

My patient has no pulse! And he's talking to me!

EMS Evaluation of patients with VADs



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Medical Director-Columbus Fire EMS

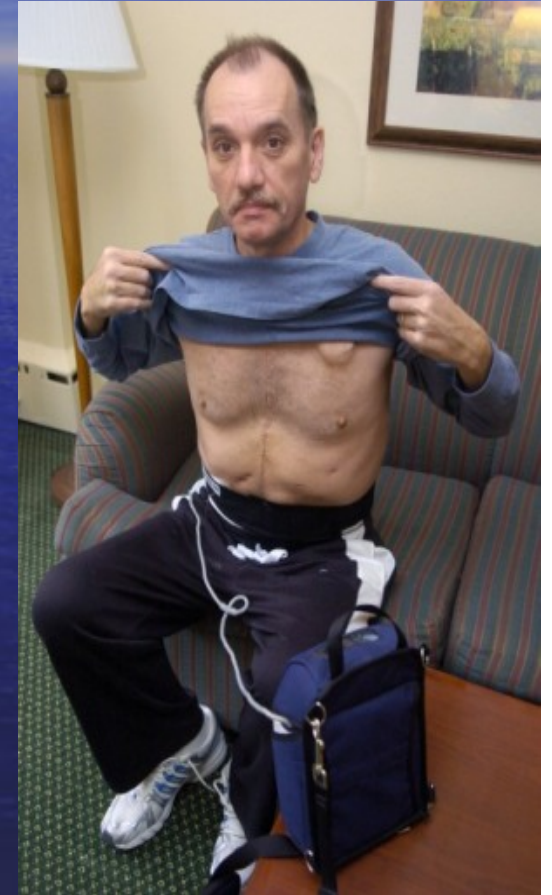
Disclosure

- Dr. Keseg has no financial interest in any companies that are involved in the manufacture of products related to this presentation.



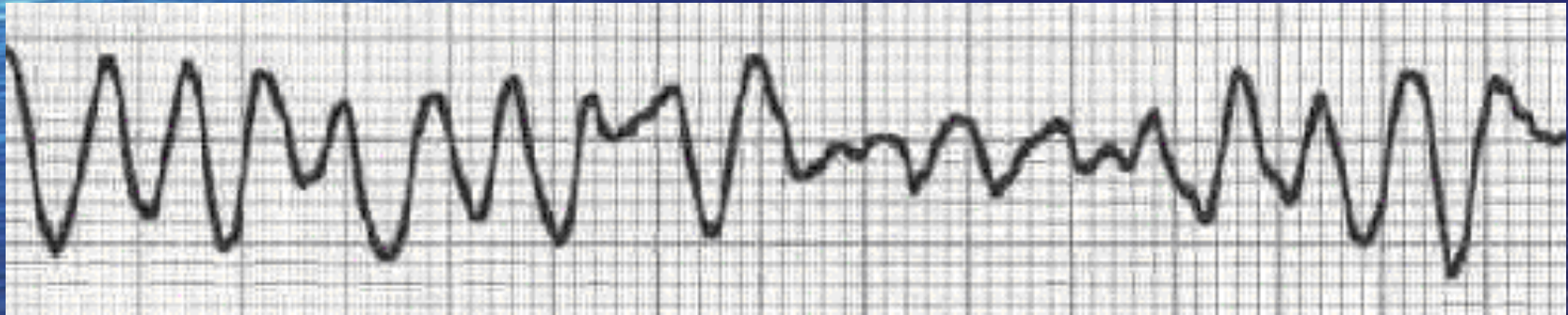
EMS Case Scenario

- Medic 14 is dispatched to a call to a residence of a 52 year old with symptoms of weakness, dizziness and nausea.
- Vitals: BP unobtainable
- Pulse hard to palpate
- Pulse OX 80% and difficult to obtain.



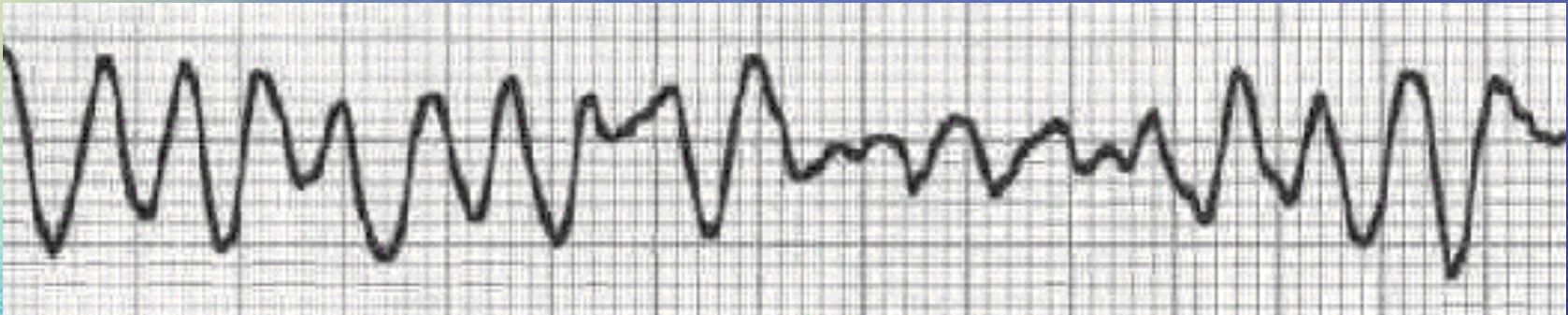
EMS Case Scenario

- Patient has Heartmate II continuous flow LVAD
- Patient is alert and talking.
- Rhythm on EKG is below.



EMS Case Scenario

- Ventricular Fibrillation and talking to me?



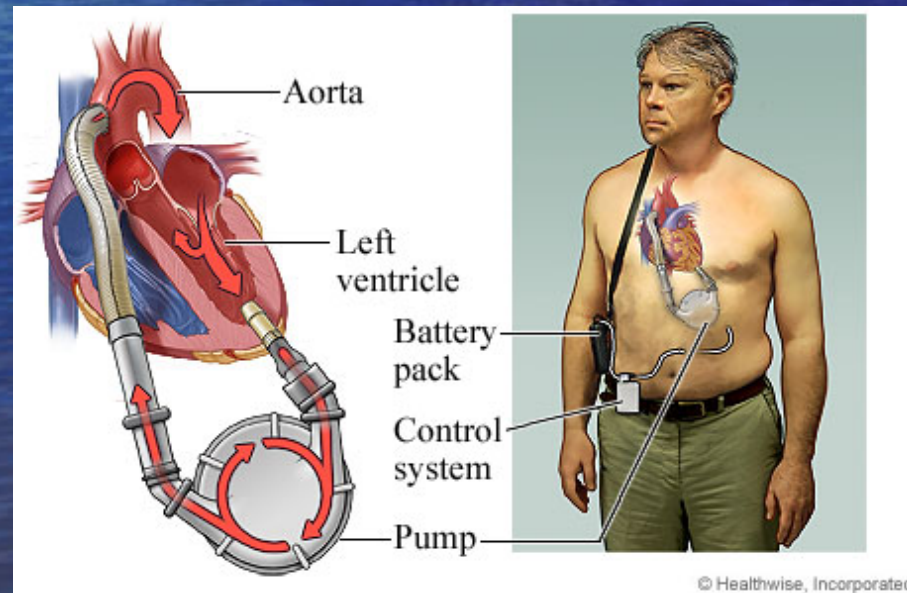
LVADs in the News

- Former Vice President Dick Cheney recently had surgery to install a “pump that helps his failing heart work”.
- Cheney, 69, has had five heart attacks since he was 37 and suffers from congestive heart failure. Cheney said at the time that the pump, called a left ventricular assist device, would allow him to resume an active life.



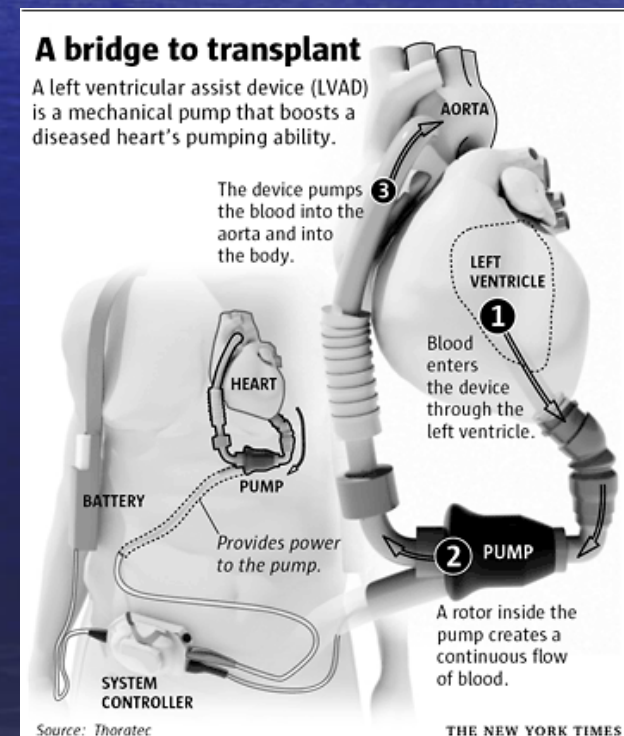
What is a VAD?

- A ventricular assist device (VAD) is a battery-operated, mechanical pump-type device that's surgically implanted.
- It helps maintain the pumping ability of a heart that can't effectively work on its own.



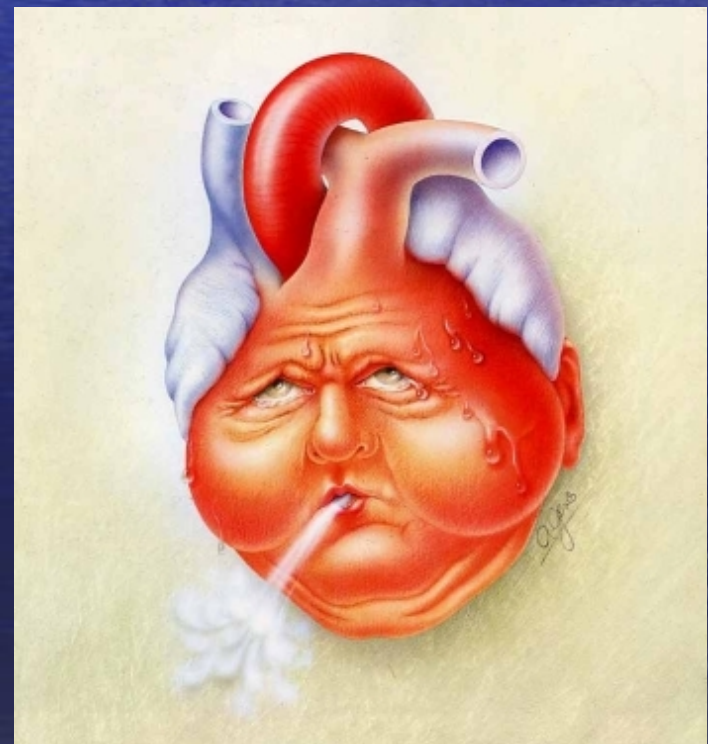
What is a VAD?

- This device is sometimes called a "bridge to transplant." People awaiting a heart transplant often must wait a long time before a suitable heart becomes available.



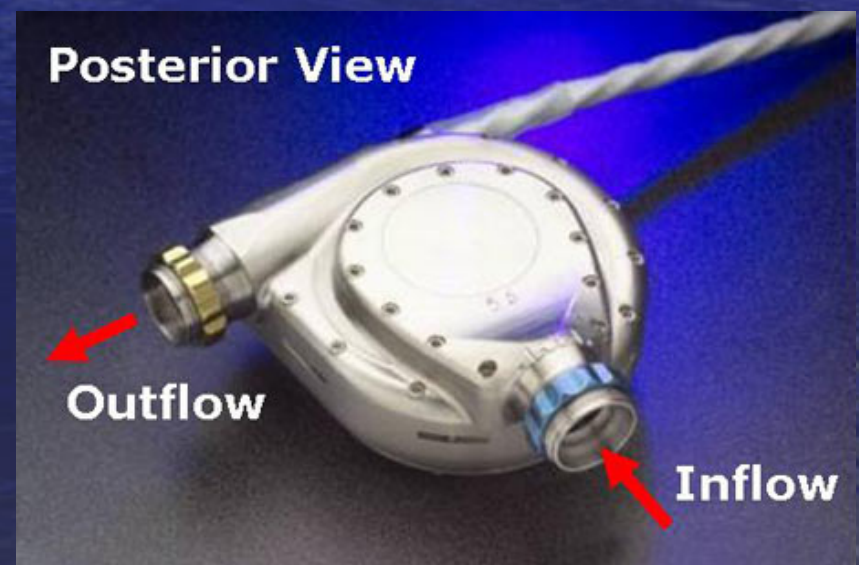
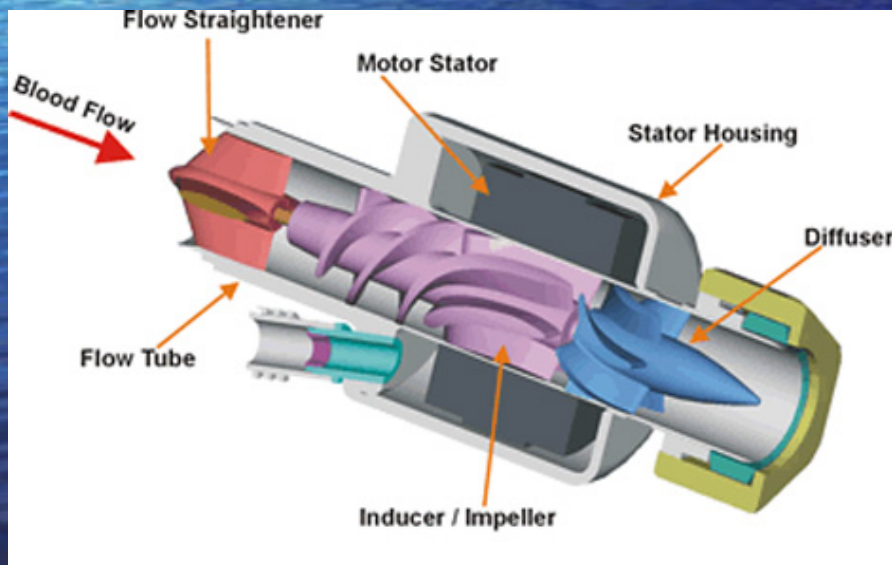
What is a VAD?

- During this wait, the patient's already-weakened heart may deteriorate and become unable to pump enough blood to sustain life.

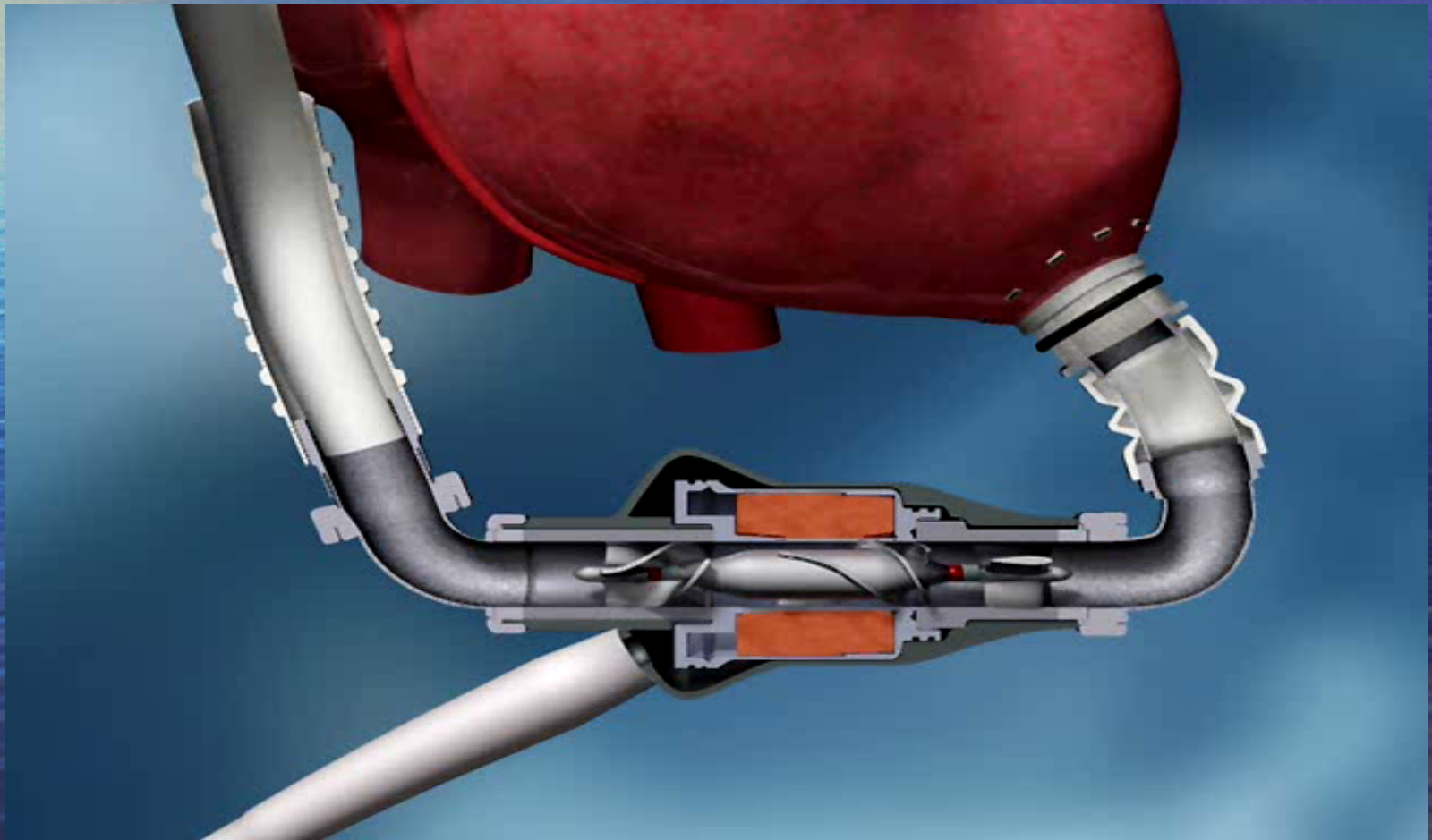


How does a VAD work?

- A common type of VAD has a tube that pulls blood from the left ventricle into a pump.
- The pump then sends blood into the aorta
- This effectively helps the weakened ventricle.

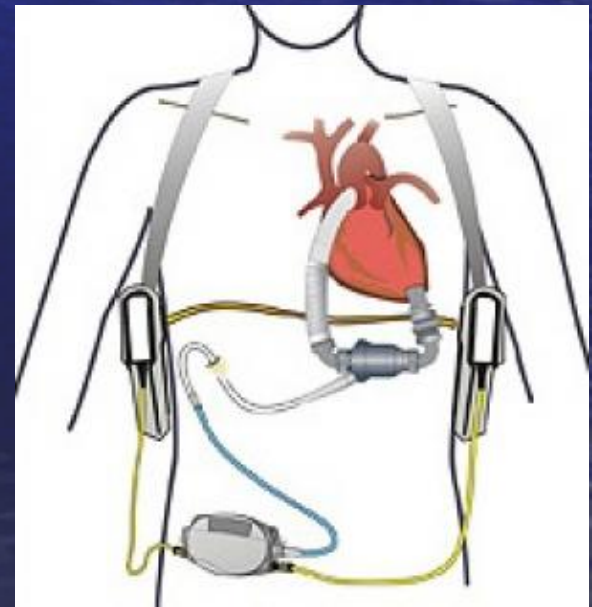
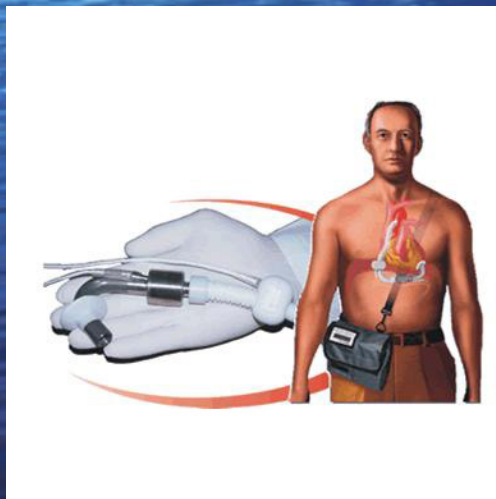


- Rotor spins
- picks up blood in LV
- then takes to aorta



How does a VAD work?

- The pump is placed in the upper part of the abdomen.
- Another tube attached to the pump is brought out of the abdominal wall to the outside of the body and attached to the pump's battery and control system.





VAD 101



- VAD patients have their native hearts that feed the assist devices.
- Native hearts must continue to circulate blood to the VAD.
- Anything impairing blood flow to the pump must be corrected.
- VAD patients are usually anti-coagulated

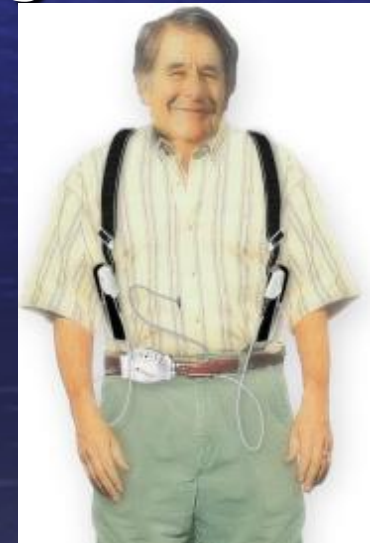
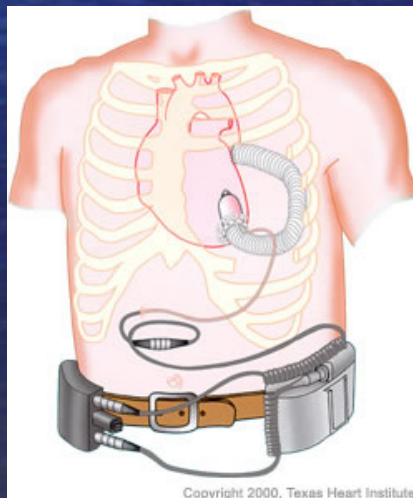
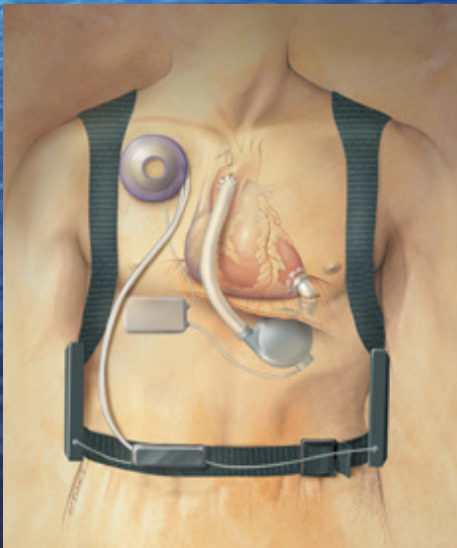
What can a VAD do?

- VADs are now portable and are often used for weeks to months to years.
- Patients with VADs can be discharged from the hospital and have an acceptable quality of life while waiting for a donor heart to become available.



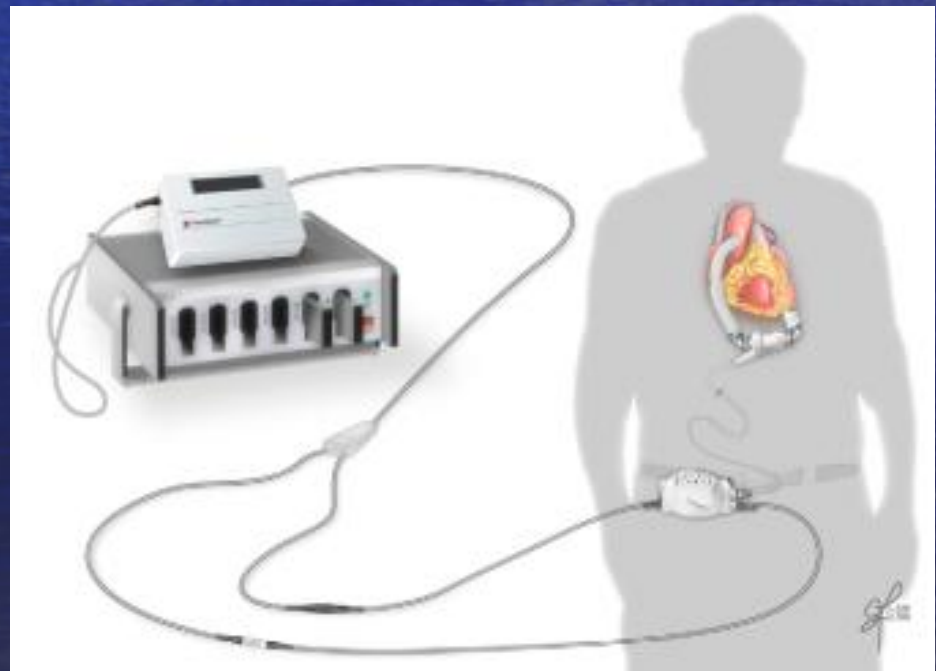
VAD Portability

- When the unit is **untethered**, rechargeable batteries are used when the patient wants to be mobile. The batteries are changed as needed. The power base unit or alternate source is used to recharge the batteries.
- The controller and batteries can be worn in a belted waist pack or alternate carrying device.



VAD Portability

- When the unit is tethered, the power supply is provided by a device called a power base unit that is plugged into an electrical outlet.



VAD Maintenance



- VADs are designed to function reliably for long periods of time. Before leaving the hospital, the patient and family are trained in the proper function and management of the device.
- A staff member (likely the VAD coordinator) will thoroughly discuss device operation and its accessories. The device will also be checked at follow-up visits.
- In the event of a problem, the device will alert the patient so that immediate action can be taken.

VADs that Deliver a Pulse

- Abiomed BVS 5000 (short-term)



- Abiomed Ventricles (short-term)



- Heartmate XVE (long term)

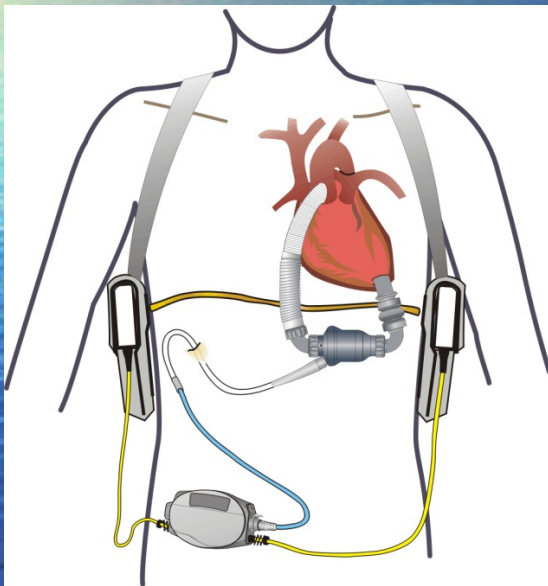


- Thoratec IVAD (long-term)



VADs that deliver Continuous Flow (No-Pulse)

- Heartware (long-term) *investigational
- Heartmate II (long-term)



- Centrimag (short-term)



Indications for VAD Placement

- Short-term for myocardial recovery.
- Long-term for “Bridge to Transplant”
- Long-term for “Destination Therapy”
 - (non-transplant candidates)

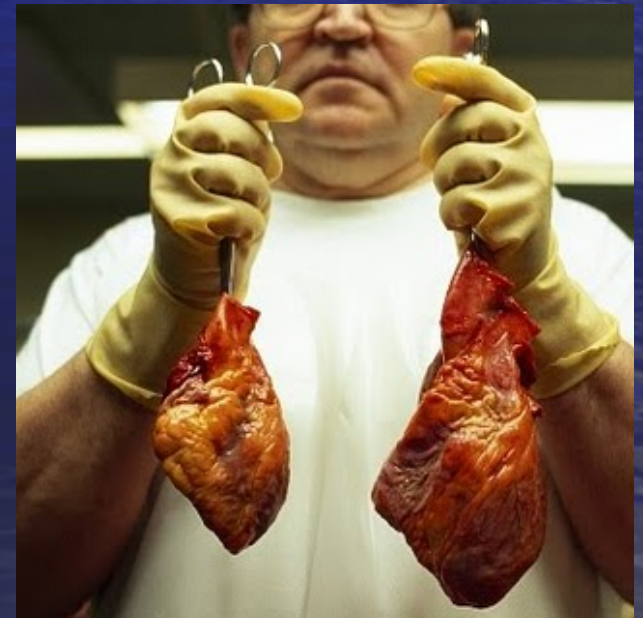
Indications for VAD Placement

- In some patients with heart failure, insertion of a VAD device can allow a damaged left ventricle to "rest" and to repair itself.
 1. Heart failure after cardiac surgical procedures,
 2. With major acute heart attacks
 3. Acute myocarditis.

TLC-II® Portable VAD Driver

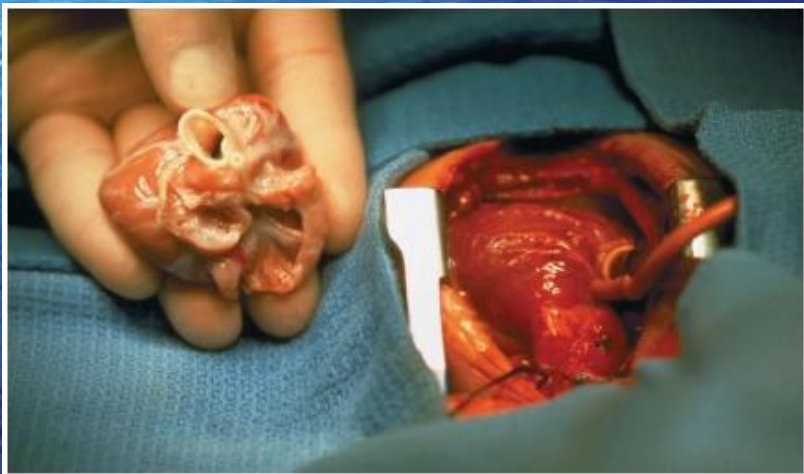


THORATEC
CORPORATION



Indications for VAD Placement

- VADs can be used as a "bridge to transplant" in people with severe chronic heart failure.
- It can help ease the work of the heart in people who are waiting for heart transplantation.



Indications for VAD Placement

- VADs can be used as "destination therapy" in people with severe end-stage heart failure who are not candidates for transplantation (because of other factors such as age, kidney disease, or lung disease), and who have an extremely poor prognosis without mechanical support.
- In these patients, the VAD *is* the treatment; there is little reasonable expectation that the VAD can ever be removed.



Myocardial Recovery Using Ventricular Assist Devices: Prevalence, Clinical Characteristics, and Outcomes

Marc A. Simon, Robert L. Kormos, Srinivas Murali, Pradeep Nair, Michael Heffernan, John Gorcsan, Stephen Winowich and Dennis M. McNamara
Circulation 2005;112:I-32-I-36

DOI: 10.1161/CIRCULATIONAHA.104.524124

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75214
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The online version of this article, along with updated information and services, is located on the World Wide Web at:
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Myocardial Recovery Using Ventricular Assist Devices Prevalence, Clinical Characteristics, and Outcomes

Marc A. Simon, MD; Robert L. Kormos, MD; Srinivas Murali, MD; Pradeep Nair, MD; Michael Heffernan, BS; John Gorcsan, MD; Stephen Winowich, BS, ChE; Dennis M. McNamara, MD, MS

Background—Ventricular assist devices (VADs) are important bridges to cardiac transplantation. VAD support may also function as a bridge to ventricular recovery (BTR); however, clinical predictors of recovery and long-term outcomes remain uncertain. We examined the prevalence, characteristics, and outcomes of BTR subjects in a large single center series.

Methods and Results—We implanted VADs in 154 adults at the University of Pittsburgh from 1996 through 2003. Of these implants, 10 were BTR. This included 2/80 (2.5%) ischemic patients (supported 42 and 61 days, respectively). Both subjects had surgical revascularization, required perioperative left VAD support, and were alive and transplant-free at follow up (232 and 1319 days, respectively). A larger percentage of nonischemic patients underwent BTR (8/74, 11%; age 30 ± 14 ; 88% female; left ventricular ejection fraction $18 \pm 6\%$; supported 112 ± 76 days). Three had myocarditis, 4 had post-partum cardiomyopathy (PPCM), and 1 had idiopathic cardiomyopathy. Five received biventricular support. After explantation, ventricular function declined in 2 PPCM patients who then required transplantation. Ventricular recovery in the 6 nonischemic patients surviving transplant-free was maintained (left ventricular ejection fraction $54 \pm 5\%$; follow-up 1.5 ± 0.9 years). Overall, 8 of 10 BTR patients are alive and free of transplant (follow-up 1.6 ± 1.1 years).

Conclusions—In a large single center series, BTR was evident in 11% of nonischemic patients, and the need for biventricular support did not preclude recovery. For most BTR subjects presenting with acute inflammatory cardiomyopathy, ventricular recovery was maintained long-term. VAD support as BTR should be considered in the care of acute myocarditis and PPCM. (*Circulation*. 2005;112[suppl I]:I-32-I-36.)

Key Words: heart assist device • heart failure • transplantation • cardiomyopathy • myocarditis

American Heart Association's 2005 Scientific Sessions

- 55 patients with end-stage CHF
- VADs reduced the risk of death in end-stage heart failure patients by **50 percent** at six and 12 months and extended the average life span from 3.1 months to more than 10 months.



BOTTOM LINE

- You will be seeing more of these!



Why do VAD patients call 911?

- Most VAD patients may call 911 because they experience a decrease in energy or may complain of weakness.
- Patient's symptoms may be atypical and vague like dizziness and nausea versus loss of consciousness.



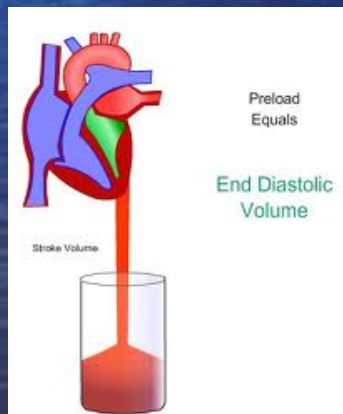
Exam variations with VAD

- Auscultation of chest sounds and maybe abdominal sounds will be affected due to pump noise.
- Pulse and BP with continuous flow pumps will be affected. Use doppler and common sense.
- Pulse oximetry may be sketchy with no-pulse VADs.
- Symptoms of arrhythmia may not be classic.



EMS Evaluation of VAD Patient

- Pump flow is dependent on preload & afterload.
- Some VADs do not have valves so retrograde flow back into the left ventricle can occur if the pump stops.
- Patients are at risk of bleeding due to anticoagulation and antiplatelet therapy.



Common Medications

- Beta Blocker
- ACE or ARB
- Spironolactone
- Diuretic
- Aspirin
- Statin
- PPI
- Iron Supplement
- Anticoagulation



EMS Evaluation of LVAD Patients

- LVAD patients bring with them two sets of medical problems.
 1. A failing heart behind the LVAD or the LVAD therapy itself.
 2. Those that have nothing to do with the LVAD or the failing heart



dreamstime.com

EMS guidelines for patients with a VAD

- If you are called on a patient who has a VAD, you should always assess and treat for other, non-VAD related, injuries and complications.
- Assess airway and breathing and perform interventions according to your EMS protocol.



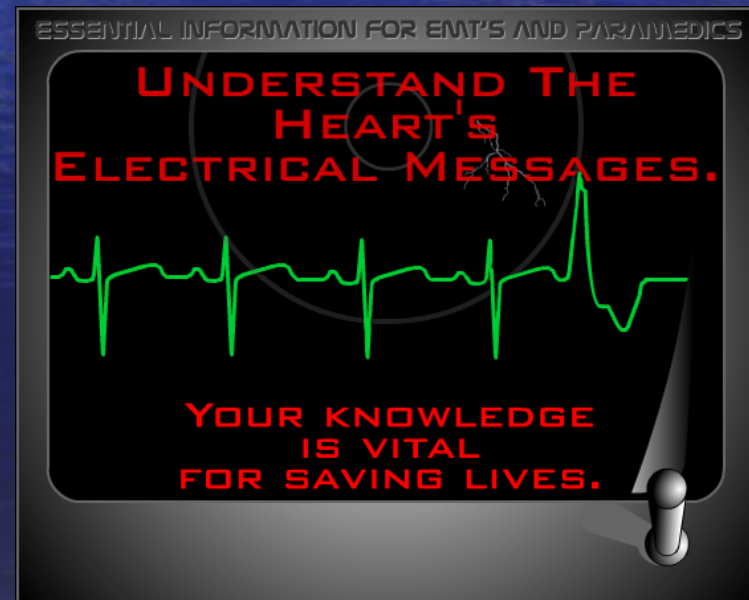
TOP SIX VAD ISSUES THAT YOU MAY ENCOUNTER with VAD Patients

6. Arrhythmia
5. Hemolysis
4. Renal Failure
3. Infection
2. Decreased Preload from dehydration
1. GI Bleeding

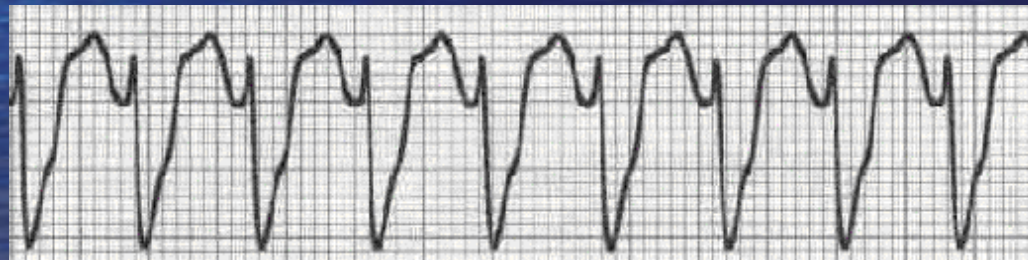
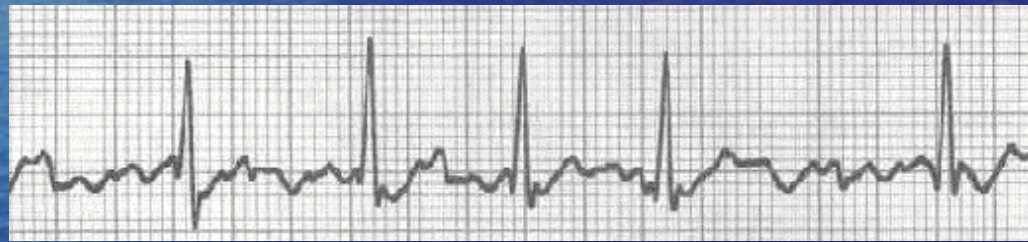
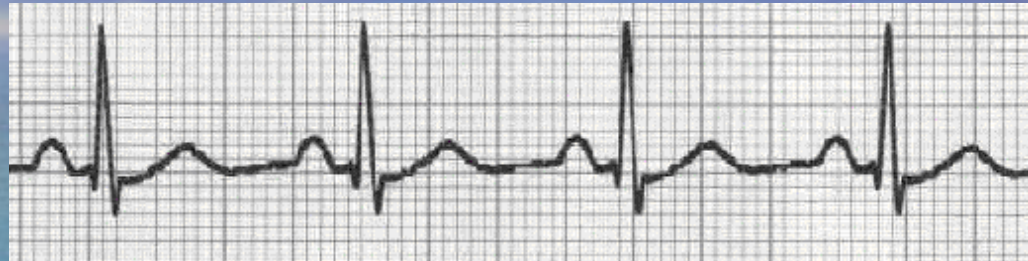


The Myth of Rhythm Disturbance

- VADs do not create special or irrelevant ECG tracings. The ECG tracing reflects the activity of the native heart behind the LVAD.

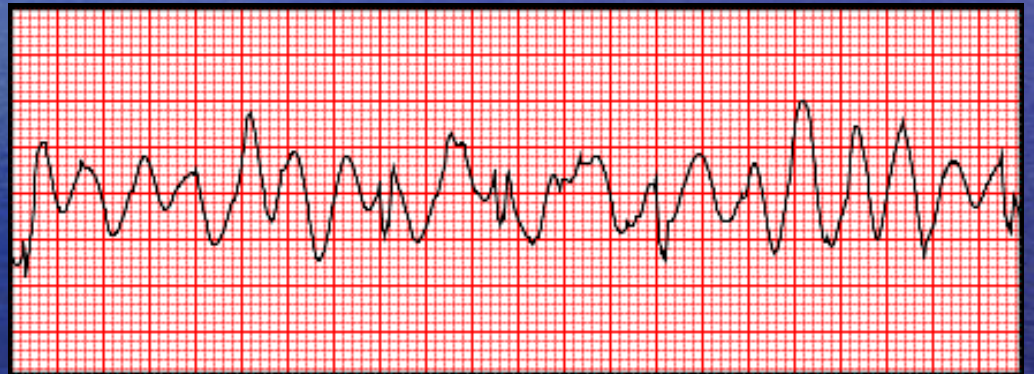


Which patient has an LVAD?



Effects of Prolonged Arrhythmia in VAD patients

- Poor perfusion
- Hypoxia
- Brain Damage
- Death



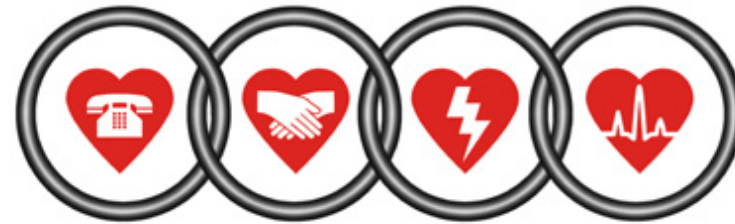
- Same as the rest of us ...just takes longer.

Ventricular Fibrillation

SHOCK!
SHOCK!
SHOCK!



CHAIN OF SURVIVAL



EARLY
ACCESS

EARLY
CPR

EARLY
DEFIBRILLATION

EARLY
ADVANCED CARE

911
Local EMS

American Red Cross

Local EMS
Hospital

EMS guidelines for patients with a VAD

- VAD patients may be in a lethal arrhythmia but remain stable.
- Treating arrhythmias is still important because ultimately the VAD is a pre-load dependent device.
- **Cardioversion and defibrillation are permitted and acceptable in LVAD patients.**



EMS Treatment for VAD Patients

- It is **not** recommended to defibrillate with the patient plugged into the AC outlet. They should be operating on battery power if use of a defibrillator is necessary.



EMS guidelines for patients with a VAD

- Keep in mind that all VADs are dependent on adequate preload in order to maintain proper function so volume resuscitation in an unstable VAD patient may be your initial therapy.
- So you should start an IV and be prepared to give fluids on all VAD patients.



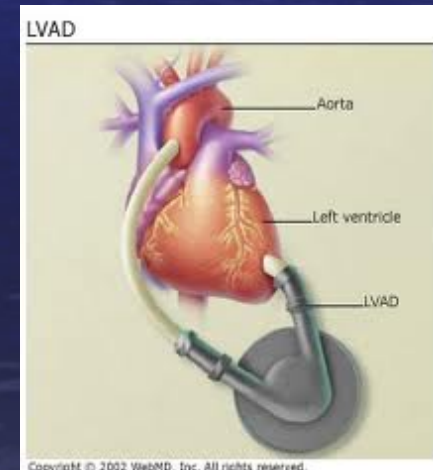
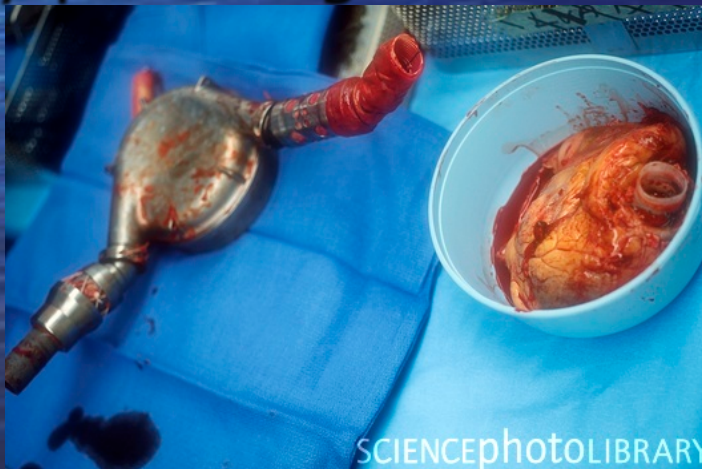
EMS guidelines for patients with a VAD

- It is important not to administer nitrates unless instructed by the patient's physician or implanting center's VAD coordinator.



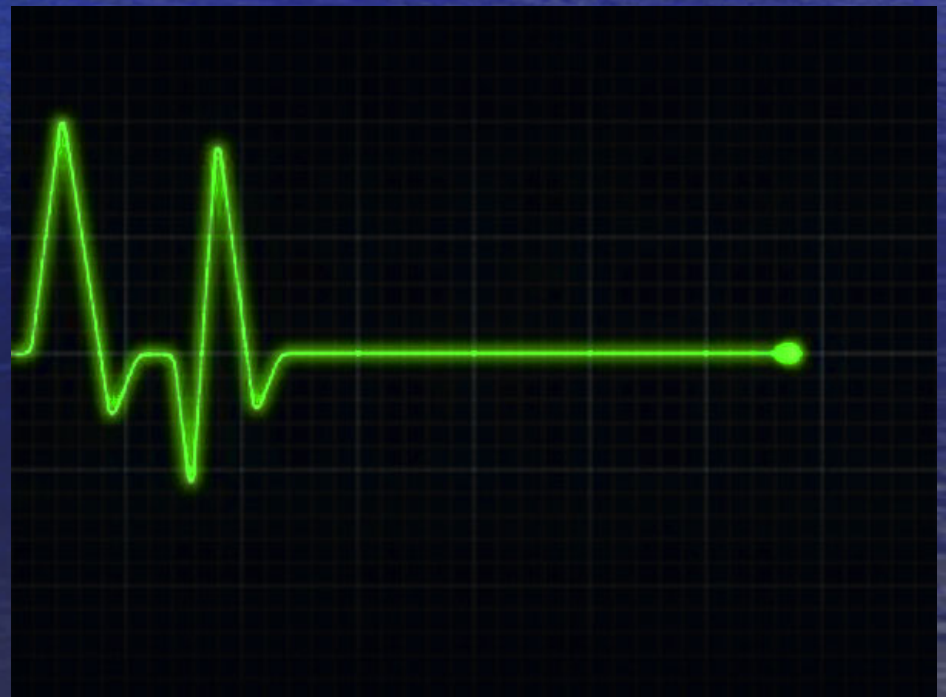
NO CPR for VAD patients!

- In the event of cardiac arrest, external chest compressions pose a risk due to the location of the LVAD outflow graft on the aorta and inflow cannulation of the left ventricle.
- Disruption of the anastomosis site could lead to fatal hemorrhage. Clinical judgment should be used when deciding whether or not to perform external compressions and calling the VAD center may provide guidance.



No CPR for patients with a VAD

- **DO NOT INITIATE CPR** unless instructed by physician or implanting center's VAD coordinator.
- Internal hardware may become displaced and cause internal bleeding and possibly death.



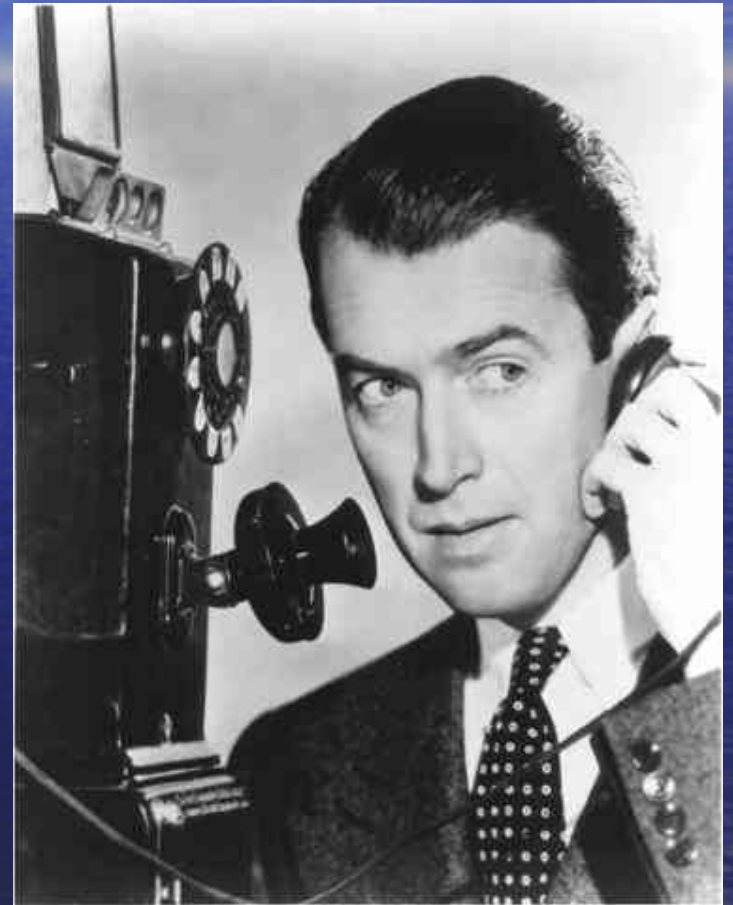
EMS guidelines for patients with a VAD

- Locate the number for the implanting center's VAD Coordinator and **listen** to family and friends.
- They are most likely the experts on how the VAD works and have been trained on how to manage the device.
- You can look in the patient's equipment bag for manuals and quick guides.



EMS Treatment for VAD Patients

- Calling the phone number on the device and speaking to personnel at the hospital where the patient received their device is always the best way to get specific guidance as to what to do with these patients in the field.



EMS guidelines for patients with a VAD

- You should try and transport to the implanting center when able. Not all hospitals are equipped to manage these complex patients and they may just have to transfer the patient.



EMS guidelines for patients with a VAD

- You should allow the patient's caregiver to remain with the patient and transport all VAD equipment with the patient.
- Remember that all equipment and cords attached to the patient should be secured and tangle free for transport to prevent device damage.

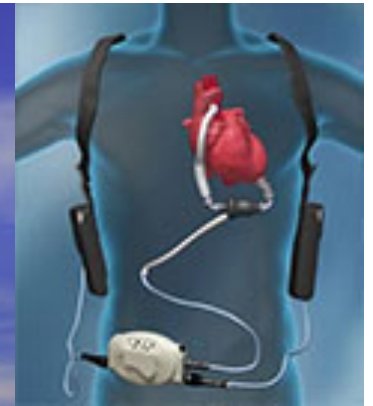


Heartmate II

- The Heartmate II is currently FDA approved for bridge to transplant therapy and was approved in January of 2010 by the FDA for use in non-transplant candidates for destination therapy.



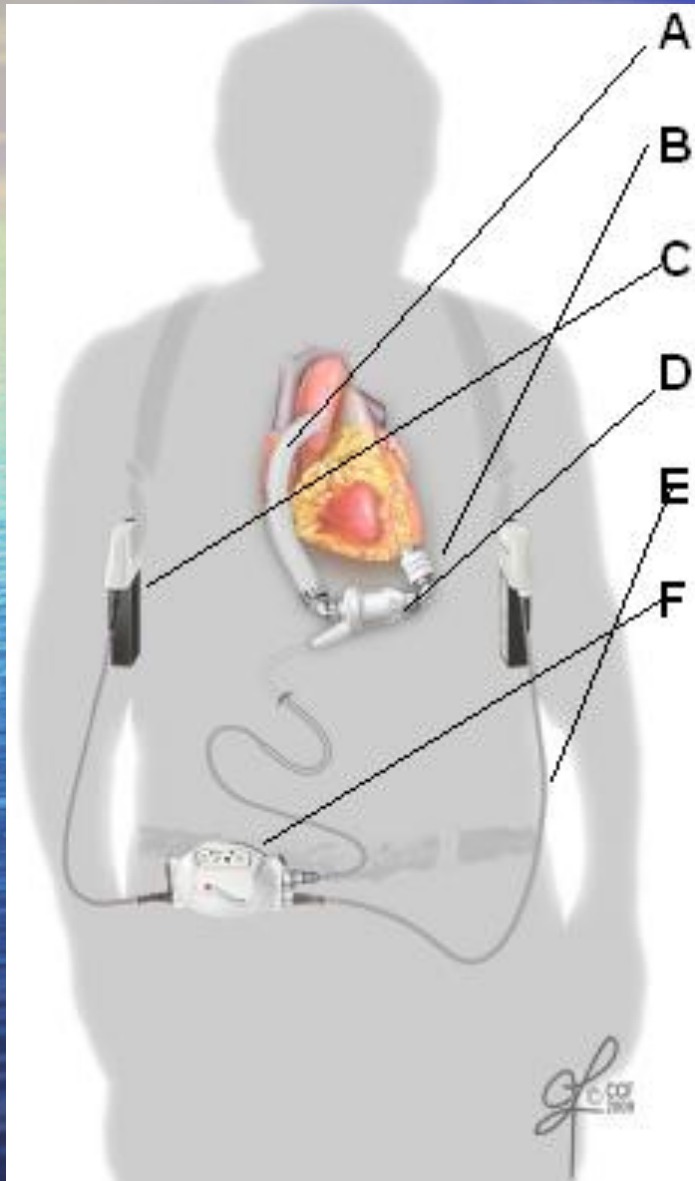
Heartmate II



- One of the more common VADs currently utilized
- Non-pulsatile axial flow left ventricular assist device. This device is small and durable and provides a constant flow of blood from the heart to the body.
- Dick Cheney has one!



Diagram of the HeartMate II and its components



Outflow tube (A) attached to the aorta (the large artery that carries blood away from the heart)

Inflow tube (B) (or conduit), attached to the bottom (apex) of the left ventricle

Power source (C) The HeartMate requires either electrical power or battery power to work. Pictured here, the device is operating on battery power.

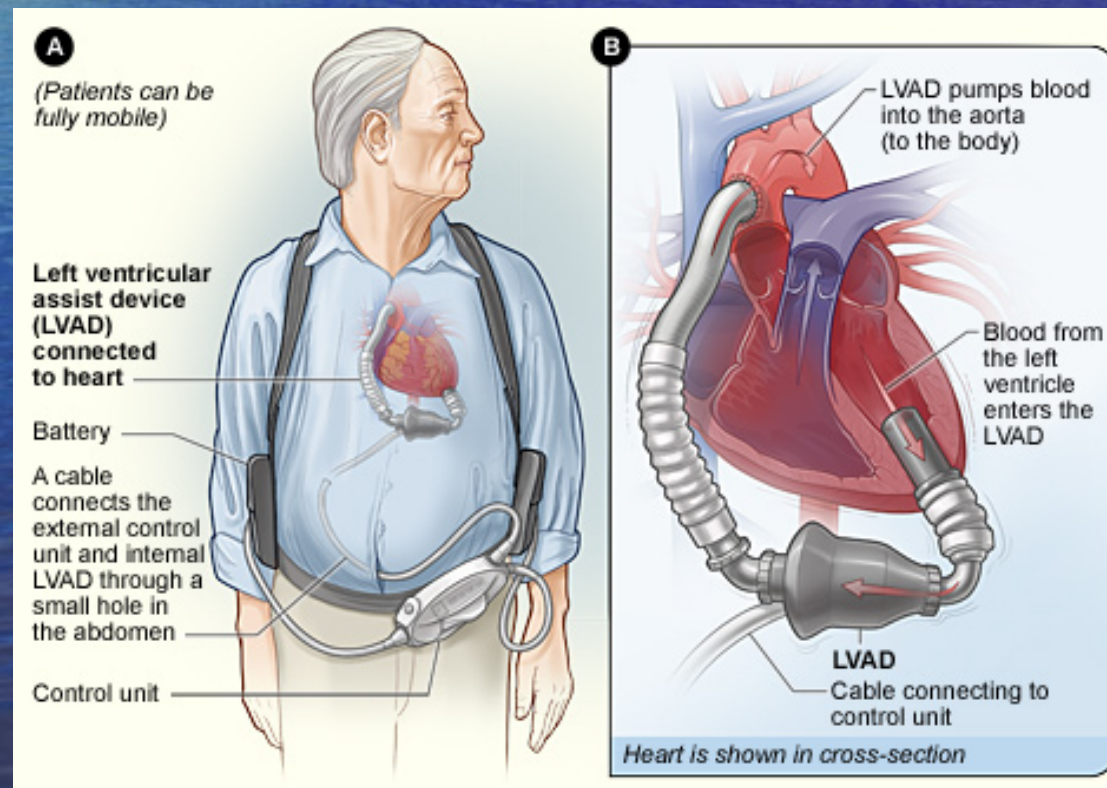
Pump unit (D)

Driveline (E) that passes from the internal device through the skin, and outside your body to the controller. It contains the electrical cables that power the pump.

External controller (F) (outside the body) that attaches to the pump through the power leads and to either a power base unit or batteries. The controller is a computer that monitors the pump's function. It displays the status of the system and has alarms that sound when necessary.

Heartmate II LVAD

- If the patient is unstable, perfusion is inadequate or the LVAD has stopped, quickly perform the following steps:



HEARTMATE II LVAD TROUBLESHOOTING

If the VAD Pump has Stopped: Equipment Disconnection, Activated Continuous Alarms, Absence of “humming” sound (stethoscope) just above diaphragm.

Confirm amount of time pump has been stopped. A prolonged period of stoppage can increase the risk of clot formation and expulsion when the pump is restarted.



See brochure!

1. Fix any external loose connections (3 possible) to the System Controller.

If pump does not re-start:

2. Consider replacing the 2 batteries (one at a time!) with new, fully-charged pair.
(Batteries are good for 3 up to 16 hours; charger / AC adapter is available from the patient.)

HEARTMATE II LVAD TROUBLESHOOTING

VAD – General Approach:

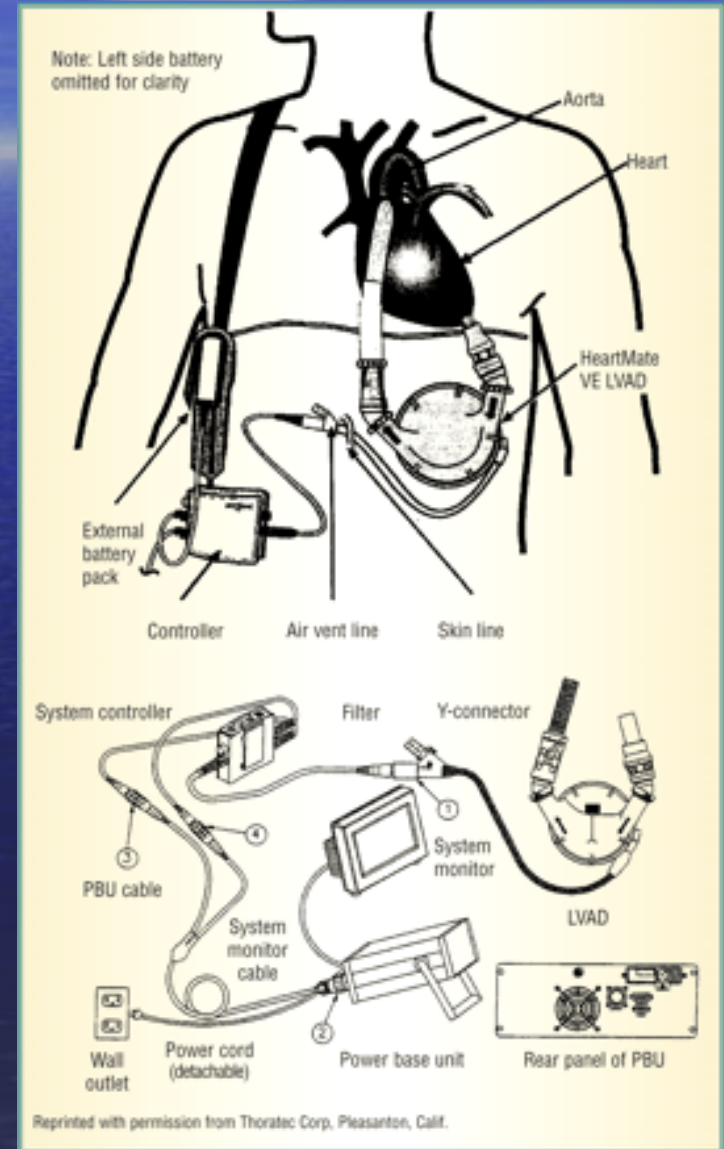
- If no VAD alarms: “Ignore the VAD” – assessment et al. per usual.
- **LOOK** for the patient’s “**Emergency Contact Card.**”
- **LOOK** for *extra* **batteries** (? w/ pt.) / **battery charger** or **AC adapter** (? @ home) / *extra system controller* (? w/ pt.)
- **HeartMate II**: make up majority of currently implanted “Community VADs”
= left ventricular assist system (refer to diagram in brochure).
- **Batteries**: must be charged & connected for the VAD for continuous function.
- **Anti-Coagulated**: assume the patient is anti-coagulated – coumadin is common.
- **EKG 12-Lead**: do per usual / no interference from VAD.
- **CPR**: avoid external chest compressions... unless no other intervention effective.
- **Arrhythmias**: symptoms may not be classic: “think like an AED” (shock if malignant).

HEARTMATE II LVAD TROUBLESHOOTING

- **Defibrillation:** provide external per usual / disconnect only: AC adapter if present.
- **Pulses:** may not be detectable due to VAD continuous blood flow mechanism.
- **Blood Pressure:** difficult to auscultate; may obtain MAP only (*consider* doppler / art. line).
- **Pulse Oximetry:** “sketchy” with no-pulse VADS.
- **Chest X-Ray:** verify internal cannula placement x2 (aorta and left ventricle).
- **Resuscitation:** LVAD is pre-load (RV) dependent (sensitive to volume status).

Heartmate II LVAD

- Check that the percutaneous lead is connected to the system controller.
- If the percutaneous lead becomes disconnected from the system controller, the pump will stop and could result in serious injury or even death.



Heartmate II LVAD

- Avoid cutting the percutaneous lead or power leads and keep them close to the patient



Heartmate II LVAD

- Check that both system controller power leads are connected to power.
- Never remove both batteries at the same time or the pump will stop. This could result in serious injury or even death.





Columbus EMS

Dear _____,

This letter is to inform you that one of our patients is being discharged in to your community. We want to let you know because this patient has special healthcare needs. As a potential first responder, you may appreciate knowing in advance how to respond to potential emergencies concerning this patient.

The patient has a HeartMate II (r) Left Ventricular Assist Device (LVAD) or blood pump. Please find attached educational materials concerning the HeartMate, patient demographics, a brief history, and contact numbers.

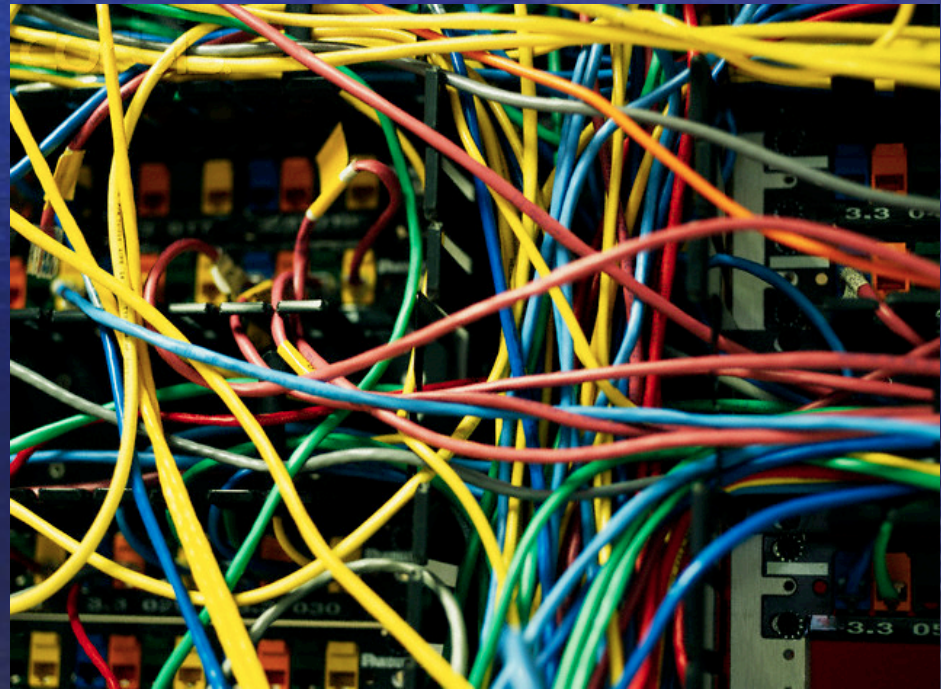
Be Prepared!

- Pay a visit to the home of the patient. Introduce yourselves as EMS providers for the local agency and make sure the patient and their family/friends know how far away you are when they call 911.



Be Prepared!

- During your visit, talk to the patient and their family/friends and familiarize yourself with the device and equipment.



Be Prepared!

- Communicate with the other EMS personnel who may run on that patient and let them know the information you learned in your visit.



Be Prepared!

- Have a plan of action and/or a protocol in place so that your approach to these patients becomes standardized and familiar.



QUESTIONS????????????????

"HeartMate II LVAS Outpatient EMS Program"

<http://www.thoratecu.com>

