

L-VAD

02/04/2020

A left ventricular assist device (LVAD) is an implantable mechanical pump that helps pump blood from the lower left chamber of a heart (left ventricle) to the ascending aorta and thus the rest of the body. It is a device that is implanted in an advanced heart failure patient who meets specific criteria. It is the best treatment for heart failure, but not a cure for it. Oftentimes, these patients are on a heart transplant list and the LVAD is a bridge to transplant. Other times, patients don't qualify for transplant for various reasons, and the LVAD will be in the patient until s/he dies. Patients with LVAD are dependent on these pumps for survival.

These devices are implanted through open heart surgery. A driveline exits the pump and houses the electrical wires. It is tunneled through the abdomen and comes out at a sterile exit site. Do NOT remove this dressing. This driveline plugs into an external controller that enables patients to look at VAD numbers, alarms, power level etc. The controller and pump are powered by batteries during the daytime or a wall unit at night. Adequate power to the controller is vital to ensure the pump continues to operate. Loss of power to the patient can stop the pump and kill the patient. These pumps are all pre-load (volume) dependent and afterload (blood pressure sensitive). Lack of hydration or low blood volume can lead to low flows on the pump. High/low blood pressure can prevent adequate flow of blood through the pump.

There are three devices on the market: HeartMate 2, HeartMate 3, and Heartware.

~~Currently~~ There are three LVAD centers. **OHSU closed in 2018 but may reopen.**

OHSU (Portland): 1-503-494-9000

Providence St. Vincent (Portland): 971-678-4042

Kaiser (Clackamas): 503-449-4672

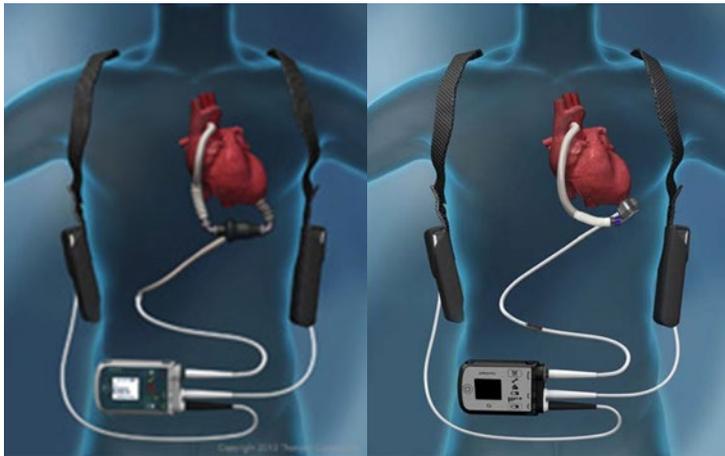
Components

- **Pump**
- **Controller**
- **Driveline**
- **Batteries and Battery Clips (for HeartMate only)**
- **Wall unit for power**
- **Battery charger**

*****ALWAYS ENSURE PATIENT TRANSPORTS WITH THEIR BACK UP BAG AND ADEQUATE EXTRA BATTERIES. ENSURE COMPONENTS ARE SECURE BEFORE TRANSPORT TO AVOID DRIVELINE PULLS*****

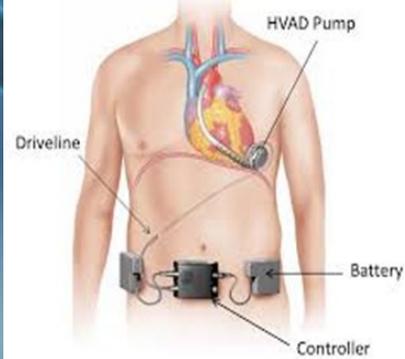
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HeartMate 2

HeartMate 3



HeartWare

NOTES AND PRECAUTIONS

1. Blood pressure may be difficult to obtain on these patients. If a pulse is palpable, you may use a regular automated cuff. If no pulse is palpable, you can only obtain blood pressure via Doppler. The mean arterial pressure goal is 60-90. Pulse pressure may be narrow.
2. Common presenting non-pump related complications including bleeding (Gastrointestinal bleeding is the most common), infection, and stroke.
3. All ACLS drugs and defibrillation may be administered. Patient's LVAD does not need to be unplugged to defibrillate or pace the patient. Leave everything attached. Most patients do have Implanted Cardiac Defibrillators (ICD) and pacemakers.
4. If the patient is in sustained VT or VF, shock the patient would be indicated. The patient in this rhythm may still be alert/oriented due to the LVAD. However, prolonged VT and VF will deteriorate the right ventricle and increase ischemia, which effects long term LVAD prognosis.
5. The LVAD does not affect the patient's EKG.
6. Any mode of transportation is permissible, these patients can fly.
7. Be sure to bring all the patient's equipment with them on transport.
8. Ensure the patient has adequate back up power with them.
 - Ensure 2 batteries are always connected to patient,
 - NEVER disconnect both batteries at the same time.
9. For any device related alarms and complications, utilize the LVAD coordinator to talk EMS through any LVAD emergency

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	<p>procedures such as a controller exchange.</p> <p>10. Please call the patient's LVAD center if the patient/family has not already reached out to the on-call LVAD coordinator.</p>
<p>SPECIFIC INFORMATION NEEDED</p>	<ol style="list-style-type: none"> 1. Listen to concerns from the patient and family members who have received device specific training. Allow them to manage the device. Bring the trained caregiver with the patient during transport if possible. Speak with the patient's LVAD coordinator to rule out any issues with the pump and help determine treatment plan. 2. Past Medical History. These patients generally have other co-morbid factors which may be the cause for acute medical care. Don't overlook these factors. 3. Device Information. <ul style="list-style-type: none"> • It is important to bring all components and information about the device, as well as the trained caregiver responsible, with the patient to the hospital. • Ensure the patient brings their back up bag, which includes a spare controller and at least 2 fully charged batteries. For patients outside of Portland, encourage patient/family to bring all batteries.
<p>PHYSICAL FINDINGS</p>	<ol style="list-style-type: none"> 1. Altered cardiac physiology. <ul style="list-style-type: none"> • Due to the VAD, this complicates patient assessment while limiting the effectiveness of normal tools. 2. Talk to the patient to assess mentation and general status. 3. Check blood glucose. 4. Most LVADs are continuous flow devices; HeartMate 3 has pulsatility every 2 seconds, so you may pick up on an artificial pulse of 30bpm. Most patients may NOT have a palpable pulse. Accordingly, <ul style="list-style-type: none"> • SpO₂ may not be accurate. If they don't appear short of breath, no need to treat low SpO₂ readings. • If the patient has a palpable pulse, you can obtain a standard blood pressure cuff reading. If the patient doesn't have a palpable pulse, blood pressure can only be assessed by Doppler. 5. Check all VAD connections to ensure adequate power and connection to the controller. 6. For HeartMate 3 patients, ensure the external modular portion of the driveline is connected (no yellow line visible). 7. Listen for "hum" for HeartMate 2 and HeartWare patients, or

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	<p>“pulsation” for Heartmate 3 patients, in epigastric region to verify device is on and functioning properly.</p> <ol style="list-style-type: none">8. Common complications include: bleeding (most notably GI bleeding), stroke, infection, and pump thrombosis.9. Apply ET_{CO}₂ for monitoring of cardiorespiratory status.<ul style="list-style-type: none">• ET_{CO}₂ < 20 verifies poor perfusion, perform CPR.• ET_{CO}₂ > 20 verifies pump is perfusing adequately, do not perform CPR.
TREATMENT	<ol style="list-style-type: none">1. These patients still have heart failure, be hesitant about pushing IV fluids unless showing clear signs of hypovolemia or hypotension are present.2. Provide respiratory and ventilator assistance per standard.3. Provide CPR ONLY if one or a more of these conditions are met: MAP < 50, Et_{CO}₂<20, pump has stopped working and replacing the controller did not restart it. See flowsheet for more information.4. Arrhythmias:<ul style="list-style-type: none">• Many of these patients have chronic runs of VT and intermittent VF.• Majority of VAD patients have Implanted Cardiac Defibrillators (ICD) /Pacemakers. They may have maxed out the shocks from the ICD before you arrive, so shock if indicated by rhythm.• Always treat sustained VF with appropriate ACLS protocols, even if the patient is awake and alert. Prolonged lack of treatment can increase ischemia and worsen right ventricular function for the patient, which shortens lifespan and increases complications.• You may administer any anti-arrhythmic per protocol• No need to disconnect any VAD component before defibrillation or pacing. You will not harm the device.• Consider sedation prior to defibrillation.
PRECAUTIONS	<p>Always transport ALL components of the device with the patient. Ensure the driveline and controller are secure before moving a patient. Driveline pulls can lead to driveline exit site infection, the #1 cause of morbidity and mortality in this patient population.</p>

Taking Blood Pressures on LVADs

