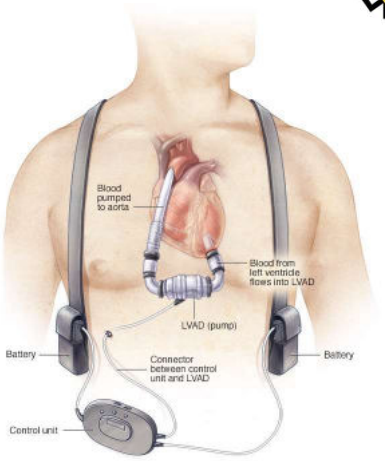




Left Ventricular Assist Devices | History & Overview

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Now, we will begin with an overview and history of LVAD devices, and why they are used. We will also review heart failure conditions. Most importantly, we will discuss the context for an E M T's role in assessing the patient and the device.

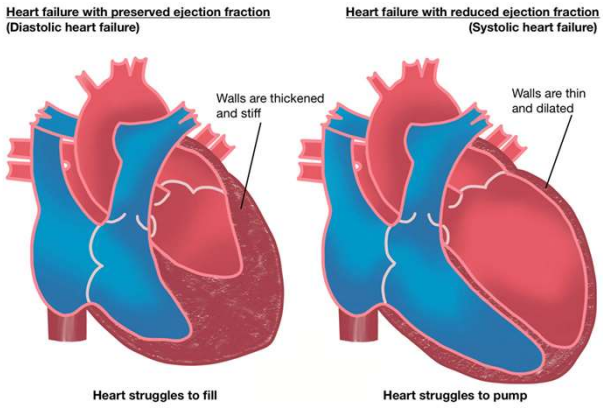
So, the prevalence of patients living with a left ventricular assist device is rapidly increasing due to improvements in pump technology. We believe there are well over 30,000 patients that have been implanted with LVADs, either as destination therapy, or as a bridge to transplant.

It is critical for first responders to be knowledgeable of current ventricular assist devices, and to be able to troubleshoot associated complications. Special consideration must be taken when managing VAD patients, including device inspection, alarm interpretation, and blood pressure measurement.

Early communication with the VAD team and the Advanced Life Support team, is essential for emergency care for these patients.

Heart Failure Classification

- Level 1 – No limitation of physical activity
- Level 2 – Slight limitation of physical activity, comfortable at rest
- Level 3 – Marked limitation of physical activity, comfortable at rest
- Level 4 – Unable to carry on any physical activity without discomfort, symptoms of heart failure at rest



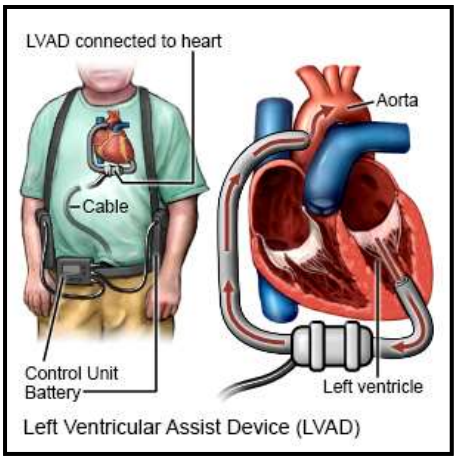
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Next, let's review the Heart Failure Classification system, to understand when LVAD devices are required.
The system has four levels, getting progressively worse as you go up the scale.
Level 1 represents no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation or dyspnea which is shortness of breath.
Level 2 represents patients with a slight limitation of physical activity. They are generally comfortable at rest. While ordinary physical activity results in fatigue, palpitation, or dyspnea.
Insertion of an LVAD may be recommended in this level 3, where the patient shows a marked limitation of physical activity. They are often comfortable at rest. However, less than ordinary activity causes fatigue, palpitation, or dyspnea.
Finally, Level 4 patients are unable to carry on any physical activity without discomfort. They experience symptoms of heart failure at rest. If any physical activity is undertaken, discomfort increases.

BACKGROUND

- VADs are a proven therapy as bridge-to-cardiac transplantation in Class IIIB and Class IV heart failure patients
- Use of VADs has been unavoidable for patients suffering end-stage heart failure due to the consistent shortage of donor organs
- HeartMate II LVAD – Example
- Be prepared for whatever type of VAD we may encounter



Left Ventricular Assist Device (LVAD)

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So, ventricular assist devices are a proven therapy as bridge-to-cardiac transplantation, in Class IIIB and Class IV heart failure patients. The dramatic increase in the use of VADs has been unavoidable for those patients suffering end-stage heart failure, due to the consistent shortage of donor organs.

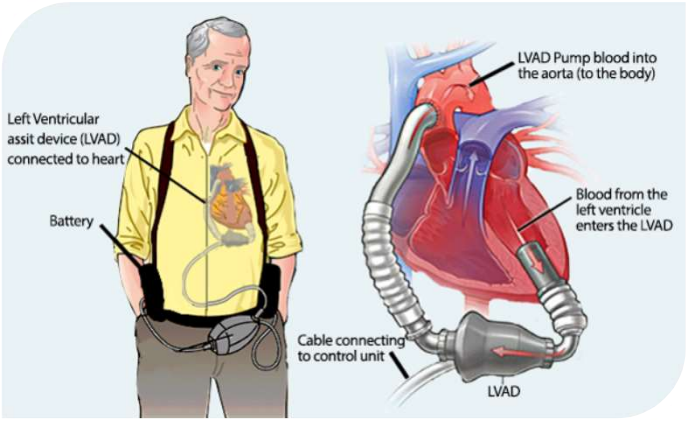
They are also used for three other conditions.

1. Destination therapy is used in patients who are ineligible for cardiac transplantation. The newer devices with improved durability have shown increased survival rates.
2. Bridge-to-the-Decision LVADs have been used as a temporary measure in patients with end-organ dysfunction due to heart failure.
3. Bridge-to-Recovery provides temporary ventricular support in some heart failure patients, and has shown to improve myocardial function, and promote recovery.

As the mean support duration for VADs increases, more VAD patients will be living in the community.
HeartMate II LVAD will be the example for this topic. Remember our role is to be prepared for whatever type of Ventricular Assist Device you may encounter.

Brief History of LVADs

- First Generation | 1994
  - ✓ Pulsatic Flow
  - ✓ HeartMate I
- Second Gen | Continuous Flow
  - ✓ HeartMate II
  - ✓ Jarvik 2000
- Third Gen | Continuous Flow, Centrifugal Pumps
  - ✓ HeartWare
  - ✓ HeartMate 3
  - ✓ SynCardia TAH



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To better understand what you may encounter on scene, here is a brief history of LVADs.

First-Generation Devices came out in 1994. These were pulsatile volume-displacement pumps. The first-generation devices required significant surgical dissection for placement, and also had a high rate of infection at the external lead. Also, the pump was audible and caused discomfort. These limitations resulted in discontinuation of their use.

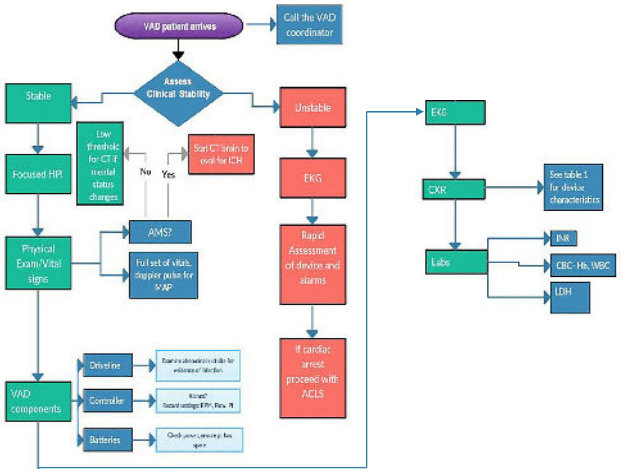
Second-Generation Devices like the HeartMate II, are continuous flow devices that use axial flow pumps. The rotor is the only moving part of these devices, making them more durable. These devices are also smaller, quieter, easier to implant, and have lower rates of infection than the first generation devices.

Third Generation Devices are continuous flow centrifugal pumps, of which the HeartWare and Heartmate III are most popular. They are designed for long durability (5 to 10 years), easy surgical placement, and low risk of hemolysis or thrombosis.

Finally, a Biventricular Assist Device is used for patients with either biventricular failure, or right ventricular failure associated with left ventricular disease. The SynCardia Total Artificial Heart (TAH) is the most widely used TAH with over 1600 patients benefiting.

Evaluating an LVAD Patient

- NIH Guidelines for ER – what can the EMT do in advance?
- Unstable
  - ✓ Assessment of device
    - Type, Emergency Number, Alarms
  - ✓ EKG, ALS, Transport
- Stable
  - ✓ Gather HPI, Physical Exam, Vitals
  - ✓ Altered Mental State?
  - ✓ Inspect LVAD components



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So, here is the essence of why, and what you need to know to treat LVAD patients. The diagram shows the NIH Guidelines for an ER dealing with a VAD patient. And as an extension, you can see what the EMT's role is for this process.

Evaluation, management, and troubleshooting for patients with a VAD, represent a unique clinical challenge. As the presence of a mechanical support device, changes the native cardiovascular physiology.

The evaluation of the stable VAD patient is similar to other patients, and should appropriately address the chief complaint. Because seemingly minor ailments can mask more significant pathology, the VAD team or coordinator should always be contacted. This will mobilize appropriate resources and facilitate communication.

Primary patient evaluation begins with a full history, physical, and evaluation of the device per the diagram. Heart rate is variable depending on the patient's intrinsic rate and rhythm. Many patients with VADs also have cardiac pacemakers or implantable cardioverter defibrillators (ICD) in place.

Remember, The continuous-flow VAD device does not generate a pulse. But patients may have enough residual or recovered ventricular function to mount intrinsic pulsatile flow – or periodic variations in flow. Because the degree of pulsatility is variable among VAD patients, a standard approach to measuring a blood pressure is recommended

So, if conditions permit, be sure to do a full assessment. Pay attention if there is an altered mental state. As soon as you can, gather phone numbers from the patient or family for Device and Patient specific Medical support. That's it for the overview. Missah will join you for the next lesson.