



VADs Aren't BAD: Emergency Care for the Patient on Mechanical Circulatory Support



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OBJECTIVES

- List indications for Mechanical Circulatory Support
- Identify types and function of Mechanical Circulatory Support
- Discuss emergency care for the patients with Mechanical Circulatory Support

WHO HAS HEART FAILURE?

- Approximately 5.7 million persons in the United States have HF with the numbers increasing.
- In the U.S., >650,000 new HF cases are diagnosed annually.
- The lifetime risk of developing HF is 20% for Americans ≥ 40 years of age.
- HF incidence increases with age:
 - 20 per 1,000 individuals 65 to 69 years of age
 - >80 per 1,000 individuals >85 years of age

HEART FAILURE (HF)

“HF is a complex clinical syndrome that results from any structural or functional impairment of ventricular filling or ejection of blood.”

HF



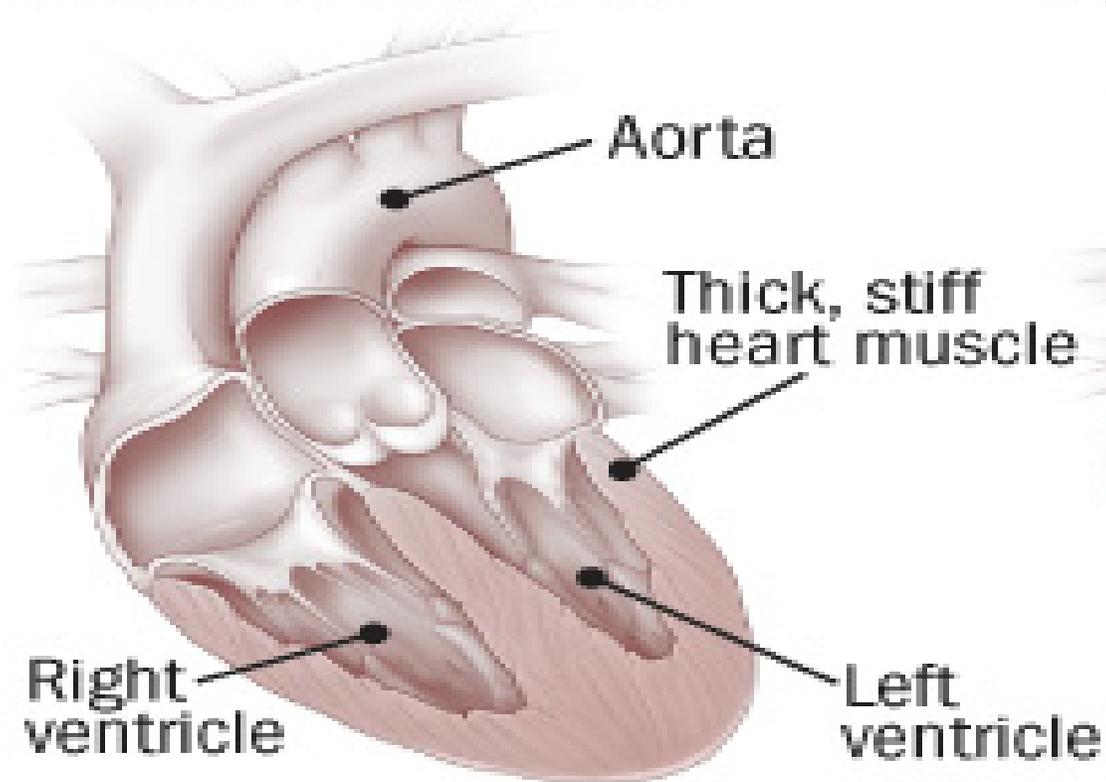
CHF

TERMS TO KNOW

- Heart Failure with Preserved Ejection Fraction (HF_pEF)
 - diastolic failure
 - EF ~ >50%
- Heart Failure with Reduced Ejection Fraction (HF_rEF)
 - systolic failure
 - EF \leq 40%
- HF_rEF and HF_pEF each make up about half of the overall HF burden.

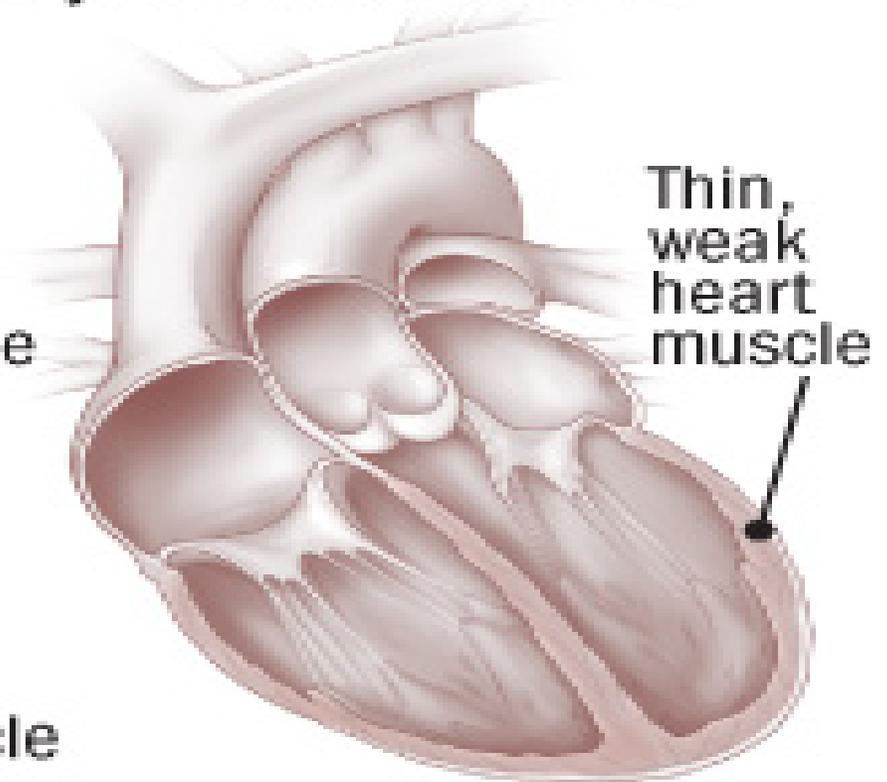
HFpEF

Diastolic heart failure



HFrEF

Systolic heart failure



HEART FAILURE SYMPTOMS

Dilated pupils, a sympathetic nervous system response

Skin pale, gray, or cyanotic

Dyspnea, SOB/OE is early symptom from pulmonary congestion

Orthopnea, cannot breathe unless sitting up

Crackles, wheeze are adventitious breath sounds

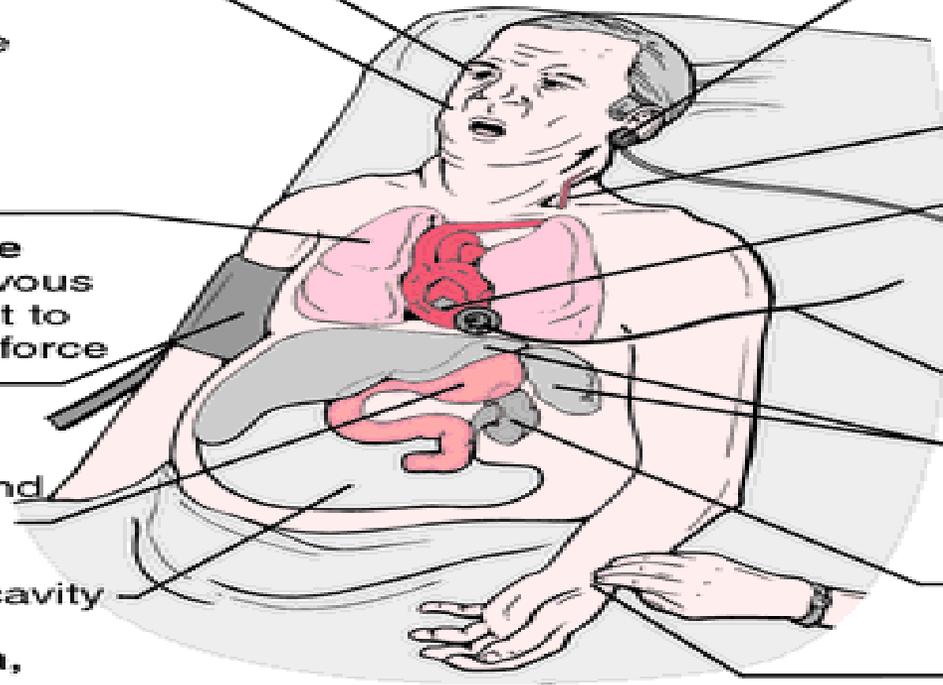
Cough, frothy pink or white sputum

Decreased blood pressure stimulates sympathetic nervous system, which acts on heart to increase rate and increase force of contraction

Nausea and vomiting as peristalsis slows and bile and fluids back up into stomach

Ascites, fluid in peritoneal cavity

Dependent, pitting edema, in sacrum, legs



Anxiety, gasping from pulmonary congestion

Falling O₂ saturation

Confusion, unconsciousness from decreased O₂ to brain

Jugular vein distention from venous congestion

Infarct, may be cause of decreased cardiac output

Fatigue, weakness from decreased cardiac output

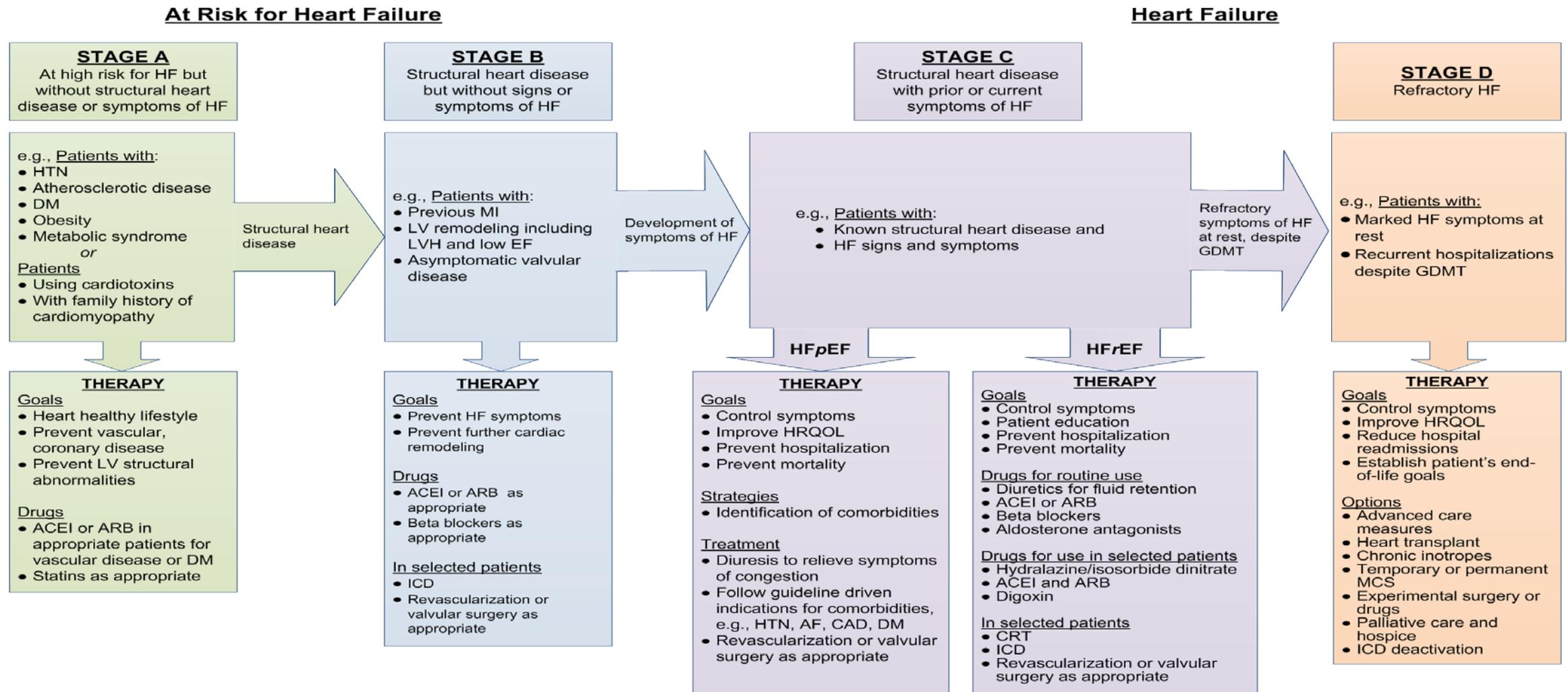
S₃ gallop, tachycardia

Enlarged spleen and liver from venous congestion. This causes pressure on breathing

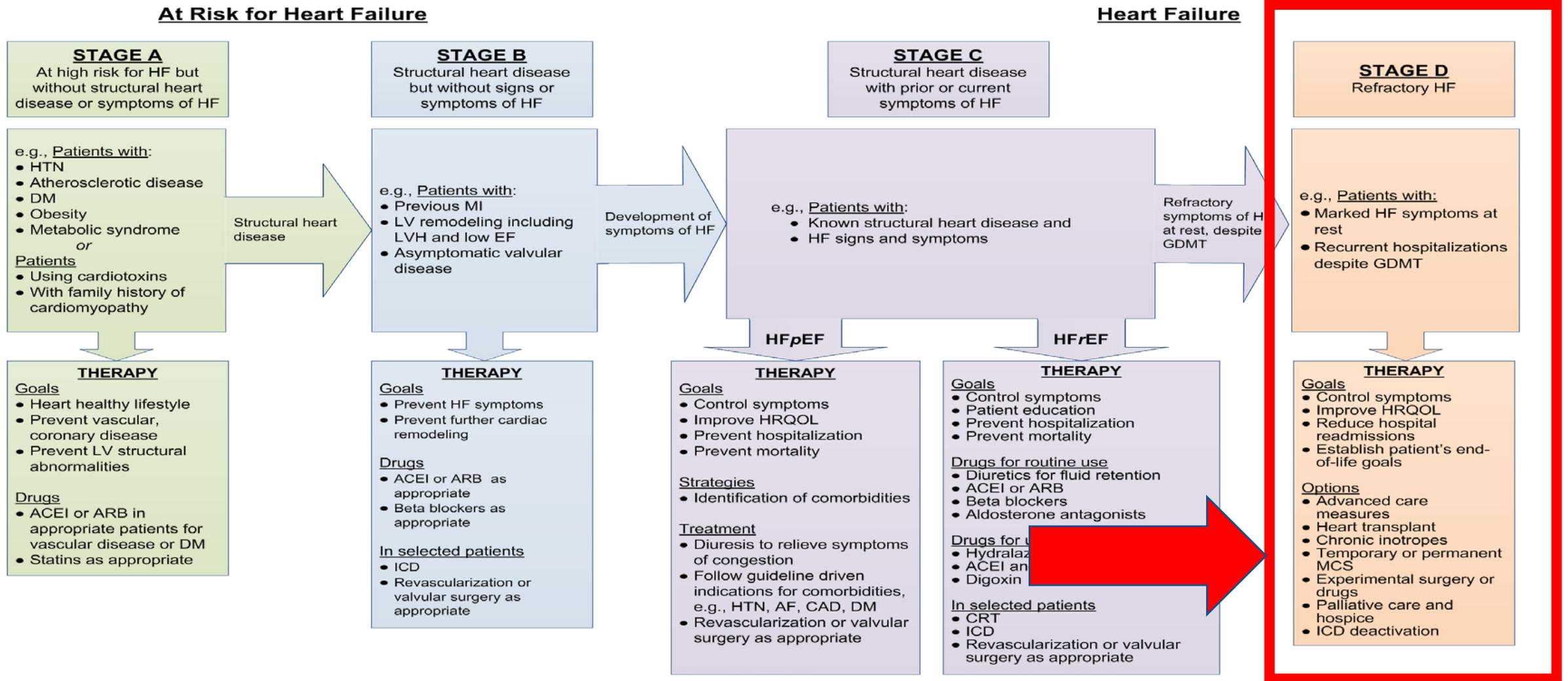
Decreased urine output

Weak pulse
Cool, moist skin

STAGES, PHENOTYPES AND TREATMENT OF HF



STAGES, PHENOTYPES AND TREATMENT OF HF

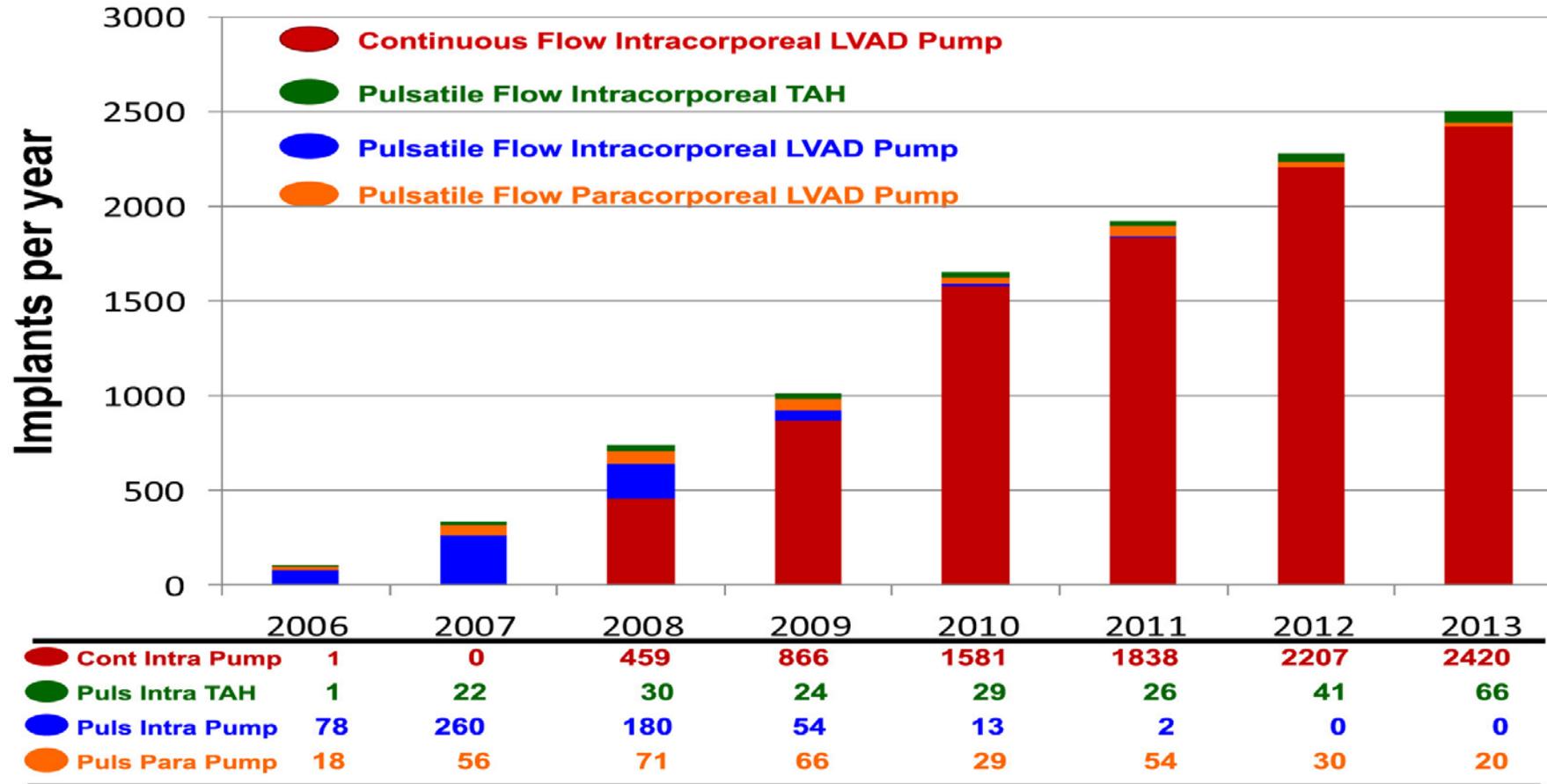


WHY NOT DIRECTLY TRANSPLANT

- Long wait
- Increased demand
- Limited donor hearts

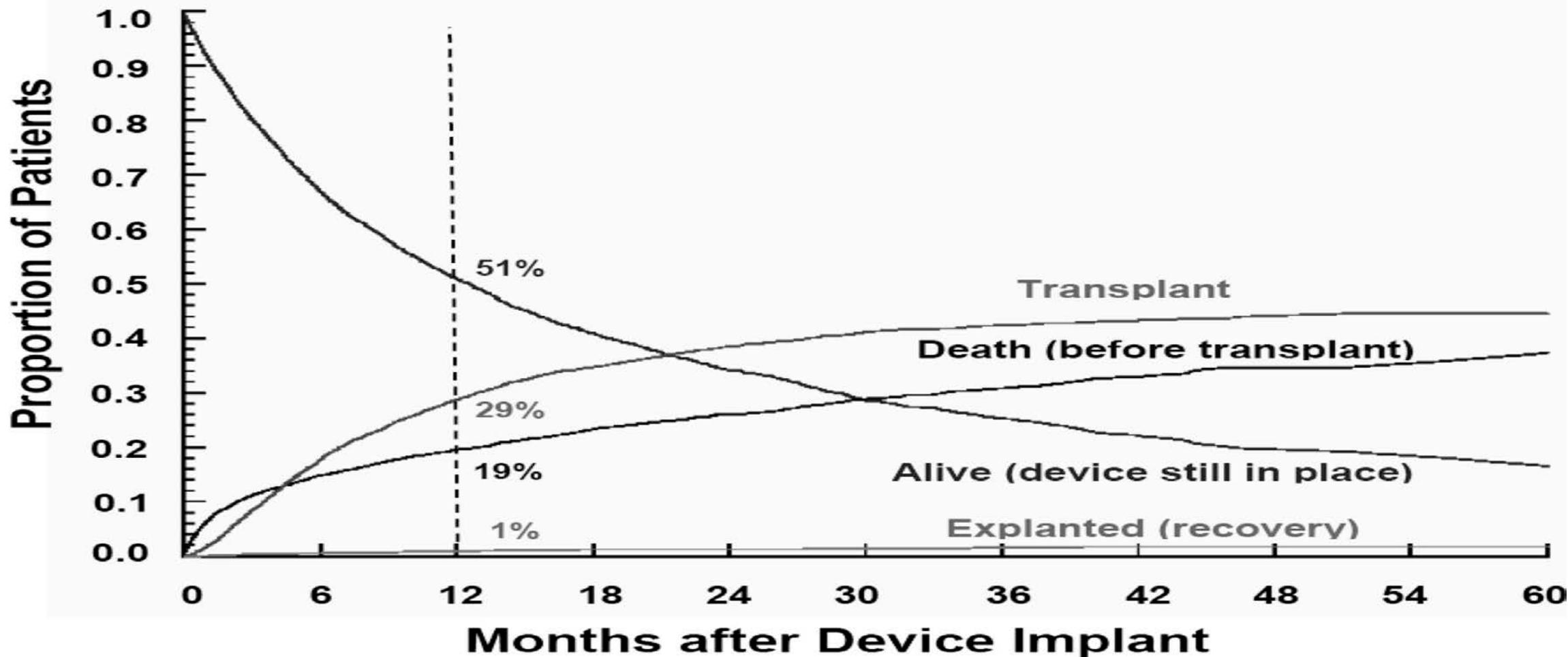


Interm@cs **Implants: June 2006 – December 2013, n = 10542**



Competing Outcomes: Death, transplant & recovery

Implant Dates: June 23, 2006 – March 31, 2011

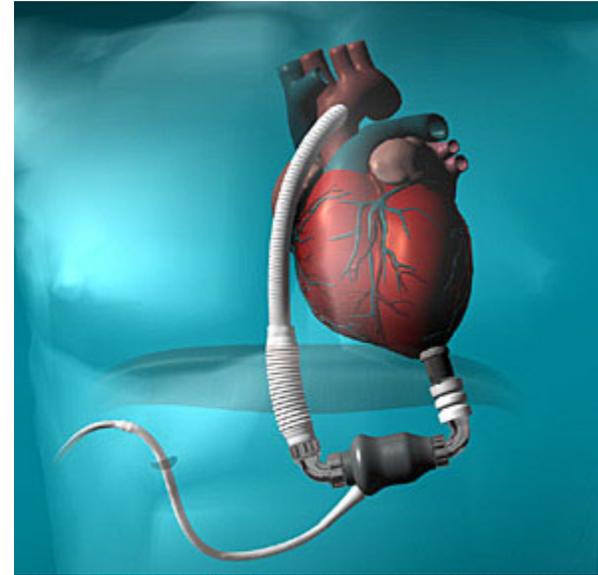


Device

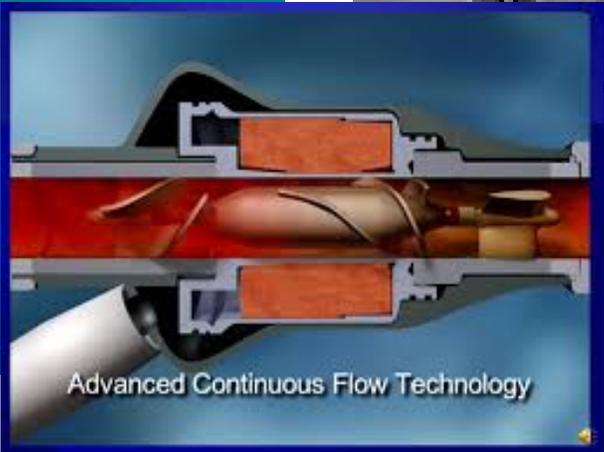
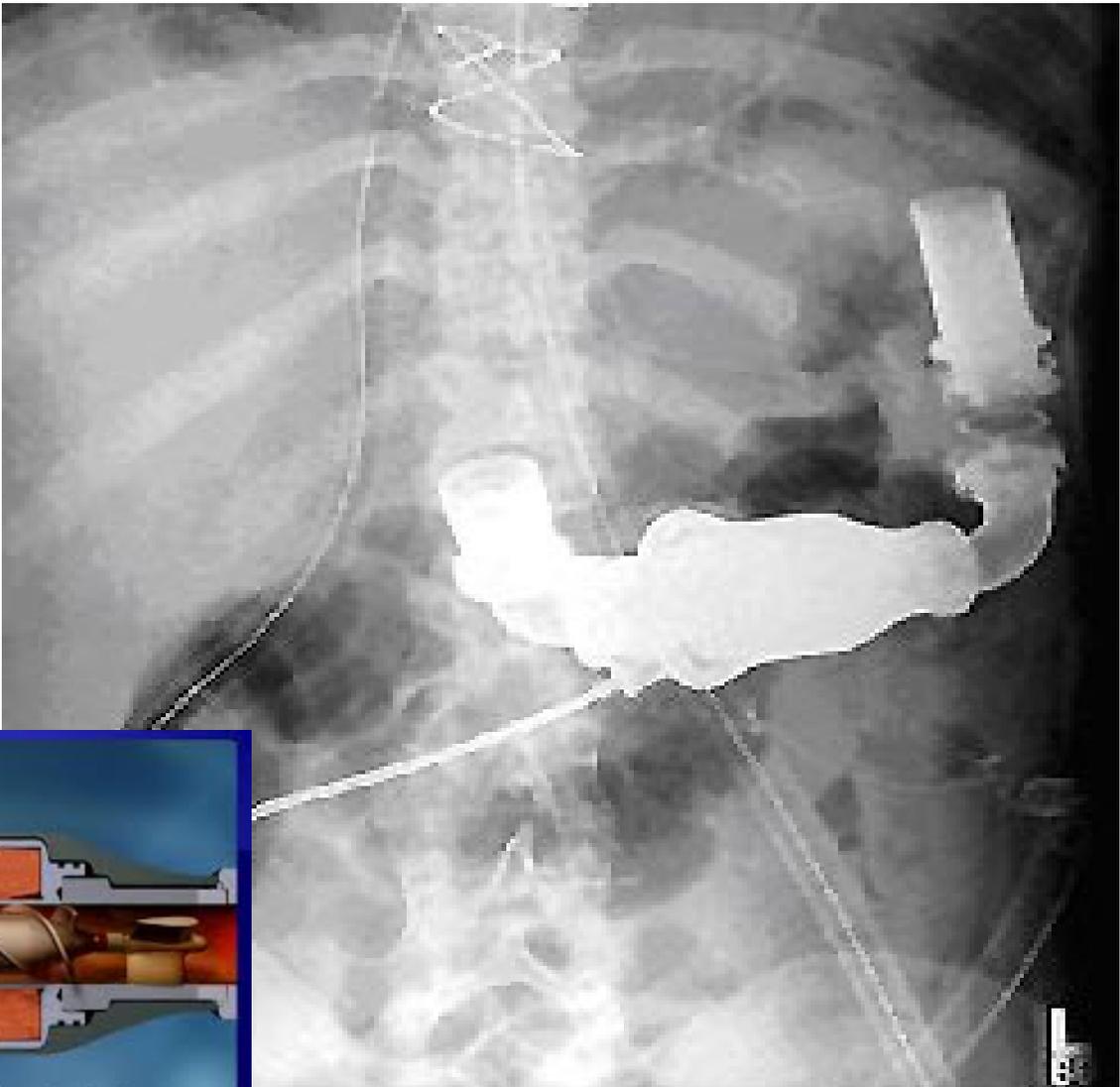
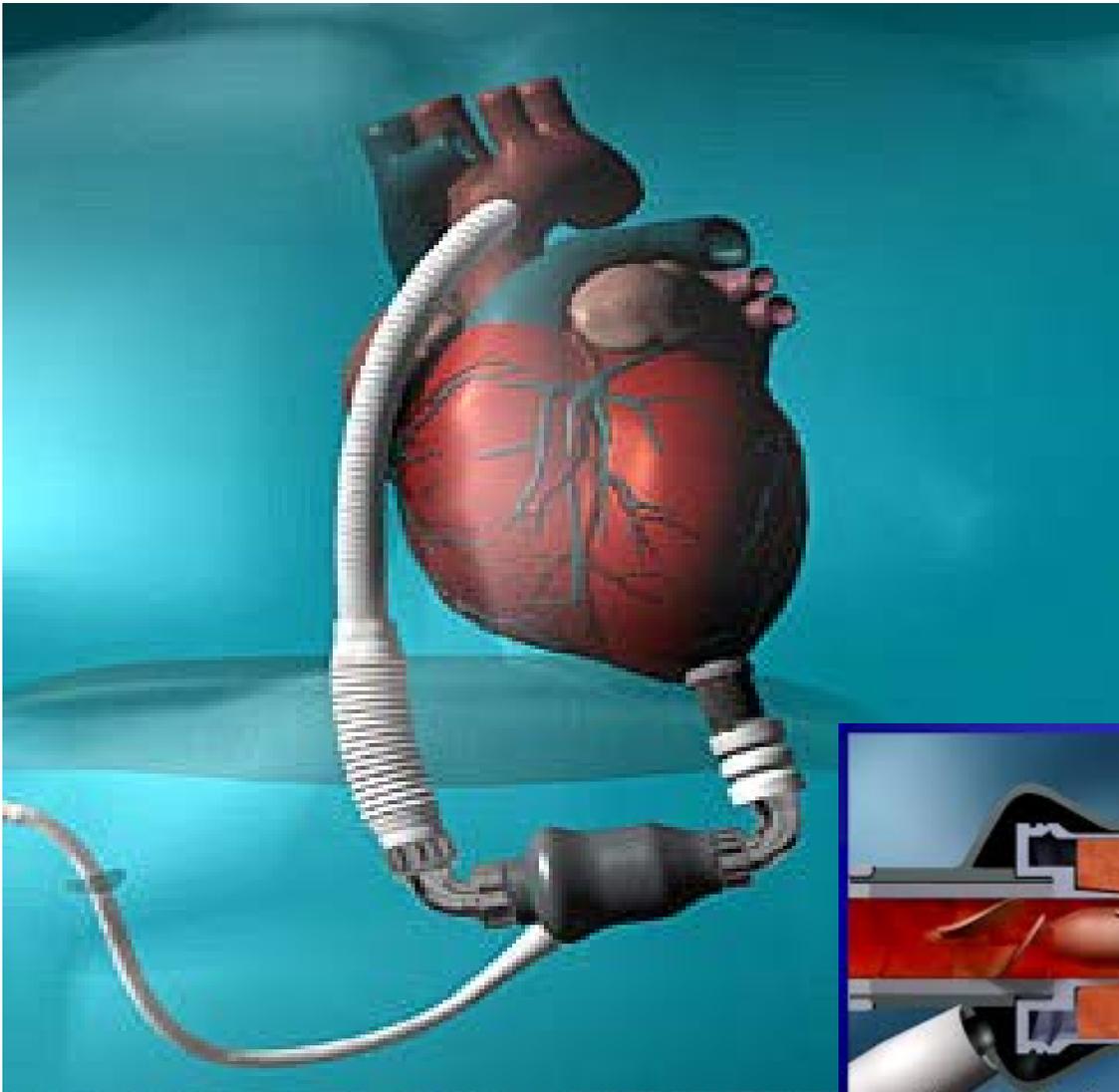


WHY A LVAD?

- Class IV Heart Failure
- Left Ventricular Failure
- In need of a Heart Transplant or for Destination Therapy
- Heart Mate 2 was FDA approved in 2008 as a bridge to transplant and 2010 as destination therapy.

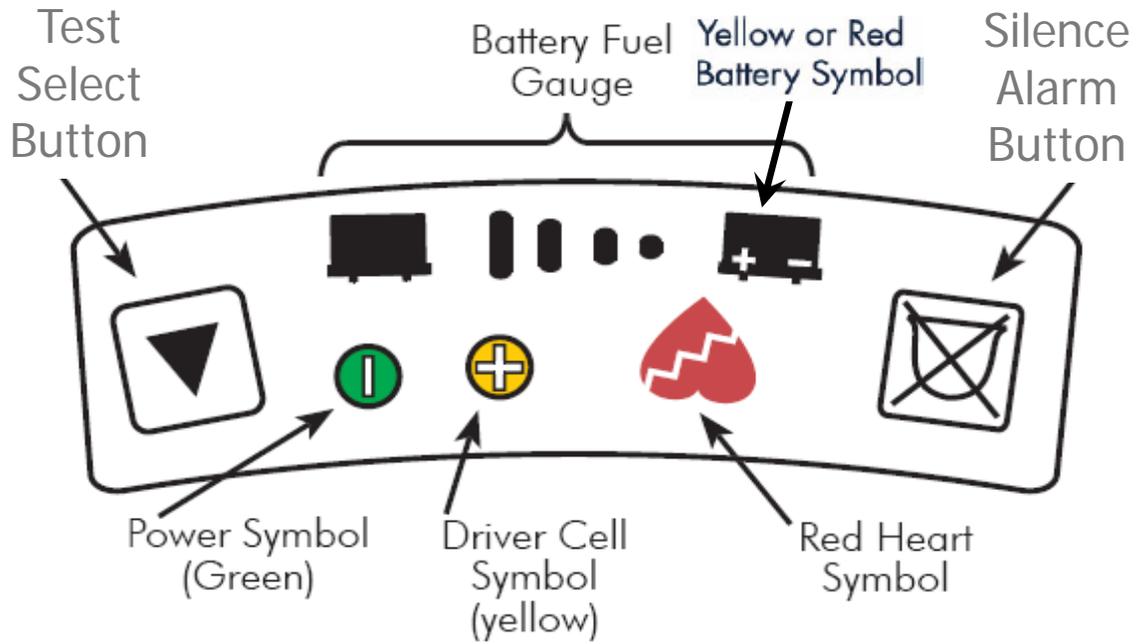


HEARTMATE II

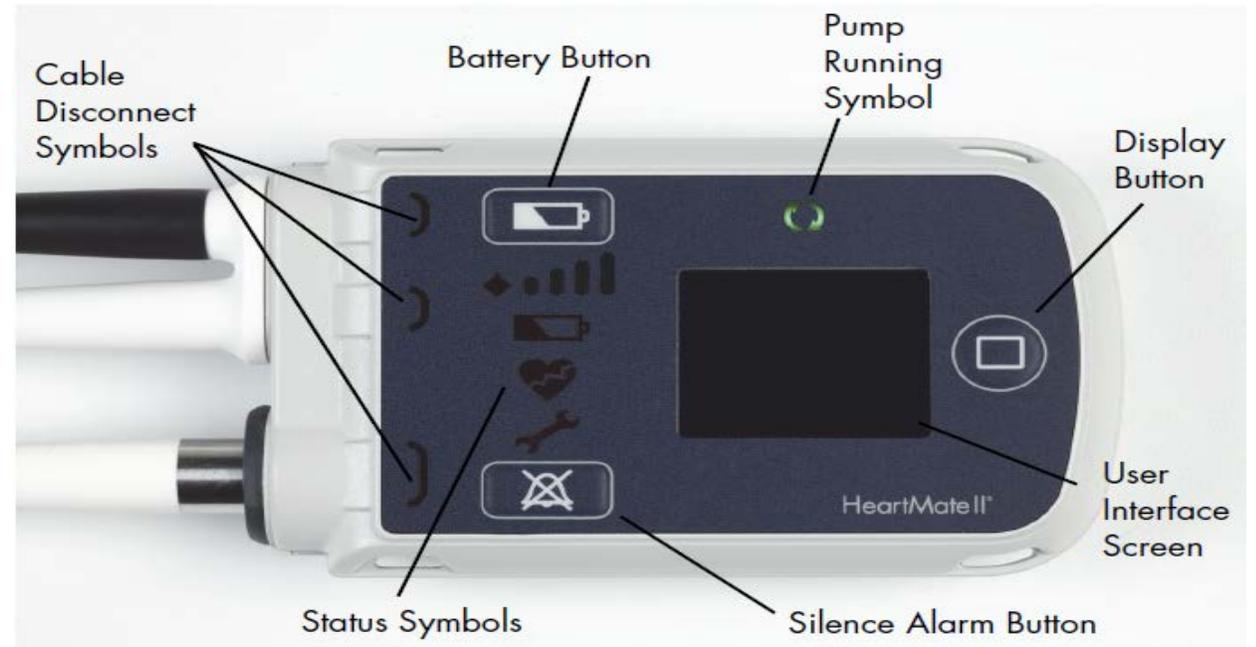


HMII CONTROLLERS

HMII SYSTEM CONTROLLER



HMII POCKET CONTROLLER

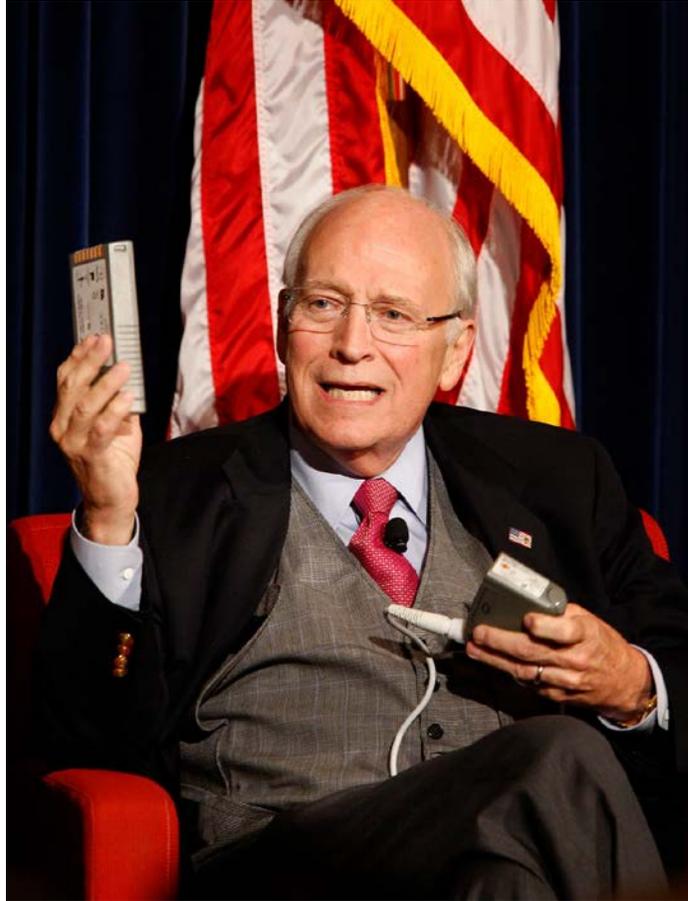


COMPONENTS

- Power Module
- Power Cable
- Battery Charger
- Batteries and clips
- System Monitor (inpatient use)
- Display Module (home with the patient)



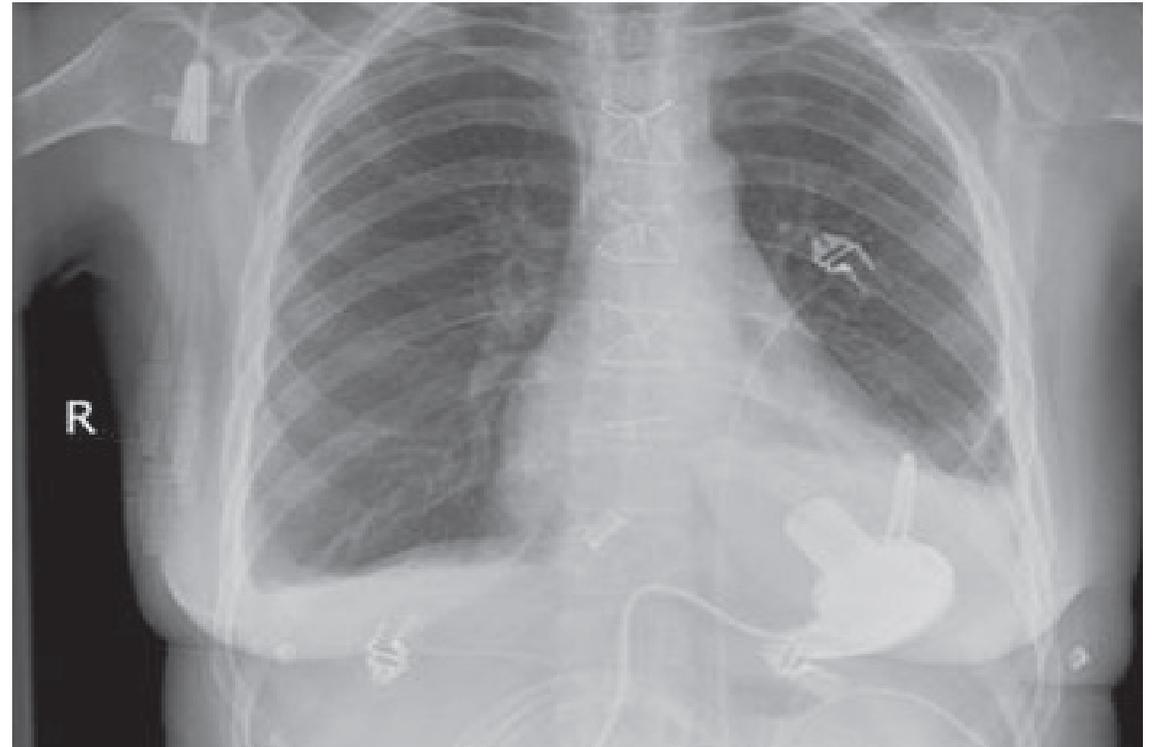
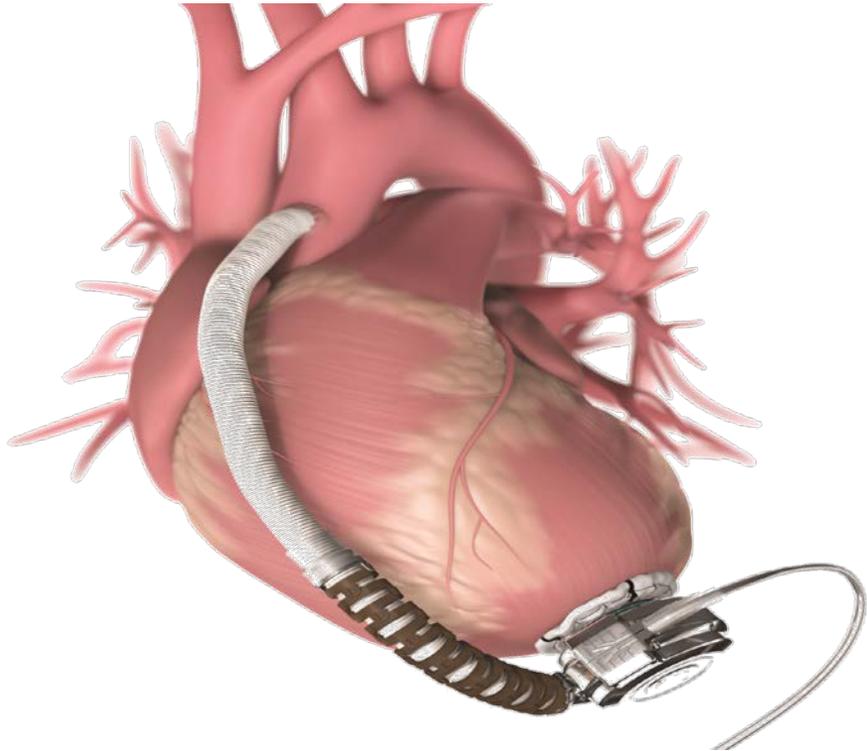
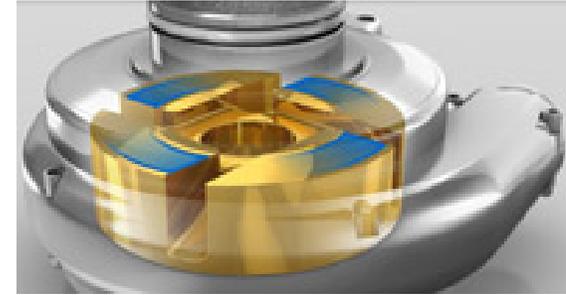
FORMER HEARTMATE II PATIENT



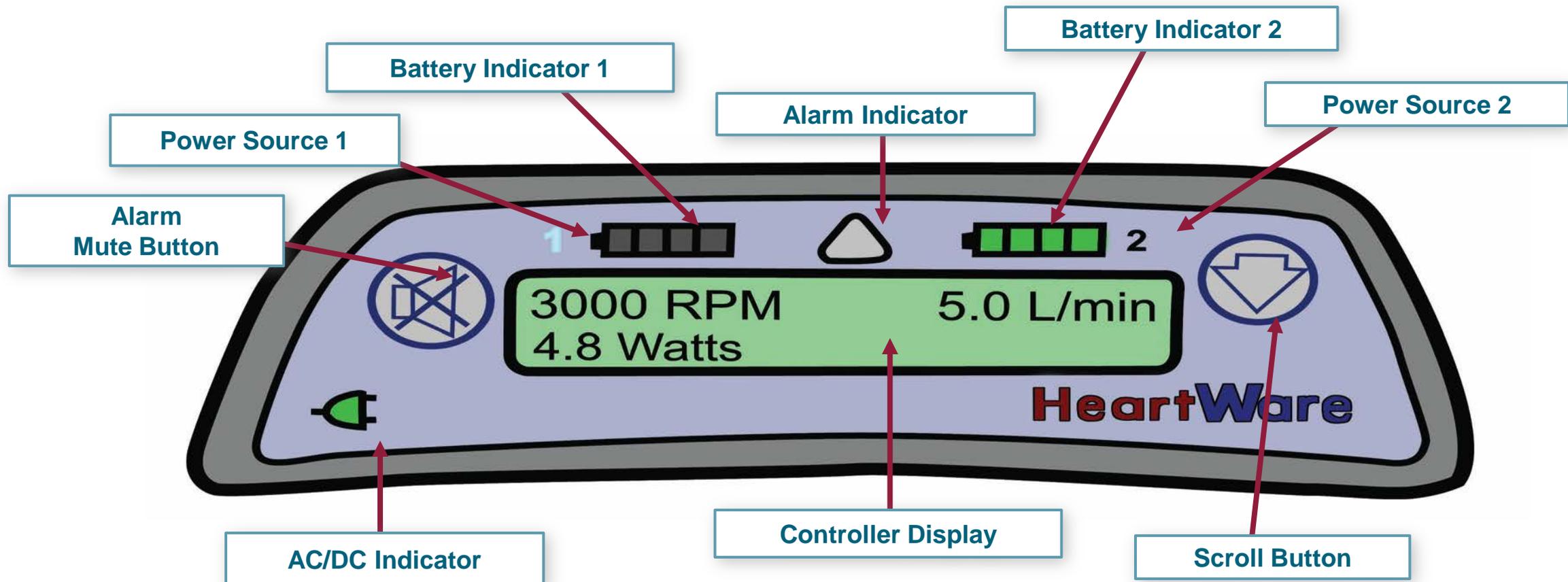
WHY A HVAD?

- Class IV Heart Failure
- Left Ventricular Failure
- In need of a Heart Transplant
- HeartWare was FDA approved in 2012 as a bridge to transplant and anticipated approval in 2015 as destination therapy.

HEARTWARE



HEARTWARE® CONTROLLER DISPLAY



COMPONENTS



HeartWare® Battery Charger
and Batteries



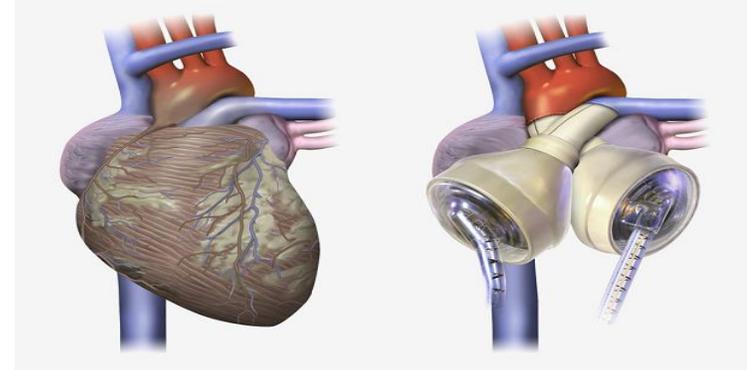
HeartWare® Controller
AC Adapter



HeartWare® Controller
DC Adapter

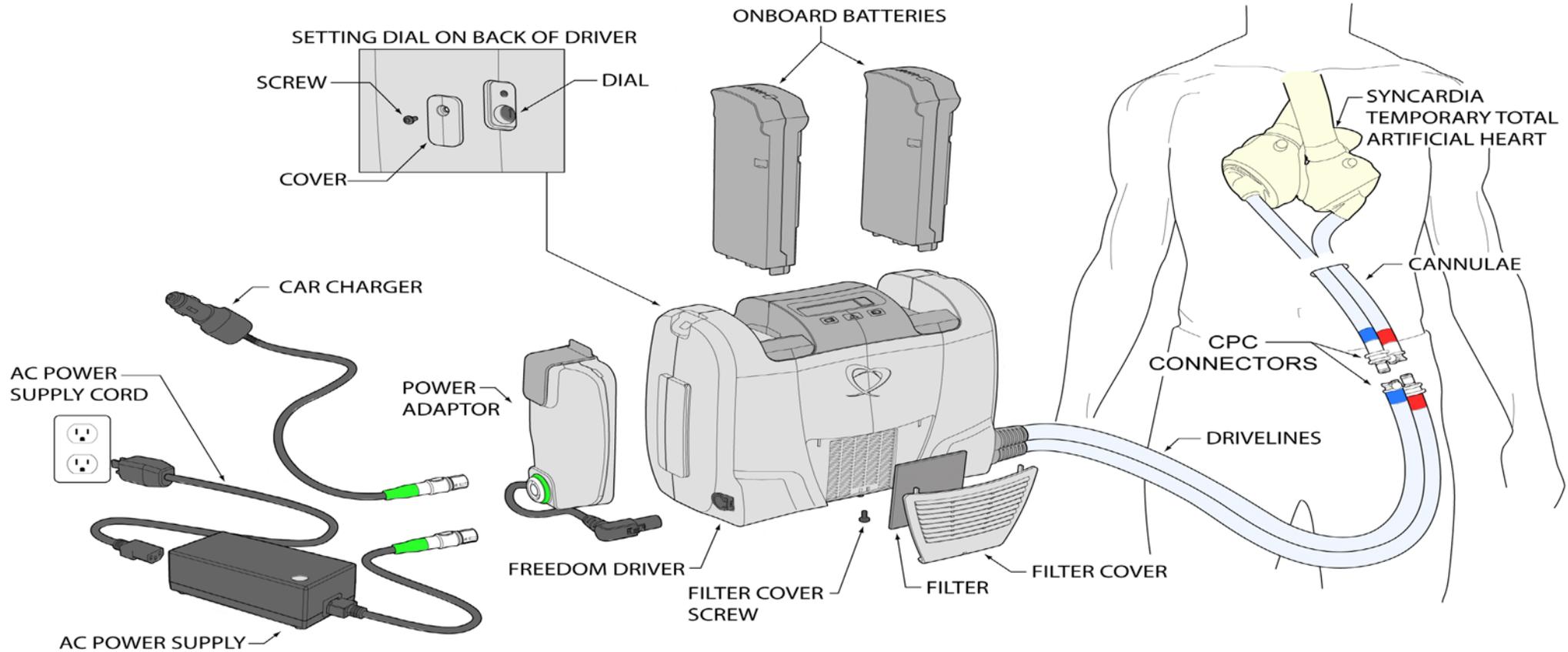


WHY A TAH?



- Class IV Heart Failure
- BiVentricular Failure, uncontrolled lethal arrhythmias, severe multi-chamber thrombi
- TAH was FDA approved in 2004 as a bridge to transplant and 2012 as destination therapy.
- Freedom Driver was FDA approved in July, 2014.

EXPLODED VIEW OF THE FREEDOM DRIVER SYSTEM



FD PARAMETERS



FREEDOM DRIVER ALARMS

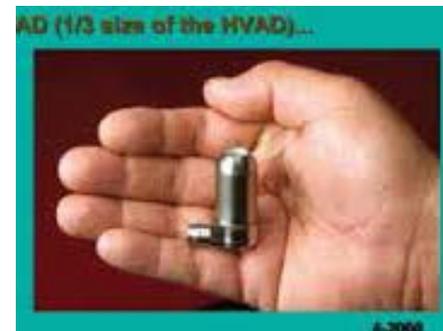
- Three Types of Alarms
 - Battery Alarm
 - Temperature Alarm
 - Fault Alarm
- Each Alarm indicated by:
 - Visual Alarm and
 - Audible Alarm
- Do not ignore Alarms
- No way to mute Alarms
- The issue that caused the alarm must be immediately addressed

STOP! PATIENT WITH ARTIFICIAL HEART

- **FOR EMS PERSONNEL:**
- ABC'S: TREAT AIRWAY AND BREATHING AS USUAL
- DO **NOT** FOLLOW ROUTINE ACLS GUIDELINES
- MUST CHECK FOR **PULSE AND BLOOD PRESSURE**
- THE HEART HAS BEEN REMOVED AND THERE IS **NO ELECTRICAL RHYTHM**
- DO **NOT** PERFORM CPR, PACING, DEFIBRILLATION. IT WON'T HELP.
- THE PATIENT IS 100% DEPENDENT ON THE PUMP FOR BLOOD FLOW.
- DO **NOT** GIVE VASOPRESSORS (EPINEPHRINE/VASOPRESSIN) UNLESS DIRECTED.
- ELEVATED BLOOD PRESSURE CAN CAUSE THE PUMP FAILURE TO WORSEN.

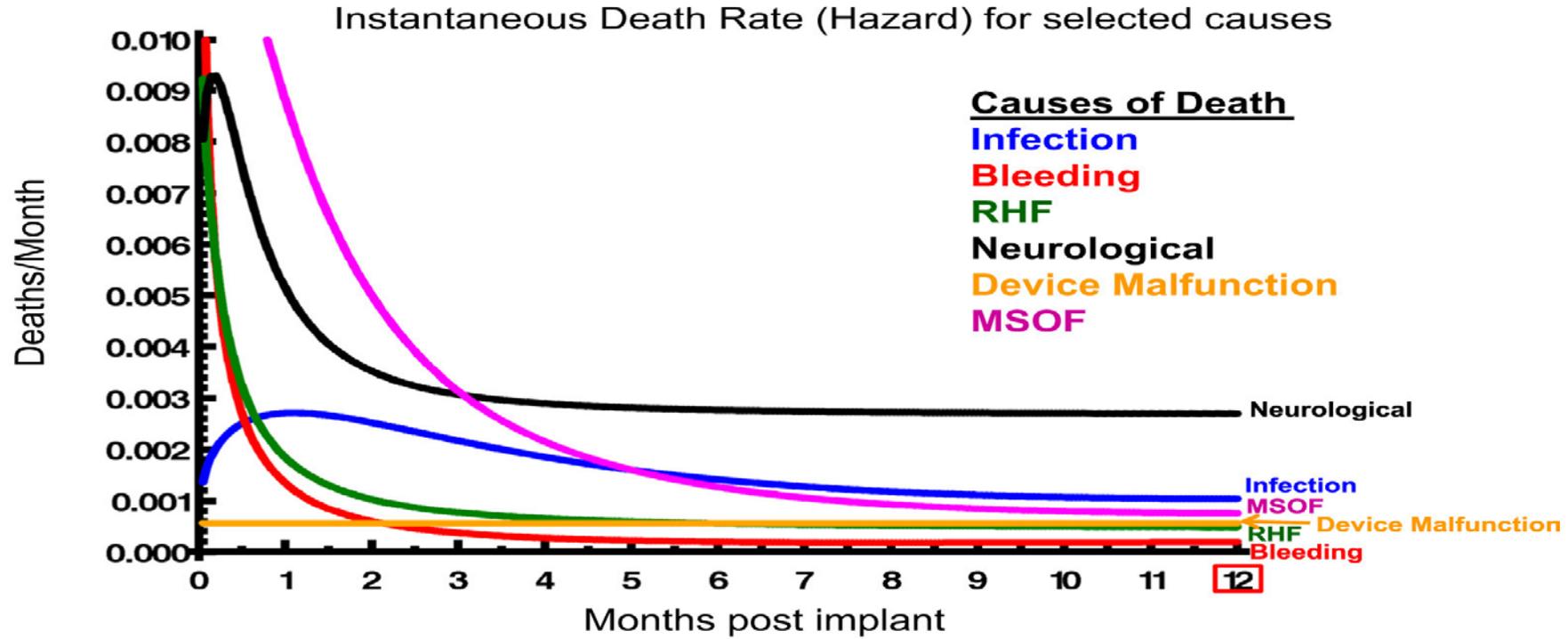


WHAT DOES THE FUTURE HOLD?



YOU READY TO GET TO WORK?

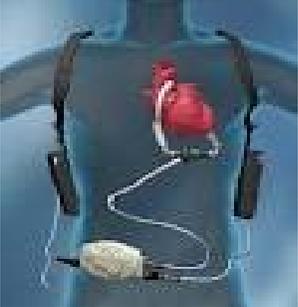
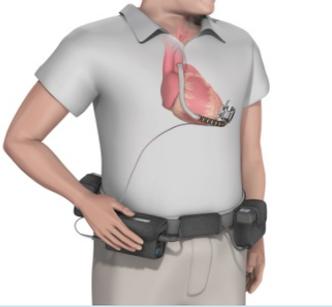
Intermedics Continuous Flow LVAD/BiVAD Implants: 2008 – 2013, n = 9372



RESOURCES

- Patient's Primary Caregiver
- Implant Center LVAD Coordinator
- Protocols in Select Regions
- Medical Control
- MyLVAD.com

MECHANICAL CIRCULATORY SUPPORT DEVICES

	Heart Mate II / Heart Ware (HVAD)		Freedom Driver Total Artificial Heart		
Native Heart in place		Yes		No – fully mechanical	
Heart rhythm		Yes		No	
Perform EKG		Yes		No	
Blood Pressure		<ul style="list-style-type: none"> • May or may not have BP using automated or manual cuff. • Use Doppler to obtain Doppler BP (similar to MAP but without invasive monitoring) • Heart Mate 2 goal 70-90 • Heart Ware goal 70-85 		Yes	<ul style="list-style-type: none"> •Goal: systolic <130 mmHg •Pts have protocol for PRN home use of Nitroglycerin SL or hydralazine by mouth at home for elevated SBP
Pulse		May NOT have a pulse due to continuous flow device		Yes – rate usually 120-130 bpm Can view rate on device	
Sounds		Can hear pump hum with stethoscope		Can hear mechanical heart valves click externally	
CPR		Yes - including chest compressions May defibrillate/cardiovert with device in place		No	
Code Drugs		Yes		No – May worsen condition	
Batteries		Pair lasts 6-10 hours / Rechargeable	Lasts 4 hours Rechargeable	Pair lasts 2 hours Rechargeable	

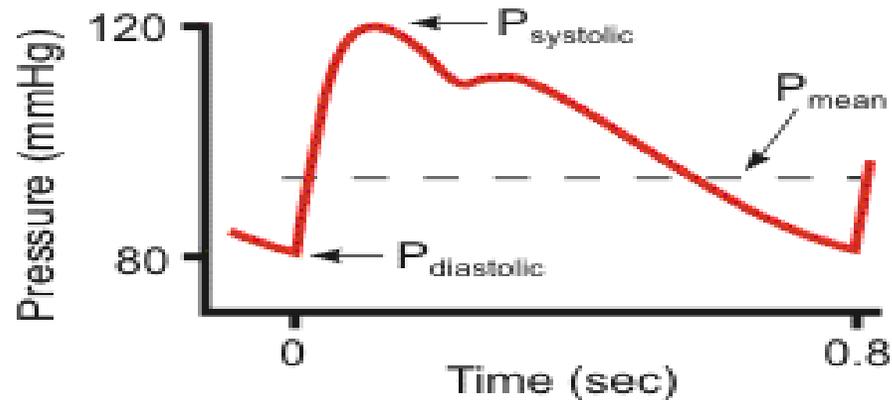


VCU Pauley Heart Center

VAD coordinator 804-828-0951 Pager #4248

DOPPLER BLOOD PRESSURE

- This is not a MAP
- Checked with a manual cuff and doppler
- Normal is 70-90



$$MAP = DP + \frac{1}{3} (SP - DP)$$

MAP is the average BP during a single cardiac cycle

MAP > 60 needed to perfuse major organs



Causes of a Hypotensive VAD-patient

VAD Related

- Pump Failure
- Pump/Cannula Obstruction
 - * Thrombus
 - * Conduit compression/kinking
- Pump Speed set too high

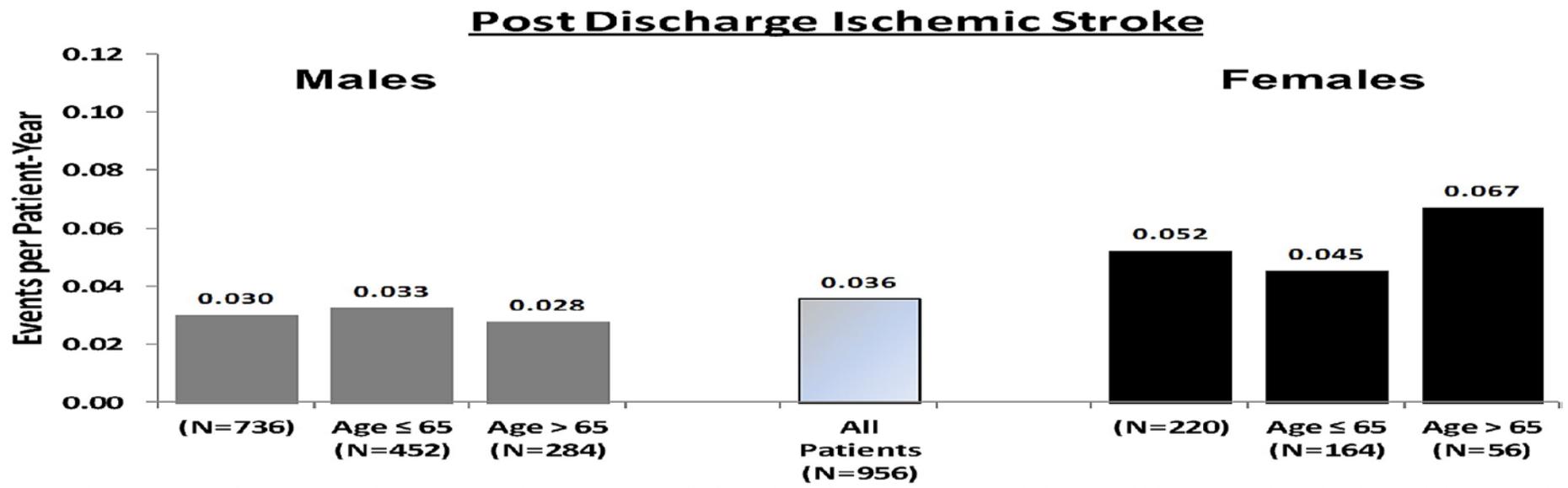
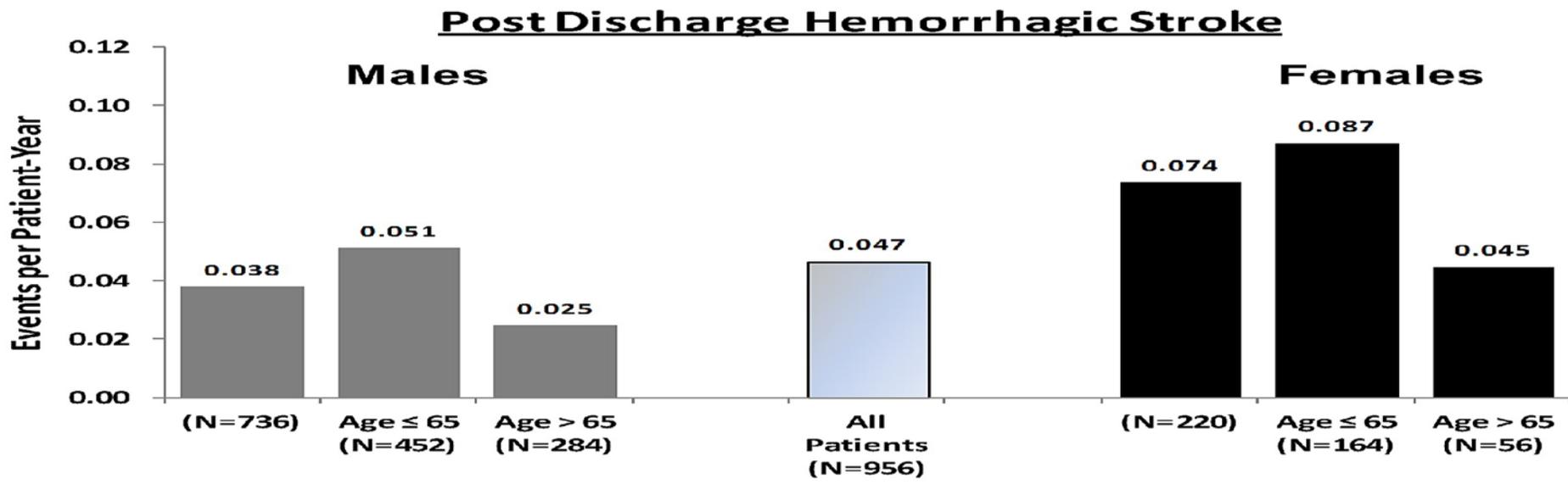
Non-VAD Related

- Hypovolaemia
 - * Dehydration
 - * Haemorrhage
- Ventricular Dysrhythmias
- Right Ventricular Failure
- Cardiac Tamponade
- Aortic Valve Regurgitation

LET'S CHECK IT OUT

- You arrive at the scene to find a Heart Mate patient with right facial droop, right sided paralysis, slurred speech.
- What do we need to do ASAP?





Boyle, A. J., Jorde, U. P., Sun, B., Park, S. J., Milano, C. A., Frazier, O. H., . . . Russell, S. D. (2014). Pre-operative risk factors of bleeding and stroke during left ventricular assist device Support An analysis of more than 900 HeartMate II outpatients. *Journal of the American College of Cardiology*, 63(9), 880-888. doi:10.1016/j.jacc.2013.08.1656

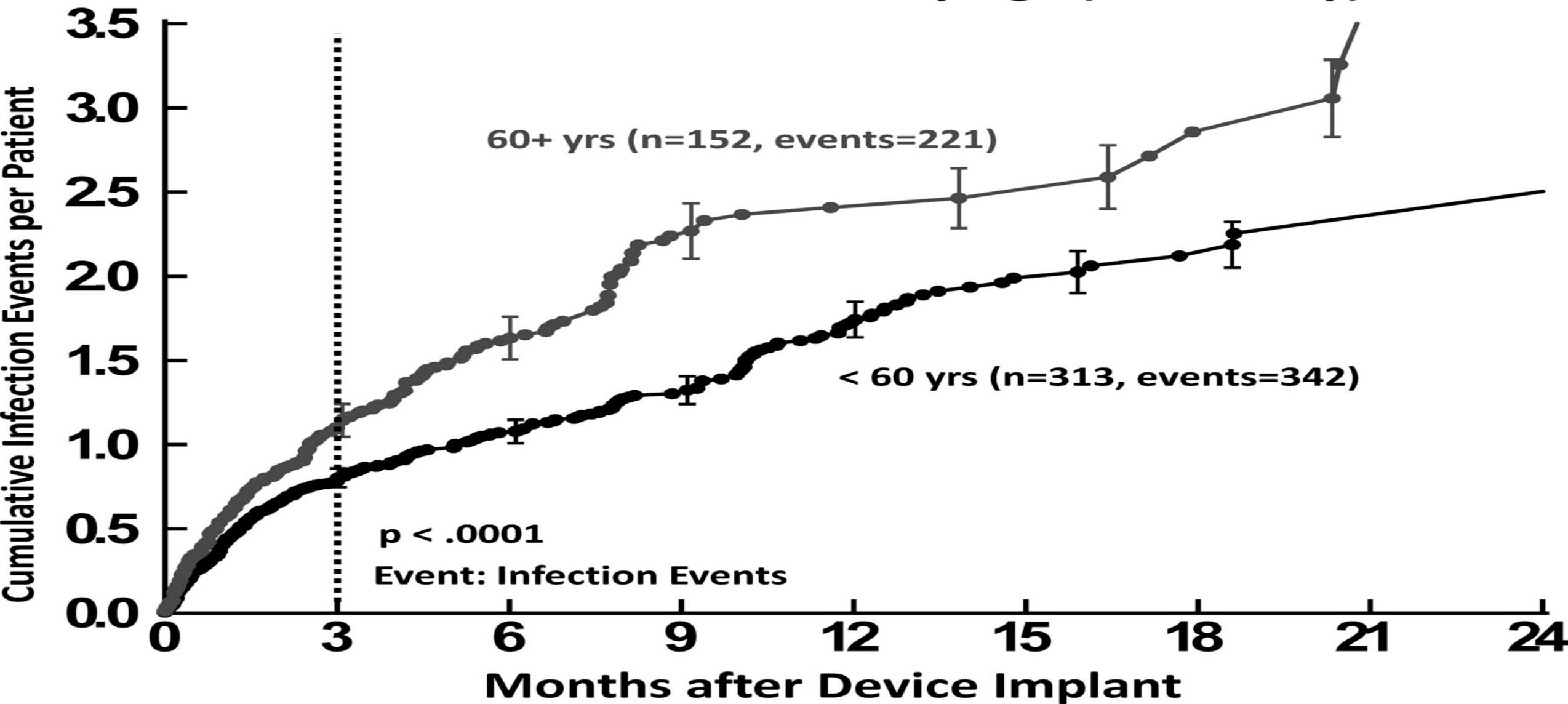
WHAT'S NEXT?

- HeartWare patient presents with severe abdominal pain.
- Pain started intermittent for several days, but now constant in RLQ.
- No nausea or vomiting.
- Started her menses.
- VAD parameters normal.

What could be wrong?



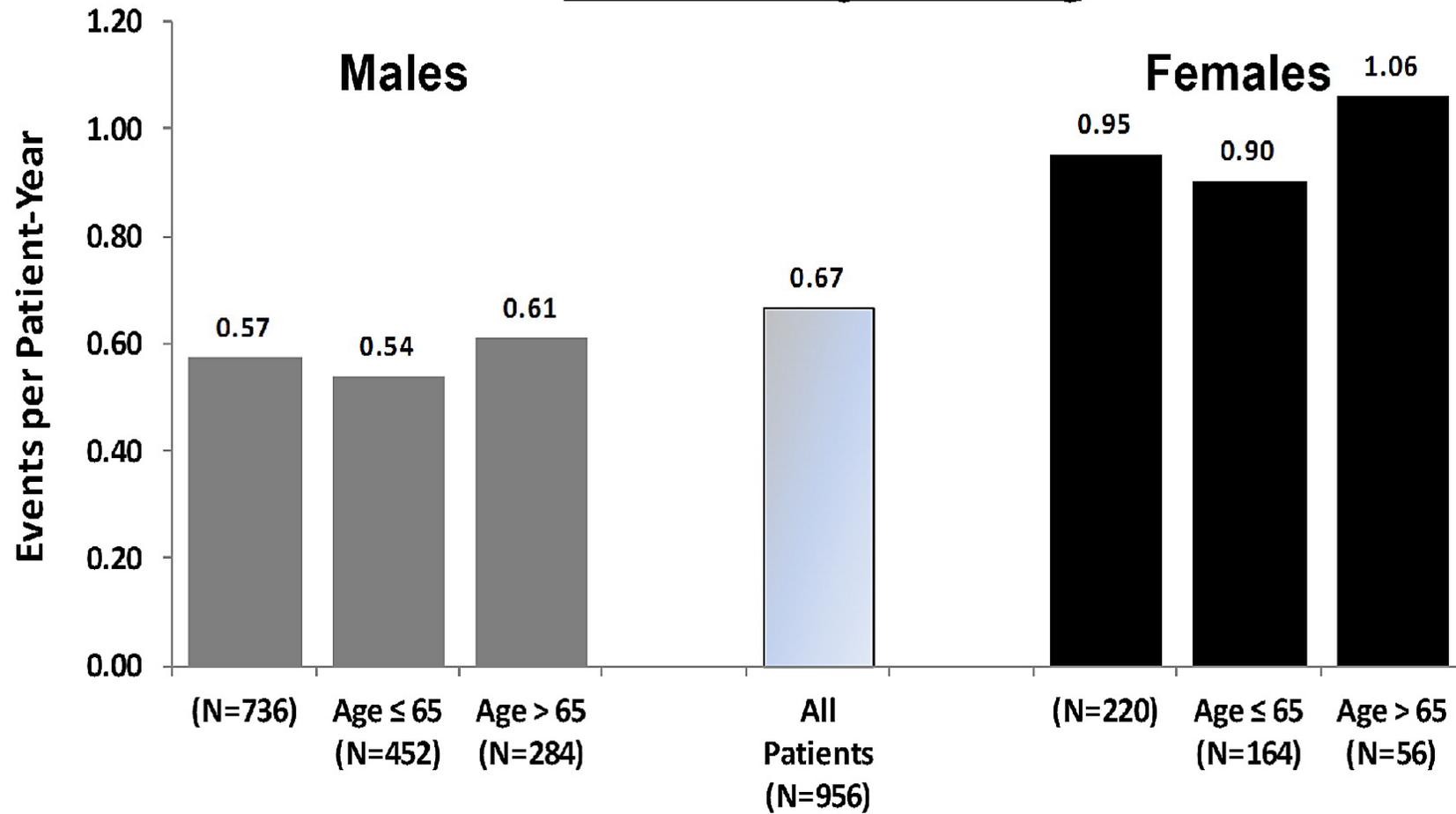
Cumulative Infection Events by Age (LVAD Only)



DRIVELINE



Post Discharge Bleeding

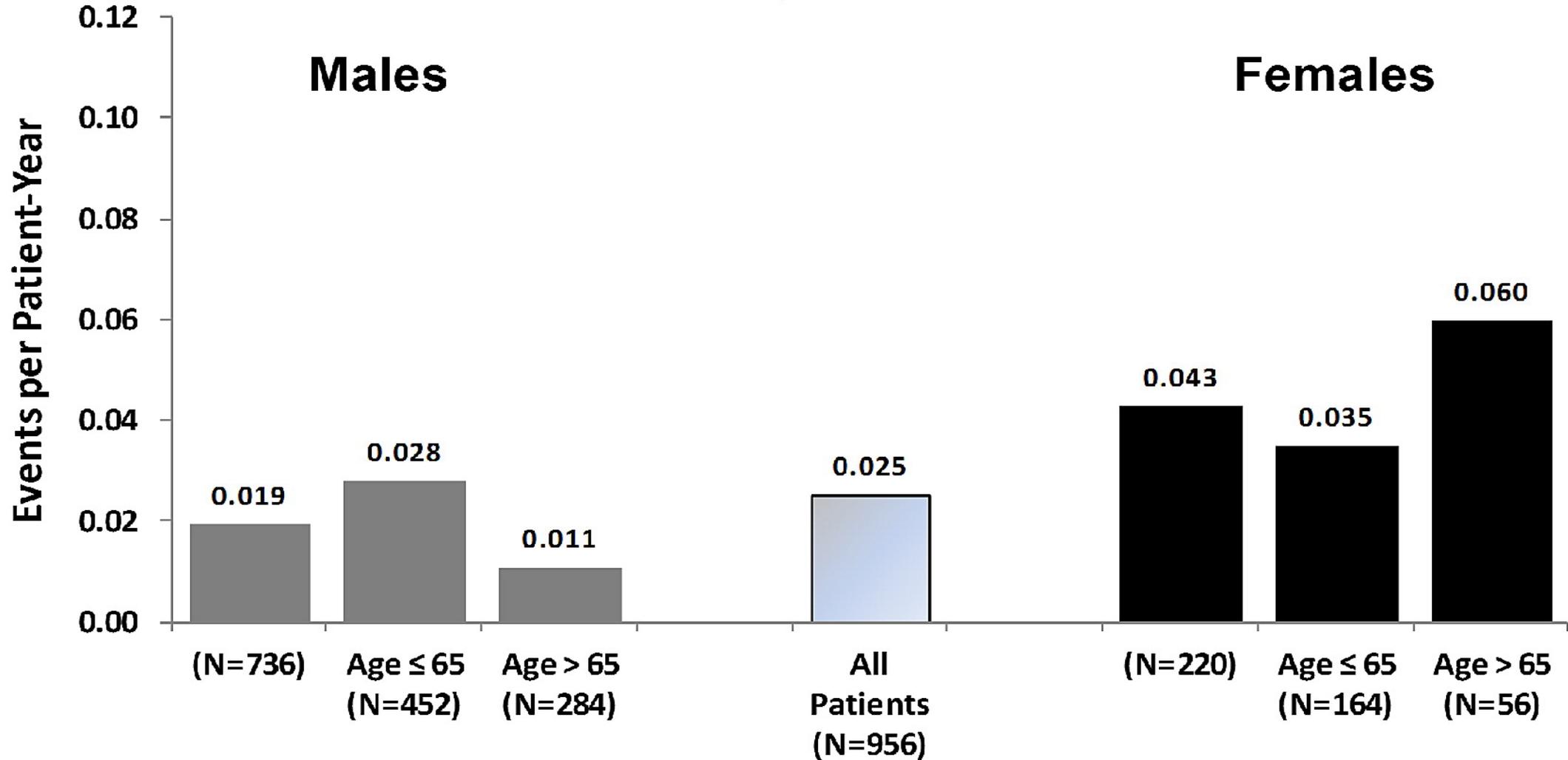


- Your assessment reveals burgundy urine.
- What might this mean?



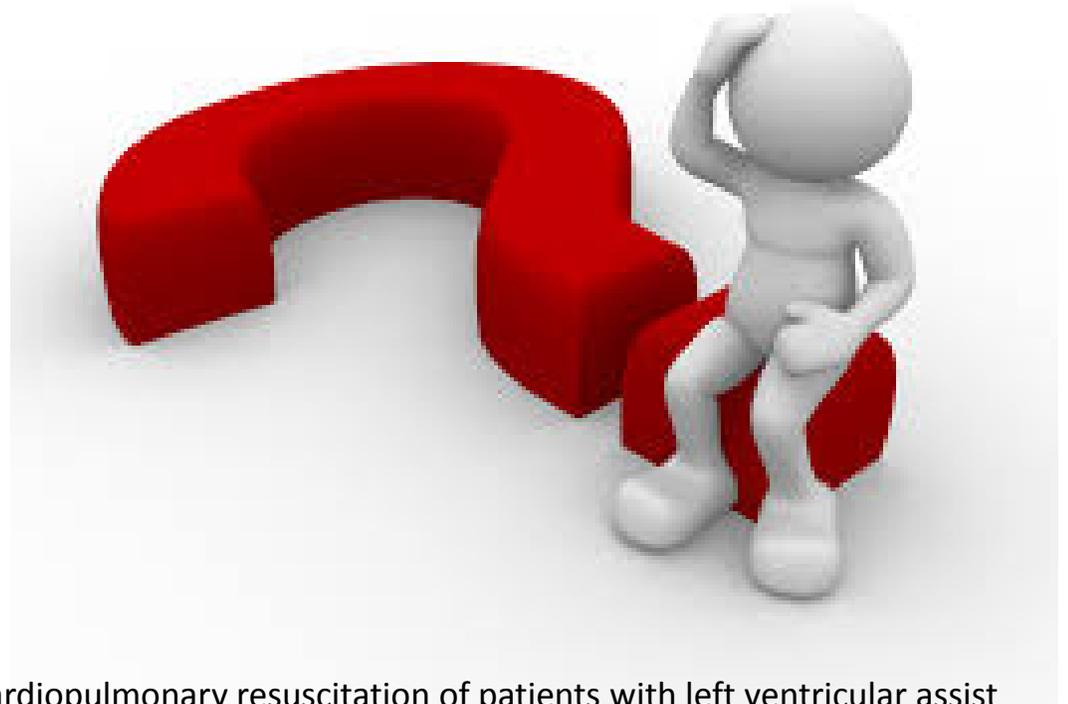
When do you call the VAD coordinator?

Post Discharge Pump Thrombosis



YOU ARE TRANSPORTING A PATIENT TO THE NEAREST HOSPITAL WHEN..

- The patient has a Heart Mate 2 and is not breathing!
- What do you do?



Mabvuure, N. T., & Rodrigues, J. N. (2014). External cardiac compression during cardiopulmonary resuscitation of patients with left ventricular assist devices. *Interactive CardioVascular and Thoracic Surgery*, doi:10.1093/icvts/ivu117

ACLS WITH VADS

- Circulation-
 - Pulsatility
 - Perfusion
 - Pump
 - Electrical Problem
- Airway-Typical Management
- Breathing-Typical Management

TRANSPORT CONSIDERATIONS

- Assess for transport needs: typical ALS ground transport, but LVAD patients may be flown by helicopter
- Where does your patient need to go? Implant center or community hospital?
- Locate and bring backup controller and batteries to the hospital with the patient.
- If not done already, assess for thorough SAMPLE history including the presence or absence of PM/AICDs as well as LVAD—plan for transport of the primary contact or caregiver as well!

TRANSPORT REPORT

- **M-Mechanism of Injury/Nature of Illness:**
 - Summary of event
 - Provide device name in report and known communication with physicians and VAD Coordinators
- **V-Vitals:**
 - Vital signs, Doppler BP if obtainable
 - 12-lead EKG, EtCO₂
 - Glucose
- **I-Interventions:**
 - Before and after EMS
- **T-Transport:** Any changes enroute?
 - Provide an accurate time of transport to aid in preparation for the patient.
- If an extended transport, identify back up transport facilities for loss of airway and circulatory compromise enroute.

www.mylvad.com/ems



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

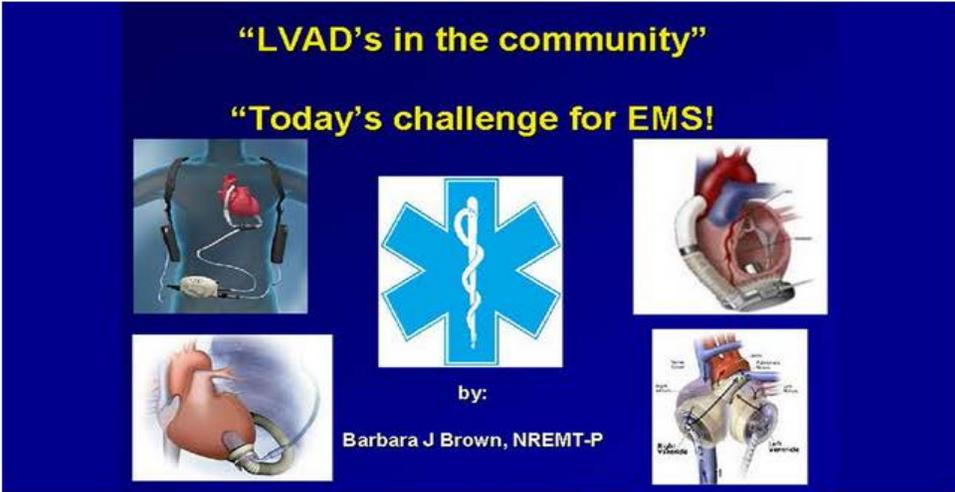
- Community Forums
- LVAD Community Blogs
- Newsletter Archives
- LVAD Stories
- Video Library

MEMBER LOGIN REGISTER PATIENT SURVEY

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Emergency Medical Services Providers



by:
Barbara J Brown, NREMT-P

EMS Field Guides

- >> [Field Guides Master Document](#)
- >> [HeartMate II@](#)
- >> [HeartMate II with Pocket Controller](#)
- >> [HeartWare@ Ventricular Assist System](#)
- >> [Thoratec PVAD-IVAD™](#)
- >> [Freedom Driver \(Total Artificial Heart\)](#)

More on MyLVAD.com

- >> [What is an LVAD?](#)
- >> [LVAD Hospital Locator](#)
- >> [National EMS Week 2012](#)

Emergency Care of LVAD Recipients



Mylvad.com

Questions?



Thank you!

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