

LEFT VENTRICULAR ASSIST DEVICE (LVAD)

A. Assessing and Treating an LVAD Patient:

1. Recognize that you have a patient with an LVAD.
2. Determine if your patient has an LVAD problem, an unrelated illness, or injury.
3. A completely stable patient may have **NO** palpable pulse or measurable blood pressure.
4. Mental status and skin color must be used to determine patient stability.
5. CPR should rarely be performed on an LVAD patient.
6. Patients with an LVAD should almost never be pronounced dead at the scene.
7. Call the Emergency Contact Number located on the LVAD control unit.

B. Overview of an LVAD:

The LVAD or Left Ventricular Assist Device is a mechanical device that takes over some or all of the pumping function of the heart's left ventricle. This device is used for patients of any age or gender with advanced heart failure who would not otherwise survive without this device.

Some LVAD patients will have an LVAD while they are waiting for a heart transplant (called Bridge-to-Transplant). Other LVAD patients, who are not eligible for a heart transplant for some reason, will live with the device for the rest of their lives (called Destination Therapy or Lifetime use).

1. How the Heart Works versus How LVADs Work:

The normal pumping function of the heart is achieved by the contraction of the left ventricular muscle which pushes a bolus of blood forward in the cardiovascular system with each contraction. This contraction is what we feel when checking a pulse, and what we hear when taking a blood pressure.

If the heart is not contracting, blood is not moving forward in the system, and we do not feel or hear a pulse. The LVAD, in contrast, flows constantly and, therefore, creates no "pulse" to feel or hear.

The LVAD is a tube that is about one (1) inch in diameter with a pump in the middle. One end of the tube (inflow) is surgically inserted into the left ventricle,

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and the other end (outflow) is sewn into the aorta, just above where it exits the heart.

The pump on the LVAD spins constantly. The right side of the heart still pushes blood through the lungs and back to the left ventricle, but then the LVAD pump pulls the blood out of the left ventricle and pumps it out to the body, taking over most or all of the failed pumping action of the left ventricle.

NOTE: The important part to EMS providers is that the pump is a constant flow pump. There is no rhythmic pumping as there is with the ventricle, and therefore there is little to no pulse. This means you can have a perfectly stable and healthy looking person who has no palpable pulse and whom you may or may not be able to take a blood pressure.

C. Assessing the LVAD Patient:

1. Recognize you have an LVAD patient.
 - a. The LVAD patient has a control unit attached to their waist or in a shoulder bag.
 - b. The control unit will be attached to batteries mounted to the belt, in shoulder holsters, or in a shoulder bag. At home, it could be attached to a long cord that connects to a large power unit.
2. Decide if you have a patient with an LVAD problem or a patient with a medical problem who just happens to have an LVAD. Patients with LVADS will have all the same illnesses and injuries as any other patient you see. Their LVAD may have nothing to do with the reason you were called.
3. LOOK:
 - a. Alarms on the control unit will most likely indicate an LVAD problem. Follow resource guides with the patient to trouble shoot.
 - b. Skin color and mental status are the most reliable indicators of patient stability for the LVAD patient.
4. LISTEN:
 - a. Listen over the LVAD pump location to make sure you can hear it running. This will be just to the left of the epigastrium, immediately below the base of the heart.

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- b. The patient and their family are experts on this device. Listen to what they have to say about any problems with the LVAD.
5. FEEL:
 - a. Feel the control unit. A hot control unit indicates the pump is working harder than it should and often indicates a pump problem such as a thrombosis (clot) in the pump.
 - b. The use of pulse and blood pressure to assess stability can be unreliable in an LVAD patient, even if they are very stable.
6. VITALS:
 - a. Pulse: Generally you will be unable to feel a pulse.
 - b. Blood Pressure: You may or may not be able to obtain a BP. Standard readings are unreliable and may vary from attempt to attempt.
 - c. Pulse Oximetry: Readings seem to be fairly accurate and consistent, according to data, despite the manufacturer stating that pulse oximetry often does not work.
 - d. Quantitative Continuous Waveform Capnography: This should remain accurate as it relies on respiration, not pulse.
 - e. Temperature: Infection and sepsis are common. Check temperature!

NOTE: *LVAD patients can remain stable and experience a range of ECG rhythms that could be dangerous or fatal in another patient. Remember blood sugar and stroke assessment, particularly for an altered mental status.*

D. Treating the LVAD Patient:

1. Generally, treatments for an LVAD patient will follow the current WVOEMS Protocols. However, there are a few special considerations to keep in mind. Do not let the LVAD distract you from treating the patient!
2. The best medical resource available to you for LVAD related problems is the patient's VAD coordinator. The patient will have a contact sheet for the VAD coordinator with them at all times. **Contact the VAD coordinator as soon as possible.**

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3. If you are assisting patient to change batteries or power source, **never** remove both batteries at the same time. This will cause the LVAD pump to immediately stop.
4. Sepsis and stroke are leading causes of death for LVAD patients.
5. Treating ECG changes:
 - a. Many LVAD patients already have an implanted defibrillator and/or a pacemaker in place.
 - b. The continuous flow of the LVAD means changes in ECG rhythms, including atrial fibrillation, SVT, ventricular tachycardia, and even ventricular fibrillation may have minimal to no short-term effect on the cardiac output and stability. Treat ECG changes according to protocol.
 - c. Use of external pacing or defibrillation is unchanged for LVAD patients.
 - d. Use of ACLS education is unchanged for LVAD patients. Follow standard AHA and protocol guidelines, as appropriate.
6. LVAD patients are always on anticoagulant medications. Even minor appearing chest or abdominal trauma, such as a seatbelt mark, could be hiding a very serious injury.
7. LVAD manufacturers currently recommend against CPR, especially if there is any evidence the pump is still functioning. There currently are no published studies or published consensus statements regarding whether and under what circumstances to perform CPR on a deceased LVAD patient. LVAD devices are not all the same and, if at all possible, clinical decisions regarding LVADs should be made in consultation with the patient's VAD coordinator. The decision to perform CPR should be made based upon best clinical judgment of the provider in consultation with the patient's family and the **VAD coordinators or Medical Command**. In any event, CPR should be initiated only where:
 - a. You have confirmed the pump has stopped (by listening for pump sounds) **AND** all trouble shooting efforts to restart it (connect wires, batteries, new control unit, etc.) have failed, **AND**;
 - b. The patient is unconscious, unresponsive, and has no detectable signs of life (no pulse, no blood pressure, no pulse oximetry reading or wave form capnography reading, **AND**;

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- c. The patient does not have a valid DNR in place.
- 8. Patients should not be pronounced dead if LVAD continues to function, unless they have obvious factors of death such as decapitation, rigor mortis, or dependent lividity.
- E. Transporting the LVAD Patient:
 - 1. Patients without an LVAD problem should be transported to the closest appropriate hospital for their condition.
 - 2. When in doubt, transport to the closest hospital to access more transport resources and support.
 - 3. Always bring the patient's resource bag with you. It should have spare batteries, possibly a spare control unit, contact sheets for the VAD coordinator, and directions for equipment and system alarms.
 - 4. Always bring spare batteries for the LVAD with the patient, even if it is not an LVAD problem. Fresh batteries generally last 3 - 5 hours. Dead batteries mean a dead patient.
 - 5. If you have a long transport or expect that the patient may be away from home for more than 4 - 5 hours, then try and bring the patient's power base unit.
 - 6. Use your patient and their family as a resource. They are experts about this device and can help you assist the patient.

Recommended Unit Resource: Print EMS Guide for Mechanical Circulatory Support and place in all ambulances (20 pages). This guide has excellent information and "trouble shooting" guidance for the five (5) LVAD devices that EMS providers may encounter. Access the resource guide at: <http://www.mylvad.com/assets/>