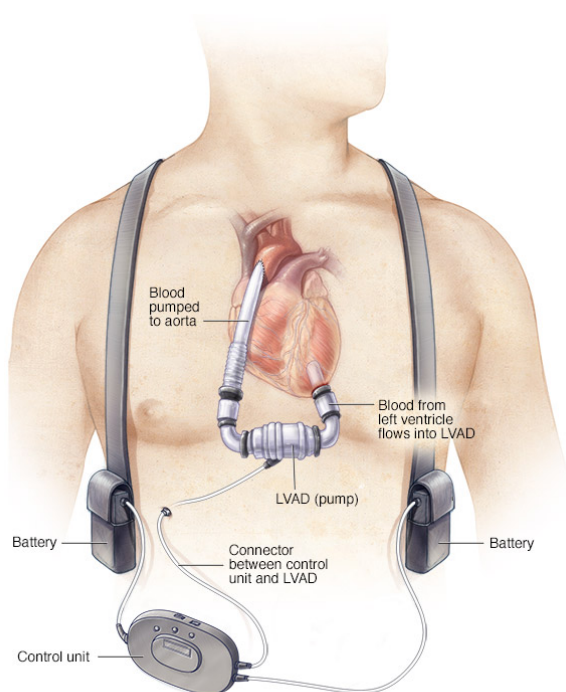


## **When The VAD Team Isn't Waiting In The Wings: Practical Info For The EM Provider**

**Casey Z. MacVane, MD, MPH  
Sugarloaf Winter Symposium 2018**

### Background

Left ventricular assist devices (LVADs) essentially replace the function of the left ventricle (LV) with a mechanical pump. The pump sits in the abdomen. The inflow cannula enters the LV and removes blood and then pumps it into the ascending aorta. The driveline connects the controller to the pump and enters the skin. Patients wear battery packs which power the controller.



© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.

Tens of thousands of LVADs have been implanted and patients with them are living longer. There are approximately 50 patients in Maine who currently have an LVAD.

Indications for LVAD placement:

1. Patients with reversible disease ie a young patient with severe myocarditis
2. Patients awaiting cardiac transplant
3. Patients with poor EF who are not transplant candidates, in this case called “destination therapy”

### Why are VADs so anxiety-provoking?

VADs are intimidating for a few reasons. 1. There are a lot of unfamiliar components. 2. You can't rely on your usual cardiovascular exam to assess a patient with a VAD. 3. These patients are sick and complicated at baseline.

### Physical Exam of VAD Patients

1. Checking a pulse: VAD's have linear (as opposed to pulsatile) flow so you can not feel a pulse.
  - The first thing you should do is listen to the patient. **If you hear a hum, the LVAD is working.**
  - Use cardiac monitor to determine rate and rhythm.
2. Obtaining a blood pressure: Because of the linear flow most conventional BP cuffs won't work.
  - Use a manual cuff and a Doppler. Inflate the cuff then slowly release the cuff until you hear dopplerable flow again. This is a close estimation of the MAP.
  - Goal is MAP 70-90. (Elevated BP/afterload can -> pump failure)
  - A lines are the most accurate measurement of BP.
3. Pulse Ox: Low O2 sat may reflect low flow. Normal O2 sat is likely accurate.
4. Other PE findings: Look for volume overload, volume depletion and signs of perfusion ie skin color and temperature and cap refill.

#### EKGs in VAD Patients

- The VAD should not interrupt the usual electrical activity of the patient. A STEMI will look like a STEMI and an arrhythmia will look like an arrhythmia.
- Be concerned with a right-sided MI in these patients. LVAD assist with LV function but they still rely on the RV to pump volume into the LV.

#### VAD Complications

1. Infections: These patients are at high risk of developing driveline infections, mediastinitis and infection in the LVAD pocket.
2. Bleeding: The patients are always anticoagulated (INR Goal usually 1.8-2.3). These patients frequently have baseline anemia (the motor chews up red cells). It is ok to reverse the coagulopathy for life-threatening GI bleeds.
3. "Suck-down phenomenon": Decreased filling of the RV can cause the myocardium to suck against the inflow of the RV. Ultrasound will help you identify this. Treat by giving IVF. In this situation the VAD may alarm but the patient usually has no clinical symptoms of the event.
4. Pump thrombosis is rare. It can occur with small emboli but doesn't usually result in pump malfunction.

#### ED Management Musts

- Always contact the VAD coordinator ASAP. These patients belong to someone who knows them well and can help you manage them.
- If you get a call from EMS that a VAD patient is coming in top the ED, back sure they have all their cords and batteries with them. This is essential if it causes a slight delay in transporting the patient.

#### Arrhythmias in VAD patients

- The LVAD only compensates for the LV. With a dysrhythmia they may be stable for a while, but once RV fails they are in trouble.
- VFib -> cardioversion (just keep pads away from controller)
- VTach -> if they are tolerating it -> ACLS meds, if refractory -> cardioversion

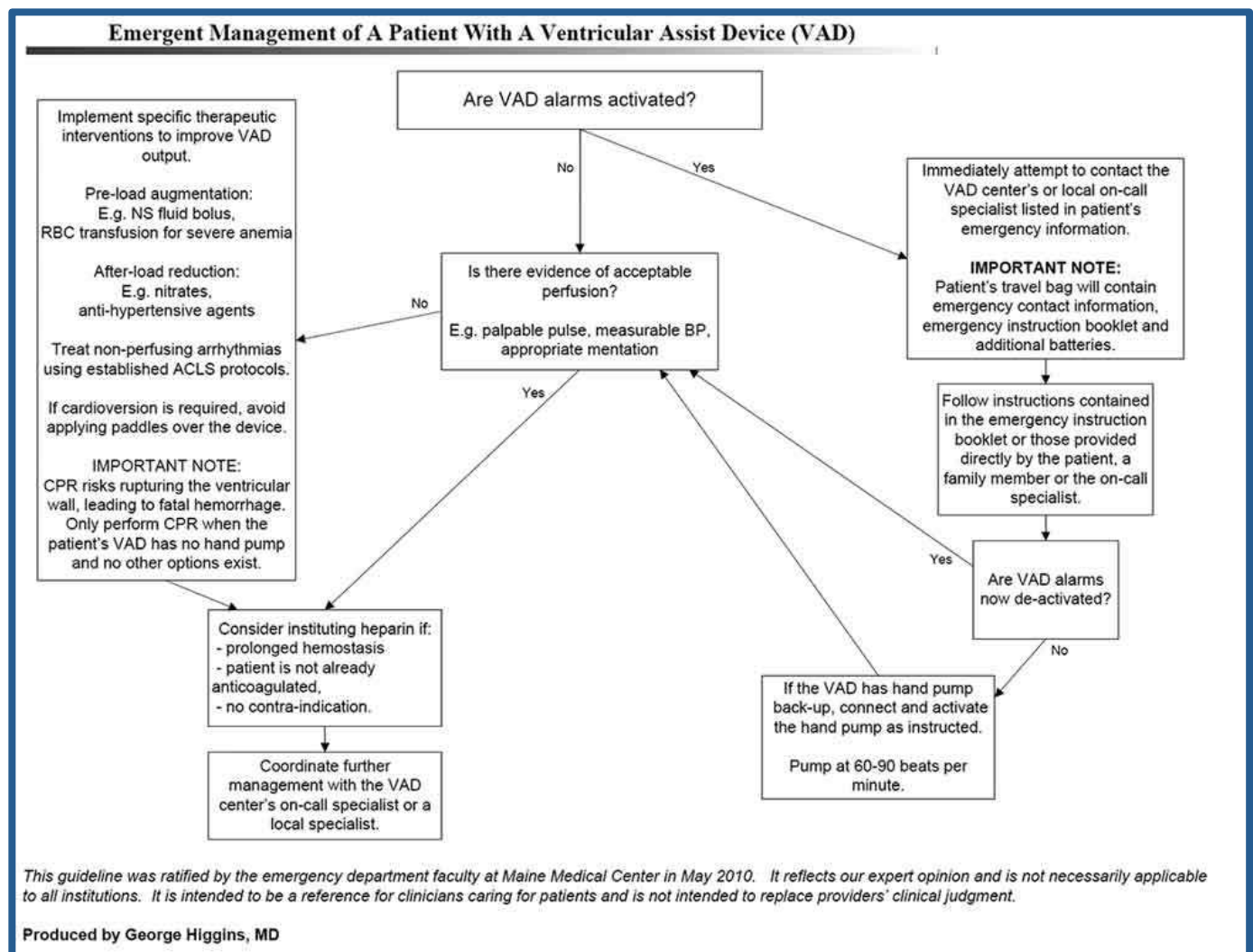
#### Unresponsive LVAD Patients in Cardiac Arrest

If you have an unresponsive patient in cardiac arrest, listen for hum. Next, check controller: Look to see that battery lights are green and that all the lines are connected. You can also feel the device. If hot it means there is resistance in the circuit either from device malfunction, a blood clot or excessive afterload. If they are unresponsive but you hear the hum, the pump is working and you need to think about other causes for their mental status. Remember that they are high risk for ICH and sepsis. If they are in true cardiac arrest and the pump is not working, you have to decide about CPR.

## CPR

This is controversial. Device manufacturers and CT surgeons say do not do CPR for fear of dislodging the inner cannula. If your patient is dead you may not have any other options. Reference #3 below is a case series of 8 LVAD patients who received CPR. In none of these patients did the cannula dislodge. Four of the eight had a good neurologic outcome. Bottom line: be sure your patient is truly in cardiac arrest (use cardiac exam techniques described above) CPR is probably ok.

## Dr. Bud Higgins's Algorithm



#### References & Further Reading/Listening

1. EMCrit podcast: <https://emcrit.org/racc/left-ventricular-assist-devices-lvads-2/>
2. EMRAP podcast, October, 2014
3. Shinar Z et al. Chest compressions may be safe in arresting patients with left ventricular assist devices (LVADs). *Resuscitation*. 2014 May;85(5):702-4.
4. Birks, E. J. (2011). A Changing Trend Toward Destination Therapy: Are We Treating the Same Patients Differently? *Texas Heart Institute Journal*, 38(5), 552–554.
5. Partyka, C. and Taylor, B. (2014). Review article: Ventricular assist devices in the emergency department. *Emergency Medicine Australasia*, 26: 104–112.
6. [www.mylvad.com](http://www.mylvad.com)