

## Ventricular Assist Devices

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April 22<sup>nd</sup> 2016



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## Disclosures

Peter Eckman, MD

I have the following pertinent financial relationships to disclose:

**-Thoratec/St. Jude Medical** – Consultant, Advisory board, Honoraria, Prior Grant Support – HeartMate II, CentriMag, HeartMate III

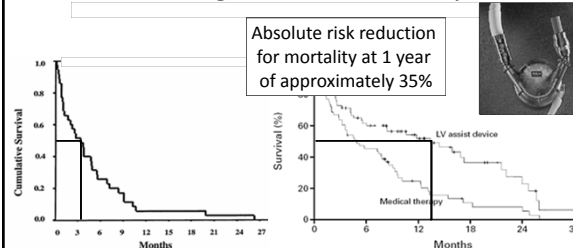
**-HeartWare** – Prior Honoraria, Prior Grant Support - HVAD

## Objectives

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1. Explain mechanism of action of durable ventricular assist devices (VADs).
2. Summarize indications and contraindications for durable VADs.
3. Describe typical outcomes for VADs, including typical adverse events.

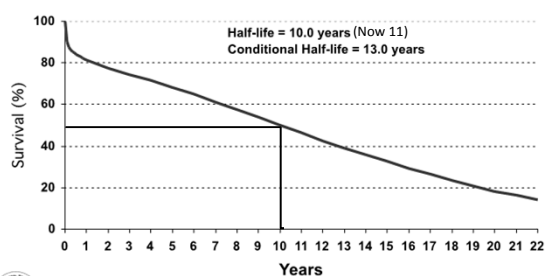
## Long-Term Inotrope Therapy is Associated with High Rates of Mortality



Hershberger RE et al. *J Cardiac Failure* 2003;9:180-7  
Rose EA et al. *NEJM* 2001; 345:1435

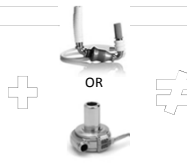
## HEART TRANSPLANTATION

Kaplan-Meier Survival (1/1982-6/2005)

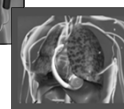


ISHLT  
J Heart Lung Transplant 2007;26: 769-781

## What is a VAD?

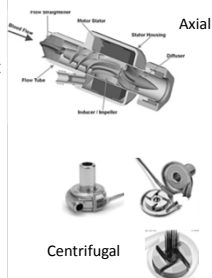


- A ventricular assist device (VAD) is a mechanical device that is used to partially or completely replace the function of a failing heart
- Goal of device: to direct blood away from the failing ventricle and provide flow to the circulation



## Pulsatile/Continuous Flow

- Pulsatile pumps mimic the natural pulsing action of the heart
  - Also known as volume displacement pumps
  - Current use uncommon
- Continuous flow pumps use either centrifugal pumps or axial flow pumps
  - Both types have a central rotor containing permanent magnets.
  - Can be by hydrodynamic or magnetic levitation



## Indications to Consider Advanced HF Therapies (VAD/Tx)

- NYHA III or IV
- >1 HF admission or unscheduled ED visit in last 6 months despite ongoing cardiologist care
- Intolerance of ACEi/ARB/BB
- CRT nonresponder
- Refractory ventricular arrhythmias
- Worsening renal function with diuresis
- Inotrope use (ever)
- 6 minute walk <300 m

## Indications for VAD

- Bridge to recovery
- Bridge to transplant
  - Pulmonary hypertension
  - Cardiorenal syndrome
  - Prolonged waiting time for suitable organ
  - Potential resolution of contraindications (cancer, smoking, etc.)
- Destination therapy
  - Ineligible for transplant



## Contraindications for VAD

- Typically >80 years old
- Lack of social support system
- Nonreversible end organ failure (dialysis, e.g.)
- Severe RV failure (MCS may still be an option)
- Little data on BSA < 1.3 m<sup>2</sup>
- Limited data on pediatric patients
- Inability to tolerate anticoagulation - relative
- Unwilling to accept blood products
- Pregnancy
- Aortic insufficiency must be addressed

## The RV



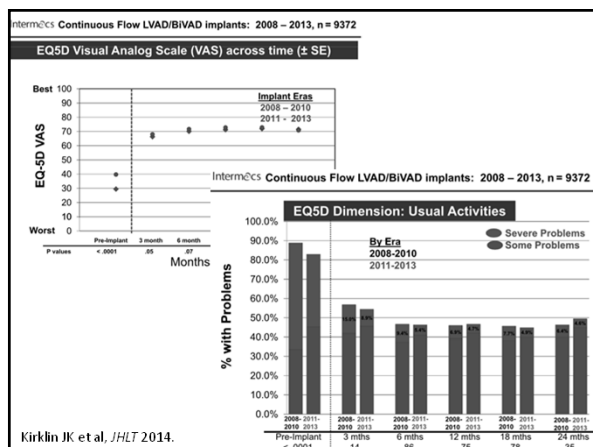
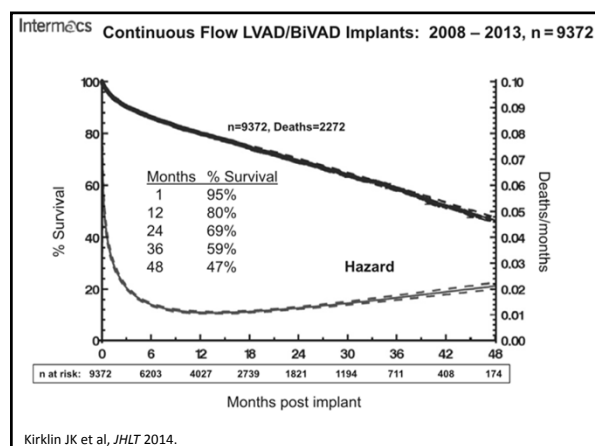
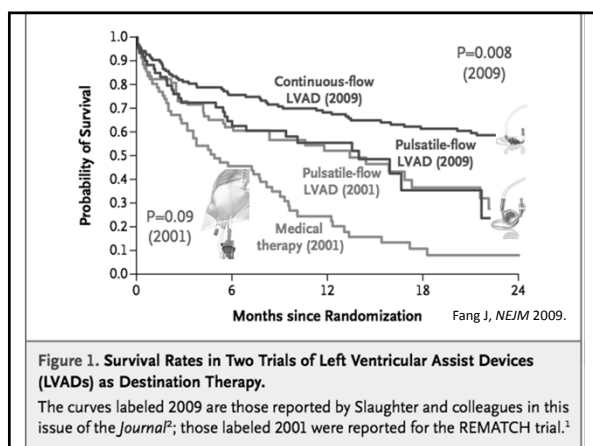
- RV failure after LVAD is a HUGE risk factor for adverse outcome
- Evaluating RV function is challenging
  - Echo usually looks terrible
  - RV failure risk models

## Predicting RV Failure After VAD

- CVP/PCWP ratio  $\geq 0.63$ , preop ventilator, BUN > 39 mg/dL
- Michigan RV failure risk score (vasopressor, AST  $\geq 80$ , bilirubin  $\geq 2$ , creatinine  $\geq 2.3$ )
- Preoperative IABP, elevated PVR, DT indication
- Age, ascites, bilirubin, INTERMACS 1
- Tricuspid annular motion < 7.5 mm
- Right-to-left ventricular end-diastolic diameter > 0.72
- Procalcitonin, neopterin, NTproBNP, big endothelin-1
- Low RVSWI

Kormos RL et al, JTCVS 2010  
Matthews JC et al, JACC 2008  
Drakos SG et al, Am J Cardiol 2010  
Holman WL et al, JHLT 2009

Puwanant S et al, JHLT 2008  
Kukucka M et al, JHLT 2011  
Henning F et al, Gen TCVS 2011  
Fitzpatrick JR 3<sup>rd</sup> et al, JHLT 2008



## Major Potential Complications

- Thrombosis (8%/year)
- Infection (10%/year)
- Stroke (10%/year)
- Bleeding (20%/year)
- Arrhythmia
- Death



## To contact me

Please call or email with any questions...  
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