



## EMS System for Metropolitan Oklahoma City and Tulsa 2024 Medical Control Board Treatment Protocols

Approved 11/08/23, Effective 1/15/24, replaces all prior versions



EMS SECTION

### 5M – VENTRICULAR ASSIST DEVICE (VAD) MANAGEMENT ADULT

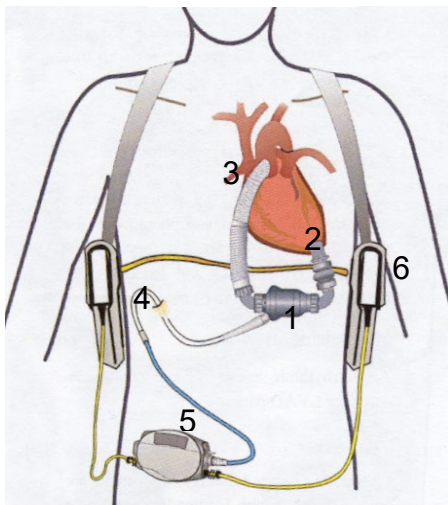
EMERGENCY MEDICAL DISPATCHER
EMERGENCY MEDICAL RESPONDER
EMT
EMT-INTERMEDIATE 85
ADVANCED EMT
PARAMEDIC

A **Ventricular Assist Device**, or **VAD**, is a mechanical device used to support circulation in a patient with significant cardiac ventricular dysfunction. The VAD, most commonly, is used to support the left side of the heart and provide extra cardiac output to the body. This device is called an LVAD or left ventricular assist device. An LVAD can be placed for short term use to bridge patients until they can receive a heart transplant (bridge to transplant) or long term use for those patients that are not candidates for heart transplant (destination therapy). A destination therapy patient will live for months to years at home with the device in place. A VAD is not a total artificial heart (TAH), which completely supports circulation in a patient whose native heart has been removed.

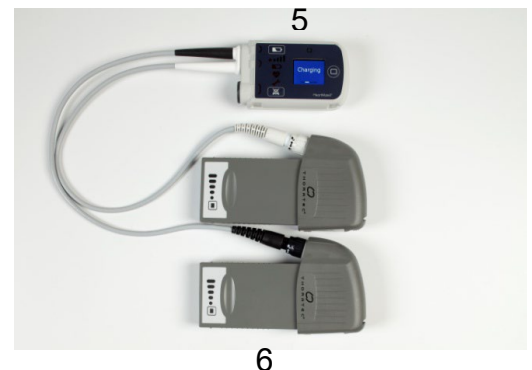
VADs can assist either the right (RVAD) or left (LVAD) ventricle, or both at once (BiVAD). The choice of device depends on underlying heart disease and the function of the right side of the heart. The most common type of device used is an LVAD.

In Oklahoma the most common VAD in use is the HeartMate® II LVAD. The Heart Mate® II uses a continuous flow pumping action to produce forward circulation. Because of the continuous flow nature of the pump, a patient with a HeartMate II® may not have a palpable pulse even though they are alive. The lack of pulse can also make it difficult, or impossible to obtain a blood pressure.

HeartMate II®



- 1) Implanted Pump
- 2) Inflow Cannula
- 3) Outflow Conduit
- 4) Percutaneous Cable
- 5) Controller
- 6) Wearable Battery





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### PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.



#### Hospital Resources in Oklahoma for Patients with a VAD and TAH:

Integris Baptist Medical Center in Oklahoma City is the only VAD/TAH surgical implant site in Oklahoma at the time of this protocol's release.

Upon arrival to the scene, contact a VAD coordinator for assistance with VAD/TAH related questions. An RN coordinator is available 24-hours a day.

**24-hour Integris Baptist Medical Center VAD/TAH phone number: 405-713-7040**

#### Cardiac Arrest Care in Patients with a VAD:

Follow same BLS and ACLS protocols (including defibrillation and cardioversion).

Perform chest compressions only after all other treatments have been applied.

Because of the assistance from the LVAD, patients may not be symptomatic with ventricular arrhythmias. Be sure to assess the patient first prior to intervention.

The LVAD does NOT interfere with the patient's heart rhythm. The native rhythm will appear on the monitor.

#### Non-Cardiac Arrest Care in Patients with a VAD:

Emergencies in a patient with a VAD can arise due to:

- Problems directly related to the VAD:
  - ⊖ Power Failure
  - ⊖ Suspected mechanical malfunctions characterized by frequent alarms emitting from the system controller, an increase or decrease in flow rates
- **Focus on switching out the system controller. (see directions below)**
- Illness/Injury not related to the VAD - treat per applicable protocol. (i.e. stroke, bleeding, etc.)

#### Power Failure of a VAD - EMS Assessment & Care:

- A patient experiencing a power failure with their VAD system will present with signs and symptoms of circulatory collapse (dyspnea, hypoxemia, hypotension, dysrhythmias, altered mental status).
- Focus on restoring power to the VAD by switching batteries in the battery pack, connecting to an AC power source, or switching out the system controller.



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### PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.

#### TROUBLESHOOTING: Heart Mate® II

##### When the Pump Has Stopped

- Check the connections between the controller and the pump and the power source and fix any loose connections.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair.
- If pump does not restart, change controllers.

#### Changing Controllers:



1. To insert the driveline, slide the safety tab back to unlock and expose the red button
2. Align the arrow on the controller to the arrow on the driveline cable until they connect, and firmly insert the driveline until it snaps into place
3. Be sure to slide the safety tab back over the red button, locking the driveline in place.
4. Tug gently on the metal portion of the driveline to ensure it is fully engaged.



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## PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.



 EMS SECTION

### Alarms: Emergency Procedures

#### Low Battery Alarm



The red low battery symbol illuminates when less than 5 minutes of battery power remain (applicable only during 14 Volt Lithium-Ion battery-powered operation).

This is a **Hazard** alarm. When the red battery symbol illuminates, immediately replace the depleted batteries with a fully-charged pair, or switch to the Power Module.

#### Yellow Wrench Alarm



The yellow wrench symbol illuminates when the System Controller detects a mechanical, electrical, or software issue with the system.

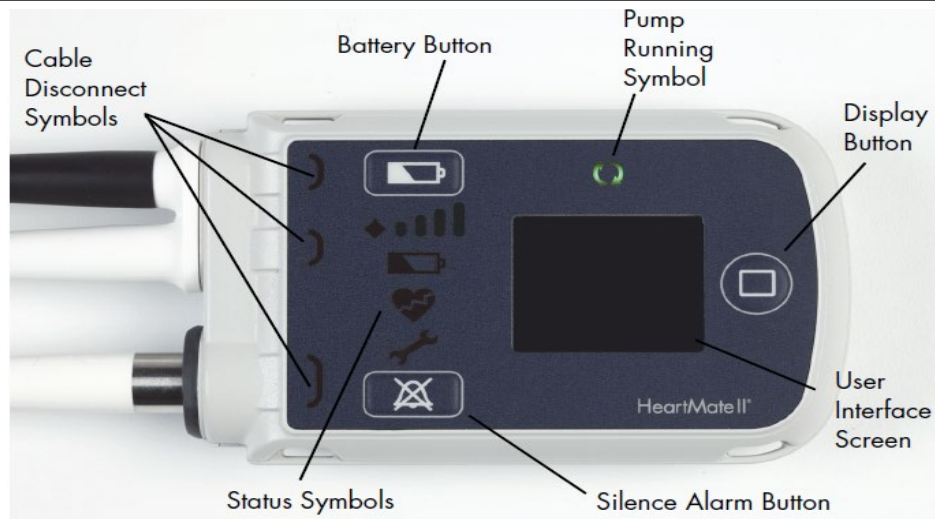
This is an **Advisory** alarm. When the yellow wrench illuminates, check the screen for troubleshooting instructions.

#### Red Heart Alarm



The red heart symbol illuminates when the System Controller detects a problem that could cause serious injury or death.

This is a **Hazard** alarm. When the red heart illuminates, check the screen for instructions and take immediate action to resolve the problem.





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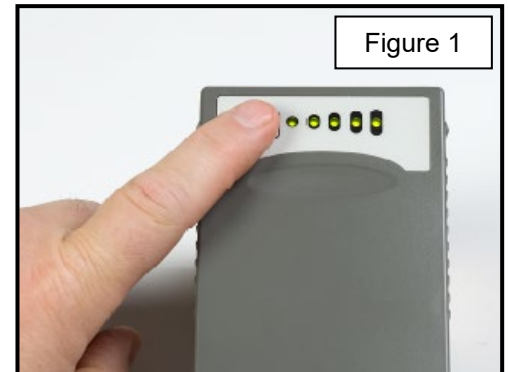


### PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.

#### TROUBLESHOOTING: Heart Mate® II

##### Changing Batteries

1. Warning: At least one power lead must be connected to a power source at all times.
2. **DO NOT remove both batteries at the same time or the pump will stop.**
3. Obtain two charged batteries from patient's black bag.
4. Check the charge of the battery by pressing the battery gauge button on the end and top of the battery. (Figure 1)
5. Remove **only one battery** from the clip by pressing the tab on the battery clip to release the battery.
6. Controller will start beeping and flashing green lights.
7. Replace with new fully charged battery by lining up the arrows on the battery and the clip and pressing until you hear a "click."
8. Repeat previous steps with the second battery and battery clip. Remove only one battery from the clip by pressing the tab on the battery clip to release the battery.





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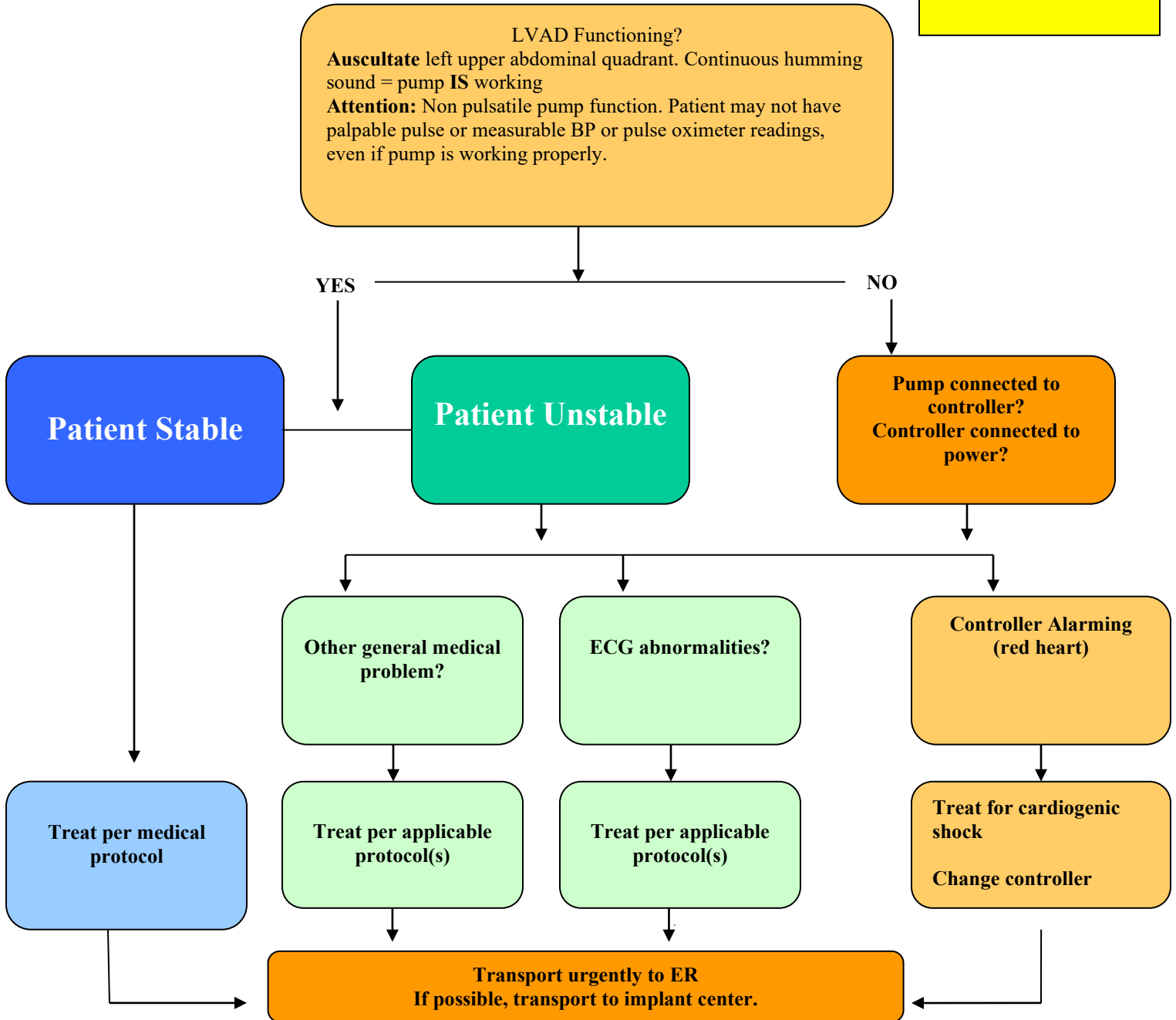
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## PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.



# HeartMate II® LVAD Patient Assessment Protocol

**Always call  
405-713-7040  
for an LVAD  
Coordinator.  
Press Option #1**



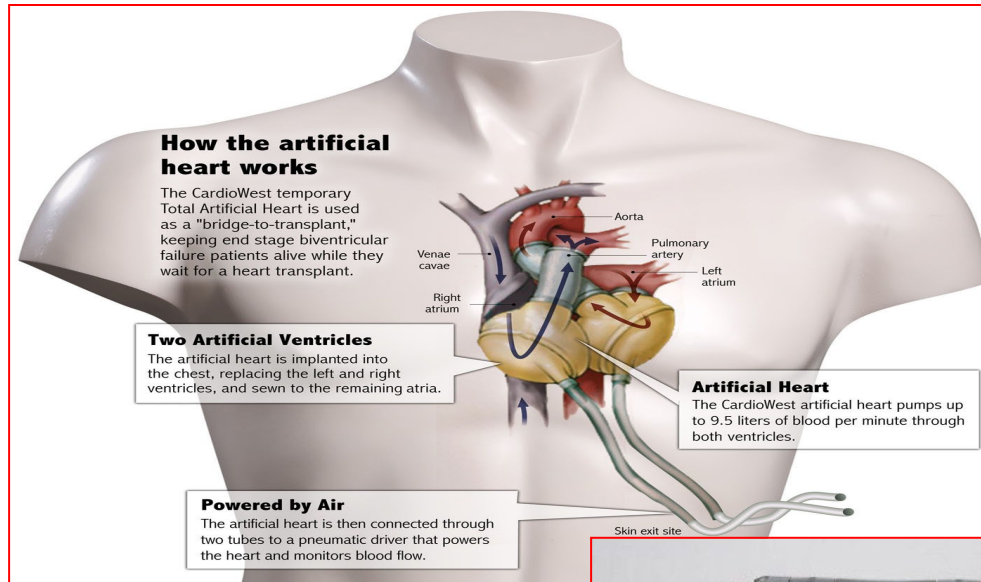
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## PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.

### Total Artificial Heart

#### Overview:



#### Basic Operations

1. Pump is connected to 2 drivelines (air lines) that are attached to the driver, which runs the pump
2. Do not kink the drivelines.
3. The electrical conduction system of the heart has been removed so a heart rhythm cannot be viewed on the ECG.
4. Batteries last approximately 2 hours for a set.
5. Plug the driver into an outlet as often as possible for power.

**PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.**

**Total Artificial Heart**

**When the Pump Has Stopped:  
Immediately switch to the back-up driver.**

**Changing to the Back-Up Driver**

1. With the Wire Cutter Tool, cut the Wire Tie under the metal release button of the CPC Connector that secures the **red** TAH Cannula to the **red** Freedom Driveline. **DO NOT DISCONNECT THE CANNULA FROM THE DRIVELINE YET.**
2. With the Wire Cutter Tool, cut the Wire Tie under the metal release button of the CPC Connector that secures the **blue** TAH Cannula to the **blue** Freedom Driveline. **DO NOT DISCONNECT THE CANNULA FROM THE DRIVELINE YET.**

	<p><b>CAUTION:</b> Before disconnecting the Drivelines of the primary Freedom Driver, you must have the Drivelines of the backup Freedom Driver within reach. <b><u>The backup Driver must be turned on by inserting 2 batteries.</u></b> Perform steps 3 and 4 <b>simultaneously.</b></p>
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3. Disconnect the **red** Cannula from the **red** Driveline of the primary Freedom Driver.
4. Press and hold down the metal release button. (Fig. 11)
5. Pull the **red** Cannula away from the **red** Driveline (Figure 12). **Immediately** insert the **red** Cannula into the new **red** Driveline from the backup Freedom Driver until you hear a click.
6. **Simultaneously** disconnect the **blue** Cannula from the **blue** Driveline of the primary Freedom Driver.
7. Press and hold down the metal release button.
8. Pull the **blue** Cannula away from the **blue** Driveline.
9. **Immediately** insert the **blue** Cannula into the new **blue** Driveline from the back-up Freedom Driver until you hear a click.

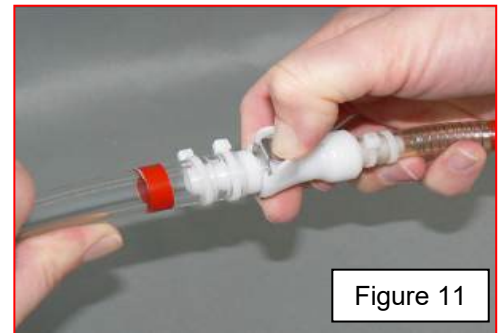


Figure 11

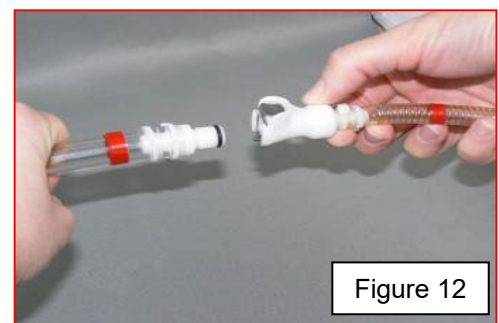


Figure 12





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### PROTOCOL 5M: Ventricular Assist Device (VAD) Management – Adult, cont.



#### Total Artificial Heart

##### Treatment Considerations:

1. External chest compressions cannot be performed on a patient with a Total Artificial Heart. Changing to the back-up driver is essential to maintaining circulation. There's no "hand-pump" to operate the Total Artificial Heart manually.
2. If the pump stops, a red fault alarm along with a continuous audio tone will sound.
3. All device settings are preset and cannot be changed in the field.
4. Since the electrical conduction system of the heart has been removed the underlying ECG rhythm will show asystole. The patient with a Total Artificial Heart should not be defibrillated.
5. If the driver pump is connected and functioning properly, the patient will have a pulse.
6. A measurable blood pressure is obtainable using a manual or automated blood pressure device.
7. Use alternative ways to assess the adequacy of perfusion such as pale vs. pink, dry vs. diaphoretic, and alert vs. confused.
8. Incorporate device into assessment.
9. General Supportive Care and initiate treatment per applicable protocol.
10. Listen just below the heart to hear if the device is running and assess for a palpable pulse.
11. If there is no palpable pulse detected, consider the following:
  - The device is not running: Troubleshoot the device and treat per protocol.
  - The device is running, but the patient is still unconscious or unstable:
    - Neurological evaluation: Possible Stroke
    - Expose the patient:
      - Be cautious with trauma shears; don't cut a driveline or cable exiting the patient's body that might be hidden under an article of clothing;
      - Assess the dressings over the driveline exit site (found in the abdominal area) for signs of infection.