesia. (Pediatric dosing, 1 mcg/kg, not to exceed the adult dose with repeat doses at 0.5-1 mcg/kg)
      b. Midazolam 2.5 - 5 mg IV/IO if SBP ≥ 100 mmHg (MAP > 65 mmHg). Repeat every 15 minutes as necessary to maintain sedation. (Pediatric dose of midazolam is 0.1 mg/kg IV/IO up to 2.5 mg), **OR**
      c. Lorazepam 1 - 2 mg IV/IO if SBP ≥ 100 mmHg (MAP > 65 mmHg). May repeat every 5 - 10 minutes as needed to a max total dose of 4 mg. (Pediatric dose of lorazepam is 0.05 mg/kg IV/IO up to max single dose of 2 mg. May repeat every 5 - 10 minutes as needed up to a max total dose of 4 mg).
      Analgesia should be addressed first. Opioids are typically the first line agents before benzodiazepines.
   2. Ketamine: Initial dose is 1 mg/kg slow IV/IO push if not used for induction. If used for induction, initial dose is 0.5 mg/kg slow IV/IO push. May repeat 0.5 mg/kg every 15 minutes as necessary to maintain analgesia and sedation. **Ketamine should not be used for sedation following ROSC in cardiac arrest patients.**

V. Consider ketamine for ongoing sedation in airway management if:
   1. Non-depolarizing neuromuscular blockade (e.g. vecuronium, rocuronium) is used at any point as a paralytic agent, or
   2. Ketamine is used for DAAM.

W. If additional paralysis is needed, administer vecuronium 0.1 mg/kg **or** rocuronium 0.5 mg/kg IV/IO.

X. Consider orogastric tube placement.

NOTES & PRECAUTIONS:

If unable to establish and/or maintain an adequate airway, transport patient, including trauma patients, to the nearest hospital to obtain definitive airway control.

A. An attempt is defined as the insertion of the laryngoscope blade or rescue airway past the teeth.
B. In most situations, intubation attempts should be limited to 2 per paramedic (with a maximum of 4 attempts prior to/during transport).
C. DO NOT rely solely on monitoring equipment. Auscultate for lung sounds and/or re-visualize with laryngoscope if there is any doubt about tube placement.
D. Continuously monitor the patient's overall condition including vital signs, $EtCO_2$, cardiac rhythm, perfusion, and ease of ventilation post-intubation.
E. With high quality CPR and mechanical CPR devices, a growing number of patients have been reported to experience "CPR Induced Consciousness". Assess for signs of consciousness by checking for spontaneous eye opening, purposeful movement, or verbal response to include moaning.
F. Succinylcholine, rocuronium and vecuronium do not affect the level of consciousness and should be used with etomidate/ketamine/midazolam.
G. Succinylcholine is contraindicated in the following:
   1. Known hypersensitivity.
   2. Major burns and crush injuries between 48 hours and 6 months old.
   3. Stroke or spinal cord injuries with profound residual deficits between 48 hours and 6 months old.
   4. Neuromuscular disease (e.g., muscular dystrophy).
   5. Suspected hyperkalemia (patients who have missed dialysis).
H. Avoid vecuronium and rocuronium in patients suspected of having underlying status epilepticus (seizures).
I. Start with 1 mg/kg of ketamine for induction. If disassociation is not achieved, administer a second 1 mg/kg dose of ketamine.
J. Rapid administration of ketamine can lead to apnea. Ketamine should be administered slowly over 60 seconds. Dilute ketamine with normal saline to a minimum of 10 ml total volume for a slower administration.
K. Ketamine can cause laryngospasm and may cause an emergence reaction with vivid dreams.
L. Pre-oxygenation can be challenging in some instances (e.g., ARDS, pneumonia). Consider a BVM with a PEEP valve or non-invasive positive pressure ventilation (e.g., CPAP/BiPAP).
M. Patients dependent on sympathetic tone may develop profound hypotension post intubation. This should be treated with fluids and/or push dose pressors per the shock protocol. It is always best to have push dose epinephrine available.

DOCUMENTATION:

Visualization of the cords (if applicable), size and depth of tube at the teeth/gums, number of attempts, 5-point check and equal chest expansion, $EtCO_2$ device used/reading, any other devices/ techniques used, reconfirmation of placement after each patient movement.

End-Tidal CO_2 Monitoring – 30.070

PURPOSE:
To define the various uses of end-tidal CO_2 ($EtCO_2$) and capnography monitoring.

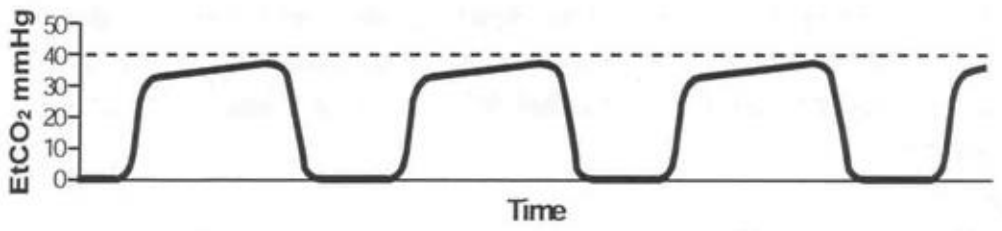
BACKGROUND:

A. Capnography (an $EtCO_2$ value with a waveform) allows for the assessment of ventilation and/or perfusion.
   1. $EtCO_2$ is primarily an indicator of ventilation in patients with normal perfusion (e.g., normal blood pressure).
   2. $EtCO_2$ is primarily an indicator of perfusion in patients with low blood flow (e.g., shock, cardiac arrest).

B. Consider use of capnography in suspected critical patients and when required by protocol.

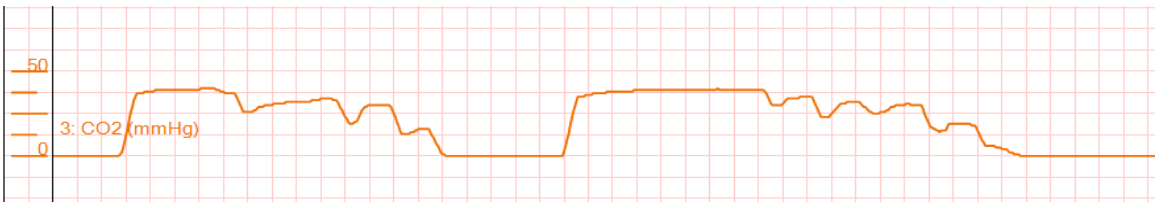
PROCEDURE:

A. Airway Management
   1. Airway Confirmation
      a. Manage airway according to ***Airway Management*** protocol.
      b. Apply waveform capnography device.
      c. Ensure appropriate normal capnographic waveform to confirm airway patency (see figure below).

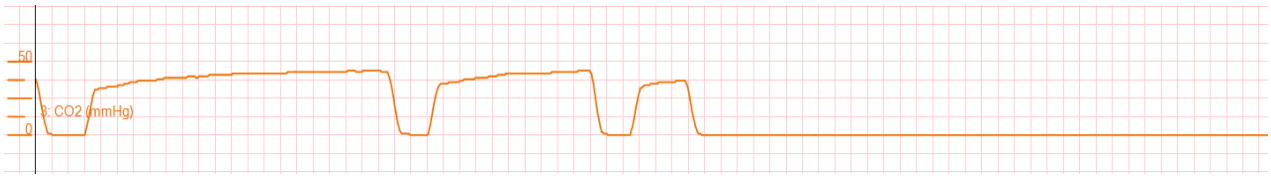


      d. Failure to obtain an $EtCO_2$ numerical reading and/or waveform requires the following immediate action:
         i. Re-visualization of the ETT using direct/video laryngoscopy.
         ii. If proper location of the ETT or i-gel is not confirmed, immediate removal of the airway and use of an alternative airway.

   2. Continued Airway Assessment
      a. A sudden drop in $EtCO_2$ output and an obvious change in the waveform (see figure below) is indicative of advanced airway displacement (most likely into the hypopharynx) or a cuff leak (e.g., under inflated balloon, balloon rupture, or poorly sized ETT or i-gel). Re-assess airway placement immediately and take corrective action.



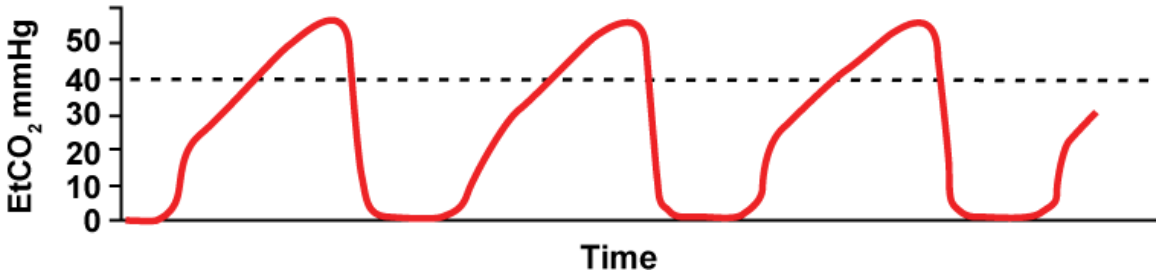
b. A sudden and sustained drop in $EtCO_2$ output (see figure below) may indicate a blocked airway (e.g., kinked tube, mucus plug).



c. Document pulse oximetry and $EtCO_2$ readings in your prehospital care report at regular intervals, especially following movement of the patient or change in vital signs.

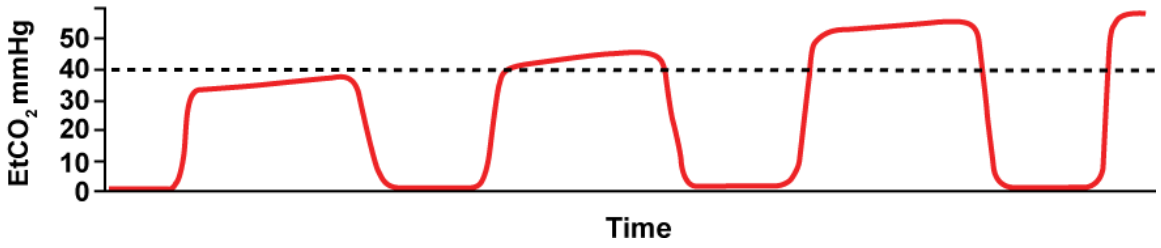
B. Cardiac Arrest
1. Manage according to ***Cardiac Arrest*** protocols.
2. Apply waveform capnography device as soon as feasible.
3. The trend of $EtCO_2$ values is the most important to guide a resuscitation.
   a. Values that decline over time may indicate poor CPR quality (e.g., need for a new compressor, LUCAS device has shifted).
4. Do NOT ventilate to EtCO2 values during cardiac arrest, as hyperventilation or hypoventilation are harmful to the patient. During cardiac arrest, the $EtCO_2$ values are indicative of pulmonary blood flow (i.e., chest compression quality).
5. A sudden and sustained rise in $EtCO_2$ values may indicate ROSC.
6. A gradual decline in $EtCO_2$ values may be the first sign of recurrent arrest in a patient who has achieved ROSC.
7. Do NOT rely solely on an $EtCO_2$ value when determining termination decisions.

C. Respiratory Distress/Respiratory Failure
1. A “shark fin” waveform can be seen in Asthma and COPD (see figure below).



2. Consider use of capnography when initiating CPAP/BiPAP as it can assist with diagnosis (e.g., evaluating for “shark fin” waveform), assess response to treatment, and can evaluate for patient decompensation.

3. Use of waveform capnography is required in patients who are experiencing respiratory depression or have received sedating medications (e.g., opiates, benzodiazepines, antipsychotics, etc.) to help detect hypoventilation (i.e. rise in $EtCO_2$ with progressively rising waveform). (See figure below).



D. Acidosis
   1. Sepsis: In patients with concern for infection and ≥ 2 of the following: respiratory rate > 20, heart rate > 90 BPM and fever (i.e., SIRS criteria), an $EtCO_2 \leq 25$ mmHg is suggestive of hypoperfusion and increased mortality. Treat per ***Sepsis Protocol.***
   2. DKA: In patients with elevated blood sugar, $EtCO_2 < 25$ may indicate DKA. Treat per ***Diabetic Emergencies*** protocol

E. Hypoperfusion (low blood flow)
   1. A low $EtCO_2$ can help determine cases of hypoperfusion (low blood flow) given the lack of blood flow to the lungs.
   2. In trauma patients, $EtCO_2 < 25$ mmHg may indicate presence of shock and is associated with the need for blood transfusion and increased mortality.

F. Traumatic Brain Injury
   1. Maintain $EtCO_2$ output between 35 - 40 mmHg. The following approximates the degree of ventilation:
      > 40 = Hypoventilation
      35 - 40 = Normal ventilation
      30 - 35 = Hyperventilation
      < 30 = Aggressive hyperventilation
   2. Patients with signs of increased intracranial pressure (unilateral dilated pupil, posturing, focal neurologic findings) maintain $EtCO_2$ between 30 - 35.

G. Transcutaneous Pacing
   1. A sudden and sustained rise in $EtCO_2$ indicates increased pulmonary blood flow and may confirm mechanical capture.

NOTES AND PRECAUTIONS:

A. Remember: Pulse oximetry does not equate to ventilation. You can have a poorly ventilated patient displaying an oxygen saturation of 100%. Excessively high $PaCO_2$ levels can be detrimental to your patient's outcome.

B. A sudden drop in $EtCO_2$ output from normal (35 - 40 mmHg) to 15 - 20 mmHg and an obvious change in the waveform is indicative of tube displacement, most likely into the hypopharynx. Re-assess tube placement immediately and take corrective action.
C. Do not rely on pulse oximetry or $EtCO_2$ monitoring solely to determine the efficacy of intubation.
D. Waveform capnography is required for all intubated patients throughout transport.
E. Failure to obtain an $EtCO_2$ numerical reading or waveform requires the following immediate action:
    1. Immediate removal of the endotracheal tube and placement of a rescue airway or BVM ventilation.
    OR
    2. Re-visualization of the ETT using direct laryngoscopy.

i-gel® Supraglottic Airway Device – 30.072

DEFINITION:
The i-gel® is a disposable supraglottic airway created as an alternative to endotracheal intubation or mask ventilation. The i-gel® is designed for positive pressure ventilation as well as for spontaneously breathing patients.

INDICATIONS:
The i-gel® supraglottic airway device can be used as an alternative to endotracheal intubation in those patients who need a secure airway.

CONTRAINDICATIONS:
A. Trismus (clenched jaw), limited mouth opening.
B. Suspected upper airway obstructions secondary to laryngeal edema, smoke inhalation, foreign body, tumor, mass, or abscess.

SIZES:

i-gel Size	Patient Size	Patient Weight (kgs)	Patient Weight (lbs)
1	Neonate	2.5	4-11
1.5	Infant	5-12	11-26
2	Small pediatric	10-25	22-55
2.5	Large pediatric	25-35	55-77
3	Small adult	30-60	66-132
4	Medium adult	50-90	110-198
5	Large adult	90+	198+

Size should be determined on lean body mass

PROCEDURE:
A. Identify correct size i-gel®.
B. Lubricate i-gel® prior to insertion with water soluble gel and only to the back side of the device.
C. If equipped, ensure that the supplemental oxygen port is capped.
D. Position the patient. The patient should always be in the "sniffing position" prior to insertion unless head/neck movements are considered inadvisable or are contraindicated.
E. If needed, use tongue depressor or curved laryngoscope blade to facilitate passage of i-gel® through the oropharynx.
F. Grasp the lubricated i-gel® firmly along the integral bite block.
G. Position the device so that i-gel® cuff outlet is facing towards the chin of the patient.
H. Introduce the leading soft tip into the mouth of the patient in a direction toward the hard palate. The leading edge of the i-gel's® tip must follow the curvature of the patient's hard palate upon insertion. Glide the device downward and backward along the hard palate with a continuous but **gentle** push until a definitive resistance is felt.
I. Determine appropriate depth of insertion. When placed correctly, the tip of the i-gel® will be within the upper esophageal opening and the cuff will be against the laryngeal framework. The incisors will be resting on the integral bite block. There is a horizontal black line on sizes 3, 4, and 5 indicating optimal position. (Fig. 1)

Fig. 1

J. Secure i-gel® to maxilla with approved holder, strap, or tape.
K. If gastric distention is present or fluid is present in the gastric channel of i-gel®, an appropriately sized lubricated orogastric tube (Fig. 2) may be passed down the gastric channel.
L. Attach capnography per protocol.

Fig. 2

i-gel Size	Maximum Size of Orogastric Tube (French Gauge) or French Suction Catheter
1	N/A
1.5	10
2	12
2.5	12
3	12
4	12
5	12/14

NOTES & PRECAUTIONS:

A. Do not use excessive force to insert the device or orogastric tube.
B. Sometimes a feel of “give-way” is felt before the end point resistance is met. This is due to the passage of the i-gel® bowl through the faucial pillars (pharyngo-epiglottic folds).
C. Once resistance is met and the teeth are located on the integral bite block, do not repeatedly push the i-gel® down or apply excessive force during insertion.
D. Do not allow peak airway pressure of ventilation to exceed 40 cm H_2O (Zoll Series 731 EMV+ or equivalent).
E. Patients with any condition which may increase the risk of a full stomach (e.g. hiatal hernia, sepsis, morbid obesity, pregnancy, or a history of upper gastrointestinal surgery), may increase the risk of aspiration.

Induced Hypothermia – 30.076

PURPOSE:
To define the procedures for inducing hypothermia following post-resuscitation from sudden cardiac arrest; with the aim to reduce the patient's body temperature to 33°- 36° C (91.4°- 96.8° F).

INDICATIONS (Must meet all indications):
A. Patients with return of spontaneous circulation (ROSC).
B. Unconscious and without purposeful response to pain or verbal stimuli.
C. Systolic BP ≥ 100 mmHg (may use pressors to maintain pressure).

CONTRAINDICATIONS:
A. Age < 13 years old.
B. Traumatic cardiac arrest or suspected significant hemorrhage.
C. Hypothermia already present.
D. Pulmonary edema.
E. Known pregnancy.
F. Refractory or recurrent VF/VT, 2nd or 3rd degree heart blocks.

COOLING METHODS:
A. Exposure combined with ice packs, and/or
B. Chilled fluid (NS or LR); stored at a temperature of approximately 4° C (39° F).

PROCEDURE:
A. Remove patient's clothing (undergarments may remain in place).
B. Obtain 12-lead ECG if feasible. If STEMI is identified, follow STEMI protocol.
C. Cooling can be initiated with ice packs applied to the groin and axilla (wet towels may be used along with ice packs). Alternatively, consider infusion of up to 1 liter of chilled fluid.
D. Do not administer medications at the same time through the same IV line as the chilled fluid. If patient begins to shiver, move, or have an increased level of consciousness, administer midazolam 2.5 - 5 mg IV/IO if systolic BP is ≥ 100 mmHg, repeating every 15 minutes as necessary to maintain sedation, **OR** administer lorazepam 1 - 2 mg IV/IO if systolic BP is ≥ 100 mmHg, repeating as necessary every 5 - 10 minutes as needed to a max total dose of 4 mg.

Intranasal Medication Administration – 30.078

DEFINITION:
In the absence of an established IV, intranasal is a rapid route offering high level of bioavailability of the medication being administered. The intranasal route can reduce the risk of needle sticks while delivering effective medication levels. The rich vasculature of the nasal cavity provides a direct route into the bloodstream for medications that easily cross the mucous membranes.

INDICATIONS:

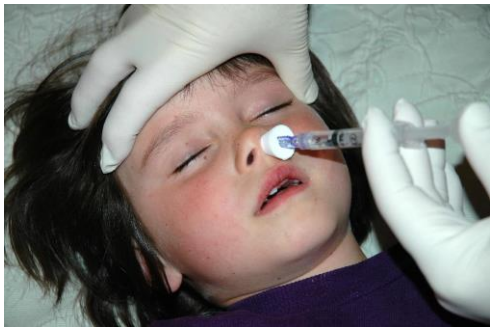
A. Patient without IV access requiring urgent medication administration (e.g., active seizure, respiratory arrest secondary to opiate overdose).
B. Alternate administration route for fentanyl administration for pain management.

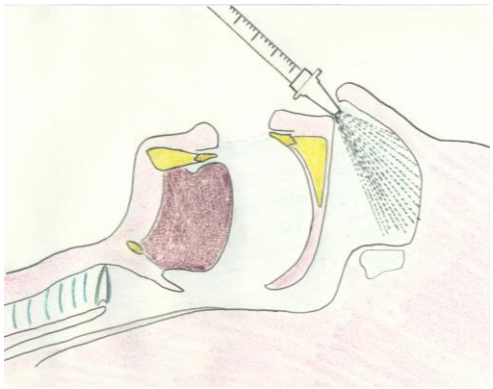
CONTRAINDICATIONS:

A. Epistaxis
B. Nasal Trauma
C. Nasal septal abnormalities
D. Nasal congestion or discharge

PROCEDURE:

A. Patient should be in a supine or recumbent position. If the patient is sitting, then compress the nares after administration.
B. Draw up medication into a syringe using appropriate transfer device.
C. Remove air from syringe.
D. Remove transfer device and place atomizer onto syringe and confirm it is secure.
E. Administer medication by briskly compressing the plunger to expel and atomize the medication administering a maximum of 1cc of solution per naris.
F. Evaluate medication effectiveness and continue with treatment protocol.





Intraosseous Access & Infusion - 30.080

DEFINITION:
Intraosseous cannulation is an alternative technique for establishing vascular access in critical adult and pediatric patients when peripheral IV access is difficult or time sensitive.

INDICATIONS:

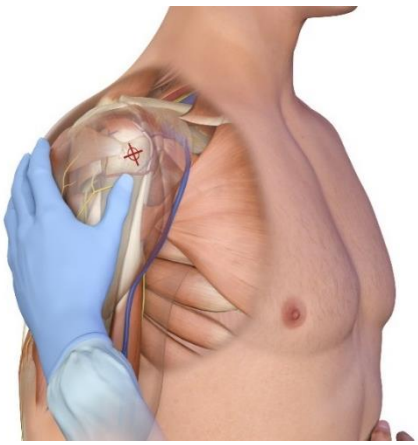
A. Intraosseous infusion is indicated in emergency situations when lifesaving fluids or drugs should be administered and IV cannulation is difficult, impossible, or too time-consuming to perform.
B. If a peripheral IV cannot be established after two attempts or within 60 - 90 seconds of elapsed time *and* in:
C. Adult and pediatric patients, within the proper weight range, who present with one or more of the following clinical conditions:
    1. Cardiac arrest.
    2. Hemodynamic instability (BP < 90 mmHg and clinical signs of shock).
    3. Imminent respiratory failure.
    4. Status epilepticus with prolonged seizure activity greater than 10 minutes, and refractory to IM anticonvulsants.
    5. Toxic conditions requiring immediate vascular access for antidote.
D. Intraosseous placement may be considered prior to peripheral IV attempts in cases of cardiopulmonary or traumatic arrest, in which it may be obvious that attempts at placing an IV would likely be unsuccessful and/or too time consuming, resulting in a delay of life-saving fluids or drugs.

EZ-IO® PROCEDURE:

A. Determine patient's weight.
B. Assemble all necessary equipment:
    1. The 25 mm (Blue) EZ-IO® needle can be utilized for patients who weigh ≥ 3 kg.
    2. The 45 mm (Yellow) EZ-IO® needle can be used for adult insertions (larger individuals weighing > 40 kg) where the 25 mm (Blue) needle is not adequate. The 45 mm needle should be used for all humeral IOs.
    3. EZ-Stabilizer® should be used to secure the needle.
C. Site selection:
    1. Proximal humerus is preferred in adult patients to achieve the following:
        a. Increased flow rates
        b. Decreased pain
        c. Closer access to central circulation (heart) during cardiac arrest and for resuscitation
    2. Proximal Tibia
    3. Distal Tibia
D. Site landmarks:
    1. Proximal humerus (contraindicated in children)
        a. Ensure that the patient's hand is resting on the abdomen and that the elbow is adducted (close to the body). Alternatively, the arm can remain adducted to the body with the arm rotated medially, thumb pointing down.

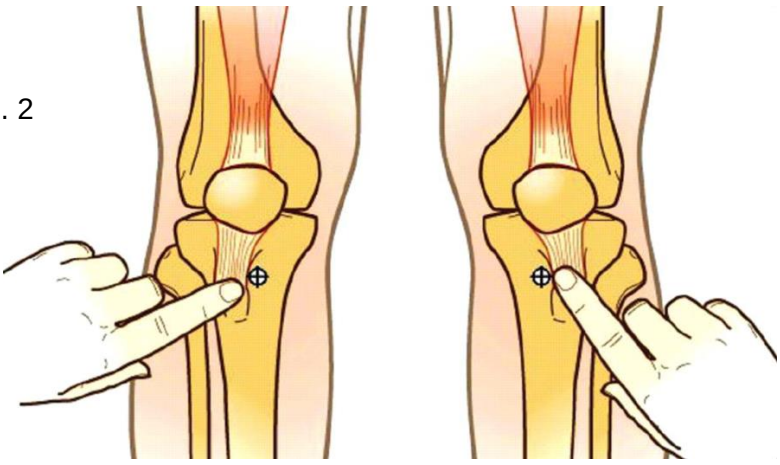
b. Insertion site is located directly on the most prominent aspect of the greater tubercle. Place palm on the anterolateral aspect of the arm and push deeply. The target will feel like a ball rolling under your palm; this is the greater tubercle. (Fig. 1)

Fig. 1



2. Proximal tibia
    a. Palpate the landmarks at the proximal tibia (patella and tibial tuberosity).
    b. Insertion site should be approximately one finger width (2 cm) medial to the tibial tuberosity, along the flat aspect of the tibia. Alternatively, landmarks are 3 cm below the patella and 2 cm medial when you can't palpate the tibial tuberosity. (Fig. 2)

Fig. 2



3. Distal tibia
   -Two finger widths proximal to the medial malleolus along the midline of the tibia. (Fig. 3)

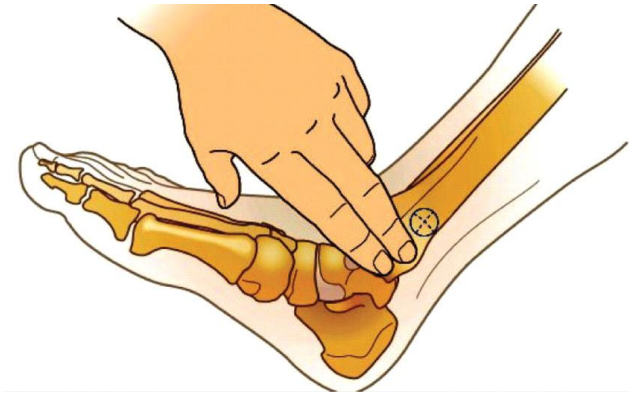


Fig. 3

E. Needle insertion
   1. Prep the surface with povidone-iodine or chlorohexidine and wipe dry with a sterile gauze pad.
   2. Stabilize patient's extremity and begin insertion from a 90-degree angle to the insertion site for both proximal and distal tibia. Insertion should be at a 45-degree angle for the proximal humerus. Push the needle set through the skin until the tip touches the bone.
   3. With the needle tip against the bone, assure adequate needle length by ensuring at least one black line (5 mm) is visible outside the skin.
   4. Gently advance the needle set into position–**do not force**. Stop when you feel the "pop" or "give" on smaller patients.
   5. When needle is in proper position, remove stylet, place the EZ-Stabilizer® on the hub, but do not secure EZ-Stabilizer® yet.
   6. Connect EZ-Connect tubing, primed with saline, to IO hub.
   7. Rapid bolus or "power" flush with approximately 10 ml normal saline **(administer lidocaine to the awake patient prior to flushing).**
   8. Confirm the catheter position:
      a. Catheter is stable at a 90-degree angle to the bone, able to aspirate blood (not always able to aspirate even with the line in the proper position), and fluids flow without evidence of extravasation.
      b. If insertion fails, leave the needle in place and clamp the EZ-Connect; do not attempt second insertion on same extremity.
   9. Secure the EZ-Stabilizer® when patency is confirmed.
   10. Consider additional bolus of saline if flow rates slower than expected.
   11. Utilize a blood pressure cuff or pressure bag around the IV bag to help infuse fluids.
   12. Monitor for patency frequently.

F. Pain Management
   1. If the procedure is performed on a conscious patient, immediately following placement of the IO needle **and before saline flush**, administer 2 ml (40 mg) of 2% lidocaine slowly over 2 minutes (rule is 2 ml of 2% over 2 min). Wait approximately 60 seconds before flushing with normal saline.
   2. In the event a patient regains consciousness and complains of severe pain secondary to the IO insertion, temporarily stop infusing the fluids, and administer lidocaine as in F.1 above. Wait approximately 60 seconds before continuing fluid administration.
   3. If fluids do not flow freely, flush IO site with an additional 10 ml normal saline.

PEDIATRIC EZ-IO® PROCEDURE (patients weighing 3 - 39 kg)

A. Assemble all equipment
   1. The 15 mm (Pink) EZ-IO® needle or 25 mm (Blue) EZ-IO needle should be used for patients who weigh less than 3 kg (approximately 6 lb.). The 15 mm needle, if carried, is used primarily on neonates.
   2. The 25 mm (Blue) EZ-IO® needle should be utilized for pediatric patients who weigh $\geq$ 3 kg or when the 15 mm (Pink) is deemed inadequate or not carried.
   3. EZ-Stabilizer should be used to secure the needle.

B. Site selection (Patients weighing 3 - 39 kg)
   1. Proximal Tibia
      a. Palpate the landmarks at the proximal tibia (patella and tibial tuberosity).
      b. Insertion site should be one finger width below the patella and one finger width medial to the tibial tuberosity. If the tibial tuberosity cannot be identified on the child, then the insertion site may be 1 cm below the patella and 1 cm medial.
   2. Distal femur
      a. Secure the leg outstretched to ensure the knee does not bend.
      b. Locate upper edge of the patella. Insertion site is one finger width above and then one finger width medial (towards the inner leg, “BIG TOE IO”) from the upper patella edge. This location will avoid the growth plate of the distal femur. (Fig. 4)

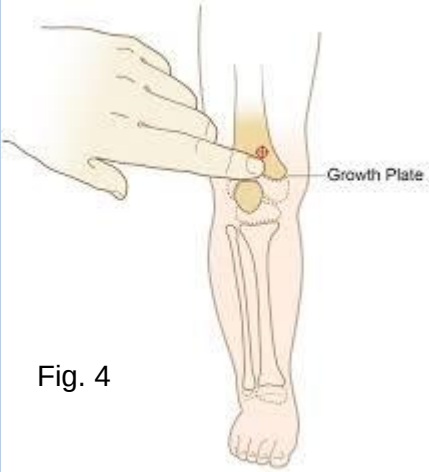


Fig. 4

C. Needle insertion
1. Prep the surface with povidone-iodine or chlorohexidine and wipe dry with a sterile gauze pad.
2. Stabilize patient's leg and begin insertion from a 90-degree angle to the insertion site. Push the needle set through the skin until the tip touches the bone.
3. With the needle tip against the bone, assure adequate needle length by ensuring at least one black line (5 mm) is visible outside the skin.
4. Gently advance the needle set into position–do not force. Stop when you feel the "pop" or "give".
5. When needle is in proper position, remove stylet, place the EZ-Stabilizer® on the hub, but do not secure EZ-Stabilizer® yet.
6. Connect EZ-Connect tubing, primed with saline, to IO hub.
7. Rapid bolus or "power" flush with approximately 5 ml normal saline.
8. Confirm the catheter position:
    a. Catheter is stable at a 90-degree angle to the bone, able to aspirate blood, and fluids flow without evidence of extravasation.
    b. If insertion fails, leave the needle in place and clamp the EZ-Connect; do not attempt second insertion on same extremity.
9. Secure the EZ-Stabilizer® when patency is confirmed.
10. Consider additional bolus of saline if flow rates slower than expected, no more than 2 - 3 ml normal saline
11. Consider a blood pressure cuff or pressure bag to help infuse fluids.
12. Monitor for patency frequently.

D. Pain Management
1. If the procedure is performed on a conscious patient, immediately following placement of the IO needle, administer 0.5 mg/kg of 2% lidocaine slowly over 2 minutes, not to exceed adult dose of 40 mg. Wait approximately 60 seconds before flushing with normal saline.
2. If fluids do not flow freely, flush IO site with an additional 2-3 ml normal saline.

Intraosseous Access & Infusion - 30.080

PEDIATRIC PROCEDURE WITH MANUAL IO DEVICE:

A. Assemble equipment
   1. Approved bone marrow needles, 15- or 18-gauge size (Jamshidi)
   2. Povidone-iodine or chlorohexidine preps
   3. Two small syringes (3 - 5 ml)
   4. One large Luer-lock® syringe (35 - 50 ml)
   5. Flush solution
   6. Sterile gauze pads and tape

B. Site Selection – Proximal tibia. Palpate the landmarks and note the entry point that is the anteromedial flat surface 1 - 3 cm below the tibial tuberosity.

C. Prep the surface with povidone-iodine or chlorhexidine prep and wipe dry with a sterile gauze pad.

D. Needle Insertion
   1. Insert the needle at the proximal tibial site, directing the needle caudally. The needle should penetrate the skin and subcutaneous tissue and be pushed through the cortex of the bone using rotation (avoid rocking the needle) until a “pop” or “give” is felt.
   2. Confirm placement of the needle by:
      a. Firm fixation of the needle and free aspiration of marrow/blood.
      b. Infusion of 2 - 3 ml of NS, palpating for extravasation or noting significant resistance. If extravasation occurs, further attempts at the site should be avoided.
      c. It is not always possible to aspirate blood/marrow, but the line may be patent.

E. Tape and secure IO needle firmly in place.

F. Start Infusion
   1. Although gravity drainage may suffice, pressurized infusions may be needed during resuscitation.
   2. When infusing medications via an IO route, pressure must be applied to the fluid bag to maintain flow rates. The provider must continually monitor the rate of infusion.

CONTRAINDICATIONS:

A. Suspected fracture of the bone selected for IO insertion.
B. Prior prosthetic joint replacement involving bone selected for IO insertion.
C. Previous significant orthopedic procedures (IO within 48 hours, surgery, etc.).
D. Infection at the site of insertion.
E. Excessive tissue at insertion site with the absence of landmarks.

Intraosseous Access & Infusion - 30.080

NOTES & PRECAUTIONS:

A. Osteomyelitis, growth plate injury (in pediatric patients), and extravasation of fluid with compression of popliteal vessels or the tibial nerve may occur.
B. Airway and breathing should be established first in accordance with other protocols.
C. Do not perform more than one attempt in each extremity.
D. Any ALS medication may be administered IO.
E. Do not give hypertonic saline through an IO line.
F. In the event of driver failure, EZ-IO® needle may be inserted manually.
G. All EZ-IO® needles are 15 gauge regardless of length.

Intravenous Access & Infusion – 30.090

INDICATIONS:

A. Normal Saline or Lactated Ringers is indicated for replacement of fluid volume losses such as in trauma, burns, dehydration, or shock.
B. A saline lock may be substituted for an IV line in all situations, except where IV fluid is the therapy of choice for volume replacement. If an IV line is started, it should be a regular macro drip unless otherwise indicated.

PROCEDURE FOR IV ACCESS:

A. IV access:
    1. Select vein and appropriate gauge catheter for the vein according to the patient's condition.
    2. Prep the skin with an antiseptic solution. If using 2% chlorhexidine allow to dry before covering with dressing.
    3. Insert the needle with the bevel up.
    4. Advance the catheter into the vein. Never reinsert the needle through the catheter.
    5. Remove tourniquet.
    6. Connect IV line or saline lock. For trauma system and burn patients, connect extension set between the IV hub and the solution bag and tubing.
    7. Assure free flow of the fluid.
    8. Cover the site with a sterile dressing.
    9. Label the IV with date and time, catheter gauge, and name/ID of the person starting the IV.

B. IV access with a saline lock:
    1. Establish IV access as above.
    2. Connect pre-flushed extension set to IV hub.
    3. Flush with normal saline checking for extravasation.
    4. If the IV lock system is used for the administration of medication, the line must be flushed after each administration.

PROCEDURE FOR IV MEDICATION INFUSION:

A. Using a Buretrol®, Volutrol®, or Soluset® volume control type device:
    1. Establish IV access and prepare solution.
    2. Connect the volume control device between the IV bag and the IV catheter.
    3. Place one hour's solution into the chamber and close the connection between the volume control device and the IV bag.
    4. Begin infusing solution at the appropriate rate.
    5. If necessary, additional solution may be placed in the volume control device chamber.
    6. Do not place more than one hour’s worth of solution in the chamber.

B. Using an infusion pump:
    1. Establish IV access and prepare solution.
    2. Connect compatible IV tubing to infusion pump according to manufacturer's directions.
    3. Begin infusing solution at the appropriate rate.

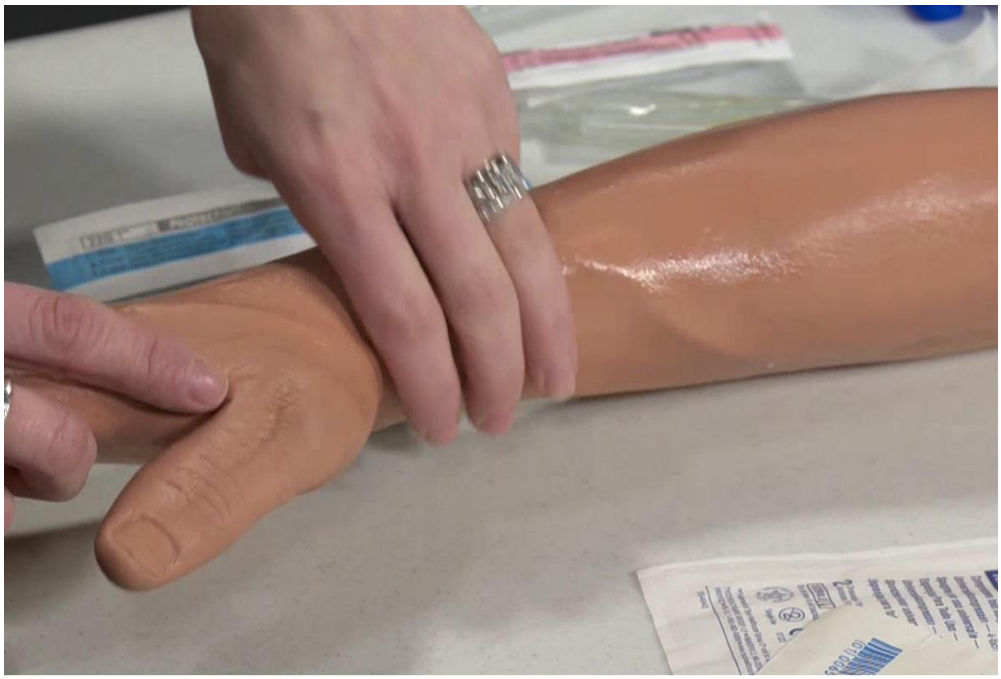
NOTES & PRECAUTIONS:

A. Normal Saline and Lactated Ringers should be used with caution in patients with renal impairment (hyperkalemia), cardiac and respiratory disorders (fluid overload), or extremes of age.
B. Avoid having the tourniquet on longer than two minutes as this can result in hemolysis and vasospasm in the extremity.
C. If possible, avoid wrist area as shown below secondary to possible radial nerve damage.
D. If patient has had a mastectomy or lymph node removal, avoid starting IV on that side as there is an increased risk of complications to the patient.

IV CATHETER FLOW RATES:

SIZE	ML/Min
18G x 1 1/4"	110
20G x 1"	65
20G x 1 1/4"	63
22G x 1"	38
24G x 5/8"	24

AVOID IV START IN THIS AREA:



King Airway® Placement – 30.105

DEFINITION:
The KING LT-D® is a disposable supraglottic airway created as an alternative to tracheal intubation or mask ventilation. The KING LT-D® is designed for positive pressure ventilation as well as for spontaneously breathing patients.

INDICATIONS:
Use of the King LT-D® airway is indicated if endotracheal intubation cannot be performed and the patient needs a secure airway.

CONTRAINDICATIONS:
A. Intact gag reflex.
B. Airway obstruction.
C. Patients under 3 feet in height.
D. Known or suspected caustic ingestion.
E. Known esophageal disease.

PROCEDURE:
A. Attach pulse oximeter and monitor oxygen saturation.
B. If vomitus, blood or other foreign material is present in the hypopharynx, rapid and aggressive suctioning and/or manual removal must be done prior to placement of the King Airway®.
C. Ventilate with BVM to optimize oxygen saturation prior to King LT-D® intubation especially if several endotracheal intubations were attempted.
D. Estimate patient's height (for sizing of King LT-D® airway) and select proper tube size.

Type	LTD	LTD	LTS-D	LTS-D	LTS-D
Size	2	2.5	3	4	5
Tube Color	Green	Orange	Yellow	Red	Purple
Patient Height	3-3.5 feet	3.5 feet	4-5 feet	5-6 feet	Greater than 6 feet
Inflation Volume	25-35 mL	30-40 mL	40-55 mL	50-70 mL	60-80 mL
Age	4-8 years	5-10 years	Adult →		

E. Lubricate the posterior distal end of the King Airway® with a water-soluble gel.
F. Place patients head into a "sniffing" position. If suspected or potential cervical spine injury keep patients head in neutral position during insertion.
G. Using a midline approach, introduce tip into mouth and advance behind base of tongue. The blue orientation line on the tube should face the chin of the patient.
H. Without using excessive force, advance tube until the base of the connector is aligned with the teeth and/or gums. Never force the tube into position.
I. Inflate the cuff using the appropriate volume of air (see table above).

J. Attach bag valve device to the tube with supplemental oxygen. While gently bagging the patient to assess ventilation, simultaneously withdraw the King Airway® until ventilation is easy and free flowing (large tidal volume with minimal airway pressure).
K. Listen for lung sounds in both lung fields and over epigastrium.
L. As soon as feasible, secure the King Airway® with an endotracheal tube holder.
M. Monitor oxygen saturation, chest rise, and attach continuous $EtCO_2$ monitor.
N. After successful placement, continue to monitor for adequate ventilations and possible displacement or cuff failure.

SUCTIONING THROUGH THE KING LTS-D:

A. Use of the gastric access lumen for suctioning and removal of stomach contents will be at the discretion of the user.
B. Attach a maximum size 18 Fr suction catheter to a portable suction unit.
C. If necessary, lubricate the catheter with a water-soluble gel.
D. Insert the suction catheter into the opening of the gastric access lumen and advance to the maximum depth.
E. Turn on suction unit and maintain continuous suction until there is no further return of stomach contents.
F. After detaching suction unit, the catheter may be left in place to prevent any additional stomach contents from being expelled from the gastric access lumen.
G. If active suctioning is not performed, a suction catheter may be placed in the gastric access lumen to act as a passive vent, and to prevent stomach contents from being expelled from the lumen.

NOTES & PRECAUTIONS:

A. It is important that the tip of the device be maintained in the patient's midline. Keeping the tip at midline assures that the distal tip is properly placed in the hypopharynx and upper esophagus.
B. Depth of insertion is key to providing a patent airway. A shallow initial insertion will require deflation of the cuffs to advance the tube deeper.
C. It is extremely important to open the airway and ensure that the tip of the King Airway® advances past the base of the tongue.
D. Unlike the Combitube®, the King LT-D® device is not designed to ventilate the patient if placed in the trachea. If unable to ventilate the patient after placement deflate balloons and adjust depth of tube to optimize ventilation.

Left Ventricular Assist Devices LVAD – 30.107

BACKGROUND:

Left ventricular assist devices (LVADs) are designed to assist the pumping function of the patient's left ventricle. The HeartWare HVAD®,HeartMate II®, and HeartMate III® devices attach to the apex of the left ventricle (pump inflow) and propel blood to the ascending aorta (pump outflow). These devices utilize an external wearable system that includes a small controller connected to the internal pump by an external driveline and is powered by two batteries. They may also be "plugged in" to 110 or 12 V power, depending on the device. When managing an LVAD patient, follow these general assessment guidelines.

ASSESSING PATIENT WITH LVAD:

A. Establish airway and provide supplemental oxygen if any respiratory signs or symptoms are present.
B. **If a patient with an LVAD is having a medical emergency, it does not necessarily mean that it is a device issue. Consider the whole clinical picture and perform a thorough patient assessment, including device function. Infection, volume depletion, stroke, bleeding, and dysrhythmias may be the cause of patient's symptoms. Most LVAD patients are anticoagulated and are at risk for bleeding complications.**
C. Auscultate heart sounds to determine if the device is functioning. Both the HeartWare HVAD® and HeartMate II®, are continuous flow devices and you should hear a "whirring" sound". Because these devices diminish pulsatile flow in the circulation, peripheral pulses may not be palpable. The HeartMate III®, although continuous flow, may provide artificial pulsatility (as well as a pulsatile hum) due to the addition of intermittent speed reduction which was designed into the device. Since this artificial pulse is not synchronized with the patient's heart rate, it may augment or diminish the native pulse. If a pulse is palpable, a BP can be attempted. Assess other signs of circulation—capillary refill, absence or presence of dizziness, temperature/ moisture of skin, end-tidal CO_2, and mental status to determine perfusion status.
D. Standard blood pressure devices may not work. If unable to obtain a blood pressure consider using the following, if available, to estimate perfusion pressure:
    1. End-Tidal CO_2 - Expected values should be between 35 – 45 mmHg.
    2. Doppler cuff pressure - Estimates the mean arterial pressure. The goal range for Doppler MAP is > 60 and less than 90.
    3. Other clinical signs – Capillary refill, mental status.
E. Locate the device to identify which type is in place and follow the device specific troubleshooting guidelines. Intervene appropriately based on the type of alarm and device.
F. Start Large Bore IV and treat with fluids as needed.
G. Pulse oximetry may not be accurate due to the continuous flow nature of the device. You may not get an accurate reading in the field.
H. Your cardiac monitor **will** work, and a reliable ECG may be obtained. Because the LVAD creates continuous flow independent of left heart function, not all arrhythmias will be symptomatic, including ventricular arrhythmias. If a patient requires defibrillation, leave the pump running and all components in place. The LVAD does not interfere with electrical conduction. In general, LVAD patients also have an AICD/Pacemaker. Do not place defibrillation pads directly over the pump or AICD/Pacemaker (consider anterior/posterior placement).
I. All ACLS medications may be administered if necessary.
J. **If suspected cardiac arrest, proceed to following flow chart:**

Call Patient's VAD Center
- St. Vincent's: 971-678-4042
- Kaiser: 503-449-4672
- OHSU: 503-494-9000 (ask for on-call LVAD coordinator to be paged)

Unresponsive LVAD patient

Is the patient breathing **AND** can you hear a VAD hum?

NO

Initiate CPR and follow ACLS protocols

YES

Doppler MAP > 50mmHg OR $ETCO_2$ > 20mmHg?

NO

YES

2nd Responder available and/or trained family member assess LVAD function:
- Look/Listen for alarms
- Check driveline connection to LVAD controller
- Check power connection to LVAD controller

If any of the following true?
- Absent VAD hum
- "Pump Off" displayed
- Flow < 1 L/min
- Pulsatility < 1

Perform controller exchange

LVAD restarted AND
- Doppler MAP > 50mmHg

OR
- $ETCO_2$ > 20mmHg

YES

Follow standard protocols except **NO CHEST COMPRESSIONS** because the VAD is likely providing adequate forward flow

NO

Continue CPR and follow ACLS protocols

- Refer to the LVAD Protocol for detail instructions on the battery and controller.
- DO NOT USE MECHANICAL CPR.
- The 2 most common causes of pump failure are disconnection of the power and failure of the controller.
- Transport LVAD patient in circulatory arrest to the nearest VAD hospital; otherwise transport the patient to their designated VAD center.
- Patients on LVAD support frequently do not have a palpable pulse or recognizable BP yet have adequate perfusion.
- In the non-invasive assessment of the BP, use a manual BP cuff with Doppler when available, with ETCO2 as the second option.
- Assess and treat non-LVAD pathology:
  - 5 H's: Hypovolemia, hypoxia, hydrogen ion (acidosis), hypo/hyperkalemia, hypothermia
  - 5 T's: Toxins, tamponade, tension pneumothorax, thrombosis-heart, thrombosis-lung
- **Keep all back-up equipment with the patient during transport!**

Left Ventricular Assist Devices LVAD – 30.107

TRANSPORTING AN LVAD PATIENT:

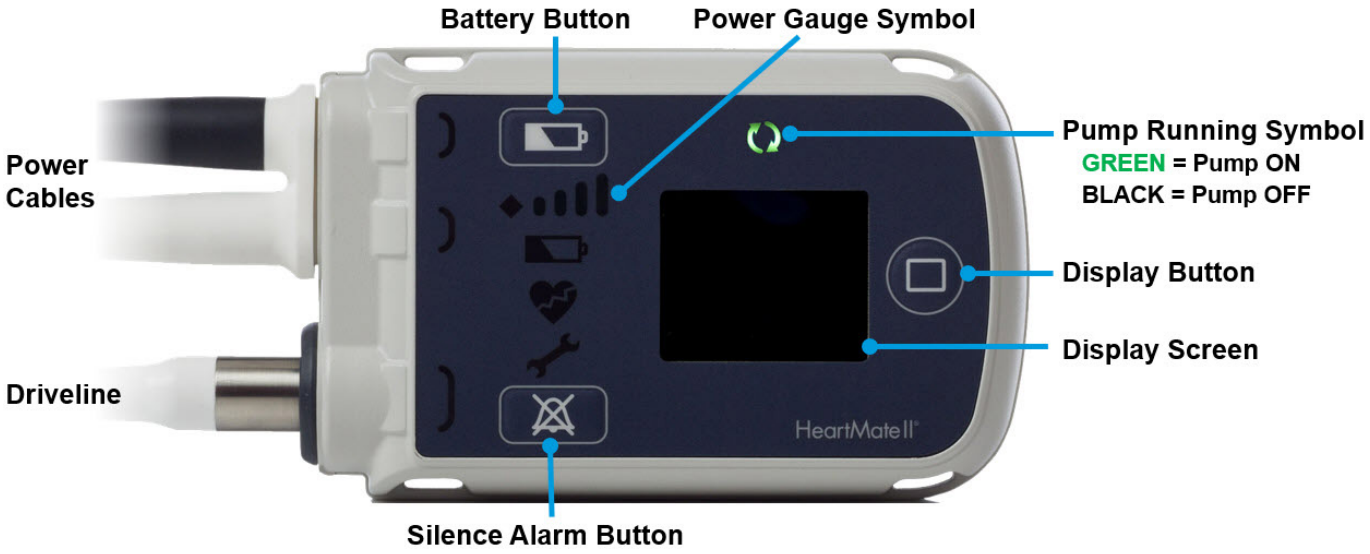
A. Consider transporting the LVAD patient in circulatory arrest to the nearest VAD hospital; otherwise transport the patient to their designated VAD center. **Call the number on the device and follow advice of the LVAD Coordinator on call for troubleshooting the device.**
B. For all other concerns contact OLMC.
C. The patient must be supported by battery power. **Remember to also transport the backup controller and the spare batteries.**
D. The controller should be kept close to the patient, and care taken to not kink the leads.
E. If removing or cutting patients clothing, use caution as not to sever the driveline.
F. Do not put external pressure on any area of the LVAD system.
G. Place gurney straps underneath the leads, and keep the batteries easily accessible.
H. Allow the trained caregiver to ride in the transport vehicle if possible to act as an expert on the device in the absence of consciousness in the patient.
I. Bring all of the patient's equipment.

NOTES AND PRECAUTIONS:

A. LVAD patients who are anticoagulated have a higher risk of bleeding and hemorrhage.
B. There are no valves on an LVAD, so there is the risk of retrograde flow and stagnation of blood if the device stops, or flow is impeded.
C. These patients are pre-load and afterload dependent, so hypovolemia can have a profound effect.
D. If a patient is **hypertensive**, flow through the device may be reduced.

HeartMate II™ Left Ventricular Assist System

System Controller



Changing Batteries

WARNING: At least one controller power cable must be connected to a power source AT ALL TIMES. Do not remove both batteries at the same time or the pump will stop.

- Obtain two charged batteries from patient's accessory bag or battery charger. The charge level of each battery can be assessed by pressing the button on the battery. Fully charged batteries will display 5 lights. (Figures 1 and 2)

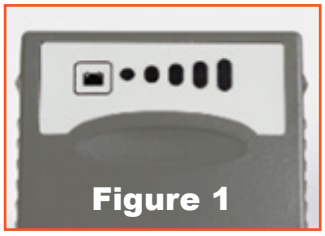


Figure 1

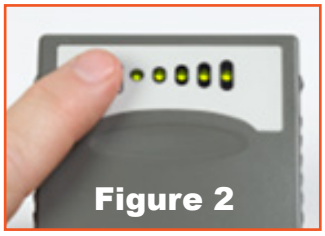


Figure 2

- Check the power level on the batteries, replace the battery with the fewest lights first. Remove only ONE battery from the clip by pressing the release button on the clip to unlock the battery. (Figure 3)

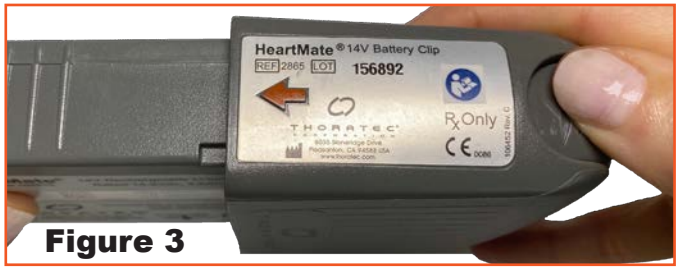


Figure 3

- Controller will start beeping and flashing yellow symbols and will read **CONNECT POWER** on the front screen.

- Insert a new, fully charged battery into the empty battery clip by aligning the **RED** arrows on the battery and clip (Figure 4). The battery will click into the clip. Gently tug on battery to ensure connection. If the battery is properly secured, the beeping and yellow flashing will stop.


Figure 4

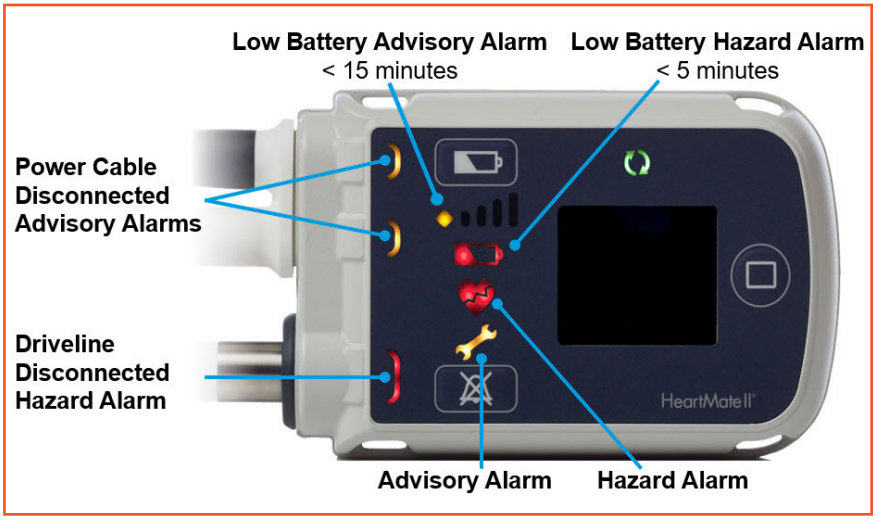
- Repeat previous steps with the second battery and battery clip.

Troubleshooting HeartMate II™ LVAS

Alarms: Emergency Procedures

When an alarm occurs:

- Contact the Implant Center for direction when possible.
- Check alarm messages on controller display screen.
- Check if pump is running:
- Allow care providers trained on LVAD emergencies to remain with the patient.



When the Pump Has Stopped

- Check the driveline and power cable connections to the controller. Fix any loose connections to restart the pump.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair. (*see Changing Batteries section on previous page*)
- If pump does not restart, change controllers if directed by implant center. (*see Changing Controllers on next page*)
- Be sure to bring ALL of the patient's equipment with them.

HAZARD ALARMS		Continuous Audible Tone
Low Flow :03 + Call Hospital Contact :07	Pump is off.	See above, when pump has stopped
	Pump flow is < 2.5 lpm.	Ensure that a power source is connected to the controller. Evaluate the patient for low flow - treat the cause. Assess volume status, hypertension, arrhythmia, right heart failure, etc.
Connect Driveline :02	Driveline disconnected.	Immediately reconnect Driveline to the controller. Check modular cable connection.
Connect Power Immediately :05 + Backup Battery :01	Both power cables are disconnected.	Immediately connect to batteries or the Mobile Power Unit.
Low Battery :06 + Replace Power :02	Low Battery Power < 5 min. remaining.	Immediately replace batteries or switch to the Mobile Power Unit.

ADVISORY ALARMS		Intermittent Audible Tone
Low Battery :06 + Replace Power Immediately :02	Low Battery Power <15 min. remaining.	Immediately replace batteries or switch to the Mobile Power Unit.
Connect Power :04	A power cable is disconnected.	Reconnect the power cable to power.
Check display for alarm type.		Call VAD Coordinator at implant center for direction.

Troubleshooting HeartMate II™ LVAS

Changing the System Controller

Step 1: Have the patient sit or lie down since the pump will momentarily stop during this procedure.

Step 2: Place the replacement Controller within easy reach, along with the batteries/battery clips. The spare Controller is usually found in the patient's travel case.

Step 3: Attach the battery clips to the replacement controller by lining up half circles, firmly pushing together, and tightening connector nut. Insert the batteries into the clips by aligning the **RED** arrows.

Step 4: On the back of the replacement controller, slide the safety lock so the red release button is fully visible. Repeat this step on the original controller.

Step 5: Disconnect the drive-line from the original controller by pressing the red release button and pulling it out. The pump will stop and an alarm will sound. **Note:** The alarm will continue until the original controller is turned off. You can silence the alarm by pressing the silence alarm button.

Getting the replacement controller connected and the pump restarted is the first priority!

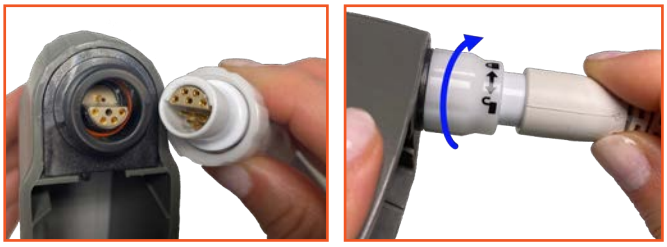
Step 6: Connect the replacement Controller by aligning the YELLOW ARROWS on the driveline and replacement Controller and firmly pushing the driveline into the replacement controller. The pump should restart, if not complete the following steps:

- Firmly press the Silence Alarm or Battery Button to restart the pump.
- Check the power source to ensure that power is going to the controller.
- Ensure the driveline is fully inserted into the socket by gently tugging on the metal end. **DO NOT** pull the driveline.

Step 7: After the pump restarts, slide the safety lock on the new controller so the red release button is fully covered. If unable to close the safety lock into fully locked position, gently push the driveline into the controller to ensure proper connection. Retry to close safety lock.

Step 8: Disconnect power from the original Controller.

Step 9: Hold down battery symbol for 5 full seconds to turn off the original controller.



Step 3

Step 4

Step 7

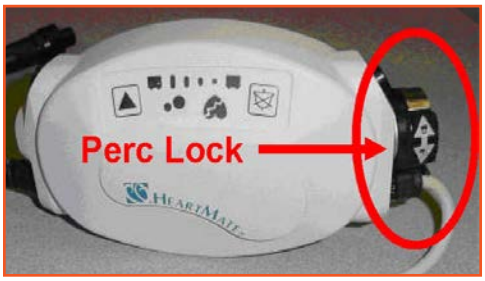
Step 5

Step 6

Step 9

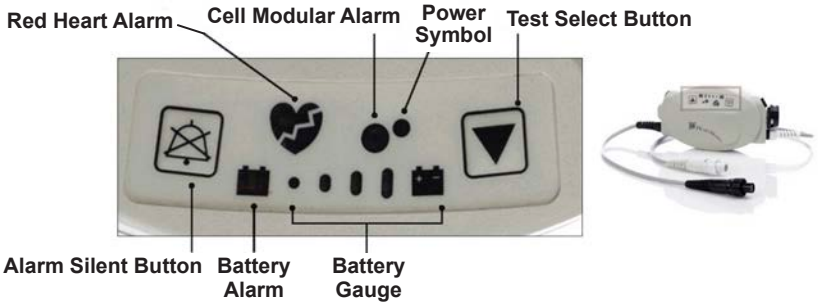
HeartMate II™ Left Ventricular Assist System

The following information applies to the original controller version called External Peripheral Controller (EPC). Some patients have this controller.



Driveline Connection: The Perc Lock must be "unlocked" in order for the driveline to be removed in a controller exchange. The Perc lock remains in locked position once the driveline has been fully inserted.

External Peripheral Controller (EPC)



2 MODES: ON, OFF

On: Driveline+Power source connected.

Off: No driveline or power source connected.

CELL MODULE BATTERY

No backup battery. The cell module battery powers an audible tone if EPC is removed from power while the driveline is connected. The cell module battery is supplied STERILE.

EVENT LOGGER

EPC does not include date/time records in event history. EPC can store 120 events.

GREEN POWER SYMBOL

Green light only mead that the controller is receiving power. Listen over the pump pocket for confirmation that the pump is running.

CONTROLLER BUTTONS

Alarm Silence Button: Displays the battery fuel gauge. Also silences hazard alarms for 2 minutes and advisory alarms for 4 hours.

Test Select Button: Activates a self test when held for 3 seconds.

Note: EPC does not include a display button or user interface screen. The Display Module is used to view pump parameter and alarm events.

SELF TEST

Press and hold the Test Select Button for 3 seconds.

LOW POWER

Yellow Battery Symbol: Displayed when only 15 minutes of external power is remaining.

Red Battery Symbol: Displayed when only 5 minutes of external power is remaining.

POWER SAVER MODE:

Entered when the battery voltage falls to a critically low level. Pump Speed is reduced to 8000 RPM.

STARTING THE PUMP

>8000 RPM: Pump starts automatically.

<8000 RPM: Start pump by pressing Alarm Silence Button or Test Select Button on EPC.

SYSTEM MONITOR EVENT HISTORY SCREEN

PI Event:

System Information:

COMPATIBILITY

System Monitors I and II, Power Module, Power Base Unit (PBU), Power Module Patient Cable (12 Volt and 14 Volt), 14 Volt Lithium-ion Batteries and Battery Clips, 12 Volt SLA and NiMH Batteries and Clips.

ALARMS

For a review of alarms and their meanings, reference the HeartMate II Alarms for Clinicians, Item 103851. Note that EPC does not include Driveline fault detection.

A battery clip can be attached to the EPC controller by lining up the half moons and gently pushing. Batteries can be attached to the battery clip by aligning the RED arrows on the battery and clip.

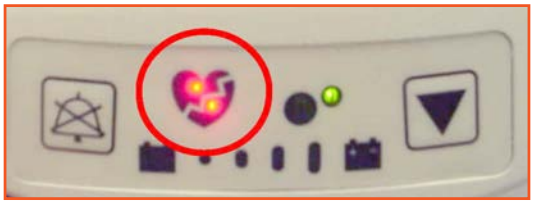
External Peripheral Controller (EPC): A percutaneous lock is located on the side of the controller.

Unlock

Locked

Alarms: Emergency Procedures

Red Heart Flashing Alarm: This may indicate a Low Flow Hazard. Check patient--the flow may be too low. If patient is hypovolemic, give volume. If patient is in right heart failure-- treat per protocol. If the pump has stopped check connections, batteries and controllers as instructed on page 5.



Yellow or Red Battery Alarm: Need to Change Batteries. See changing batteries section on page 5.

HeartWare™ HVAD™ System

Driveline

Power Source #2

Battery Charge Indicator

ALARM ADAPTER

- Used to silence the [No Power] alarm.
- Should only be used on a controller that is NOT connected to a patient's pump.
- Insert into data port covered with a dust cap of the original controller after a controller exchange BUT before the power sources are disconnected or the [No Power] alarm will sound for up to two hours.

Red Alarm Adapter

DRIVELINE CONNECTION

To Connect to Controller:

- Align the two red marks and push the driveline connector straight into the silver driveline port. (Figure A)
- The Driveline Cover must completely cover the Controller's silver driveline connector to protect against static discharge. (Figure B)

Figure A

Figure B

NOTE: an audible click should be heard when connecting the Driveline to the controller. Failure to use the Driveline Cover may cause an Electrical Fault Alarm.

TO DISCONNECT A DEPLETED BATTERY

- Make sure there is a fully charged battery available to replace the depleted one.
- Disconnect the depleted battery by turning the connector sleeve counterclockwise until it stops.
- Pull the connector straight out from the controller.

CONNECTING POWER TO CONTROLLER

To Connect a Charged Battery:

- Grasp the cable of the charged battery at the back end of the connector (leaving front end of connector free to rotate)
- Line up the solid white arrow on the connector with the white dot on the Controller.
- Gently push (but DO NOT twist) the battery cable into the Controller until it naturally locks into place; you should hear an audible click.
- Confirm that the battery cable is properly locked on the controller by gently pulling the cable near the controller power connector.
- **DO NOT force the battery cable into** the controller connector without correct alignment as it may result in damaged connectors .

Power Source Connection

HeartWare™ HVAD™ System Emergency Operation

STEPS TO EXCHANGE THE CONTROLLER

Exchange the controller when the controller display indicates [Change Controller]. Priority is to restart the pump quickly.

It may be helpful to remember the 4 P's:

1. **POWER...** Connect a power source to the new controller.

2. **PUMP...** Restart the pump by connecting the driveline to the new controller.

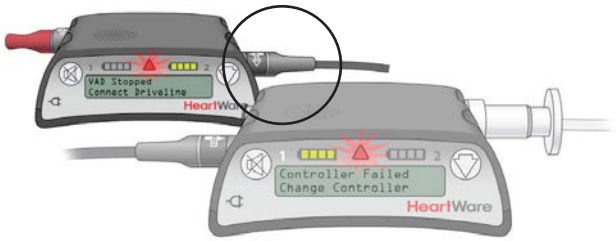
3. **PREVENT...** Prevent the [No Power] alarm on the original controller with the red alarm adapter or by pressing the Scroll and Mute buttons at the same time until a "beep" is heard, or for at least 5 seconds.

4. **POWER...** Connect a second power source to the new controller.

Step 1: Have patient sit or lie down and place the back-up controller within easy reach. The backup controller will become the new controller.

Step 2: Connect one **POWER** source to the new controller.

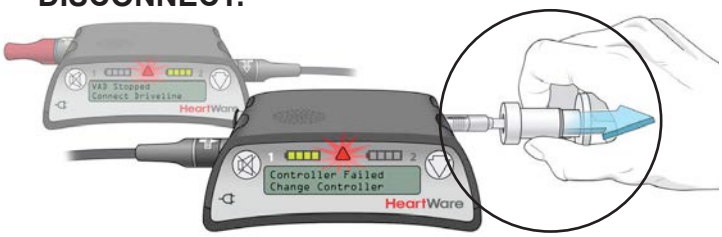
NOTE: The new controller may alarm after 10 seconds with a [VAD Stopped, Connect Driveline] high alarm. This is expected behavior.



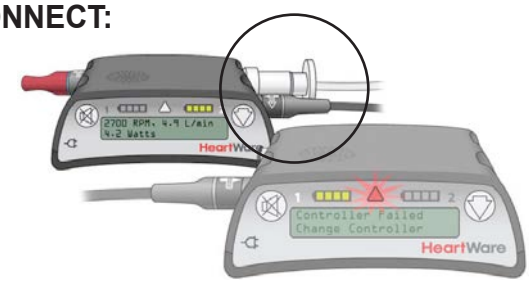
Step 3: Disconnect the driveline from the original controller and connect the driveline to the new controller. This should restart the **PUMP.**

• Verify that the pump is working. The RPM, L/min and Watts numbers should show on the Controller Display. If the pump does not restart, re-check driveline and power source connections, if it still doesn't start, call the patient's VAD team for assistance.

DISCONNECT:



CONNECT:



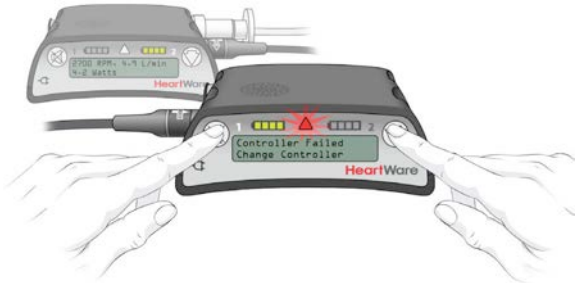
• If you have only connected 1 power source to the new controller, you will also have a [Power Disconnect, Reconnect Power] alarm.

HeartWare™ HVAD™ System Emergency Operation

Step 4: PREVENT the [No Power] alarm from sounding on the original controller. This needs to be done before removing all power. There are 2 options, see below:

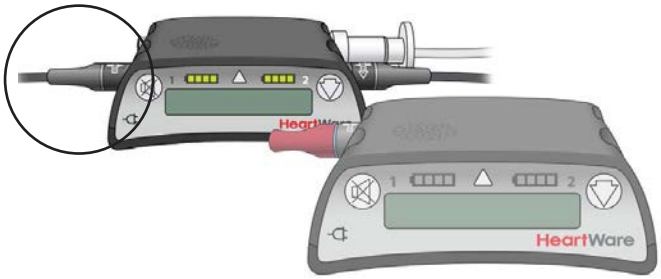
- If a red alarm adapter is available:
  - – Insert it into the connector data port on the original controller
  - – You can now remove all power from the original controller and no alarm should sound.

- If no red alarm adapter is available:
  - – Press and hold the “Alarm Mute” and “Scroll” buttons on the original controller until a “beep” is heard, or for at least 5 seconds.
  - – Release the “Alarm Mute” and “Scroll” buttons.
  - – You can now remove all power from the original controller and no alarm should sound.

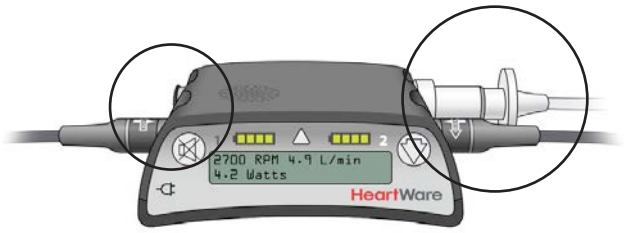


- If you removed power before silencing the [No Power] alarm, reconnect a power source and follow the steps above to silence it.

Step 5: Connect a second **POWER** source to the new controller.

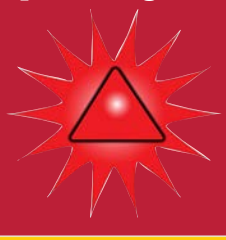
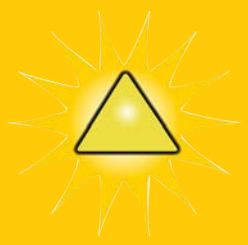


Step 6: Be sure the driveline cover is over the silver driveline connector and the data port is covered by the dust cap. If the red alarm adapter is connected to the controller that is now running the pump, remove it and close the cap on the data port.



Call the patients VAD team to obtain a new back-up controller.

HeartWare™ HVAD™ System Troubleshooting

Alarm Type	Alarm Display (Line 1)	Action (Line 2)
ALARM [No Power]	[no message]	[no message]
	When both power sources (2 batteries or 1 battery and an AC adapter or DC adapter) are removed. NO message will display on the controller. The [No Power] alarm will sound but the Alarm Indicator on the controller WILL NOT light. This indicates the pump has stopped. You should immediately connect two power sources.	
HIGH-CRITICAL [Flashing Red] 	[VAD Stopped]	[Connect Driveline]
	[VAD Stopped]	[Change Controller]
	[Critical Battery]	[Replace Battery 1]
	[Critical Battery]	[Replace Battery 2]
	[Controller Failed]	[Change Controller]
MEDIUM [Flashing Yellow] 	[Controller Fault]	[Call]
	[Controller Fault]	[Call: ALARMS OFF]
	[High Watts]	[Call]
	[Electrical Fault]	[Call]
	[Low Flow]	[Call]
	[Suction]	[Call]
LOW [Solid Yellow] 	[Low Battery 1]	[Replace Battery 1]
	[Low Battery 2]	[Replace Battery 2]
	[Power Disconnect]	[Reconnect Battery 1]
	[Power Disconnect]	[Reconnect Power 2]

[CALL] VAD team listed on the patient's contact sheet.

HeartMate 3™ Left Ventricular Assist System

1. **Can I do CPR?**

   Yes, in the right clinical scenario. Chest compressions may pose a risk of dislodgement - use clinical judgment. If compressions are administered, confirm function and positioning of the pump.

2. **Can the patient be defibrillated while connected to the device?**

   Yes you can defibrillate, and you do not have to disconnect anything.

3. **Can this patient be externally paced?**

   Yes.

4. **What type of alarm occurs in a low flow state?**

   A red heart alarm indication and steady audio alarm will sound if less than 2.5 lpm. Can give a bolus of normal saline and transport to a VAD center.

5. **Can I change the speed of the device?**

   No, it is a fixed speed.

6. **Does the patient have a pulse with this device?**

   Likely they will not because it is a continuous flow device, however some patients may have a pulse.

7. **What are acceptable vital sign parameters?**

   MAP 70 - 90 mm Hg with a narrow pulse pressure.

FAQs

- Pump has “artificial pulse” created by rapid speed changes in the pump. This can be heard when auscultating the heart and differs from other continuous flow devices.
- May not be able to obtain cuff pressure (continuous flow pump).
- Pump connected to driveline exiting patient’s abdominal area and is attached to controller which runs the pump.
- Pump does not affect ECG.
- All ACLS drugs may be given.
- A pair of fully charged batteries lasts up to 17 hours.
- Any emergency mode of transportation is ok. These patients are permitted to fly.
- Avoid pulling, twisting, or kinking the driveline when strapping the patient to a stretcher.
- Be sure to bring **ALL** of the patient’s equipment with them.

The HeartMate 3™ LVAD has a modular cable connection near the exit site of the driveline (Figure 1). This allows a damaged driveline to be quickly replaced (if damage is external).

- When disconnecting a driveline, NEVER use the modular cable connection.
- If the modular cable requires replacement, it must be done at and by the implanting center. Patients are not given a backup modular cable.
- If the connection is loose, a yellow line at the connection will be showing. If the line is visible, turn the connector in the locked direction. It will ratchet and stop turning once tight.

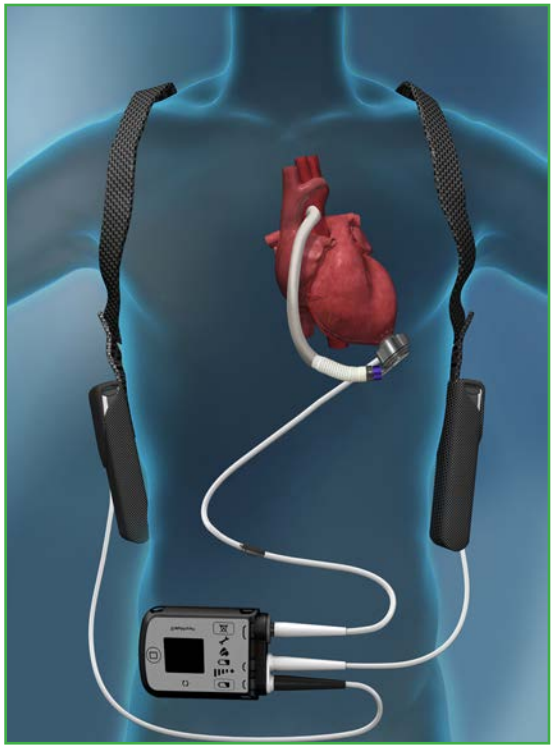
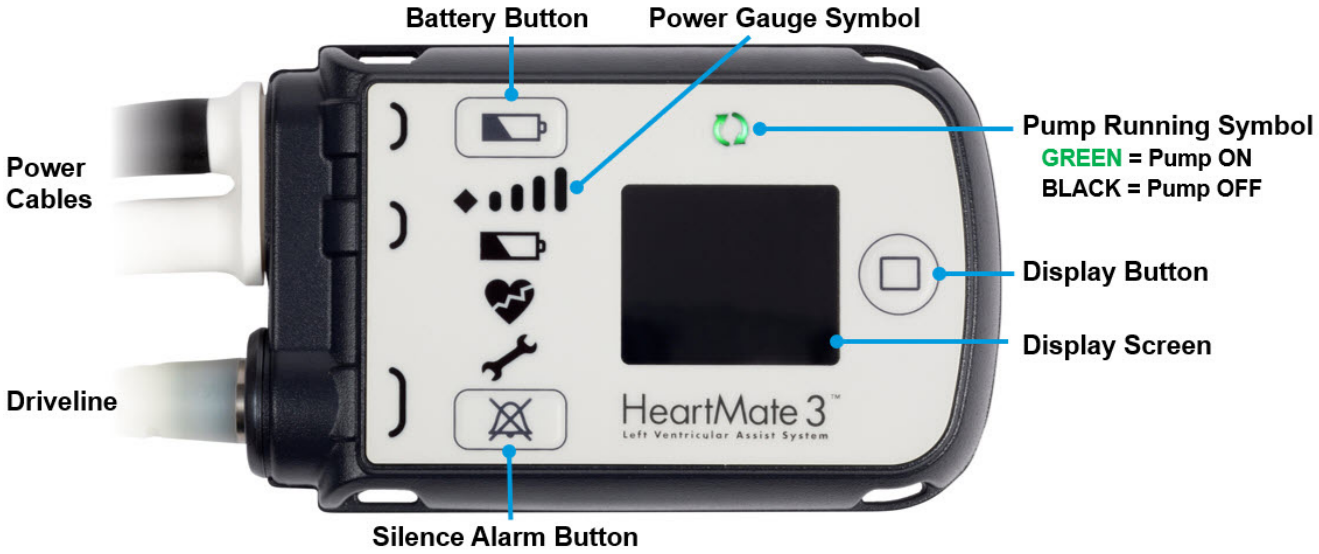


Figure 1

HeartMate 3™ Left Ventricular Assist System

System Controller



Changing Batteries

WARNING: At least one controller power cable must be connected to a power source AT ALL TIMES. Do not remove both batteries at the same time or the pump will stop.

- Obtain two charged batteries from patient's accessory bag or battery charger. The charge level of each battery can be assessed by pressing the button on the battery. Fully charged batteries will display 5 lights. (Figures 1 and 2)

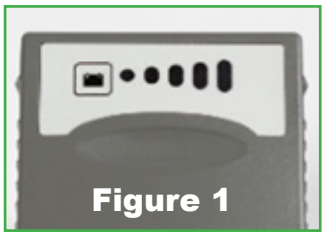


Figure 1

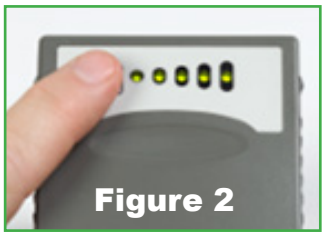


Figure 2

- Check the power level on the batteries, replace the battery with the fewest lights first. Remove only ONE battery from the clip by pressing the release button on the clip to unlock the battery. (Figure 3)

Figure 3

- Controller will start beeping and flashing yellow symbols and will read **CONNECT POWER** on the front screen.

- Insert a new, fully charged battery into the empty battery clip by aligning the **RED** arrows on the battery and clip (Figure 4). The battery will click into the clip. Gently tug on battery to ensure connection. If the battery is properly secured, the beeping and yellow flashing will stop.


Figure 4

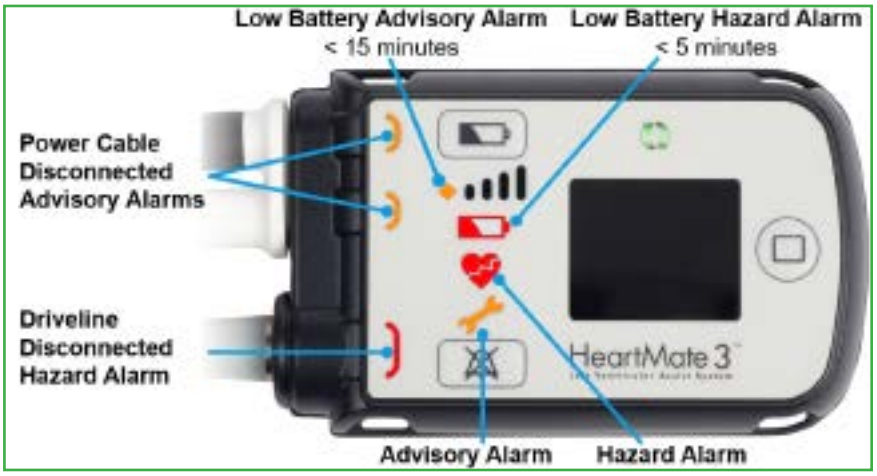
- Repeat previous steps with the second battery and battery clip.

Troubleshooting HeartMate 3™ LVAS

Alarms: Emergency Procedures

When an alarm occurs:

- Contact the Implant Center for direction when possible.
- Check alarm messages on controller display screen.
- Check if pump is running:
- Allow care providers trained on LVAD emergencies to remain with the patient.



When the Pump Has Stopped

- Check modular cable connection, driveline and power cable connections to the controller. Fix any loose connections to restart the pump.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair. (see Changing Batteries section on previous page)
- If pump does not restart, change controllers if directed by implant center. (see Changing Controllers on next page)
- Be sure to bring ALL of the patient's equipment with them.

HAZARD ALARMS		Continuous Audible Tone
Low Flow :03 + Call Hospital Contact :07	Pump is off.	See above, when pump has stopped
	Pump flow is < 2.5 lpm.	Ensure that a power source is connected to the controller. Evaluate the patient for low flow - treat the cause. Assess volume status, hypertension, arrhythmia, right heart failure, etc.
Connect Driveline :02	Driveline disconnected.	Immediately reconnect Driveline to the controller. Check modular cable connection.
Connect Power Immediately :05 + Backup Battery :01	Both power cables are disconnected.	Immediately connect to batteries or the Mobile Power Unit.
Low Battery :06 + Replace Power :02	Low Battery Power < 5 min. remaining.	Immediately replace batteries or switch to the Mobile Power Unit.
ADVISORY ALARMS		Intermittent Audible Tone
Low Battery :06 + Replace Power Immediately :02	Low Battery Power <15 min. remaining.	Immediately replace batteries or switch to the Mobile Power Unit.
Connect Power :04	A power cable is disconnected.	Reconnect the power cable to power.
Check display for alarm type.		Call VAD Coordinator at implant center for direction.

Troubleshooting HeartMate 3™ LVAS

Changing the System Controller

Step 1: Have the patient sit or lie down since the pump will momentarily stop during this procedure.

Step 2: Place the replacement Controller within easy reach,along with the batteries/battery clips. The spare Controller is usually found in the patient's travel case.

Step 3: Attach the battery clips to the replacement controller by lining up half circles, firmly pushing together, and tightening connector nut. Insert the batteries into the clips by aligning the **RED** arrows.

Step 4: On the back of the replacement controller, slide the safety lock so the red release button is fully visible. Repeat this step on the original controller.

Step 5: Disconnect the drive-line from the original controller by pressing the red release button and pulling it out. The pump will stop and an alarm will sound. Note: The alarm will continue until the original controller is turned off. You can silence the alarm by pressing the silence alarm button.

Getting the replacement controller connected and the pump restarted is the first priority!

Step 6: Connect the replacement Controller by aligning the WHITE ARROWS on the driveline and replacement Controller and firmly pushing the driveline into the replacement Controller. The pump should restart, if not complete the following steps:

- Firmly press the Silence Alarm or Battery Button to restart the pump.
- Check the power source to ensure that power is going to the controller.
- Ensure the driveline is fully inserted into the socket by gently tugging on the metal end. **DO NOT** pull the driveline.

Step 7: After the pump restarts, slide the safety lock on the new controller so the red release button is fully covered. If unable to close the safety lock into fully locked position, gently push the driveline into the controller to ensure proper connection. Retry to close safety lock.

Step 8: Disconnect power from the original Controller.

Step 9: Hold down battery symbol for 5 full seconds for complete shutdown of old controller.

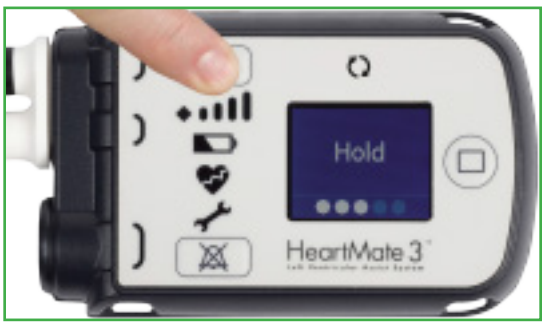
Step 3

Step 4

Step 7

Step 5

Step 6



Step 9

LUCAS® Chest Compression Device – 30.108

INDICATIONS:

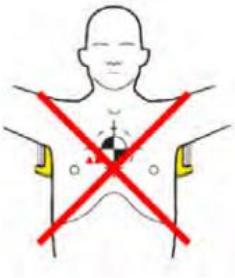
The LUCAS device may be used on patients who have suffered cardiac arrest where manual chest compressions would otherwise be used.

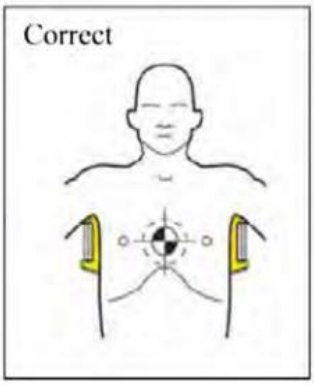
CONTRAINDICATIONS:

A. Patient too small: If the LUCAS device alerts with 3 fast signals when lowering the suction cup, and you cannot enter the PAUSE mode or ACTIVE mode.
B. Patient too large: When the upper part of the LUCAS device cannot lock to the Back Plate without compressing the patient's chest.
C. LVAD or HVAD patients.

PROCEDURE:

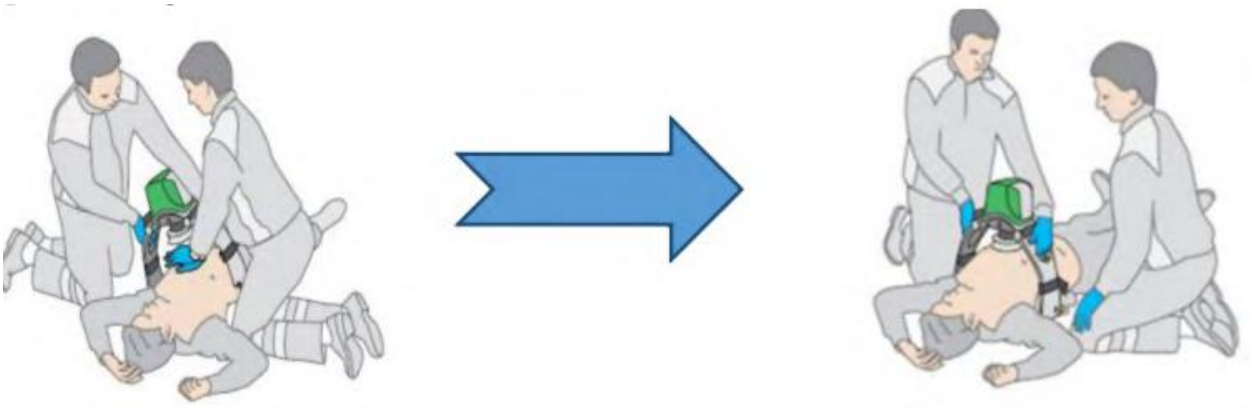
A. All therapies related to the management of cardiopulmonary arrest should be continued as currently outlined.
B. Initiate resuscitative measures:
    1. The LUCAS device should ideally not be placed until at least two cycles of CPR have been completed. The Back Plate can be placed at any time.
    2. Manual chest compressions should be initiated and maintained while the LUCAS device is being prepared and placed on the patient. Preparing the LUCAS device should be done in a slow and controlled manner.
    3. Limit interruptions to chest compressions to < 10 seconds.
C. Unpack the device:
    1. Open Carrying Case.
    2. Remove Back Plate.
D. Place the Back Plate:
    1. Support the patient's head.
    2. Briefly pause CPR, if needed, to place Back Plate:
        a. Using the patient's arms, lift the patient's upper body a small distance, **OR**
        b. Roll the patient from side to side, **OR**
        c. Slide up from the legs to under the torso.
    3. Back Plate should be **centered on the nipple line** and the top of the Back Plate should be located below the patient's armpits.





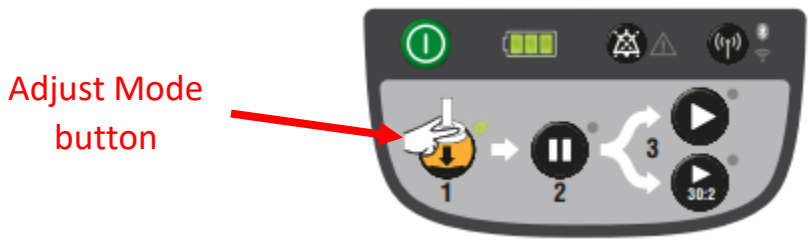
4. **RESUME MANUAL CPR IMMEDIATELY.**

E. Attach LUCAS device:
   1. Remove LUCAS device from the Carrying Case.
   2. Push ON/OFF on the User Control Panel of the LUCAS device for 1 second to power up device. The device will perform a 3 second self-test.
   3. Hold by the handles and pull Release Rings once to assure Claw Locks are open.
   4. Attach the Claw Lock to the Back Plate on the side closest to the person holding the LUCAS device.
   5. Position the LUCAS device across the patient, between the arms of the person who is performing chest compressions.
   6. Place hand closest to patient's leg on the top of the Suction Cup, ready to lower it down.
   7. Confirm with the CPR provider that you are ready to place the device. CPR provider will count down when ready to attach the second Claw Lock.

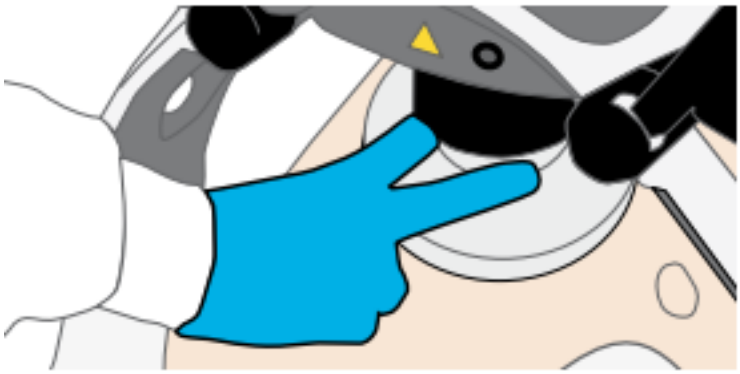


   8. At this point, the person performing manual compressions stops and assists attaching the Claw Lock to Back Plate on their side.
   9. Pull up once to make sure that the parts are securely attached.

F. Adjustment and Operation:
   1. Make sure that the LUCAS device is in the ADJUST MODE (Green light illuminated). If not illuminated, press once.



2. Push the Suction Cup down with two fingers until the pressure pad touches the patient's chest.



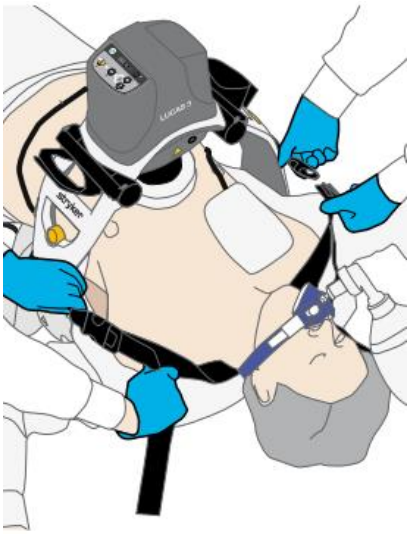
3. Use your finger to make sure that the lower edge of the Suction Cup is immediately above the end of the sternum.

4. If proper positioning is not achieved, pull the Suction Cup up and readjust.
5. Press Pause to lock the Start Position.

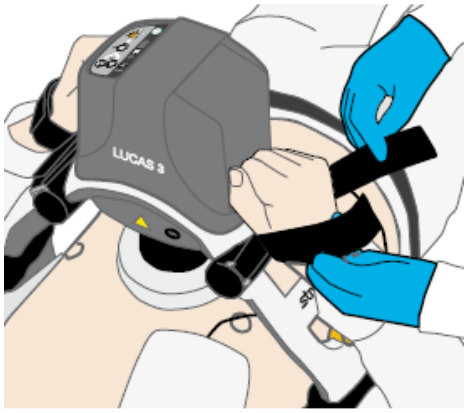
6. Push appropriate Active button for either continuous compressions or 30:2 compressions.

7. You can use a marker or other pen to mark the edges of the Suction Cup to monitor for any migration of the device.
8. Ventilations:
   a. During Continuous Mode, the green LED signal will blink 10 times per minute to alert for ventilation during ongoing chest compressions.
   b. During 30:2 mode, the LUCAS will provide an audible alert just prior to completing the 30-compression round. The LUCAS will then pause for the pre-set ventilation time.

G. Apply Stabilization Strap:
   1. Place the LUCAS stabilization strap behind the patient's neck and attach the straps to the buckles located on the support legs of the LUCAS device and secure strap firmly. **<u>This will prevent the LUCAS device from migrating towards the patient's feet.</u>**



2. Place the patient's arms in the straps located on the upper part of the support legs of the LUCAS device.



H. Pulse checks and defibrillation:
   1. Pre-charge the monitor prior to the end of the two-minute cycle.
   2. Locate a pulse.
   3. Pause: Stop the compressions by pushing the Pause button. **Limit chest compression pauses to < 10 seconds.**
   4. If no pulse and/or no defibrillations are required, Press the 30:2 or continuous active button to resume compressions. Monitor should then be disarmed.
   5. If the rhythm requires defibrillation, press the 30:2 or continuous active button to resume compressions, then discharge the defibrillator. **Defibrillation can and should be performed with the LUCAS device in operation.**

I. ROSC: If the patient obtains ROSC, the Back Plate should be left in place. The LUCAS device unit can be removed from the Back Plate to facilitate patient care if necessary.

J. Batteries and Power Supply:
   1. A full charged battery will provide 45 minutes of uninterrupted operation.
   2. Battery levels:
      a. 3 lit green lights = 45 minutes of operation
      b. 2 lit green lights = 30 minutes of operation
      c. 1 lit green light = 15 minutes of operation
      d. Flashing yellow light = < 10 minutes of operation
      e. Red Light = < 5 minutes of operation
   3. To change a battery during operation:
      a. Coordinate with partner.
      b. Push Pause to temporarily stop compressions.
      c. Using two hands, pull battery out and then upward to remove it.
      d. Install a fully charged battery.
      e. Wait momentarily until the green Pause button illuminates.
      f. Push the appropriate Active button to resume compressions.

4. The LUCAS device may be operated using the AC power cord. Note that the battery must be in place (and not dead) to complete the circuit. The battery will not charge when the device is in operation.
5. When stored **and not in use**, the battery is automatically being charged when the device is plugged into a wall outlet. The LUCAS device should be stored plugged into a wall outlet.

K. Care of the LUCAS device after each use:
1. Remove the Suction Cup and the stabilization strap (if used, remove the patient straps).
2. Clean all surfaces and straps with a cloth and warm water with an appropriate cleaning agent.
3. Let the device and parts dry.
4. Replace the used battery with a fully charged battery.
5. Remount (or replace) the SUCTION CUP and straps.
6. Repack the device into the carrying case.
7. Make sure that the charging cord is plugged into the LUCAS device.
8. The LUCAS device in the carrying case should be charged and secured while stored.

L. Data Transmission: Follow agency guidelines for the uploading of data from the LUCAS device.

NOTES AND PRECAUTIONS:

A. IF DISRUPTION OR MALFUNCTION OF THE LUCAS DEVICE OCCURS, IMMEDIATELY REVERT TO MANUAL CPR.

B. Defibrillation pads and wires should not be underneath the Suction Cup.

C. Do not use the securing straps for lifting purposes. The handles under the Claw Locks on the Back Plate can be used to move the patient onto a scoop stretcher or mega mover/buds handles (backboard should be avoided).

D. If the position of the Suction Cup migrates during operation, push Pause button, then the Adjust button and adjust the position.

E. Follow agency guidelines for the replacement of disposable parts and for general cleaning and preventative maintenance.

APPENDIX


Carrying Case
Patient wrist straps
User Control Panel
Release Rings
Suction Cup
Backplate
Stabilization Strap
Claw Locks
stryker
LUCAS
LUCAS 3
LUCAS

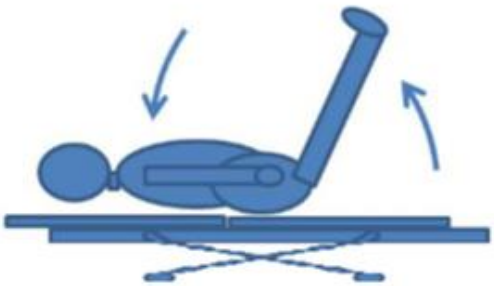
Modified Valsalva Maneuver – 30.110

DEFINITION:
Traditional vagal maneuvers have a low frequency of successfully converting Supraventricular Tachycardia (SVT) to sinus rhythm. However, Modified Valsalva Maneuvers have been repeatedly shown to have a high rate of rapid success in terminating SVT, thereby decreasing the need for administration of medications, IV access, and reducing patient discomfort.

INDICATIONS:
SVT (Regular narrow complex tachycardia- QRS < 0.12 secs)

CONTRAINDICATIONS:
A. Atrial fibrillation or atrial flutter
B. Hemodynamic instability or SBP <90
C. Known aortic stenosis
D. Inability to physically perform procedure due to anatomy

PROCEDURE:
A. Perform 12-lead EKG prior to performing modified-Valsalva maneuver.
B. Record rhythm strip during procedure.
C. Have the patient sit in an upright position.
D. With the assistance of a 10 ml syringe, encourage the patient to strain for a full 15 seconds, trying to push out the plunger by forced expiration.
E. Lay the patient supine and elevate their legs 45° - 90° for 15 seconds.
F. Lay the patient's legs flat for 60 seconds.
G. If the rhythm has changed or there is a significant change in heart rate after maneuver, perform repeat 12-lead EKG.
H. May repeat x 1 if patient has not converted to sinus rhythm.



PEDIATRIC VAGAL MANUVERS:
A. Infants and toddlers: Place ice packs on the face.
B. Pre-school and older: Have child blow on a syringe.

Orogastric Tube Insertion and Maintenance – 30.115

OVERVIEW:

While a patient is being ventilated with a BVM, trapped air can gather in the stomach increasing the risk of vomiting and aspiration. In addition, an enlarged stomach pushes against the diaphragm to increase intrathoracic pressure, decrease venous return, and interferes with lung ventilation.

INDICATIONS:

To alleviate gastric distention, reduce aspiration, and facilitate ventilation in intubated patients.

CONTRAINDICATIONS:

A. Known alkali or acid ingestion.
B. Known esophageal varices.
C. Esophageal obstruction.
D. Suspected epiglottitis or croup.

PROCEDURE:

A. Assemble equipment:
    1. Proper size orogastric tube
    2. Lubricant
    3. 30 or 60 cc syringes
    4. Suction unit

Gastric Tube Size Guide	
Age	**Size**
Less than 1 year	Refer to Pediatric Guide
1 yr. to 16 yrs.	10 - 14 French
Older than 16 yrs.	Up to 18 French

B. With patient's head in a neutral position measure tube length from xiphoid process to angle of jaw to corner of the mouth. Place a mark on the tube to indicate how far to advance the tube.
C. Lubricate end of tube; about 3 - 4 inches.
D. Gently insert tube and advance toward posterior oropharynx.
E. For non-traumatic patients, repositioning the head into a slightly flexed forward position may facilitate OG tube passage past the hypopharynx and into stomach.
F. Continue to insert tube to the measured mark). Secure tube with tape.
G. Attach syringe to the distal end of the OG tube.
H. Confirm tube placement by placing stethoscope over epigastrium and auscultate while inserting 30 - 60 ml of air in tube. You should hear gastric gurgling.
I. Secure tube in place with tape.
J. Place the tube to low continuous suction as needed, gastric contents should be visible in tubing.
K. Document tube size and depth, color, consistency, and amount of gastric contents.

Orogastric Tube Insertion and Maintenance – 30.115

NOTES AND PRECAUTIONS:

A. OG tube placement can cause bradycardia.
B. Do not delay transport for this procedure.
C. Monitor SpO_2 and $EtCO_2$ continuously.

Patellar Dislocation Reduction – 30.118

INDICATIONS:

Isolated non-traumatic lateral patellar dislocation.

CONTRAINDICATIONS:

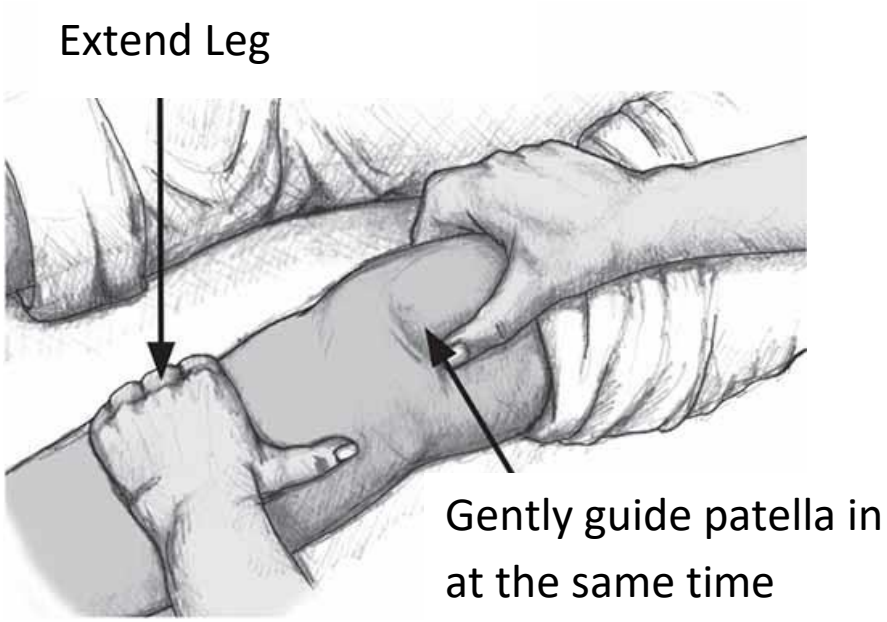
A. Direct traumatic mechanism of injury (impact directly to the knee).
B. Any sign of associated patella fracture (crepitus).
C. Any associated injury to same extremity (femur fracture, tibia/fibula fracture, pelvic fracture).

PROCEDURE:

A. Follow Pain Management protocol.
B. Patient will usually present with the knee flexed and an obviously laterally displaced patella.
C. Gently apply pressure to the lateral aspect of the patella (directing it medially) while extending the leg.

NOTES & PRECAUTIONS:

A. Reductions should not be attempted for medial dislocations, as these commonly have associated fractures.
B. Patients should be splinted and transported regardless of success of reduction attempt. If a patient does not want transport after successful reduction, OLMC contact is mandatory as part of the refusal process.



Pelvic Immobilization – 30.132

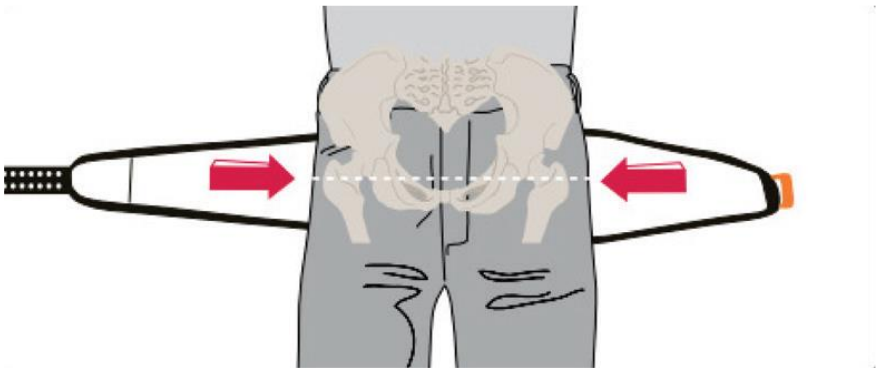
PURPOSE:
The initial reduction of an unstable pelvic fracture (to lessen ongoing internal bleeding and to ease the pain by splinting the fracture) using either a specifically applied sheet or another approved device.

INDICATIONS:

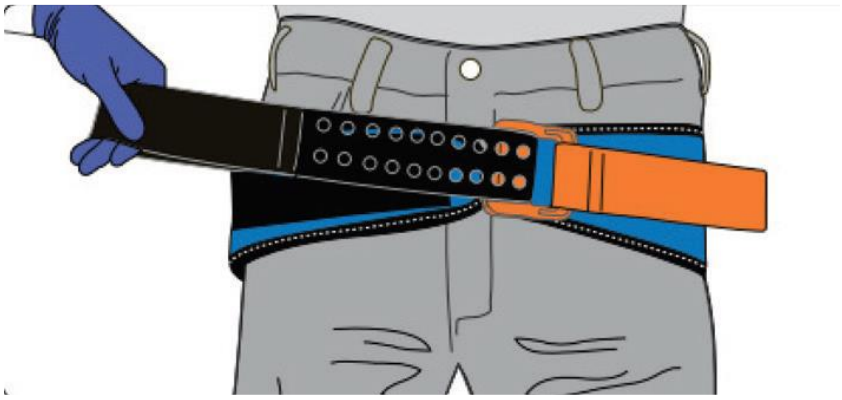
A. To be applied in all trauma patients who have appropriate mechanism(s) of injury and who present with pelvic instability.
B. Consider pelvic wrap in trauma patients who have appropriate mechanism(s) of injury and who are in shock.

PELVIC SLING PROCEDURE:

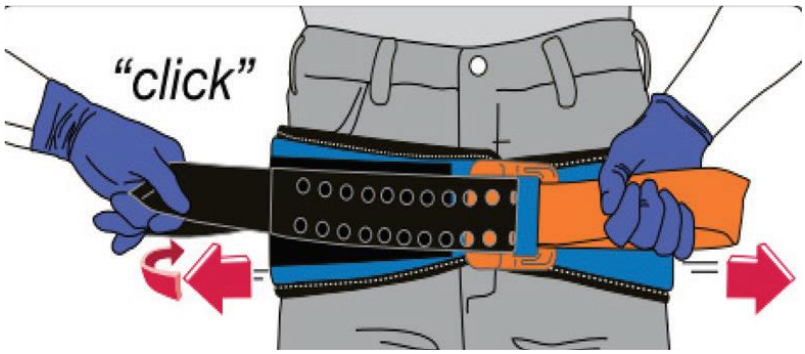
A. Remove objects from patient's pocket or pelvic area. Place SAM® Pelvic Sling gray side up beneath patient at level of trochanters (hips).



B. Place BLACK STRAP through buckle and pull completely through.

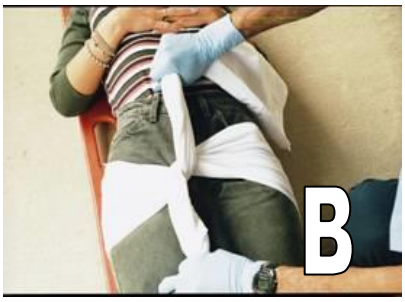


C. Hold ORANGE STRAP and pull BLACK STRAP in opposite direction until you hear and feel the buckle click. Maintain tension and immediately press BLACK STRAP onto surface of SAM® Pelvic Sling to secure.



PELVIC WRAP PROCEDURE:

A. Fold the sheet smoothly lengthwise to about 9 inches wide (do not roll) and apply underneath the pelvis, centered on the greater trochanters. Assure the patient's pockets are empty (if applicable) to avoid placing pressure on the objects into the patient.
B. Tighten the sheet around the pelvis and adjust the tension to try to return the pelvis to normal anatomical position.
C. Secure using a knot or clamps if available.



NOTES & PRECAUTIONS:

A. Always re-check the position of the sheet (in terms of up and down). You should still be able to feel the anterior superior iliac spines after placement. If not, the sheet may be too high on the pelvis and must be repositioned.
B. If the pelvis is unstable on initial exam, do not repeat the exam.
C. Blood loss in a pelvic fracture can be significant. Monitor closely and treat per Shock Protocol.
D. Consider placing prior to extrication from a vehicle if feasible.
E. The pelvic sling/wrap is contraindicated for suspected isolated hip fractures (i.e. ground level falls).

PICC Line Access – 30.140

BACKGROUND:
A Peripherally Inserted Central Line (PICC) is a common method of maintaining long-term venous access in select patients. PICC lines are typically inserted into the antecubital fossa, and then threaded into central circulation. PICC lines are flushed with heparin to maintain patency and therefore it is imperative to aspirate 5 ml of blood from the line prior to use.

INDICATIONS:

A. PICC lines may be accessed when there is a need for drug or fluid administration and traditional means of venous access are unsuccessful.
B. Patient or patient's caregiver requests use of PICC line.

CONTRAINDICATIONS:

A. Inability to aspirate or infuse through the catheter.
B. Catheter located in any place other than the patient's upper arm.
C. Need for rapid fluid resuscitation.

PROCEDURE:

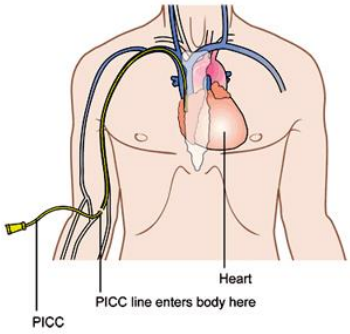
A. Use clean gloves and maintain sterility as much as possible.
B. If there is a needleless type port on the distal end of the catheter, perform the following: *(figure 1)*
    1. Scrub the port with an alcohol pad for at least 15 seconds and allow to dry for at least 5 seconds.
    2. Attach a 10 ml syringe (without saline) to the port.
    3. Unclamp if necessary (needleless port may not have a clamp).
    4. Attempt to aspirate at least 5 ml of blood. Blood should draw freely. If it does not, remove the syringe and DO NOT use the catheter for access.
    5. If blood aspirates freely, remove the 10 ml syringe with blood and discard.
    6. Attach a 10 ml syringe with NS and gently flush the line. Never use a smaller syringe. If line does not flush, remove the syringe and DO NOT use the catheter for access.
    7. If line flushes, remove the syringe and attach the catheter to the end of the IV tubing and begin infusion of NS or LR. Adjust the rate to the needs of the patient within the limits of the catheter.
    8. Administer medications though IV tubing port if indicated.

C. If there is a capped needle-type port on the distal end of the catheter, perform the following: *(figure 2)*
    1. Scrub the cap with an alcohol pad for at least 15 seconds and allow to dry for at least 5 seconds.
    2. Clamp the catheter tubing using ONLY the existing clamp on the catheter and then remove the cap. **Never allow a central line to be open to air.**
    3. Attach a 10 ml syringe on the catheter end.
    4. Unclamp the catheter.
    5. Attempt to aspirate at least 5 ml of blood. Blood should draw freely. If it does not, re-clamp the line and remove the syringe. DO NOT use the catheter for access.
    6. If blood aspirates freely, clamp the catheter again.
    7. Remove the 10 ml syringe with blood and discard.

8. Attach a 10 ml syringe with NS.
9. Unclamp and gently flush the line. Never use a smaller syringe. If line does not flush, re-clamp the line and remove the syringe. DO NOT use the catheter for access.
10. If line flushes, re-clamp and remove the syringe.
11. Attach the catheter to the end of the IV tubing.
12. Unclamp the catheter and begin infusion of NS or LR. Adjust the rate according to the needs of the patient within the limits of the catheter.
13. Administer medications though IV tubing port if indicated.

NOTES & PRECAUTIONS:

A. **Do not administer medications, flush, or aspirate with less than a 10-cc syringe. Smaller size syringes generate too much pressure and can damage the catheter.**
B. **Do not attempt to reinject aspirated blood as it may contain clots.**
C. The maximum flow rates for a PICC line is 125 ml/hr for less than size 2.0 French, and 250 ml/hr for catheters over 2.0 size French.
D. Keep patient's arm straight to avoid kinking the PICC line and obstructing flow.
E. Ensure all line connections are secure.
F. PICC lines access the patient's central circulation and the risk of infection is high. Avoid contamination to ports and connections while accessing.
G. **Do not administer the following medications through a PICC line:**
    1. **Adenosine** - The line may rupture during rapid infusion due to over pressurization.
    2. **Dextrose 50%** – The catheter can be damaged due to the viscosity of the fluid.



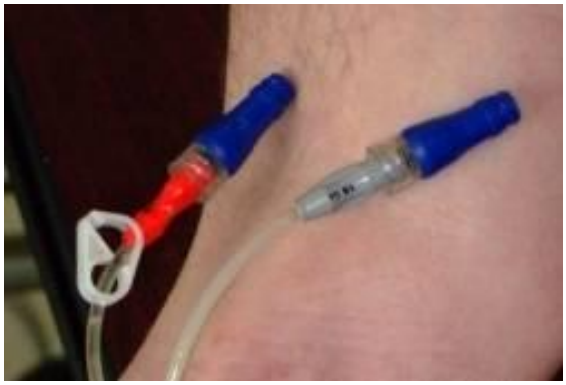


Figure 1- Needleless port

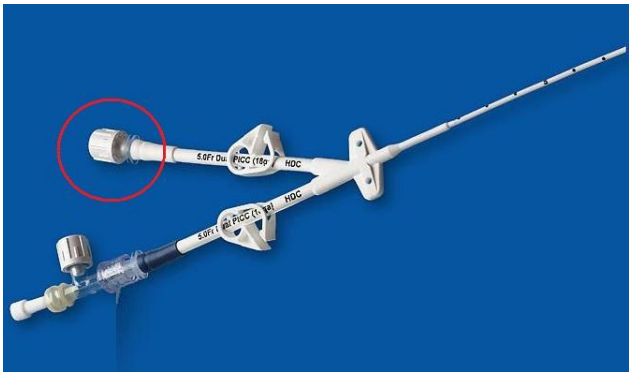


Figure 2 – Non-needleless type port with cap

Positive End-Expiratory Pressure (PEEP)– 30.145

DEFINITION:
Positive end-expiratory pressure (PEEP) is a method of ventilation in which airway pressure is maintained above atmospheric pressure at the end of exhalation by means of a mechanical impedance (PEEP valve). PEEP has some similarity to CPAP/BiPAP although it is delivered through bag instead of a facemask. It can be delivered via bag-valve-mask or bagging into an endotracheal tube. At the end of exhalation PEEP prevents alveolar collapse (i.e. the alveoli stay open) and improves oxygen exchange across the alveolar membrane. Additionally, PEEP may recruit more alveoli that have collapsed, which may further improve oxygenation. **ADDING PEEP IS DONE TO IMPROVE OXYGENATION.** The disadvantage to PEEP is that it may increase intrathoracic pressure, which may reduce blood flow in cardiac arrest or a shock state.

INDICATIONS:
Hypoxia, either prior to or post intubation despite appropriate bag ventilation with 100% oxygen.

CONTRAINDICATIONS:
A. Cardiac arrest (absolute).
B. Hypotension or shock state (relative). May still choose to apply PEEP when preparing to RSI a hypoxic/hypotensive patient.

PROCEDURE:
A. If not already applied, apply PEEP valve to bag device.
B. Dial PEEP valve to 5cm H_2O and bag per usual.
C. Increase PEEP by 5cm H_2O every 3 - 5 minutes until hypoxia resolves (oxygen saturation > 95%).
D. Maximum PEEP is 15 cm H_2O.

NOTES AND PRECAUTIONS:
A. Increasing bagging rate will not necessarily improve oxygenation but can cause hyperventilation, which can be detrimental to patients.
B. PEEP valve may come out of the package set to five or zero. Be aware of valve settings.
C. **Maximum PEEP in pediatrics is 5cm H_2O.**

Sports Equipment Removal – 30.160

DEFINITION:
To provide direction on the safe removal of protective sports equipment that includes helmet and shoulder pads. This procedure page uses football gear as an example, but these guidelines can be used with other sports equipment as well.

PROCEDURE:

A. **Initial Evaluation**
   1. The initial evaluation should begin by assessing level of consciousness, breathing, and circulation. If the athlete is breathing and stable, but a neck injury is suspected, a quick sensory and motor nerve exam should be initiated.
   2. After the quick neurological exam on a stable athlete, the facemask should always be removed.

B. **Face Mask Removal**
   1. Stabilize the head.
   2. Cut side and top attachments at loop to remove face mask. Some helmets will need a cutting tool to “release” the top of the facemask from the helmet.
   3. Quick release face masks are also in use and found on newer helmets. One popular device looks like a “rivet” instead of a screw. The release mechanism can be activated by pressing it down with a pen or tip of a screwdriver. Athletic trainers and coaching staff are familiar with this and can provide assistance.

C. **General equipment removal guidelines:**
   1. If the athlete has neck pain, numbness or tingling, extremity weakness, or is unconscious, the helmet and shoulder pads should not be removed on the field of play.
   2. If access to the airway is compromised, removal of the helmet and shoulder pads may be initiated.
   3. **If removing equipment, always remove the helmet and the shoulder pads, never just one or the other.** Leaving the helmet on or just the shoulder pads on by itself creates head, neck, or spinal cord flexion.

D. **Removal of helmet and shoulder pads as a unit:**
   1. Gear removal starts from the head and proceeds down the body.
   2. Remove the helmet first and then remove the shoulder pads, and leg gear. **Do not start with the shoulder pads.**
   3. Cut chin straps.
   4. Release cheek pad snaps.
   5. Use a **two-person technique** to remove the helmet.
      a. Person at the top firmly holds manual c-spine at the top using two hands to stabilize the patient's helmet.
      b. The other responder, starting at the chin, slides his or her hands inside the patient's helmet "firmly" gripping the head and sliding their hands inside the helmet.
      c. Responders transition manual c-spine responsibility from the person at the top of the head/ helmet to the person supporting the patients head from underneath.
      d. Firm control of the head and neck is the goal. The person at the top proceeds to remove the helmet off the patient's head in a coordinated and smooth manner. **DO NOT SPREAD APART SIDES OF HELMET.**
      e. Once helmet is removed, the person at the top of the head resumes manual c-spine until full c-spine precautions are in place.
   6. Cut shoulder pad straps.
   7. Cut both the jersey and shirt up sleeves towards midline of body.
   8. Person at head stabilizes maxilla and occiput and gives commands.
   9. Position three people on each side, with one stabilizing the head. Another person removes the equipment as a unit.

<u>While backboard and straps are being prepared</u>:

E. **Chest access:**
   1. Cut jersey and front laces of shoulder pads.
   2. Flip out shoulder pads. Some newer systems allow the shoulder pads to come apart prior to removal. Athletic trainers and coaching staff are familiar with these systems and can provide assistance.
   3. Place hands on shoulders with thumbs grasping the clavicle and fingers surrounding the upper trapezius muscles.
   4. Secure the athlete's head between the responder's forearms.

F. **Backboard utilization:**

1. Log rolling is the preferred method for movement as crews are most familiar with this technique and understand the importance of moving the patient as a unit and maintaining inline alignment of the head, neck, and spine.
2. The lift technique is an alternative method that could be used for smaller patients, but it is manpower intensive. If lifting, remember to lift as a unit. Slide backboard into place from feet.
3. The person at head initiates commands and oversees proper placement and techniques.
4. Position three responders on each side of body; one at shoulders, one at hips, and one at legs.
5. One other person is in charge of the backboard and slides it into place.
6. If the helmet is not resting on board, padding can be added to fill space.
7. Fasten straps and tape helmet to board.
8. Chinstrap remains in place unless it interferes with airway.
9. Recheck sensory and motor nerve vitals for changes and document.

NOTES & PRECAUTIONS:

Athletic Trainers and coaching staff are subject matter experts when it comes to the gear regardless of the sport. Collaborate with them early and often.

Suctioning – 30.161

INDICATIONS:
When patient is exhibiting respiratory difficulty secondary to secretions in airway or the potential for aspiration exists.

PROCEDURE:

A. Oral Suctioning

1. Pre-oxygenate patient with 100% oxygen.
2. Assemble equipment: Suction unit with tonsil tip or dental tip, personal protective equipment (gloves, goggles, gown).
3. Attach required monitoring equipment.
4. Turn suction unit on and confirm mechanical suction is present.
5. Insert tip without suction.
6. Cover thumbhole to begin suction if using a tip other than dental tip.
7. Apply suction for < 15 seconds.
8. Monitor patient's oxygen saturation.
9. Re-oxygenate patient for at least 2 - 3 minutes between suctioning attempts.

B. Tracheal Suctioning

1. Pre-oxygenate patient with 100% oxygen.
2. Assemble equipment: Suction unit, correct size suction catheter, sterile rinse, personal protective equipment (gloves, goggles, gown).
3. Attach required monitoring equipment.
4. If patient is being ventilated with BVM through an endotracheal tube prior to suctioning, have someone else remove the bag from end of ET tube prior to suction attempt.
5. Insert catheter into the ET tube without applying suction.
6. Advance catheter as far as possible.
7. Withdraw slowly using **intermittent** suctioning while rotating catheter.
8. Do not suction more than 15 seconds.
9. Monitor patient's oxygen saturation.
10. Rinse catheter in sterile saline.
11. Re-oxygenate patient for at least 2 - 3 minutes between suction attempts.

C. Suctioning with Meconium Aspirator

Tracheal suctioning is not indicated in the vigorous infant born with meconium stained fluid, whatever the consistency. Simply use a bulb syringe or large bore catheter to clear secretions from the mouth and nose as needed.

1. Assemble equipment: Suction unit, appropriate size ET tube, personal protective equipment (gloves, goggles, gown).
2. Attach required monitoring equipment.
3. Turn suction unit on and confirm mechanical suction is present.
4. After infant has been intubated, attach meconium aspirator to end of ET tube.
5. Cover thumbhole to begin suctioning while slowly withdrawing the ET tube. Do not suction for more than 15 seconds.
6. Monitor patient's oxygen saturation and heart rate and stop if patient becomes bradycardic.

7. Re-oxygenate patient for at least 2 - 3 minutes between suctioning attempts.
8. If patient has not been intubated and meconium is thick, at the least, aggressive oropharyngeal suctioning should be carried out with the largest diameter suction device available.

D. Suctioning with Nasal Aspirator Device

1. Assemble equipment: Bulb syringe, suction unit with nasal aspirator, personal protective equipment.
2. If nasal secretions are thick consider instilling 1 - 4 drops of NS into nares to loosen prior to suctioning.
3. If using electric suction be sure vacuum is set less than 100 mmHg.
4. Gently place device tip into nostril. Avoid placing against inside walls of nostril.
5. Apply suction (< 15 seconds if using electric suction).
6. Repeat as needed.

NOTES & PRECAUTIONS:

A. Oral and tracheal suctioning can cause trauma to the oropharynx and airway, bradycardia, or hypoxia. It should not delay other resuscitation.

B. Suction pressure should be set as low as possible and yet effectively clear secretions. Negative pressure of less than 80 - 100 mmHg in neonates and less than 150 mmHg in adults are recommended.

C. When suctioning the intubated patient, the diameter of the suction catheter should not exceed one half of the internal diameter of the endotracheal tube.

TASER® Barb Removal – 30.162

INDICATIONS:

Taser® barbs should be removed at the request of law enforcement if:

A. The patient has been adequately subdued so as not to pose a danger to Fire/EMS personnel. AND,
B. The barbs are not embedded in the face, neck, or groin areas.

PROCEDURE:

A. Perform patient assessment.
B. Monitor vital signs and LOC. Ensure that vital signs are in the normal limits for the situation.
C. Expose the area where Taser® barb has implanted under the skin.
D. Cut wires from the barb if still attached.
E. Place thumb and forefinger above and below the barb parallel to the portion of the shaft implanted in the patient's skin.
F. Spread your thumb and forefinger apart to stretch the skin tightly over the barb.
G. Holding tension, use needle-nose pliers (or similar tool) with gripping strength and grasp the end of the barb protruding out of the skin near the wire lead and firmly pull out the barb with one quick jerking motion.
H. Assess the skin where the barb was removed. The skin should be cauterized from the electrical current. Dress the wound to prevent infection.
I. Contact OLMC if unsure whether to transport.

NOTES & PRECAUTIONS:

A. Patients should be in police custody and monitored by police for the safety of medical personnel.
B. Do not remove Taser® Barbs from the face, neck, or groin area. Stabilize the barbs and transport to the Emergency Department.
C. Tasers® emit two barbs. Make sure both are removed. Treat all barbs as a biohazard and dispose as you would any other sharps.
D. Potential trauma may have occurred before (during a struggle) or after the patient was hit by the Taser® (e.g., patient falls and hits head).
E. Consider whether the patient meets criteria for Altered Mental Status or Poisonings and Overdoses protocols.
F. CAUTION: Where barbs have wires still connected to the Taser® Gun, shock can still be delivered.

Tension Pneumothorax Decompression – 30.170

DEFINITION:
The emergency decompression of a tension pneumothorax using an over-the-needle catheter.

INDICATIONS:
To warrant chest decompression in the field, the patient must be significantly symptomatic or in extremis (at risk of death) with:

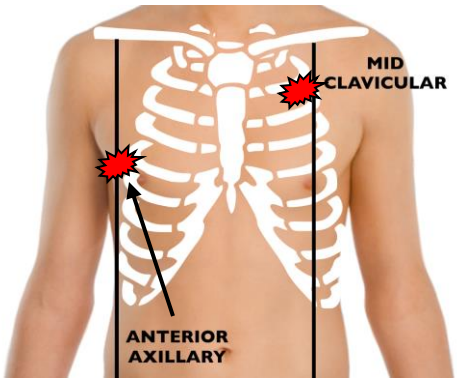
A. High clinical suspicion **and**,
B. Progressive respiratory distress **and**,
C. Shock symptoms with low or rapidly decreasing blood pressure.

and at least one of the following:

A. Decreased or absent breath sounds.
B. Consistent history (e.g., chest trauma, COPD, asthma).
C. Distended neck veins.
D. Tracheal shift away from affected side (late sign).
E. Asymmetrical movement on inspiration.
F. Hyper-expanded chest on affected side.
G. Drum-like percussion on affected side.
H. Increased resistance to positive pressure ventilation, especially if intubated.

EMS witnessed traumatic arrest patients with abdominal or chest trauma for whom resuscitation is indicated should have bilateral chest decompression performed even in the absence of the above signs.

PROCEDURE:
A. Expose the entire chest.
B. Establish landmarks:
    1. Anterior – 2nd intercostal mid clavicular **or if unavailable.**
    2. Lateral – 4th intercostal space anterior axillary (above nipple).
C. Clean chest vigorously with appropriate antiseptic.
D. On affected side, locate the landmark and insert a large gauge over-the-needle catheter with syringe attached along **the superior margin** of the rib below (e.g. top of third rib to enter second intercostal space).
E. If the air is under tension, the barrel will pull easily and "pop" out of the syringe.
F. Remove syringe, advance catheter, and remove needle.
G. Secure from movement.



Tension Pneumothorax Decompression – 30.170

NOTES & PRECAUTIONS:

A. Patient's chest should be auscultated often for return of tension or other respiratory complications.
B. Tension pneumothorax is a rare condition, but can occur with trauma, spontaneously, or as a complication of intubation. Tension takes time to develop, but forceful positive ventilation may increase the rate of development.
C. Simple or non-tension pneumothorax is not life threatening and should not be decompressed in the field.
D. The ideal decompression catheter length is three inches.
E. Possible complications:
    1. Creation of pneumothorax if none existed previously.
    2. Laceration of lung or pericardium. Stop needle advancement once it has popped through the pleura and advance the catheter only.
    3. Laceration of blood vessels. (Always slide the needle above the rib).
    4. Infection. Clean rapidly but vigorously; use sterile gloves if possible.
F. Tension pneumothorax can be precipitated by the occlusion of an open chest wound. If the patient deteriorates after dressing an open chest wound, remove the dressing.

Tourniquet Placement – 30.175

DEFINITION:
Placement of a circumferential band around a limb to occlude arterial blood flow distal to the band.

INDICATIONS:
Extremity hemorrhage that is uncontrollable by less aggressive means (direct pressure, bandaging, or pressure dressing) OR a wound that could cause life threatening extremity hemorrhage during an ongoing tactical problem (e.g. potential building collapse, mass casualty event, amputation).

PROCEDURE:

A. Fully expose and evaluate the wound.
B. Apply tourniquet directly to the skin, 2 - 3 inches proximal to the most proximal limb wound, not over a joint.
C. Tighten until all bleeding stops and no distal pulse is palpable.
D. Secure the windlass per manufacturer instructions.
E. If one properly placed tourniquet does not control bleeding, a second should be placed proximal to the first and tightened appropriately.
F. Endeavor to keep all tourniquets exposed.
G. Mark with time of application and communicate this to receiving providers.
H. Re-evaluate tourniquets frequently to ensure they have not loosened.

NOTES & PRECAUTIONS:

A. If an improvised tourniquet is present before medical provider arrival, place a commercial tourniquet per protocol and remove the improvised tourniquet if operationally feasible**.**
B. Properly applied tourniquets will rarely damage tissue if removed within two hours.
C. If unable to fully expose a limb and identify all wounds on that limb place the tourniquet as high on the limb as possible. Once all wounds on that limb can be identified, every effort should be made to move the tourniquet to 2 - 3 inches proximal to the most proximal wounds, and not on a joint.
D. Intermittently loosening and tightening a tourniquet to “reperfuse” a limb is of no benefit and dangerous as it encourages additional bleeding.
E. A single commercially available tourniquet completely occludes femoral artery blood flow about 70% of the time. Two tourniquets placed side by side completely occlude about 80% of the time.
F. The ability of the tourniquet to completely occlude arterial flow is dependent on limb circumference. Larger limbs are more difficult to occlude.
G. A persistent pulse, continued venous congestion / distention, re-bleeding after initial hemorrhage control, and expanding hematoma are all indications of an ineffective tourniquet.
H. Clothing, padding under the tourniquet, and limb movement all cause tourniquets to loosen over time and should be avoided.
I. Tourniquets can cause significant pain and may require narcotics for pain control.
J. Proper placement of a CAT® tourniquet on a lower extremity requires threading the circumferential band through both slits of the buckle.
K. Proper placement of the SOFTT tourniquet requires tightening the knurled screw on the buckle before tightening the windlass.

Transcutaneous Pacing – 30.180

DEFINITION:
Transcutaneous pacing is the technique of electronic cardiac pacing accomplished by using skin electrodes to pass repetitive electrical impulses through the thorax.

INDICATIONS:
Transcutaneous pacing should be considered in bradycardia with evidence of inadequate perfusion, (e.g. altered mental status, chest pain, hypotension, other signs of shock).

PROCEDURE:

A. Ensure ECG pads are attached, and monitor displays a rhythm.
B. Attach pacing electrodes to anterior and posterior chest just to the left of the sternum and spinal column, respectively. Alternatively, pads may be placed in the standard anterior and lateral position as with defibrillation. If there is difficulty in obtaining capture, try alternative position.
C. Begin pacing at a heart rate of 80 beats per minute and 30 mA current output.
D. Increase current by increments of 10mAs while observing monitor for evidence of electrical capture. Confirm mechanical capture by checking pulses and BP.
E. If patient is comfortable at this point, continue pacing. If patient is uncomfortable, administer midazolam 2.5 - 5 mg slow IV/IO push, or if no IV, 5 mg IM/IN (may repeat once) **OR** administer lorazepam 1 - 2 mg IV/IO, may repeat every 5 minutes as needed to a max total dose of 4 mg. If no IV, 2 mg IM, may repeat once in 10 minutes. Call OLMC for additional orders.
F. If patient still complains of pain, repeat dose of midazolam once and contact OLMC.
G. If the patient remains unconscious during pacing, assess capture by observing the monitor and evaluating pulse and blood pressure changes. In the event of electrical capture and no pulses, follow PEA protocol.
H. If there is no response to pacing and drugs, consult with OLMC. If a change in pacing rate is desired, contact OLMC.

PEDIATRIC PATIENTS:
Use above guidelines except:

A. Administer midazolam 0.1 mg/kg IV/IO to a max of 5 mg (may repeat once after 5 minutes) **OR** administer lorazepam 0.05 mg/kg IV/IO to a max single dose of 2 mg, may repeat every 5 minutes to a max total dose of 4 mg. If no IV, 0.1 mg/kg IM to a max single dose of 2 mg, may repeat once in 10 minutes. Call OLMC for additional orders.
B. Use anterior/posterior pad placement first for patients less than 1 year.
C. Begin pacing at smallest mA output.
D. Increase current in increments of 10 mA while observing monitor for evidence of electrical capture.
E. Confirm mechanical capture by checking pulses and BP.
F. Contact OLMC for adjustments to rate based on age and response to pacing.

NOTES & PRECAUTIONS:

Transcutaneous pacing should not be used in the following settings:

A. Asystole.
B. Patients meeting Death In The Field criteria.
C. Patients in traumatic cardiac arrest.

XSTAT– 30.200

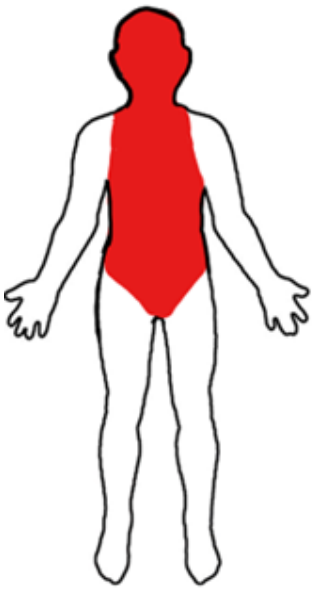
DEFINITION:
The XSTAT is a first-in-kind expanding dressing approved for internal use. A syringe-like applicator applies compressed mini-sponges deep into a wound. Upon contact with blood, the sponges expand to 10 - 12 times their compressed volume within approximately 20 seconds compressing the wound to stop bleeding.

INDICATIONS:
XSTAT is for the control of severe, life-threatening bleeding from junctional wounds in the groin or axilla that are not amenable to tourniquet applications in adults and adolescents. It should only be used for patients at high risk for immediate life-threatening bleeding from hemodynamically significant, non-compressible junctional wounds.

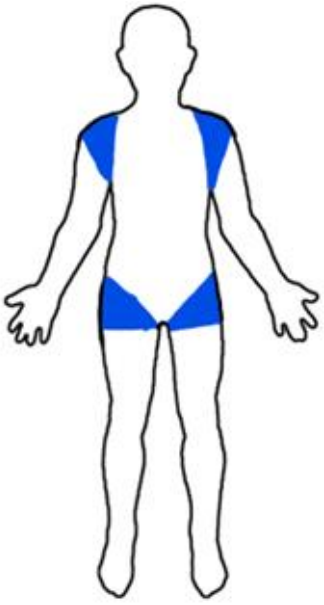
CONTRAINDICATIONS:
XSTAT is not indicated for use in the:

A. Thorax
B. Pleural cavity
C. Mediastinum
D. Abdomen
E. Retroperitoneal space
F. Sacral space above the inguinal ligament
G. Tissue above the clavicle

Contraindicated areas:



Approved areas:



SIZES:

XSTAT comes in two sizes:

PROCEDURE:

A. Open the package and remove the applicator.
B. Insert applicator into wound track as close to bleeding source as possible.
C. Insert plunger into applicator, push plunger firmly to deploy sponges.
D. If resistance met, pull back slightly on applicator to create additional packing space then continue to depress.
E. Use additional applicators as needed to completely pack wound.
F. Cover wound with a proper dressing.
G. If bleeding persists, apply manual direct pressure until bleeding is stopped.

NOTES & PRECAUTIONS:

A. Tourniquets are still the first line treatment for extremity wounds distal to a junction.
B. A radiopaque marker is embedded into each of the mini-sponges to make them detectable by X-Ray.
C. Never attempt to remove the mini-sponges from the wound. They must be removed by a surgeon after achieving proximal and distal vascular control.
D. The manufacturer includes a Casualty Card inside the XSTAT package.
    1. Instructions to the surgeon for removing the sponges from the wound are included on the back of the card.
    2. Record the use of XSTAT on the card and forward these instructions to the medical treatment facility.
E. Segments of the applicator tip may break away during application and be left in the wound.
    1. After injecting the mini-sponges, check the applicator tip for missing segments
    2. Do not attempt to retrieve missing segments from the wound
    3. Record the number of lost segments on the Casualty Card.

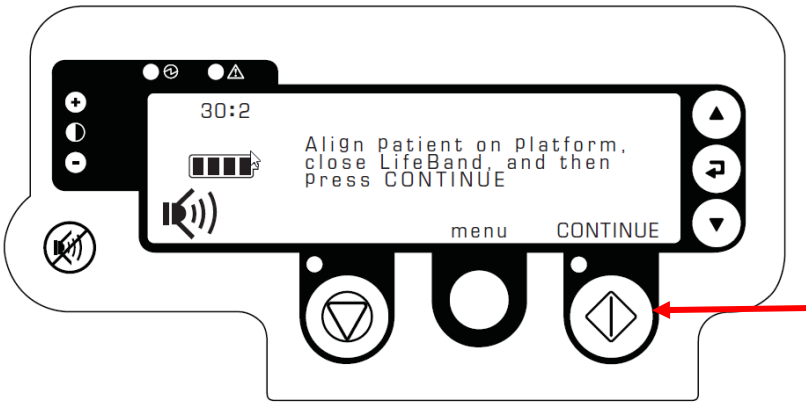
INDICATIONS:
The AutoPulse device may be used on patients who have suffered cardiac arrest where manual chest compressions would otherwise be used.

CONTRAINDICATIONS:

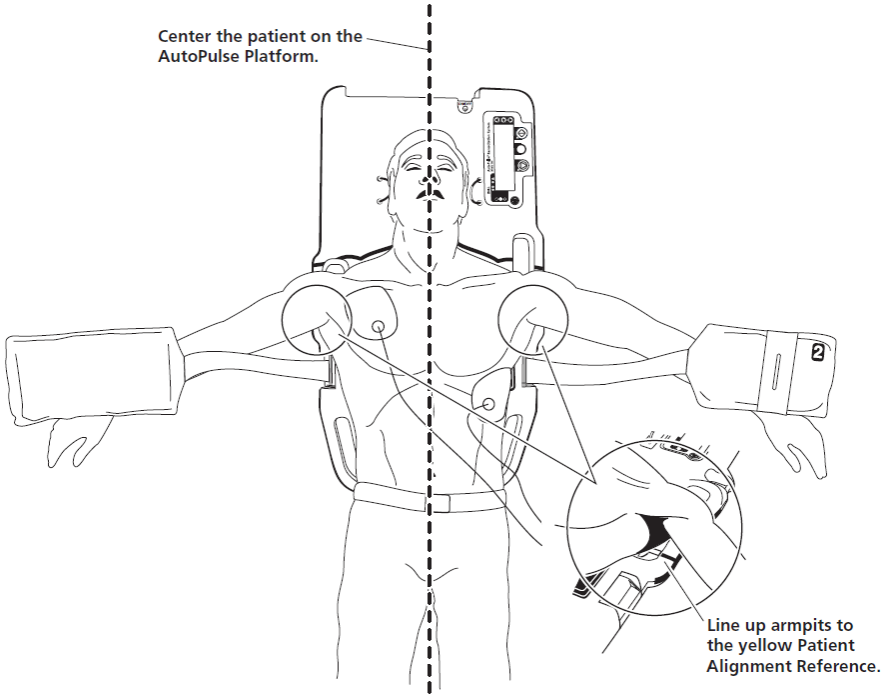
A. Less than 18 years of age.
B. Patients too large or small: Chest circumference less than 29.9” or greater than 51.2” or greater than 300 lbs.
C. LVAD or HVAD patients.
D. Not recommended in cardiac arrest from trauma.

PROCEDURE:

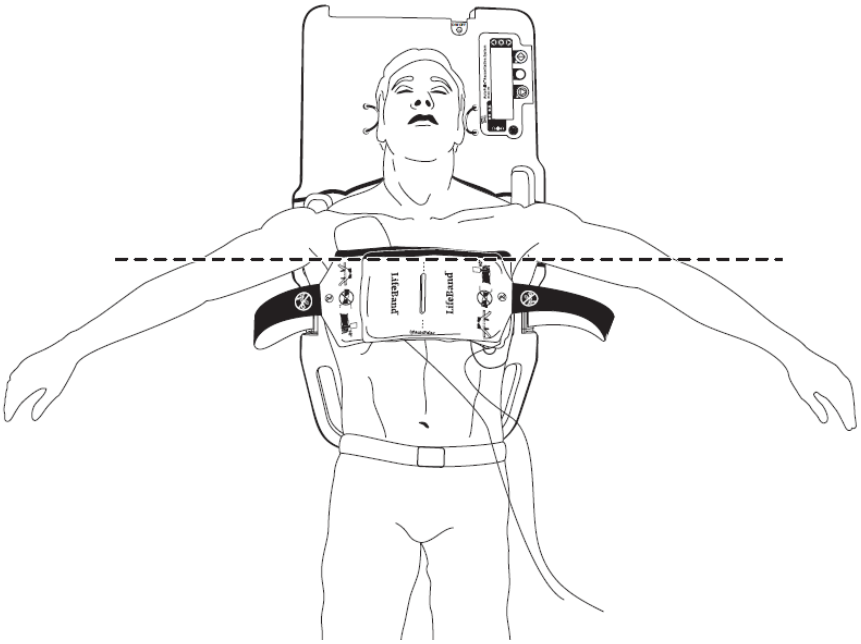
A. All therapies related to the management of the cardiopulmonary arrest should be continued as currently outlined.
B. Remove the patient’s clothing from the waist up. Clothing may disrupt the use of the device.
C. Prepare the device for placement:
    1. Turn the device on to ensure it is ready for use. The device will read “Align Patient on platform, close LifeBand, and then press continue”.



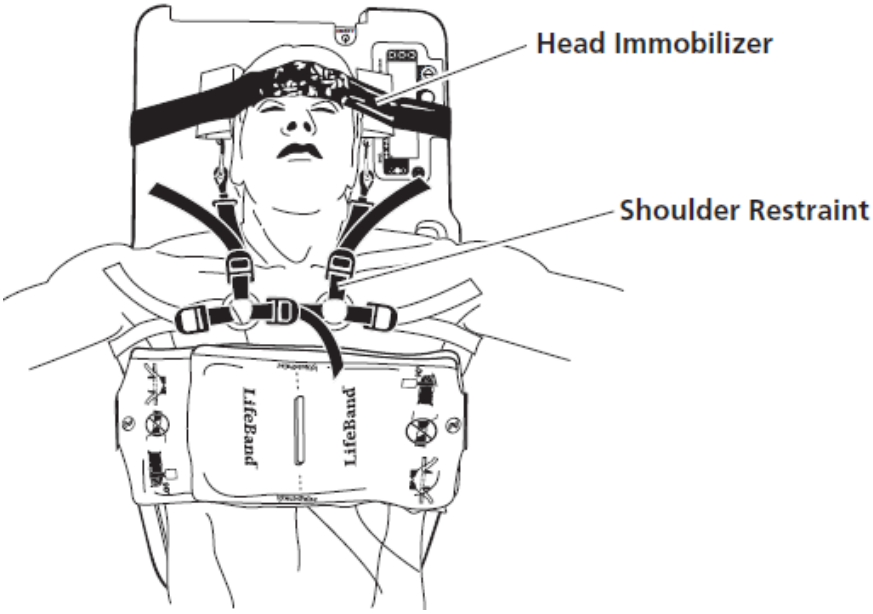
    2. In a coordinated effort during a predetermined pause place the patient in a sitting position. Then place the device behind the patient and lay the person down.
    3. Position the patient so they are centered from left to right and that the armpits are aligned with the yellow line positioning guides on the board.



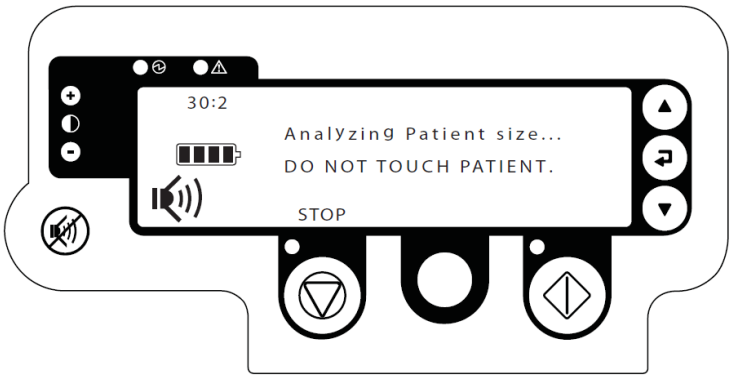
4. Place the LifeBand around the patient's chest.



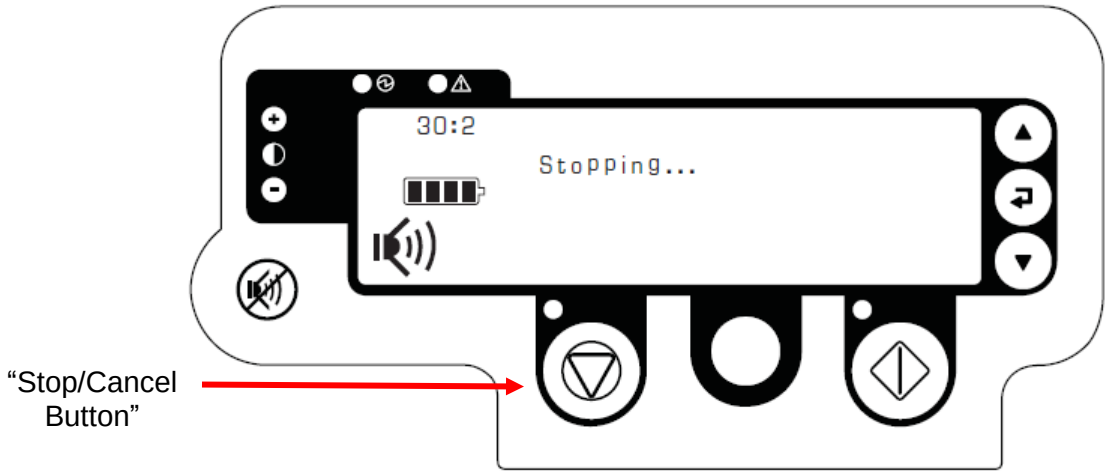
5. Lift the LifeBand to its fullest extension, ensuring there are no twists or obstructions. Center the LifeBand on the patient's chest.
6. Attach the shoulder restraint to keep the patient properly aligned.
7. If needed, you may also secure the head to the AutoPulse.



D. Using the Device:
   1. Press and release the start/continue button once. There will be a 3 second pause for the device to adjust to the patient.
   2. After the 3 second verify patient alignment pause is complete, compressions will automatically begin. You may press the Start/Continue button to immediately initiate compressions ahead of that time.



3. Depending on the Mode setting in Administrative Menu, the AutoPulse will perform 30:2, 15:2, or Continuous compressions.
4. In 30:2 mode it performs 30 compressions and then pauses for three seconds to permit the user to ventilate the patient before automatically resuming compressions.
5. If in the 30:2 mode, an audible tone will sound on the 28th, 29th, and 30th compression. Then a 3 second pause to allow for 2 ventilations.
6. In Continuous mode, an audio cue tone for ventilation will sound 8 times per minute.
7. At the initiation of compressions, the counter at the right center of the display panel screen will be set to 00:00 and will automatically begin recording the elapsed time until the Stop/Cancel button is pressed.
8. When the Stop/Cancel button is pressed, the counter will immediately reset to zero and begin recording the elapsed “no-flow” time. The counter will reset to zero when chest compressions are started again.
9. To access the patient or to pause the AutoPulse for any reason, press the Stop/Cancel button.



10. After either successful resuscitation or termination of activities, press the Stop/Cancel button followed by the On/Off button. The Stop/Cancel button action will cease the compression cycles and relax the LifeBand. The On/Off button action will power down the AutoPulse.

NOTES AND PRECAUTIONS:

A. If disruption or malfunction of the AutoPulse device occurs, immediately revert to manual CPR.

B. The AutoPulse should only be used by trained individuals.

C. Do not block the vents of the AutoPulse Platform.

D. If you must move or realign the patient, you must press the Stop/Cancel button before adjustment.