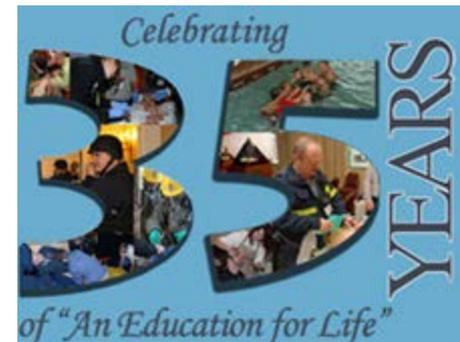


EMS Symposium 2014 LVAD Patients.... Get Them Back To The Implanting Center..... Alive!

Tonya Elliott, RN MSN CCTC CHFN
Clinical Specialist MedStart Washington
Hospital Center
November 7, 2014



Disclosures

- ▶ I have not relevant financial disclosures



Objectives

- ▶ By the end of the lecture participants will:
 - State the indications for VAD implant
 - State key components of VAD systems
 - Describe patient pump complications
 - Identify VAD resources

Dick Cheney: Conversation To The National Stage

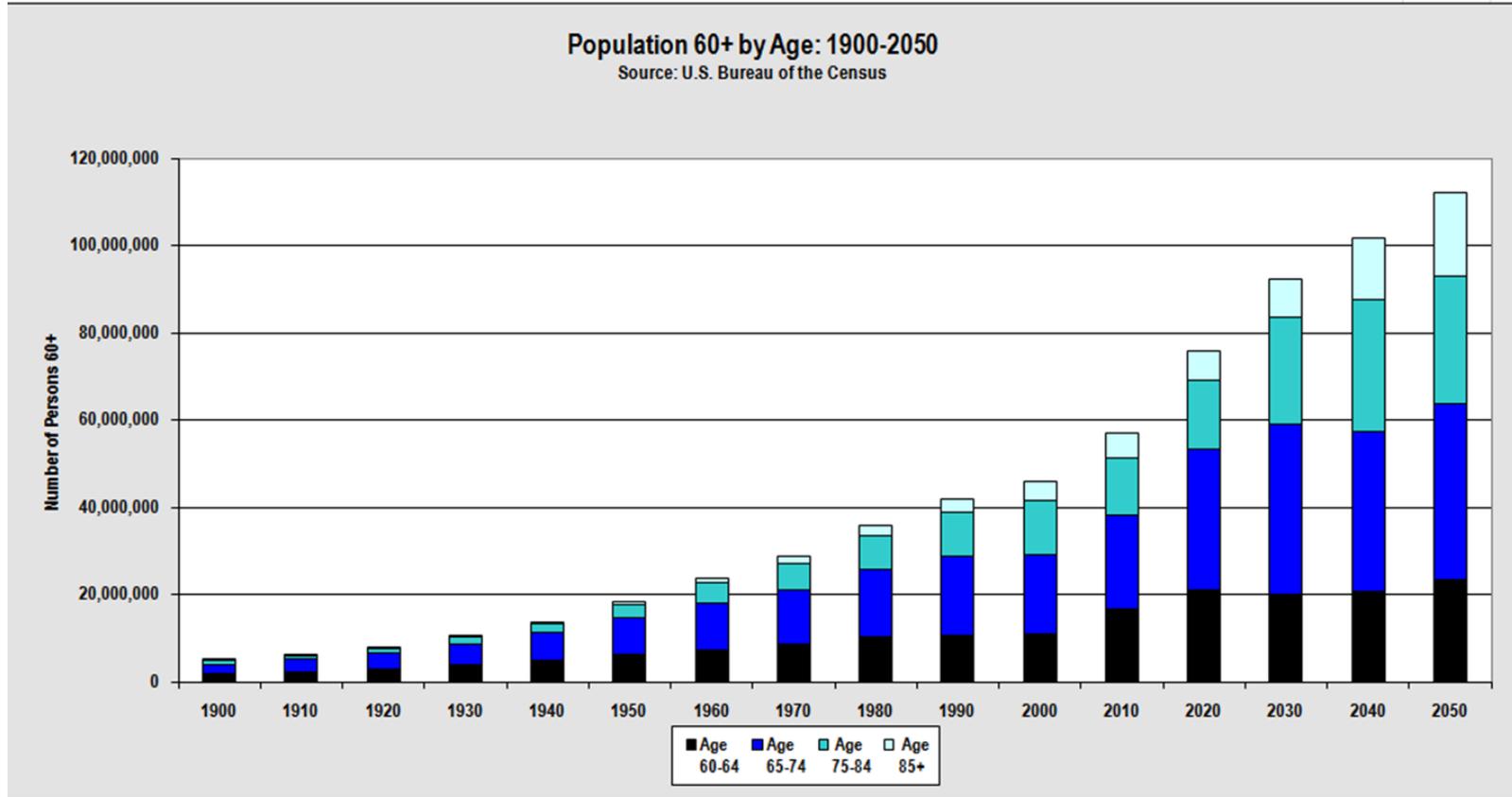


Why You Need To Know This Stuff: Heart Failure in US: Growing Epidemic

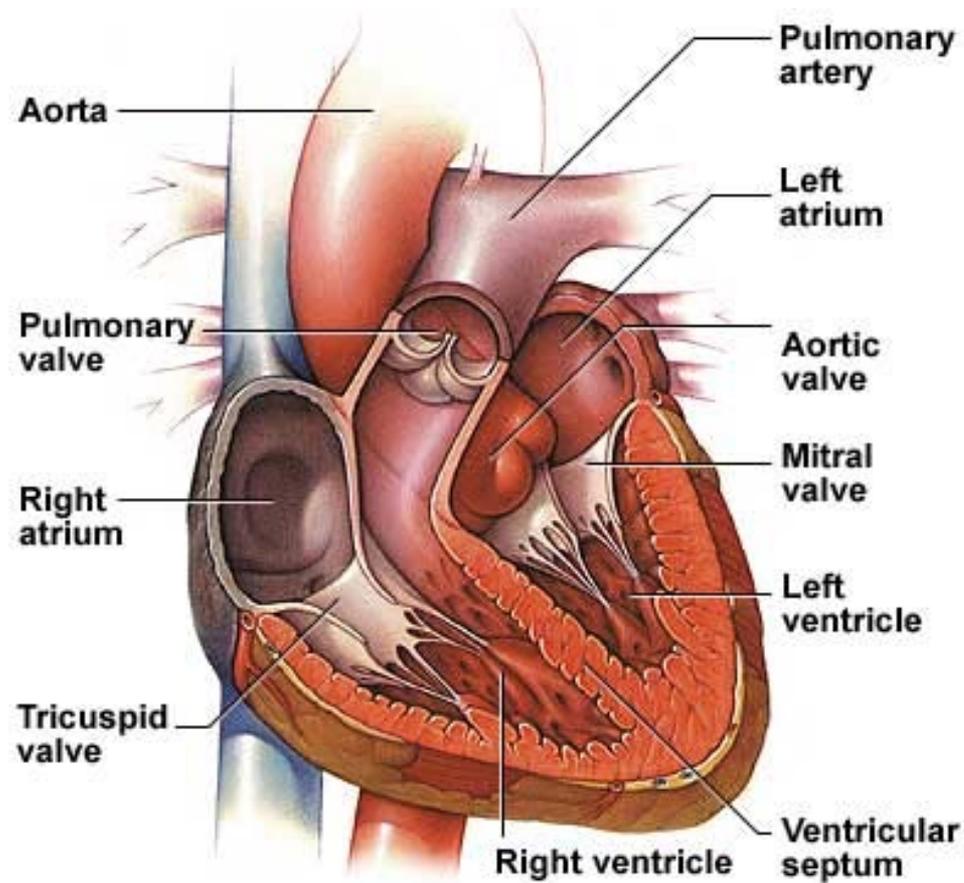
- ▶ Affects ~5.5 million patients¹
 - ~1 of every 100 people >65 yr
 - 550,000 new cases each year
 - *Aging population* will mean millions more within 30 years
- ▶ Mortality
 - 33% at 1 yr²
 - 50% at 5 yr³
 - In-hospital 3.9%⁴

Aging Population

This chart shows the large increase in the population 60 and older from 4.9 million people in 1900 to 45.8 million in 2000 and projected to 92.2 million in 2030 and 112 million in 2050.



Normal Heart Function

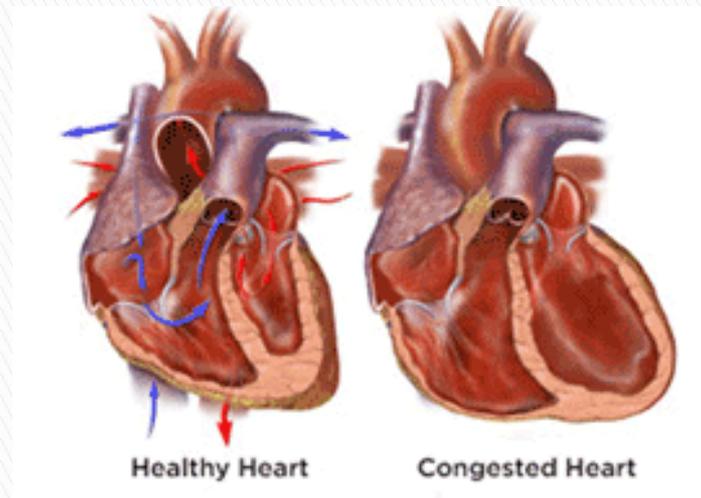


© Mayo Foundation for Medical Education and Research. All rights reserved.

Heart Failure (HF): The Heart Isn't Strong Enough

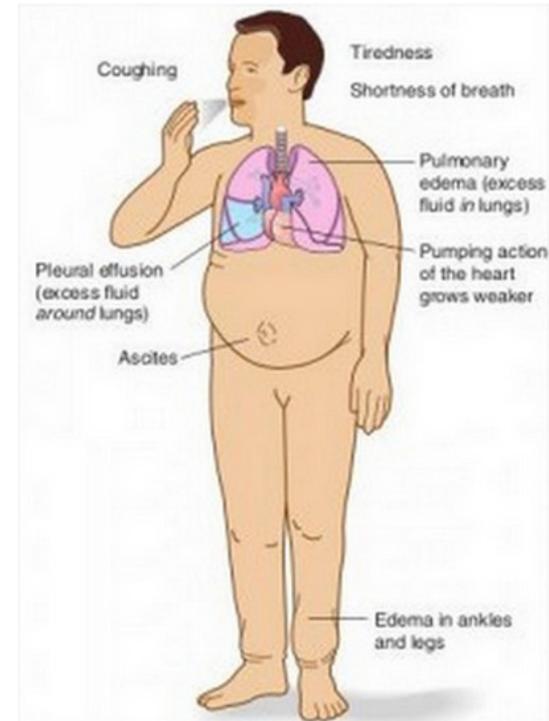
What causes HF:

1. Ischemic Disease:
Coronary Artery Disease
2. Valvular Disease: Heart
Valve don't prevent
backwash
3. High Blood Pressure
4. Diabetes
5. Post partum
6. Viral
7. Idiopathic
8. Infiltrative
9. Restrictive
10. Non -compaction
11. Exposure to cardiac
toxic substances:
 1. Chemo
 2. ETOH



What Symptoms Will Patients Have?

- ▶ Shortness of Breath
- ▶ Cough
- ▶ Fatigue
- ▶ Congestion
- ▶ Swollen abdomen
- ▶ Edema

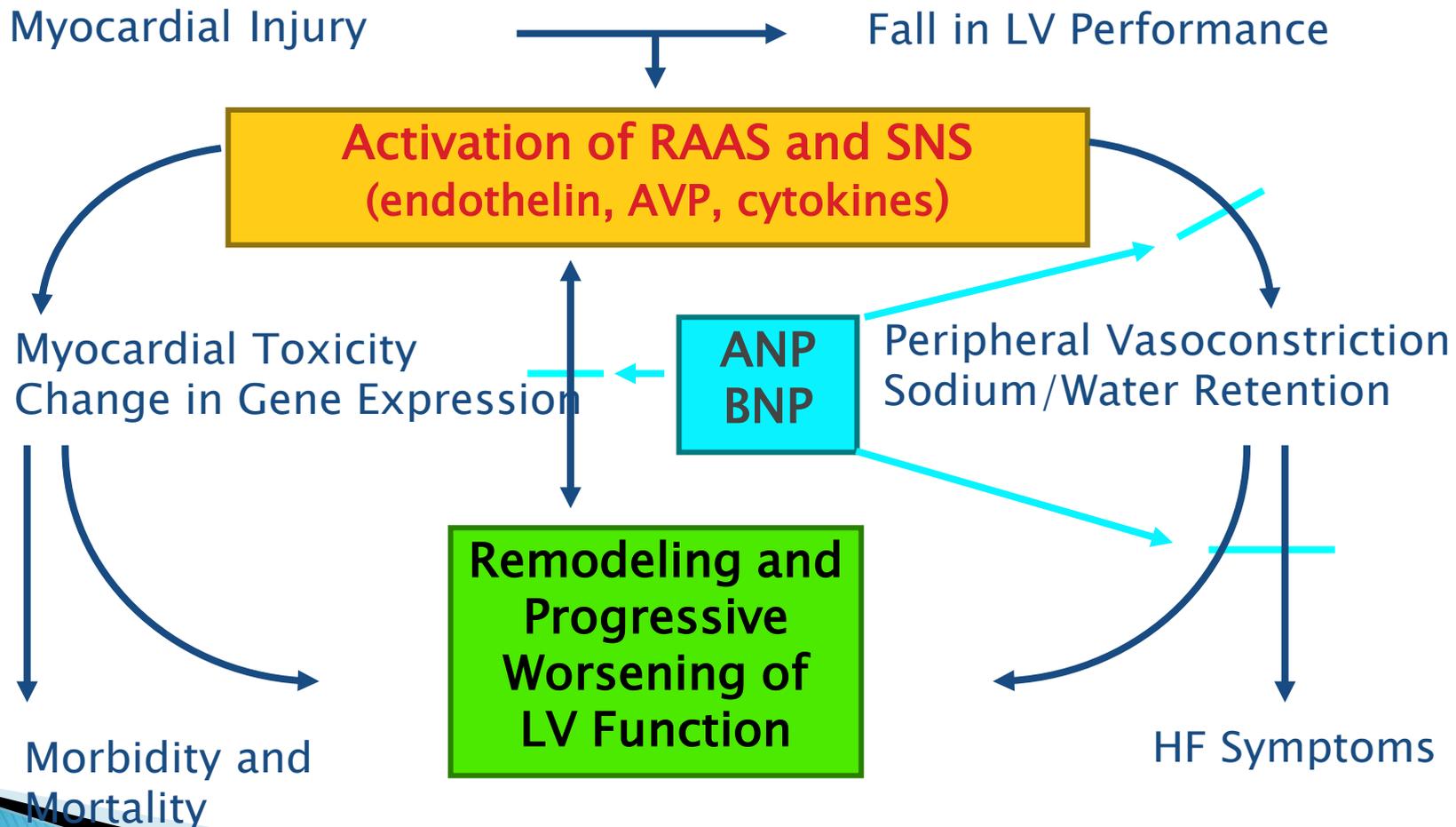


Heart Failure Definition

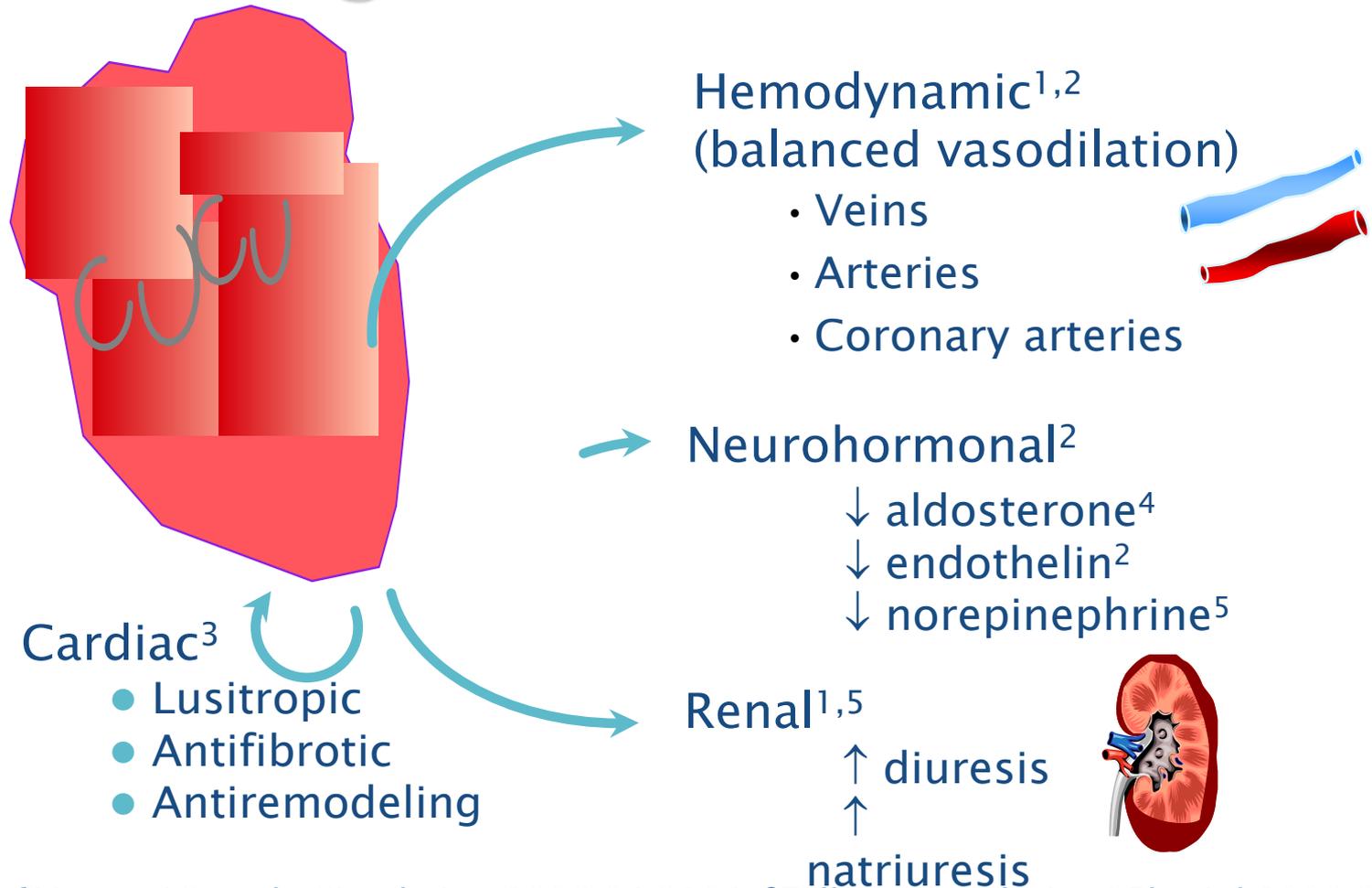
HF, a complex clinical syndrome, can result from any structural or functional cardiac disorder that impairs the ventricles' ability to fill with or eject blood.

Cardinal symptoms are fatigue and dyspnea, and clinical signs are fluid retention and exercise intolerance

Pathophysiology of ADHF



Physiologic Actions of Endogenous hBNP



¹Marcus LS et al. *Circulation*. 1996;94:3184; ²Zellner C et al. *Am J Physiol*. 1999;276(3 pt 2):H1049; ³Tamura N et al. *Proc Natl Acad Sci U S A*. 2000;97:4239; ⁴Abraham WT et al. *J Card Fail*. 1998;4:37; ⁵Clemens LE et al. *J Pharmacol Exp Ther*. 1998;287:67

What Do We Do?

ACC/AHA Guidelines

- ▶ Education
- ▶ Diagnostic testing/ Evaluation
- ▶ Medication management
- ▶ ICD
- ▶ CRT
- ▶ Referral to an advanced HF VAD/Tx program
 - Class 1 recommendation for all patients failing optimized maximum medical management

**Education:
Medication Noncompliance or
mistakes = 24% readmission**



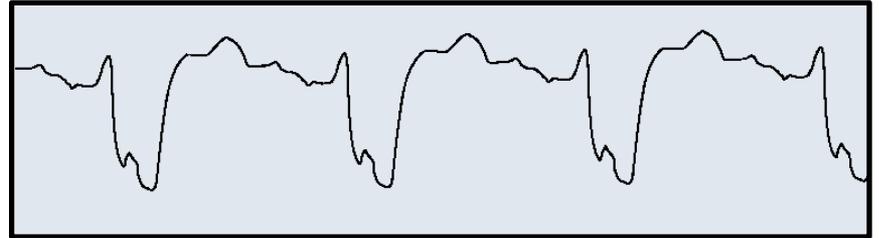
Treatments



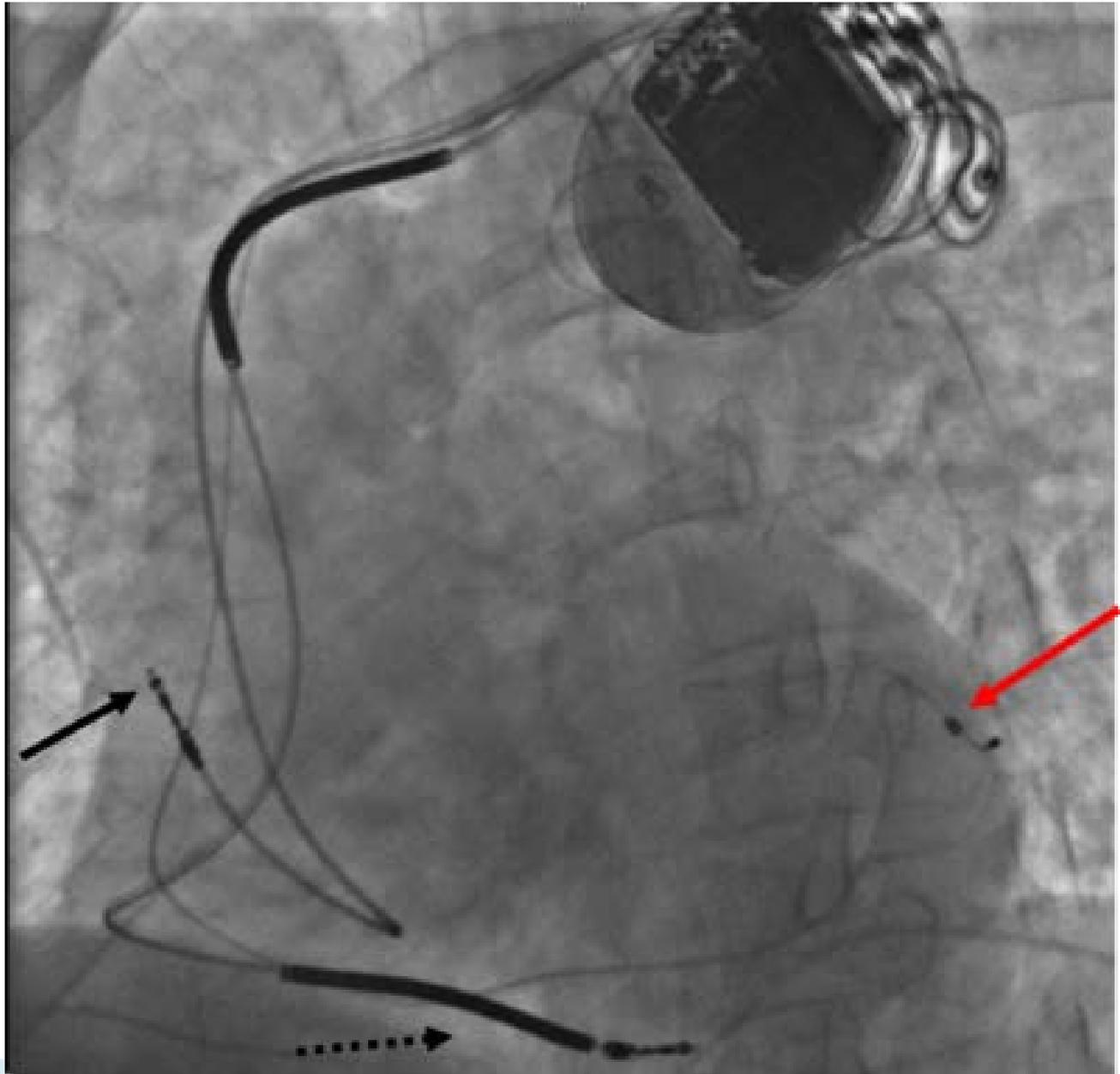
- ▶ Oral medications
 - Beta Blockers
 - ACE Inhibitors
 - Diuretics
- ▶ IV medications
 - Inotropes
- ▶ Devices
 - ICDs
 - BiV Pacemakers
- ▶ Heart replacement
 - VADS
 - Transplant

Cardiac Resynchronization Therapy

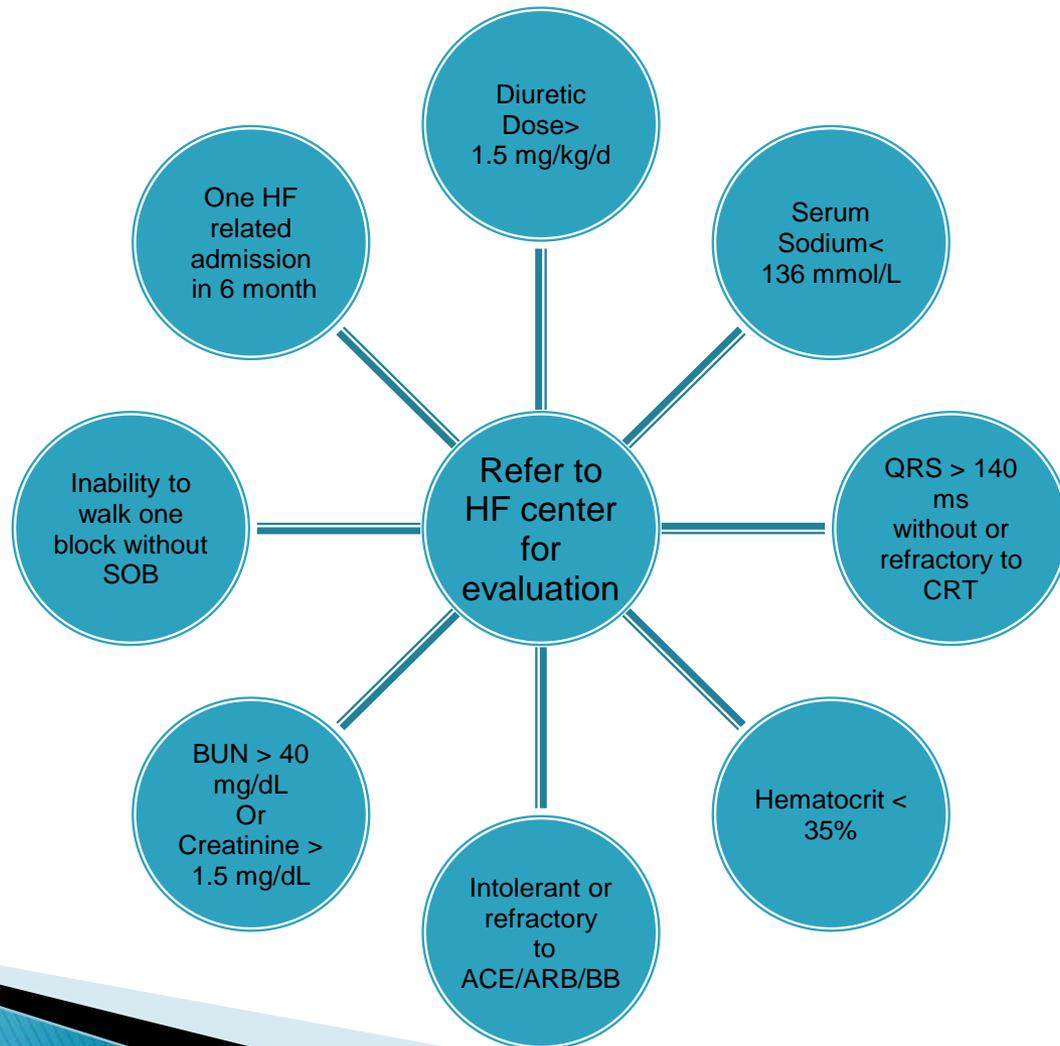
- ▶ Cardiac resynchronization, in association with an optimized AV delay, improves hemodynamic performance by forcing the left ventricle to complete contraction and begin relaxation earlier, allowing an increase in ventricular filling time.
- ▶ Coordinate activation of the ventricles and septum.



ECG depicting cardiac resynchronization



Patient Referral Guidelines



Three Indications

- ▶ Bridge to transplant (BTT)
- ▶ Destination therapy (DT)
- ▶ Recovery



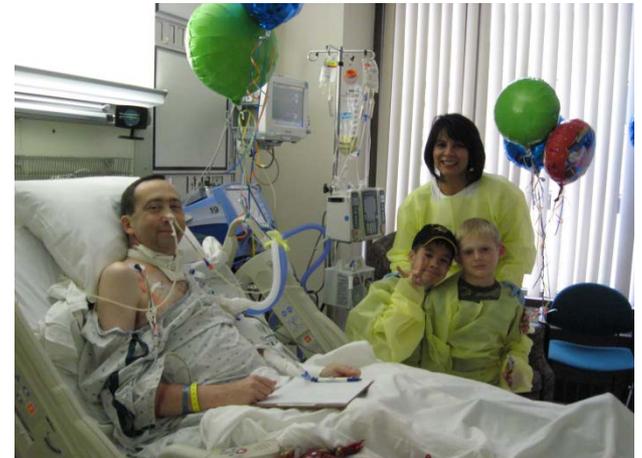
Indications for VAD Surgery

- ▶ NYHA functional class IV symptoms
- ▶ Life expectancy <2 years due to heart failure
- ▶ Failure to respond to optimal medical management for at least 60 of the last 90 days
- ▶ Left ventricular ejection fraction $\leq 25\%$
- ▶ Refractory cardiogenic shock or cardiac failure†
- ▶ Peak oxygen consumption $\leq 14 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$
- ▶ Continued need for intravenous inotropic therapy limited by symptomatic hypotension, decreasing renal function, or worsening pulmonary congestion
- ▶ Recurrent symptomatic sustained ventricular tachycardia or ventricular fibrillation in the presence of an untreatable arrhythmogenic substrate

Contraindications for VAD Surgery

- ▶ Potentially reversible cause of heart failure
- ▶ Recent or evolving stroke
- ▶ Neurological deficits impairing the ability to manage device
- ▶ Coexisting terminal condition (eg, metastatic cancer, cirrhosis)
- ▶ Abdominal aortic aneurysm ≥ 5 cm
- ▶ Biventricular failure in patients older than 65 years
- ▶ Active systemic infection
- ▶ Fixed pulmonary or portal hypertension
- ▶ Severe pulmonary dysfunction (eg, FEV1 < 1 L)
- ▶ Impending renal or hepatic failure
- ▶ Multisystem organ failure
- ▶ Inability to tolerate anticoagulation

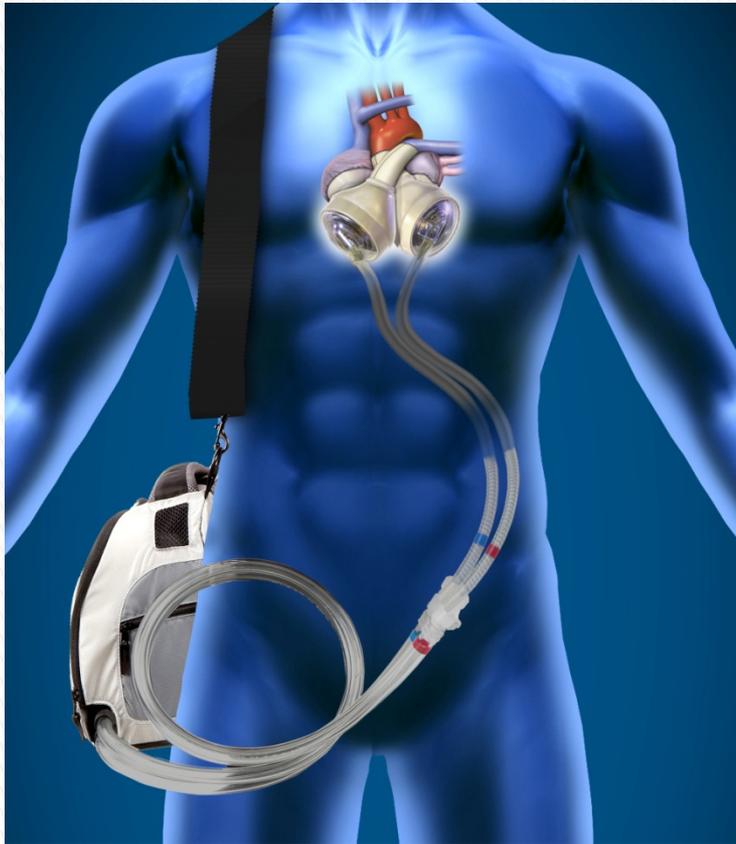
Post Operative Course



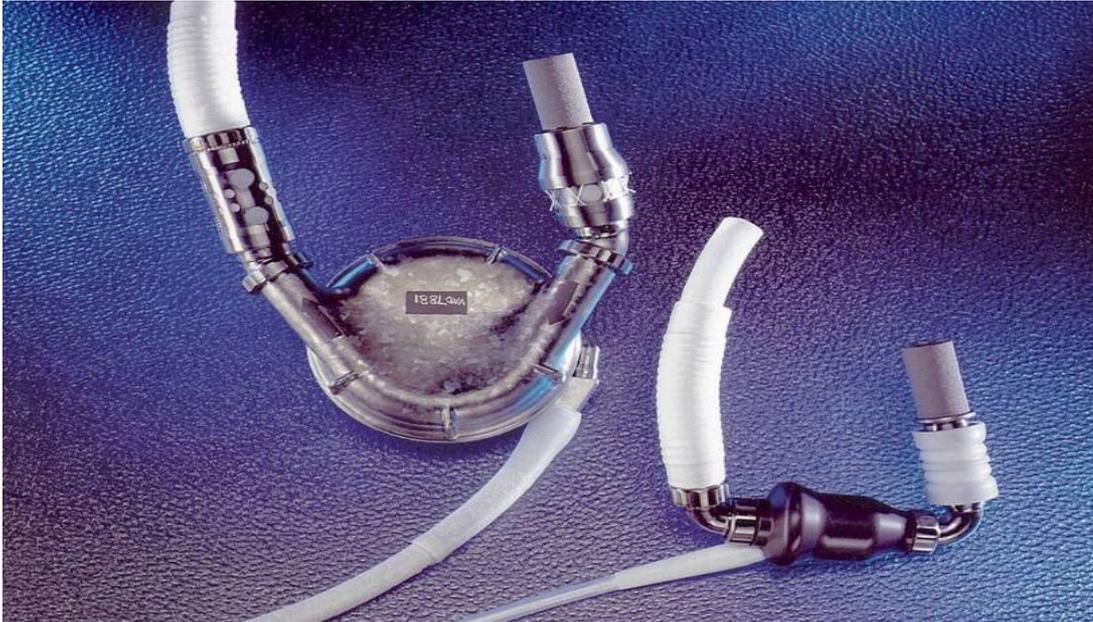
Biventricular Support



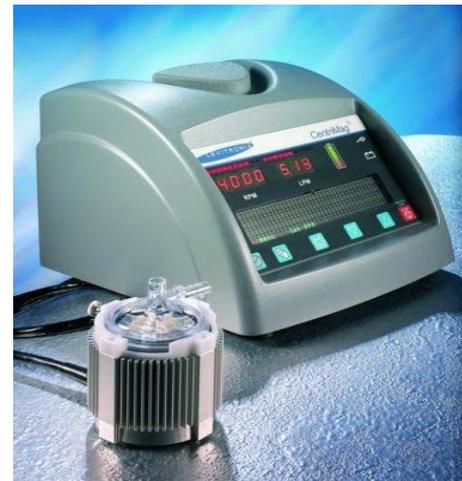
Total Artificial Heart



1st Generation Pump vs. 2nd



Short term Mechanical Support



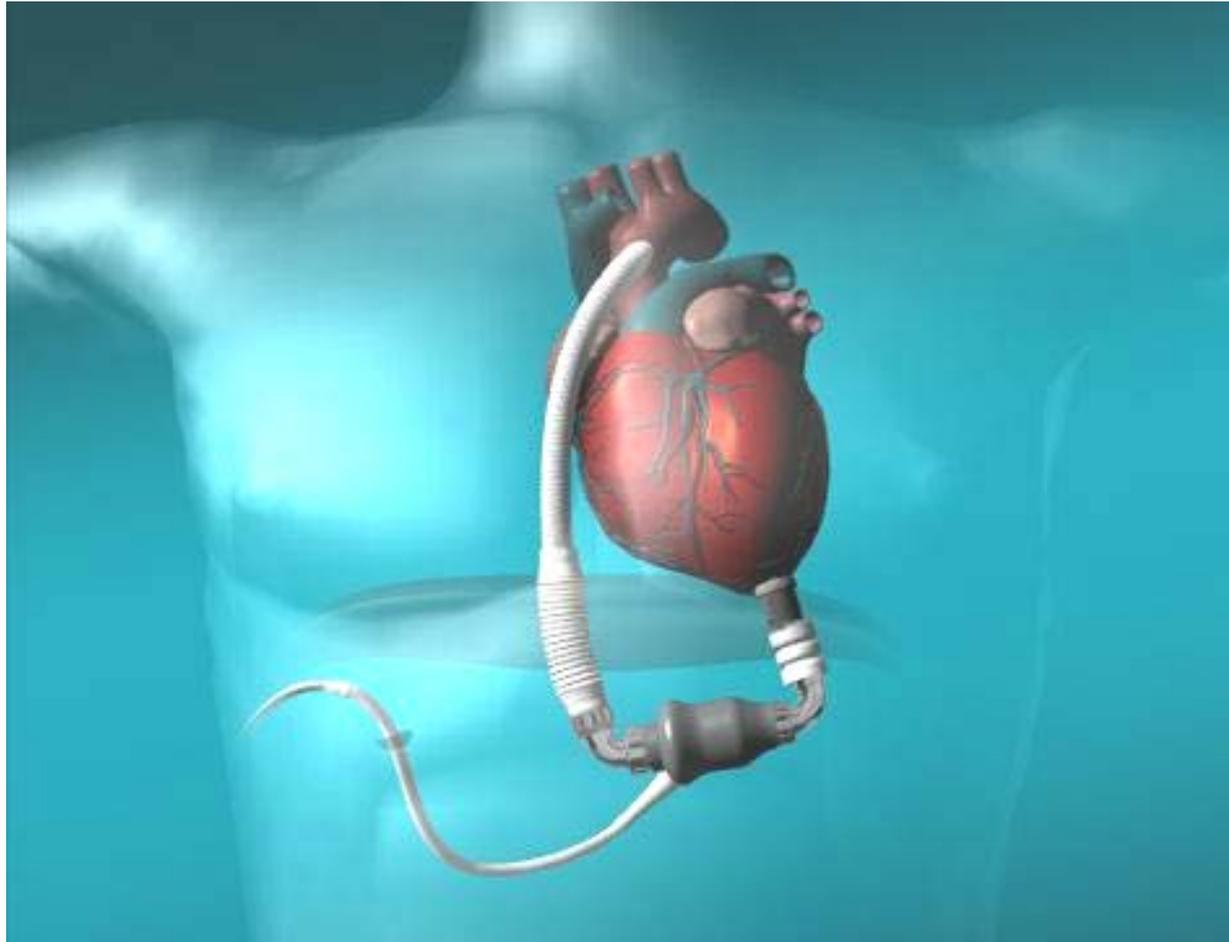
Temporary BiVADs



Surgical Implant

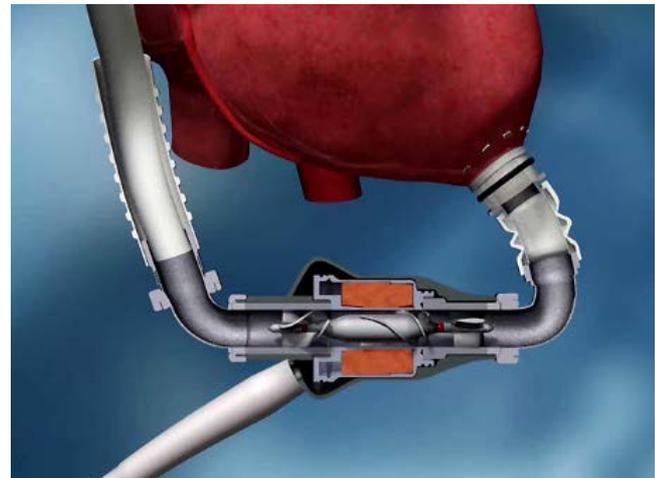


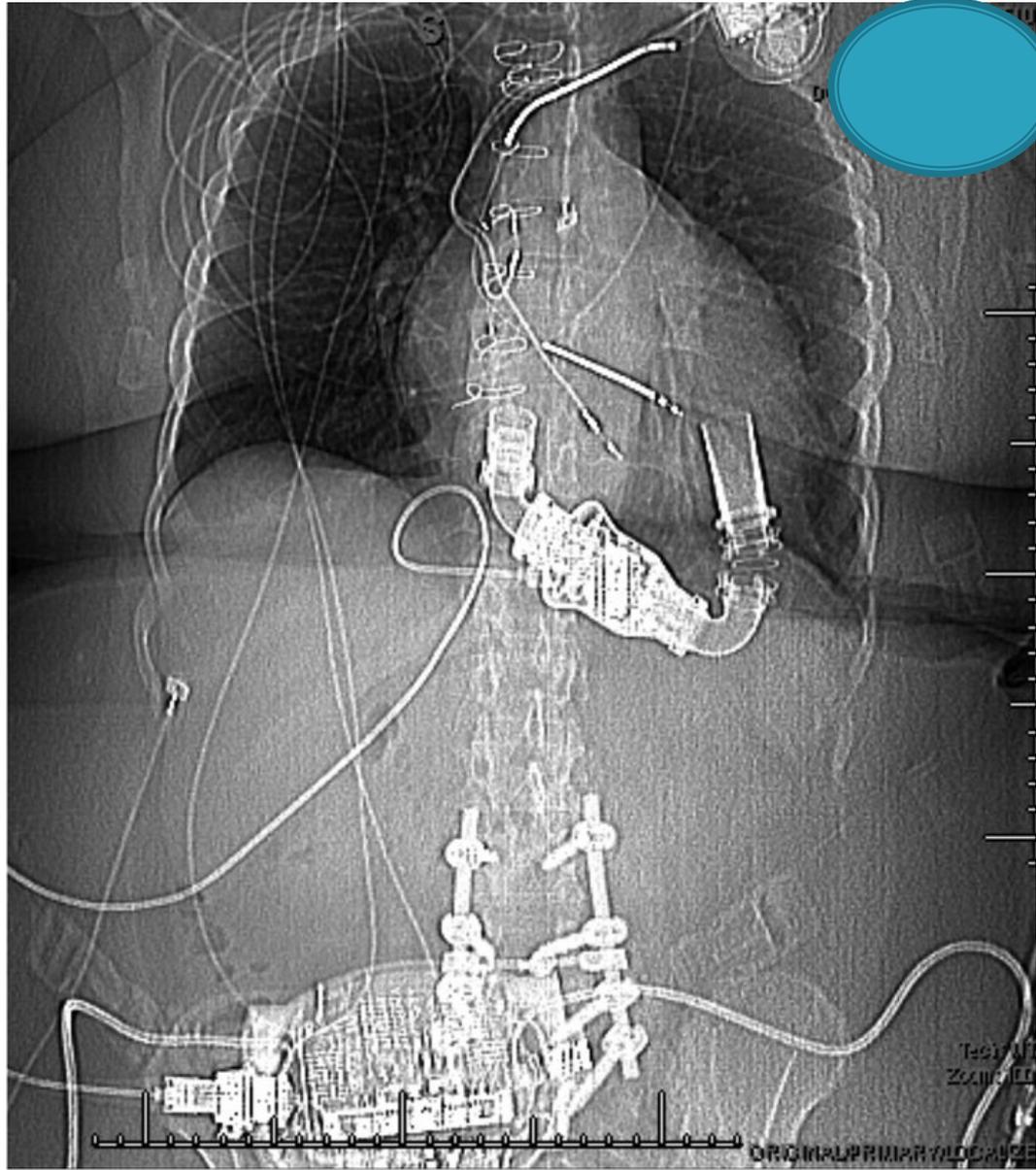
Surgical Implant



Heart Mate II

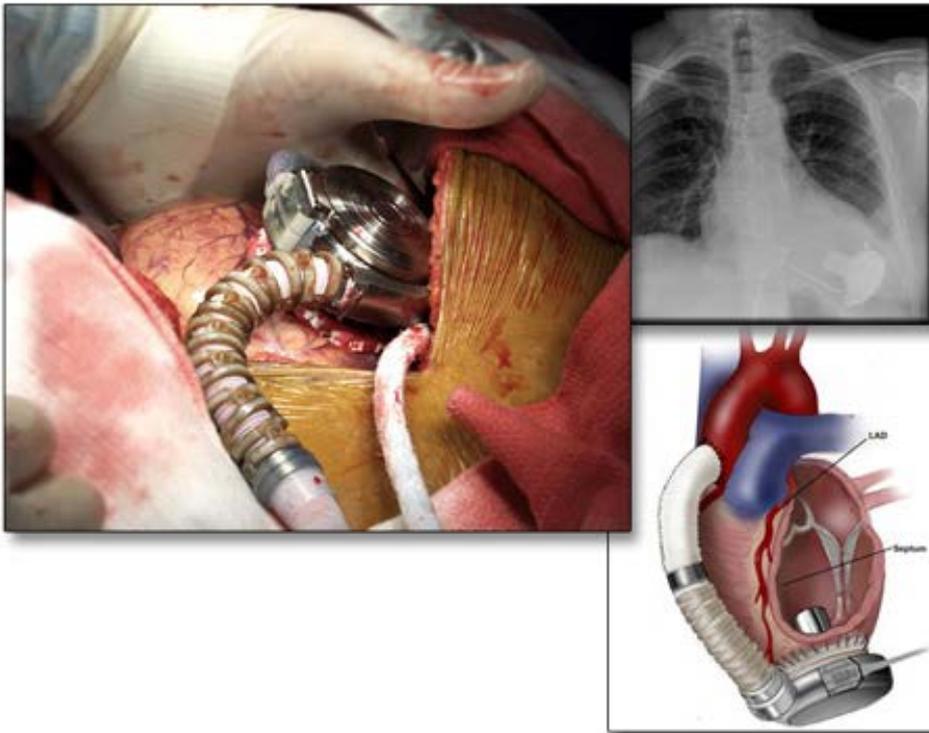
- ▶ Approved for BTT
- ▶ Approved for DT
- ▶ Axial Flow
- ▶ 2nd Generation
- ▶ Over 10,000 implants world wide





HeartWare

HeartWare HVAD Implanted in Pericardial Space



Potential Benefits

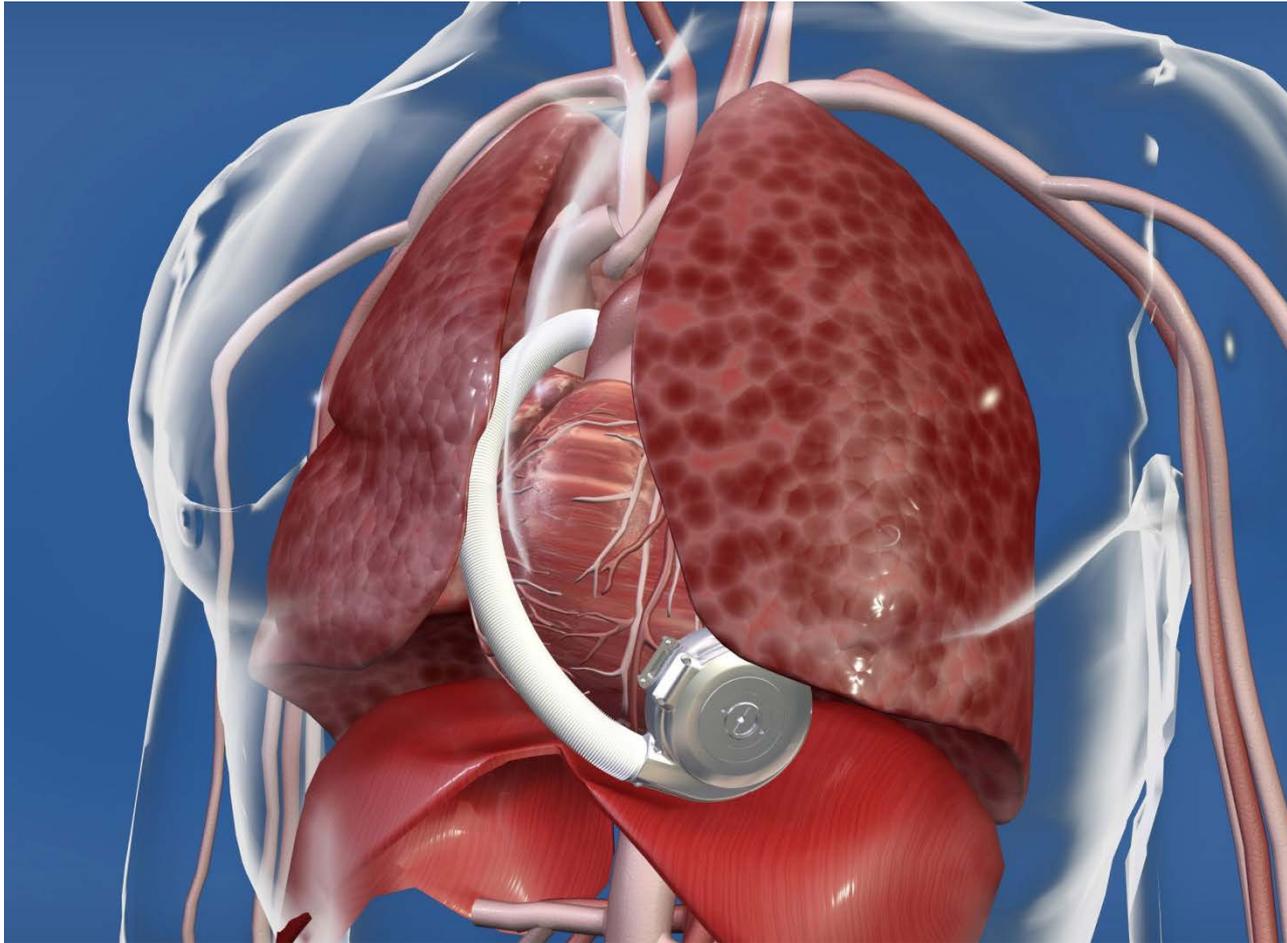
No pump pocket or
abd surgery

Shorter implant time

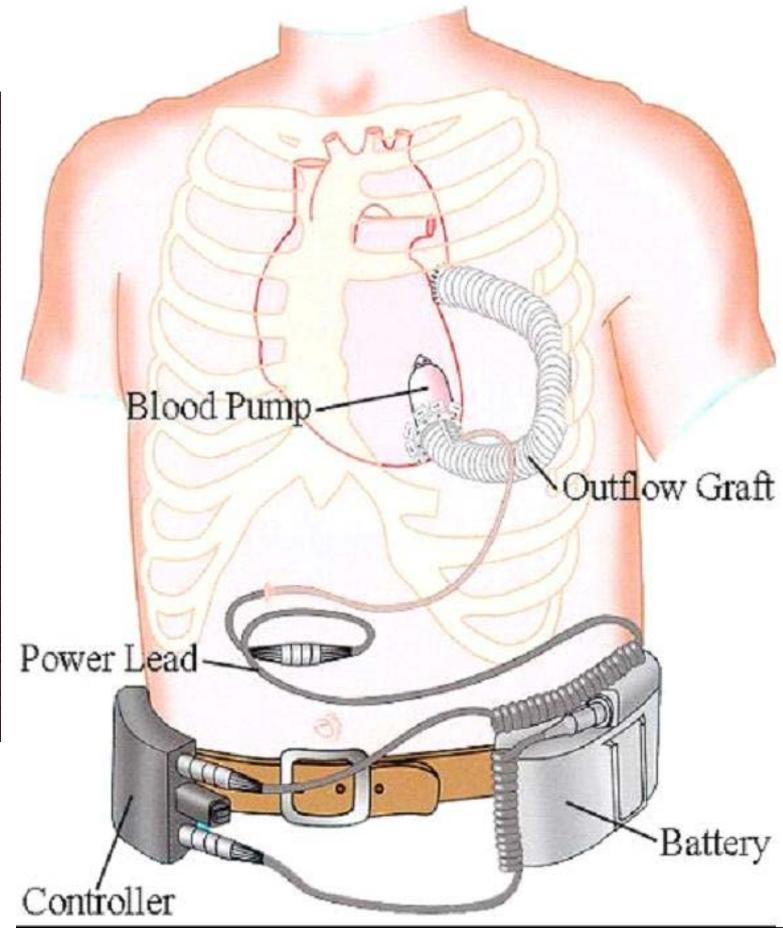
Reduced procedural
invasiveness
and complexity

Reduced recovery time

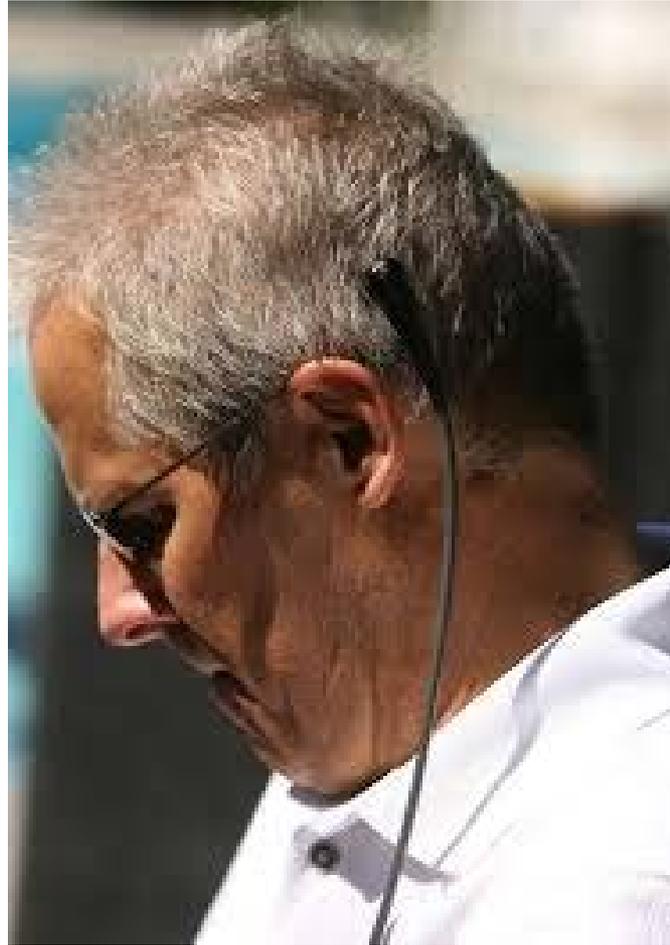
HeartWare



Jarvik: Externals and Power Source

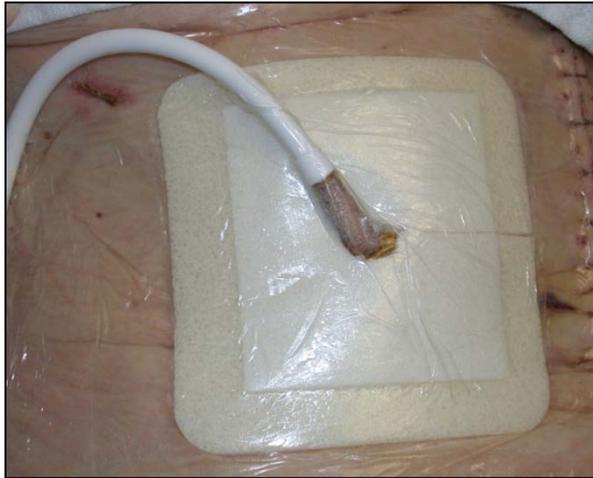


Cochlear Exit Site for Jarvik

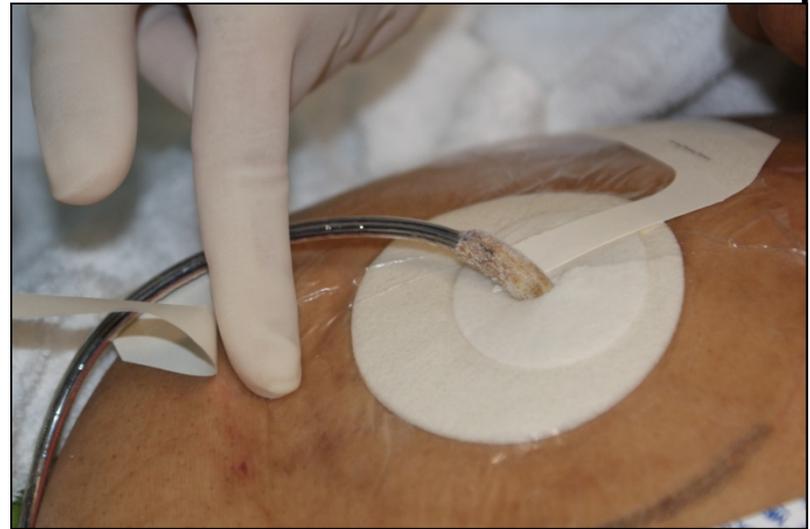


Drive Line Exit Site (DLES)

HeartMate II



HeartWare





Infected Drive Line



Reduce DLES Infections with Securement Devices Anchor



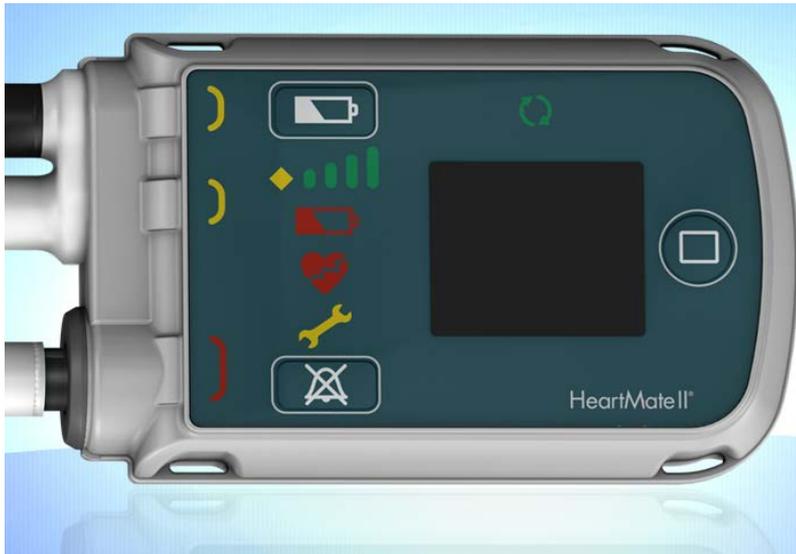
Trauma Scissors

- ▶ Be cautious with the trauma scissors
- ▶ Could easily cut a cable
- ▶ Disrobe or palpate for equipment before cutting off clothes



Controllers: The Brains

▶ HMII PC



▶ HeartWare



System Monitors: Used at Implanting Centers



Power Module/AC adapter



	HeartMate II	HeartWare
Connections	White to white/ black to black	One to AC adapter, the other to battery
Outlet (s)	Only plug into a red outlet	Only plug into a red outlet
Back-up	Patient's home, Implanting center	Patient has two AC adapters

Batteries



	HeartMate II	HeartWare
Clips	Has battery clips attach it to controller	Does NOT require battery clip. Gentle twist connection
% Power (1 bar =25%)	Can check charge of system on controller 	Can check on battery, but when connected to controller always look at controller for most accurate %

Patients with a Ventricular Assist Device Need Special Considerations

article

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EMAIL PRINT

David Hildebrandt, RN, NREMT-P | David Page, MS, NREMT-P | Jessica L. Boughton, BSN, RN | Katarzyna M. Hryniewicz, MD | Nader Moazami, MD | Paul Satterlee, MD | From the February 2012 Issue | Wednesday, February 1, 2012

Editor's note: A presentation related to this article will be featured at the 2013 EMS Today Conference and Expo. [Click here](#) for more information and to register!

Learning Objectives

- >> Describe the indications and function of ventricular assist devices (VAD).
- >> Assess patients with an implanted VAD.
- >> Differentiate between emergency care for the VAD patient and other patients in cardiogenic shock.
- >> Outline a treatment algorithm for an emergency related to a VAD device.

Key Terms

Ejection fraction: The amount of blood released during each contraction of a ventricle compared with the total volume of blood released by both ventricles.

Hypertension: Marked high blood pressure persistently exceeding 140/90.

Hypovolemia: Lowered solute concentration on one side of a semipermeable membrane than on the other.

Myocarditis: Inflammation of the cardiac muscle.

Ventricular assist device: An artificial device implanted in the chest to assist a damaged or weakened heart in pumping blood—also called a VAD, or an LVAD when the device is connected to the left ventricle.



Listen with a stethoscope over the pump pocket at the lower left rib margin on the anterior chest. A distinct hum will be heard.

FEATURED IN PATIENT CARE

- [Innovative & Cutting-Edge Resuscitation Practices](#)
- [Effect of Prehospital Airway Management on Cardiac Arrest Outcomes](#)

Quick Tips for Left Ventricular Assist Devices (LVADs)

- >> Let patient and/or caregiver lead. They will be your experts.
- >> Remember not to perform chest compressions because they could dislodge the pump, making the patient bleed to death. (Unless the patient is in obvious cardiac arrest and the pump isn't working. Use the assistance of the VAD coordinator to figure this out before starting any compressions).
- >> Perform all other BLS/ACLS protocols as written.
- >> Defibrillate/cardiovert as normal. Don't place pads over the device under the patient's skin.
- >> Remember that these patients typically have an extremely reduced pulse rate or none at all.
- >> A Doppler device and manual blood pressure cuff are the most accurate way to obtain blood pressure. The first sound heard is approximately equivalent to the mean arterial pressure, and 60–90 mmHg is the acceptable range.
- >> Keep in mind that it may be difficult to obtain accurate O₂ saturation because of little or no pulse.
- >> Be careful when removing/cutting off clothes to ensure you don't cut through the driveline, which is the power cord of the pump.
- >> Avoid kinking or twisting driveline when strapping the patient onto the stretcher.
- >> Keep batteries and controller in reach and secured to the patient during transport. Keep them dry.
- >> Take the patient's emergency travel bag when leaving the scene. It has an extra controller, batteries and the VAD coordinator's emergency contact number.
- >> Keep in mind that the most common complications are bleeding (nasal, gastrointestinal or intracranial), thromboemboli (pulmonary embolism, myocardial infarction or cerebrovascular accident), right-sided heart failure, pump malfunction and infection.

Issues and Concerns

- ▶ Patient identification
 - ▶ LVAD device alarms
 - ▶ Patient medical problems
 - Poor pump filling leading to suction events
 - Drive line issues
 - ▶ Provider education/preparation
- 

911 Had MANY Lessons For Us



Field Guides

HeartMate II®

1. Can I do external CPR?
Only if absolutely necessary

2. If not, is there a "hand pump" or external device to use?
No.

3. If the device slows down (low flow state), what alarms will go off?
A red heart alarm light indicator and steady audio alarm will sound if less than 2.5 l/min.

4. How can I speed up the rate of the device?
Check for hypovolemia or right heart failure and treat

5. Do I need to heparinize the patient if it slows down?
Usually no, but you will need to check with implanting center

6. Can the patient be defibrillated while connected to the device?
Yes

7. If the patient can be defibrillated, is there anything I have to disconnect before defibrillating?
No.

8. Does the patient have a pulse with this device?
May have weak pulse or lack of palpable pulse.

9. What are acceptable vital sign parameters?
MAP 70-90 mm Hg with a narrow pulse pressure

10. Can this patient be externally paced?
Yes.

Adapted from Swank, L., and Walle, J. A. Mechanical Circulatory Devices in Transport in ASTM: Patient Transport: Principles and Practice, 4th ed., Mundy, 2011, p. 168.

TRUBLE SHOOTING: HeartMate II®

When the Pump Has Stopped

- Check the connections between the controller and the pump and the power source
- Fix any loose connection (s) to restart the pump.
- If the pump does not restart and the patient is connected to batteries replace the current batteries with a new, fully-charged pair (see changing batteries section on next page)
- If pump does not restart, change controllers (see changing controllers section on next page)

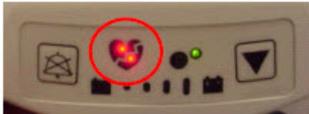
Alarms: Emergency Procedures

Yellow or Red Battery Alarm: Need to Change Batteries.
See changing batteries section on next page.

Red Heart Flashing Alarm: This may indicate a Low Flow Hazard. Check patient—the flow may be too low. If patient is hypovolemic, give volume. If patient is in right heart failure—treat per protocol. If the pump has stopped check connections, batteries and controllers as instructed in the section above.

FAQs

- May not be able to obtain cuff pressure (axial flow pump)
- Pump connected to electric line exiting patient's abdominal area and is attached to computer which runs the pump.
- Pump does not affect EKG
- All ACLS drugs may be given.
- No hand pump is available.
- A set of batteries last approximately 3 hours
- Any emergency mode of transportation is ok. These patients are permitted to fly.
- Be sure to bring ALL of the patient's equipment with them.



This guide does not supersede manufacturer instructions. Copy with permission only. March 2009

Who Is the Patient?????



Heart Mate II Patient



HMII Patient

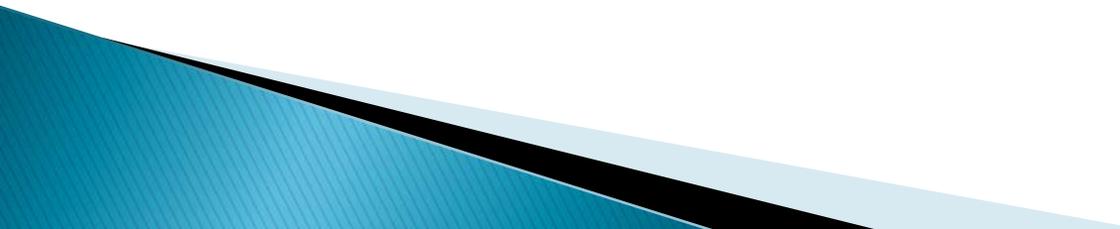
- ▶ Implanted
12/27/2010
- ▶ Golfer
- ▶ Drives
- ▶ Travels



HeartWare Patient at Home



Team Approach

- ▶ One person checks the alarms – begins checking connections
 - ▶ One person pulls the field guides
 - ▶ One person gets the VAD coordinator on the phone
 - ▶ One person may start IV and get heart rhythm monitor
 - ▶ Find the home binder with additional VAD information and patient medications
- 

What Do You Need To Think About

- ▶ Patient identification
 - ▶ Continuous Flow means a change in how we monitor VS
 - ▶ External components are attached to the pump, the pump is attached to the heart
 - ▶ Bring back up VAD supplies from the patient's home and/or personal bags
 - ▶ Call the implanting center
 - ▶ Packing the patient up for transport
- 

Assessment

- ▶ Focus on the basic signs of adequate perfusion
 - Warm extremities
 - Level of consciousness
 - Skin color (pink vs ash)
- ▶ Traditional EMS parameters may not be reliable (BP, pulse, Spo2 etc..) to help make decisions about what protocol to implement
- ▶ EMS protocols are based upon pulsatile blood flow.

What Can You Do to Assess the VAD Patient?

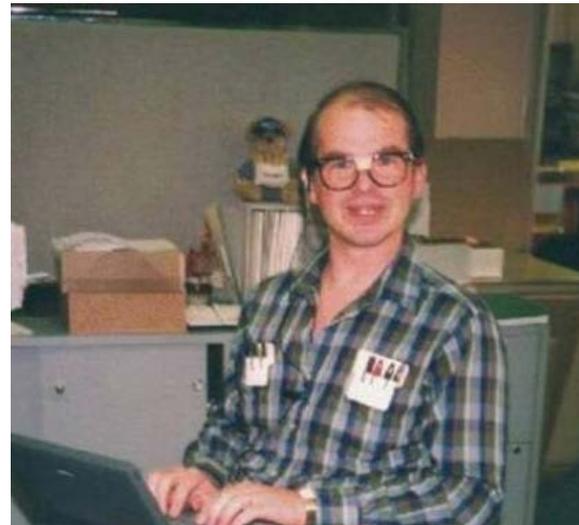
- ▶ Patient:
 - Breathing?????
 - LOC
 - Skin Color and Temp
 - Symptoms
- ▶ Vital Signs
 - Listen to the chest to hear the pump
 - May try to get a blood pressure and O2 Sat
- ▶ VAD Controller
 - *Pump parameters*: Read the numbers
 - Alarms?

Measuring Pressure in Patients with No Pulsatile Flow: MyLVAD



Why Doesn't the Pump Fill? = Low Flow Alarms -> SHABDORC:

- ▶ S sepsis
- ▶ H hypertension
- ▶ A arrhythmias
- ▶ B bleeding
- ▶ D dehydration
- ▶ O overdrive, occlusion
- ▶ R right heart failure
- ▶ C clot



Pump Thrombosis



Anticoagulation

- ▶ Coumadin
 - INR goal 2 – 3



warfarin (Coumadin)

Patient Packaging

- ▶ Keep stretcher/spider straps under the device cables to avoid any pulling or torque.
- ▶ Keep system controller secured on top of the patient
 - Not dangling on the side
 - It may get caught on something
- ▶ Bring all extra equipment
 - Bag with back up controller and batteries

KED Warning

Kendrick Extrication Device

The Kendrick Extrication Device (KED) is designed to immobilize a patient found in a sitting position. It is most commonly used in automobile accidents where the patient is stable. If the patient is unstable, you will need to perform a Rapid Extrication.



KED (Kendrick Extrication Device):

- ▶ Used to extract a person from a car that is in a sitting position who may have a C-spine injury
- ▶ It's essentially a Jacket with "board slats" to keep them in line.
- ▶ The problem is that the last strap that is very tightly secured is the last one which comes across the patients chest before extracting from the vehicle.
- ▶ LVAD would be a contraindication for the use of this device.

Potential Protocol Conflicts

- ▶ Which team is dispatched?
 - ▶ **Chest compressions?**
 - ▶ Medication titration based on blood pressure in continuous flow patients?
 - ▶ Where do you take VAD patients?
- 

BLS vs. ALS Transport Decision

- ▶ VAD patients need ALS transport regardless of the emergency
 - ▶ Team needs to be ready to respond to a VAD device emergency during the transport even if the call was non-life threatening
 - ▶ Don't create emergencies by forgetting the power source
- 

Local ER vs VAD Center

- ▶ Twisted ankle
- ▶ Device malfunction
- ▶ Complicated patient/ pump clinical problem
- ▶ Always page the on call VAD coordinator



Protocol Development

- ▶ Get your OMD on board with writing LVAD/EMS protocols
 - ▶ Take the guess work out of decision making especially when it is a life/death situation
 - ▶ The time to problem solve is not when you step into a VAD patient's house
- 

Ask The Local Implanting Center How They Notify You?

ADDRESS OF CLOSEST FIRE STATION

STREET:

CITY:

NON EMERGENCY PHONE NUMBER:

SIGNATURE OF CONTACT AT THE STATION

TITLE

DATE/TIME -----

www.MYLVAD.com

The screenshot shows the MyLVAD website interface. At the top left is the MyLVAD logo. The main navigation bar includes links for 'FOR RECIPIENTS & CAREGIVERS', 'FOR MEDICAL PROFESSIONALS', and 'MyLVAD COMMUNITY'. Below this is a secondary navigation bar with 'MEMBER LOGIN', 'REGISTER', social media icons for Facebook (315 likes) and Twitter (Follow), and a search bar labeled 'Search MyLVAD'. The main content area features a large image of an ambulance with a text overlay titled 'EMERGENCY CARE OF LVAD RECIPIENTS'. Below the main content are two columns: 'MyLVAD NEWSFEED' and 'MyLVAD'S MOST HEARTED'. The newsfeed shows a post by ANGELA_MURRAY dated 11/6/2012. The 'Most Hearted' section shows a post by CINDERS dated 11/2/2012 with 9 hearts.

MyLVAD

FOR RECIPIENTS & CAREGIVERS
Introduction to LVADs
LVAD Technology
Living with an LVAD
LVAD Hospital Locator Map

FOR MEDICAL PROFESSIONALS
LVAD Coordinators
LVAD Coordinator Locator Map
Emergency Medical Services

MyLVAD COMMUNITY
Community Forums
Newsletter Archives
LVAD Stories
Video Library

MEMBER LOGIN REGISTER

Like 315 Follow

Search MyLVAD Go

EMERGENCY CARE OF LVAD RECIPIENTS

We are dedicated to ensuring the best emergency care of LVAD recipients. We provide you with the most up to date information about LVADs and how they impact the EMS world. Click here to download LVAD Field Guides.

Learn More

MyLVAD NEWSFEED

New Reply To:
Blog for Teens, 20s, & 30s w/ the LVAD

Posted 11/6/2012
By ANGELA_MURRAY

Kori,
I'm so please to see this. My son got his LVAD Sept 2010. He had just celebrated his 24th birthday shortly before he became ill...then found out that all 4 chambers of his heart were ...

Read Post

MyLVAD'S MOST HEARTED

Vests, holsters & such...

Posted 11/2/2012
By CINDERS

Heart This 9

My husband was implanted on December 9th, 2011...we are having trouble trying to find the most ...

Read Post

"You're braver than you believe,
and stronger than you seem."

Why We Do What We Do!



25 Years: Heart Strong



Thomas Cook, 50, is among the longest-surviving heart transplant patients on record. Twenty-five years ago, a donor heart was transplanted into his chest, and Thomas was the

News

[Two High Quality Achievement Awards for Stroke Center](#)

[MedStar Washington Hospital Center Named to Becker's "100 Great Hospitals in America"](#)

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