

An increasing number of individuals are discharged home implanted with a left ventricular assist device or left ventricular assist system (LVAD/LVAS) to sustain life while either waiting for a heart transplant, treatment for congestive heart failure, or as destination therapy. The most common device being used in our community known to REMAC is the HeartMate II left ventricular assist system. This advisory shall provide guidance to the EMS provider when encountering a patient with such device regardless of whether the emergency is due to the device or not.

An LVAD/LVAS is a surgically implanted, battery-powered pump that helps the left ventricle pump adequate amounts of blood to the body. The LVAD/LVAS is implanted in the upper abdomen and connected to a power supply located outside the body. Blood is sent through a tube in the left ventricle into the LVAD/LVAS, which pumps the blood through another tube into the aorta and throughout the body. An LVAD/LVAS can be implanted in people who are candidates for a heart transplant as a "bridge to transplant." Some patients may experience improved heart function while the LVAD/LVAS is in place, which may make the transplant unnecessary. In patients who are ineligible for a heart transplant, the LVAD can be a "destination therapy," that is, the LVAD/LVAS is implanted permanently.

A patient may request emergency medical services for a problem that may or may not be related to the device, or cardiac in nature. The patient and family are likely to be very well trained in responding to emergencies related to the device. Defer to the expertise of the patient and family when possible. This material is not a substitute for additional education from appropriately trained individuals.

Warnings and Precautions:

- Patient will not have a palpable pulse or measurable blood pressure even when the pump is providing adequate circulation.
- An LVAD/LVAS patient's ECG heart rate will differ from the pulse rate since the LVAD/LVAS is not synchronized with the native heart rate.
- LVAD/LVAS patients should be assessed for signs of circulation as an indication of adequate perfusion (capillary refill, skin color, warmth).
- Check with family for DNR or MOLST instructions.
- The use of automated blood pressure monitoring devices may not yield accurate data. Manual auscultation with a Doppler (if available) to assess blood pressure is recommended.
- Keep the Power Module (PM)/Power Base Unit (PBU) away from water. If the PM/PBU comes in contact with water, the pump may stop, or the patient may receive a serious electrical shock.
- Connect the device to a properly tested, grounded and dedicated AC outlet when necessary. Do not use an adapter for an ungrounded wall outlet or power strip.
- Do not connect to an outlet controlled by a wall switch.
- In the event that the LVAD/LVAS stops operating, attempt to restore pump function immediately. In the event that the LVAD/LVAS stops operating and blood is stagnant in the pump for more than a few minutes, there is risk for stroke or thromboembolism.
- Disconnecting both System Controller power leads at the same time will result in a loss of pump function. One System Controller power lead must be connected to a power source at all times.
- Disconnecting the percutaneous (skin) lead from the Controller System will result in loss of pump function. The System controller must be reconnected as quickly as possible to resume pump function.

Continued.

Warnings and Precautions – continued:

- Do not force connections. You can break a pin which will interfere with proper functioning of the device.
- At least one set of fully-charged spare batteries and back System Controller should remain with the patient at all times.
- Do not disconnect controller from patient unless instructed by Medical Control.
- For patients with LVAD/LVAS requiring CPAP by protocol, understand this is a relative contraindication. Our regional center does not believe this is a contra-indication, caution should be observed and Medical Control should be contacted.

Handling Emergencies related to the LVAD/LVAS:

An emergency condition exists whenever the device is potentially or actually unable to pump an adequate amount of blood. These conditions are signified by a HAZARD ALARM symbol and CONTINUOUS AUDIO TONE. Always defer to the patient and family if the System Controller needs to be replaced or any other emergency involving the device. Contact Medical Control if family or patient is unable to assist.

There is no back up pump. In the event that LVAD/LVAS stops operating, all attempts must be made to restore function immediately by:

- Checking the percutaneous lead connection to the System Controller;
- Switch power source, and/or
- Replacing the System Controller.

Emergency Scenarios

- A. LVAD/LVAS Failure – Continuous Alarm (Red Heart) – LVAD/LVAS may have stopped:**
- The patient's own heart is intact and may provide minimal cardiac output while the LVAD/LVAS is stopped.
 - **ALS providers should place the patient on a cardiac monitor and fully assess the patient. Medical Control should be contacted for treatment orders and to assist with a destination decision.**
 - **BLS providers should request an ALS intercept, transport should not be delayed. Medical Control should be contacted for destination decision.**
- B. LVAD/LVAS Working – “Low Flow Hazard” alarm - ECG Abnormal**
- The HeartMate II LVAD is dependent on right ventricular function. With an arrhythmia a decreased functioning right ventricle will affect LVAD /LVAS flows. The LVAD/LVAS may be able to maintain flow high enough to keep patient from going into shock.
 - **ALS providers should place the patient on a cardiac monitor and treat the underlying rhythm. Medical Control should be contacted for additional treatment orders and to assist with a destination decision.**
 - **BLS providers should request an ALS intercept, transport should not be delayed. Medical Control should be contacted for destination decision.**

Continued.

Emergency Scenarios – continued:

C. LVAD /LVAS Working - “Low Flow Hazard” alarm - ECG Normal

- Suspect internal bleeding (hypovolemia).
- **ALS providers should initiate care for hypovolemia and contact Medical Control for additional orders for volume replacement and for destination decision.**
- **BLS providers should request an ALS intercept, transport should not be delayed. Medical Control should be contacted for destination decision.**

BLS APPROACH: If the patient is unconscious and a pulse and respirations cannot be detected, the BLS provider **should not initiate chest compressions.** The AED should be applied and be allowed to analyze the underlying rhythm. If a shock is indicated the provider should defibrillate. The provider must contact Medical Control for further instructions.

ALS APPROACH: If the patient is unconscious and a pulse and respirations cannot be detected, the ALS provider **should not initiate chest compressions.** The cardiac monitor should be applied and the underlying rhythm analyzed. If a shock is indicated the provider should defibrillate. The provider must contact Medical Control for further instructions.

Emergencies unrelated to the LVAD/LVAS:

An emergency condition unrelated to the LVAD/LVAS should be handled according to the currently accepted protocol to manage that situation. However, all precautions and warnings will be followed.

Transport Decision:

When an emergency condition exists, unless the patient is in extremis, the patient should be transported to Stony Brook University Hospital (LVAD Center) if it is no more than 20 minutes past the closest hospital. Medical Control may be contacted for assistance with a transportation destination decision.

END OF LVAD ADVISORY