



VENTRICULAR ASSIST DEVICES

Effective: January 1, 2020
Replaces: February 12, 2015
Review: January 1, 2022

1. Purpose

- 1.1. The purpose of this policy is to provide prehospital personnel with guidelines on how to assess and treat patients with ventricular assist devices (VAD). A VAD (right, RVAD or left, LVAD) is a device that supplements or replaces the cardiac ventricle in pumping blood.
- 1.2. Patient's with VADs present prehospital providers with unique assessment difficulties because of the physiology related to the VAD. While first generation VADs were pulsatile (a cyclic pump), second generation VADs (which most patients today have) are nonpulsatile (continuous flow).
- 1.3. Prehospital EMS providers will not be able to obtain a pulse-oximetry reading or a blood pressure (auscultated or noninvasive) on patient's that have second generation VADs. Any palpated peripheral pulse or pulse oximetry waveform will correspond to that of the native heart and not reflect the output of the combined native heart and VAD. Noninvasive blood pressure devices may not be accurate. If a palpable pulse is present, then a NIBP measurement can be attempted. VADs are dependent upon preload so hypovolemia, vasodilation, dysrhythmias or worsening ventricular function can reduce their output.
- 1.4. VAD systems consist of external battery systems, controller and drive line and the implanted VAD as well as battery charging systems, spare batteries and spare controller.
- 1.5. Prehospital EMS providers should rely upon the patient's level of consciousness, skin signs, capillary refill, respiration and end-tidal CO₂ to make any clinical decisions. It should be noted that patients with a VAD may also have an implanted cardioverter-defibrillator (ICD) and/or a pacemaker/ICD.

2. Procedure

- 2.1. Assess the patient to determine whether symptoms are patient-related or device-related. A quick check of device function is palpating the vibration or auscultating the sound of the centrifugal or turbine rotor over the device, usually in an abdominal or left chest location.
- 2.2. The unresponsive VAD patient:
 - 2.2.1. Airway and Breathing: Manage the airway using BVM, LMA or ETI with ETCO₂ as a monitor of both ventilation and perfusion. Pulse oximetry may not be accurate.
 - 2.2.2. Circulation: Auscultate for the VAD rotor hum and note any alarms activated on the control unit. The VAD Coordinator can assist in interpreting control unit alarms. It is likely the patient or companions will be in contact with their VAD Coordinator before and by the time of EMS arrival.



- 2.2.2.1. If the patient is unresponsive, apneic, with no rotor hum and with control unit alarms begin chest compressions.–Mechanical CPR devices are contraindicated.
- 2.2.2.2. If there is rotor hum and no alarms indicating device failure continue airway management and ventilation. ETCO₂ will be the indicator of perfusion.
- 2.3. Follow the appropriate treatment protocol based upon the patient's clinical presentation.
- 2.4. If defibrillation or cardioversion is required, then follow the appropriate treatment protocol. If the patient is hemodynamically stable as indicated by good mental status the VAD Coordinator may advise not to defibrillate or cardiovert. A VAD patient with a functioning device may remain conscious during sustained ventricular fibrillation or ventricular tachycardia.
 - 2.4.1. If an AED is applied and a shock is advised, deliver the shock only if the patient is unresponsive.
- 2.5. The on-call VAD coordinator for the patient's VAD program may be on the telephone with the patient, caregiver or companion simultaneously with the call to 911. The VAD coordinators will be able to assist in determining whether the patient's symptoms are device related. The VAD coordinators can help provide advice on patient and device assessment but cannot provide direct medical control. It will be useful to talk to the VAD coordinator before making Base Hospital contact for treatment or destination determination.
- 2.6. When transporting VAD patients to a hospital, bring the entire VAD battery and charger, batteries and backup controller with the patient.

3. Special Considerations

- 3.1. VAD centers in Santa Clara County are located at Kaiser Santa Clara Hospital and Stanford University Hospital. If a VAD patient presents with stroke symptoms, these two centers would be the preferred destinations. A VAD patient visiting from outside of the Santa Clara County area should be transported to either of these two VAD centers for device-related problems.
- 3.2. There are no absolute medication contraindications for VAD patients.
- 3.3. Nausea and syncope may be early indicators of decreased perfusion.
- 3.4. Chest compressions can be performed in an unresponsive, apneic VAD patient with an audible and visual device failure alarm.
- 3.5. Other than obvious signs of death, do not determine death in the field for patients with a functioning VAD. Additional evaluation will be necessary to assess for native heart motion and VAD function. Transport the VAD patient to a VAD center to determine discontinuation of the VAD and determination of death.
- 3.6. In traumatic injury of a VAD patient consider major trauma designation since the patient will be anticoagulated. Thoracic and abdominal trauma could affect the left ventricular and proximal aortic anastomoses.



3.7. VAD patients are at high risk for the following conditions:

- 3.7.1. Hemorrhage
- 3.7.2. Stroke
- 3.7.3. Sepsis
- 3.7.4. Dysrhythmias
- 3.7.5. Equipment failure, including:
 - 3.7.5.1. Controller failure
 - 3.7.5.2. Battery failure
 - 3.7.5.3. Drive line failure
 - 3.7.5.4. Pump failure (e.g. pump thrombosis)

3.8. If a VAD patient must be evacuated from a residence (e.g. power failure, flooding, structure fire, neighborhood evacuation) all VAD support equipment should be recovered to the extent it is safe to do so and kept with the patient. VAD patients are electricity-dependent and will need to evacuate to or shelter in a location with electrical power. VAD support equipment includes batteries, AC and DC adapters, backup controller, battery charger and drive line dressing supplies.