

LVAD (Left Ventricular Assist Device) Protocol

Unresponsive/Unconscious/Arrest Patient with NO SIGNS OF LIFE

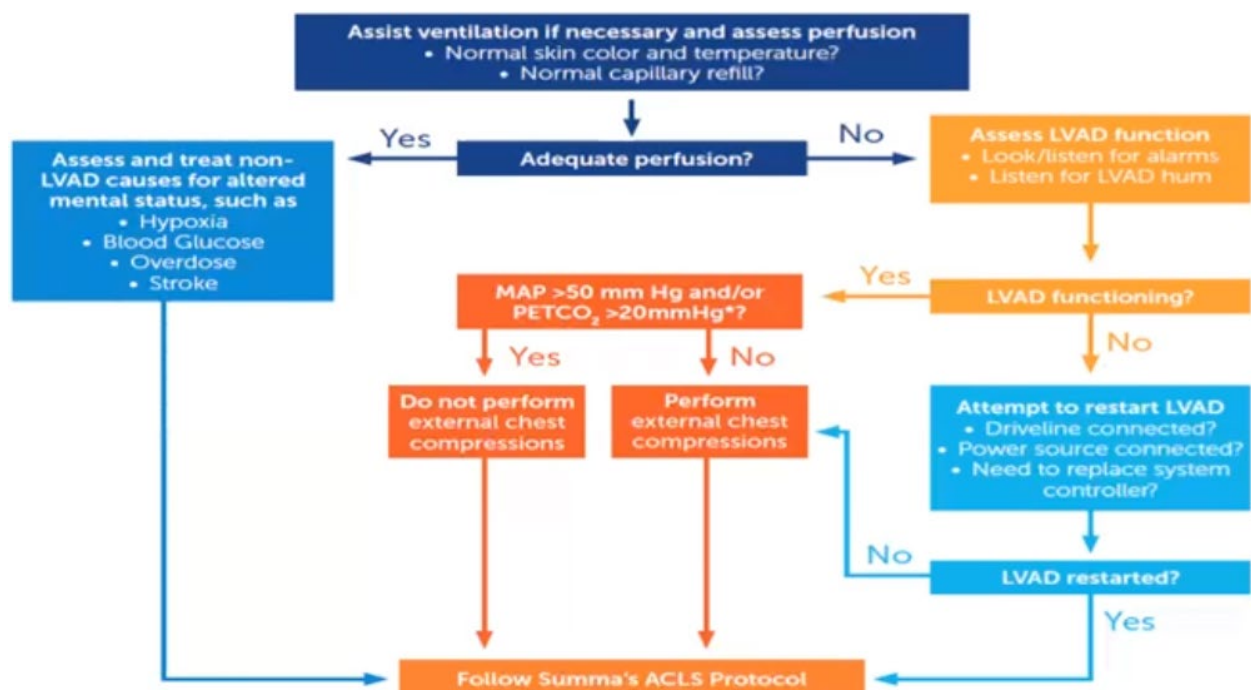
Look for DNR-CCO or DNR-CCA? Do they have a DNI order? Treat Accordingly

EMT-B:

- Start bag valve mask ventilation immediately
- Apply ETCO₂, obtain MAP, and auscultate for the pump's normal hum sound
 - ETCO₂ < 20 mmHg or MAP < 50 mmHg or no pump sounds are indications to start CPR in the unresponsive LVAD patient
 - Rapidly assess for reversible causes of pump failure such as a disconnected driveline or power source (see QR links below for device specific guide)
- Check SaO₂, glucose, consider overdose, stroke, sepsis, and other pathology which are significantly more common than pump failure in the unconscious LVAD patient
- **Contact patient's LVAD coordinator**
- Talk to the family – they have been trained extensively on the device and can provide guidance, recent history, **and contact for their LVAD coordinator.**
- Bring the patient's "backup bag" to the ED – should contain at least 2 extra batteries and a spare control unit. If the patient has a home battery charger dock, bring that too

A-EMT & PARAMEDIC:

- Consider rapid placement of supraglottic airway (SGA) or endotracheal tube (ETT)
- Perform EMT-B interventions and follow standard ACLS, **LVADs can be shocked**



Responsive patient WITH signs of life:

EMT-B:

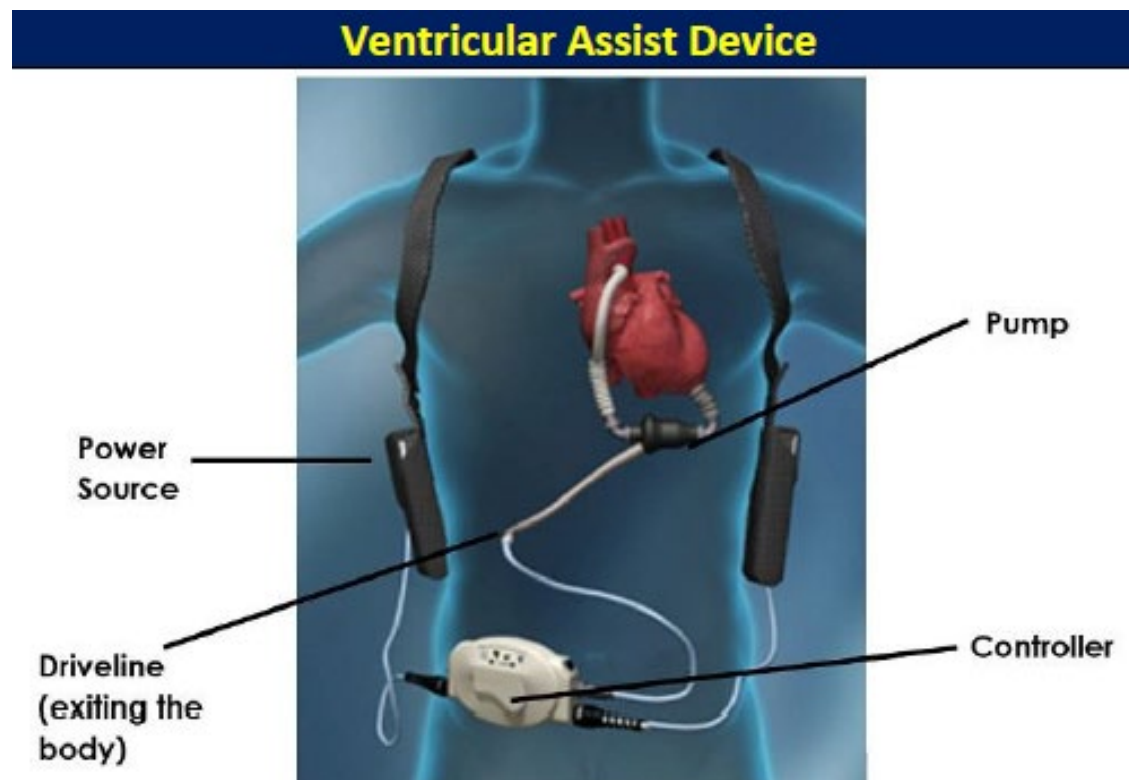
- Auscultate the chest and listen for continuous whirring/hum sound
- Use a manual blood pressure cuff first to calculate the MAP
Summa Health Cardiology's goal MAP is 65-85 mmHg
- If you cannot obtain MAP manually, next try measuring MAP with the cardiac monitor
- Write down the following information from the LVAD control unit's display:
 - Pulsatility index
 - Power output (watts)
 - Flow rate (L/min)
 - Speed (RPM)
 - **It is not possible to accidentally alter the pump's settings by obtaining this information from the control unit in the field, so do not hesitate to record these numbers**
- Talk to the patient's family – they have been trained extensively on the device and can provide guidance and recent history
- Bring the patient's "backup bag" to the ED – should contain at least 2 extra batteries and a spare control unit. If the patient has a home battery charger dock, bring that too

A-EMT & PARAMEDIC:

- MAP < 65 mmHg is indicative of poor perfusion. Patients may also display pale or mottled skin, delayed capillary refill (remember, no palpable pulse), dry mouth, confusion, or ETCO₂ < 35 mmHg
- If signs of poor perfusion, administer normal saline bolus 500 mL IV/IO. May repeat 2 more times for a total of 1500 mL. Hold if pulmonary edema present
- Act on guidance from the LVAD Coordinator. If unable to reach the LVAD Coordinator, call Online Medical Control (OLMC) instead

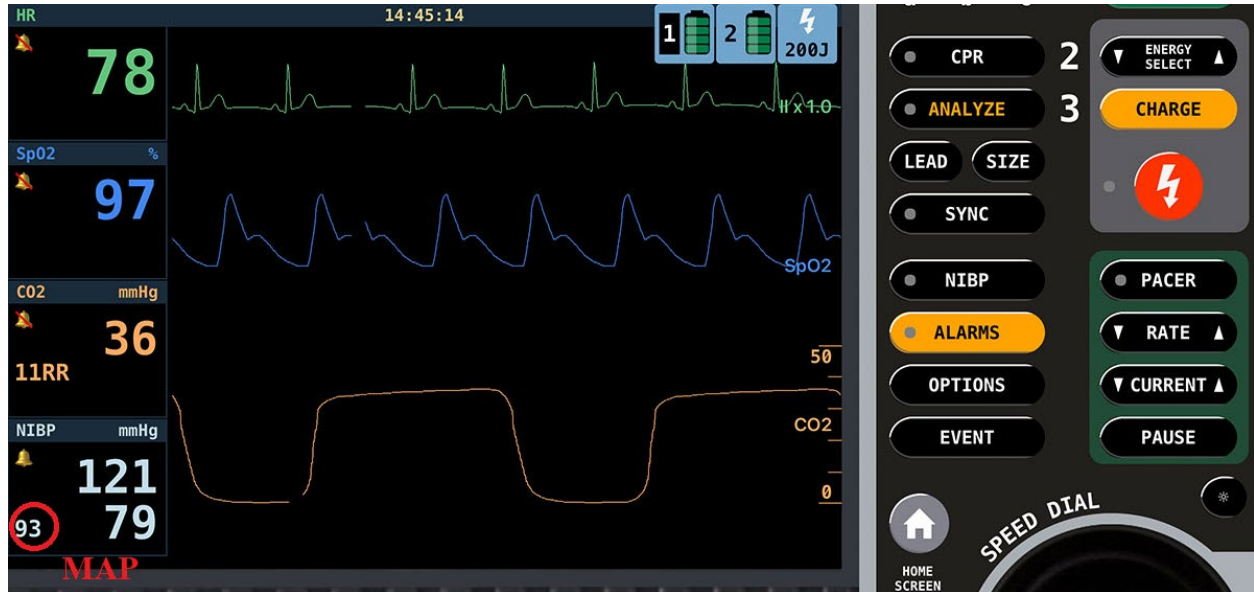
LVAD (Left Ventricular Assist Device) General Care

- These devices are very expensive and come with 24/7 on-call LVAD coordinators. Unless the patient is in arrest or unconscious, call the number of the LVAD coordinator (will either be printed on the device or family/patient will know it by heart); inform them of what's going on, then write down and act on their advice prior to transport
- **LVAD = Left Ventricular Assist Device** – a surgically implanted battery-powered pump for heart failure. Can be a bridge to a heart transplant or permanent “destination therapy” for patients with severe/end-stage CHF
- An LVAD assists the heart's left ventricle (LV) in delivering blood to the body. It consists of external batteries and control unit, and an internally implanted tube that allows blood to travel from the LV → Pump → Outside the heart → Aorta → Body



- If the device is working, you will likely **NOT** feel a pulse. Additionally, SaO2 sensor may not read and EKG may suffer electromagnetic interference (move the leads).
- Auscultation of heart sounds should reveal a steady hum/whine noise. **Hum = Good!**
- **Talk to the patient's family** – they have been trained extensively on the device and can provide guidance and recent history
- Obtaining a BP is difficult. When evaluating an LVAD, the Mean Arterial Pressure (MAP) matters much more than the BPsyst or BPdias. For an LVAD, the **IDEAL MAP is > 65 mmHg**

- To obtain the MAP, use a *manual* blood pressure cuff *first* and listen with your stethoscope (“old-school” method). The heart monitor’s automatic cuff may not be reliable on these patients. When listening, the first sound that you hear is the MAP. If you cannot hear the MAP manually, attempt to use the monitor’s automatic cuff. The MAP is reported in parentheses (e.g. “122/67 (85)” means the MAP is 85 mmHg) or beside the BP on the monitor’s display. The systolic and diastolic numbers may be non-sensical and should not be trusted, but if displayed, the MAP is often correct



- LVADs love volume! They are very preload-dependent and poor perfusion can be corrected with a fluid bolus (see above)
- Patients will be on blood thinners and will be vulnerable to GI bleeds, traumatic brain bleeds, hemorrhagic strokes, hemoptysis, etc. Standard protocols still apply
- Transport conscious patients with LVADs to an LVAD-capable facility (ideally where it was installed). If unresponsive or in arrest, transport to geographically closest facility
- Figure out what kind of device the patient has – there’s often a sticker on the control unit:

Green = Heartmate III

Orange = Heartmate II

Blue = Heartware

Purple = Jarvik 2000

Pink = Freedom Drive Total Artificial Heart

When to start CPR?

- **Starting CPR in the LVAD patient can be a difficult decision**
- Unconscious LVAD patients may be mistaken for LVAD patients in arrest (i.e. unresponsive and no palpable pulse)
- **Device failure is rare in LVAD patients.** Check SaO₂, glucose, consider overdose, stroke, sepsis, and other pathology which are significantly more common
- It is possible that CPR will dislodge the device and lead to death by exsanguination. **However, if an LVAD patient has NO signs of life (e.g. motionless, unconscious, apneic, or agonal respirations), AND if there is device failure (e.g. no hum) OR insufficient bodily perfusion from the LVAD (e.g. ETCO₂ < 20 mmHg, MAP < 50 mmHg), the patient requires chest compressions or they will almost certainly die**
- You may attempt to rapidly trouble-shoot simple causes of device malfunction:
 - re-connect drive-line
 - reconnect power-source or backup battery
 - replace system controller (family will be extensively trained and know where the backup is)
- When in doubt, be biased toward action and start CPR
- During CPR, use manual compressions. No mechanical compression devices on LVAD patients
- LVADs are pumps; they do not treat coronary artery disease or arrhythmias. **12-lead EKGs, cardiac monitors, pacing, synchronized cardioversion and defibrillation all still work on LVAD patients.** Follow appropriate protocols for STEMI and dysrhythmias

Malfunctioning Device

- Know which device you are dealing with first and have an emergency guide ready

MCSEMG Emergency Guide App



- If you suspect device is malfunctioning, immediately contact LVAD Coordinator to troubleshoot device