

# Corrective Surgery in Severe Heart Failure

**Jon Enlow, D.O., FACS**  
**Cardiothoracic Surgeon**

**Riverside Methodist Hospital, Ohiohealth**  
**Columbus, Ohio**

# Session Objectives

- 1.) Identify which patients with severe heart failure due to ischemic cardiomyopathy are candidates for primary surgical revascularization using preoperative testing such as cardiac MR, echo, and perfusion imaging.
- 2.) Describe the indications for corrective surgery in patients with severely diminished ejection fraction who have valve disease, including need for multivalve repair/replacement.
- 3.) Describe options for evaluating ventricular function in patients with severe mitral regurgitation and why ejection fraction alone may overestimate the patient's function.
- 4.) Identify which patients would be better served with moving directly to an advanced heart failure pathway (LVAD, transplant).

# ***“THE FOCUS”***

- ***The “high risk” ischemic, valvular, or combined; sub-acute/chronic cardiomyopathy patient***
- ***Certainly a very heterogeneous population in of itself.....***

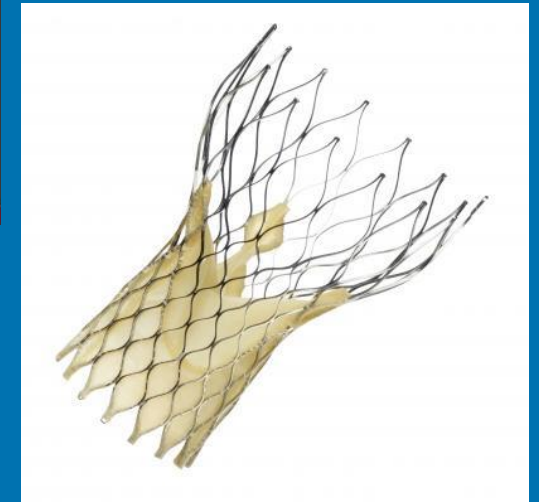


**VS.**



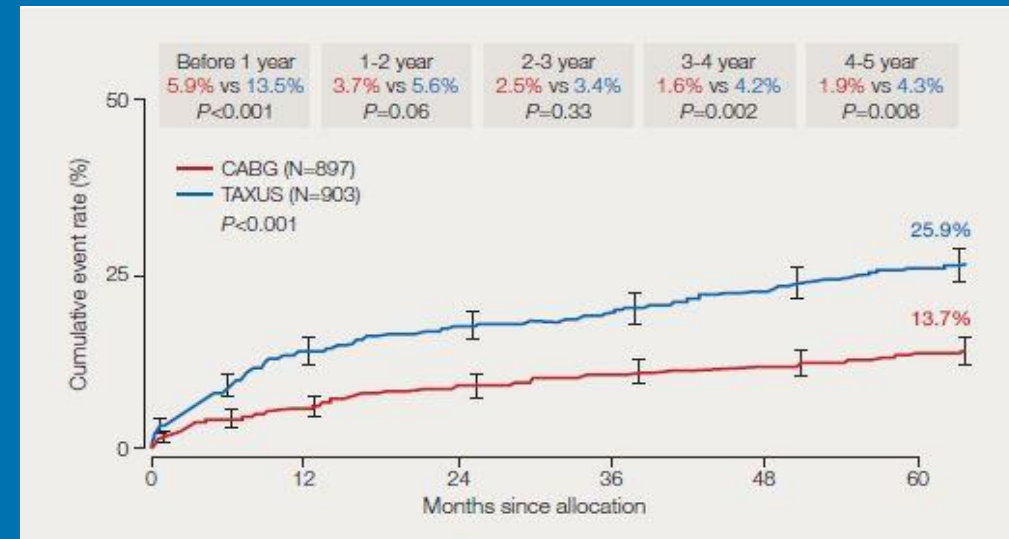
# Changes affecting the care of HF patients....

- Sicker HF patients
- Outcome Reporting
  - STS/Private Payer/Medicare
  - Public Reporting/Healthgrades/ect
  - Bundled Payment Care Initiatives
- “Non Operative” and Minimally Invasive Approaches
  - Heart Team / “Structural Heart”
  - PCI advances, pVAD support ect.
  - TAVR, Mitraclip.....
- Advanced Heart Failure Strategies Acceptance and Outcomes



# CABG and Ischemic Cardiomyopathy

- Early Trials (CASS, Veterans, ect)
  - Low % of EF < 35 patients (only about 7% with documented EF < 40%)
  - Survival and “Anginal Symptom Control” were the primary focus
  - EF improvement was noted
  - Lack of current standards of “optimal medical mgt”
- More Recent Trials (Syntax, Freedom, ect.)
  - Based on coronary anatomy and ACS/Angina
    - 2% of Syntax Enrollees had EF < 30%
    - Continues to show benefit of CABG in a complex patient population



1.) Circulation 1983; 68:939-950

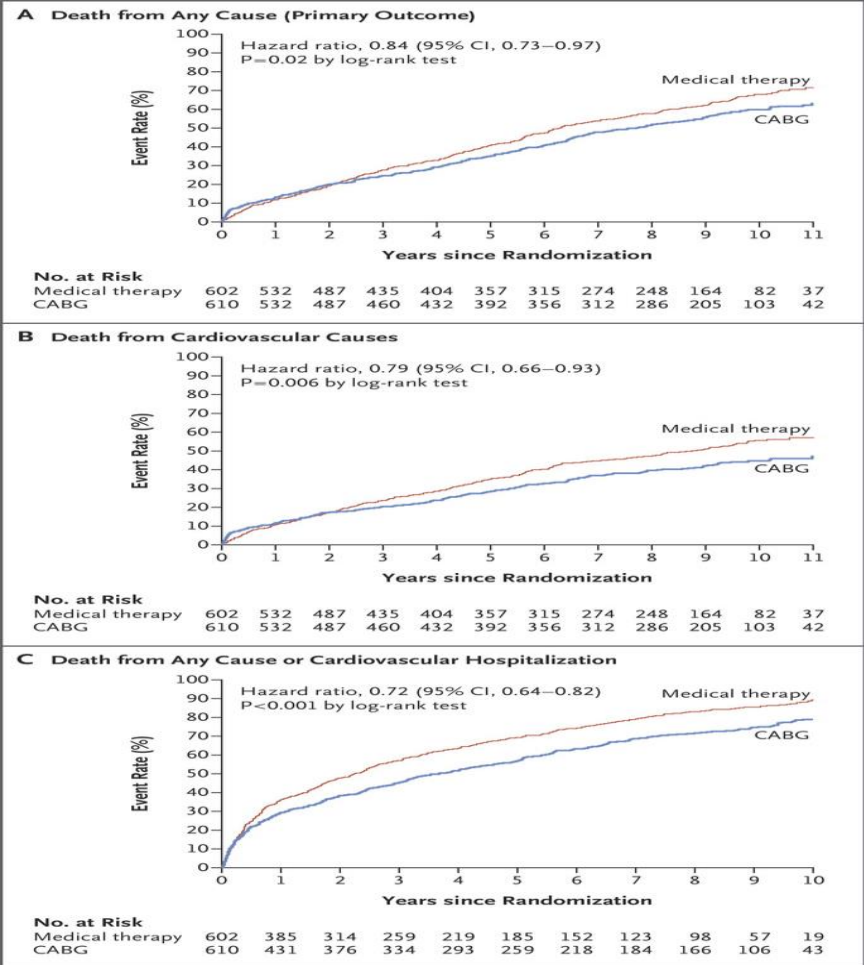
3.) Circulation 2014; 129:2388-94

2.) N Engl J Med 1984;

311:1333-1339

# “STICH and STICHES”

- Finally some data to support CABG (*or revascularization in general*) *in Heart Failure.*
  - *CABG + Optimal Medical Therapy over Optimal Medical Therapy Alone*
    - Cardiovascular mortality was lower in the medical therapy + CABG arm (28% vs. 33%, HR 0.81, 95% CI 0.66-1.00, p = 0.05)
    - Cardiovascular repeat hospitalization (58% vs. 68%, HR 0.74, 95% CI 0.64-0.85, p < 0.001)
    - Repeat revascularization (39% vs. 55%, HR 0.60, 95% CI 0.51-0.71, p < 0.001)
    - No survival or symptom based advantage to advocate routine SVR in addition to CABG
    - “All cause mortality” similarity likely relates to diminishing CABG benefit with advancing age and competing co-morbidities.
    - Should encourage CAD evaluation in severe HF pt’s where traditionally there was lack of evidence to support LHC.



5.) N Engl J Med 2016; 374:1511-1520

# 2013 ACCF/AHA Guideline for the Management of Heart Failure

Recommendations	COR	LOE	References
CABG or percutaneous intervention is indicated for HF patients on GDMT with angina and suitable coronary anatomy, especially significant left main stenosis or left main equivalent	I	C	10, 12, 14, 848
CABG to improve survival is reasonable in patients with mild to moderate LV systolic dysfunction and significant multivessel CAD or proximal LAD stenosis when viable myocardium is present	IIa	B	848–850
CABG or medical therapy is reasonable to improve morbidity and mortality for patients with severe LV dysfunction (EF <35%), HF, and significant CAD	IIa	B	309, 851
Surgical aortic valve replacement is reasonable for patients with critical aortic stenosis and a predicted surgical mortality of no greater than 10%	IIa	B	852
Transcatheter aortic valve replacement is reasonable for patients with critical aortic stenosis who are deemed inoperable	IIa	B	853
CABG may be considered in patients with ischemic heart disease, severe LV systolic dysfunction, and operable coronary anatomy whether or not viable myocardium is present	IIb	B	307–309
Transcatheter mitral valve repair or mitral valve surgery for functional mitral insufficiency is of uncertain benefit	IIb	B	854–857
Surgical reverse remodeling or LV aneurysmectomy may be considered in HF/EF for specific indications, including intractable HF and ventricular arrhythmias	IIb	B	858

CABG indicates coronary artery bypass graft; CAD, coronary artery disease; COR, Class of Recommendation; EF, ejection fraction; GDMT, guideline-directed medical therapy; HF, heart failure; HF/EF, heart failure with reduced ejection fraction; LAD, left anterior descending; LOE, Level of Evidence; and LV, left ventricular.



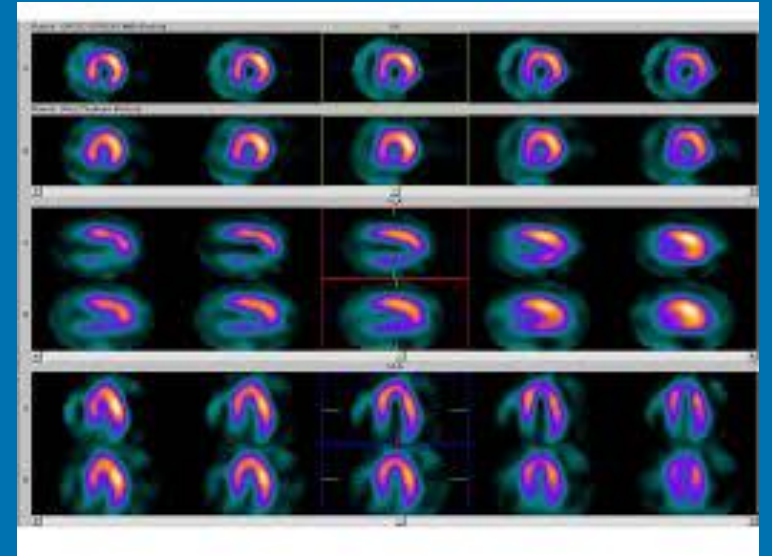
# “Viability”

- Controversy after the STICH Trial
  - STICH : Viability didn't matter.....

- Meta-analysis – Allman et al. -
  - J Am Coll Cardiol. 2002 Apr 3;39(7):1151-8.

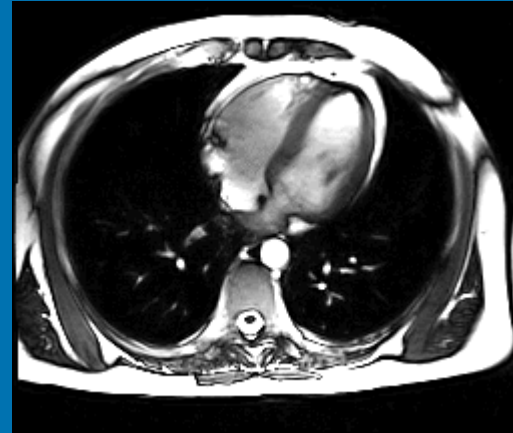
## » Two Subsequent Reviews

- Circulation. 2008 Jan 1;117(1):103-14. doi: 10.1161/CIRCULATIONAHA.107.702993.
- Current Problems in Cardiology, Volume 32, Issue 7, July 2007, Pages 375-410



# Viability Testing – Does Modality Matter?

- ECHO
- Dobutamine Stress ECHO
- Nuclear Studies
- CMR
- PET – Viability Testing



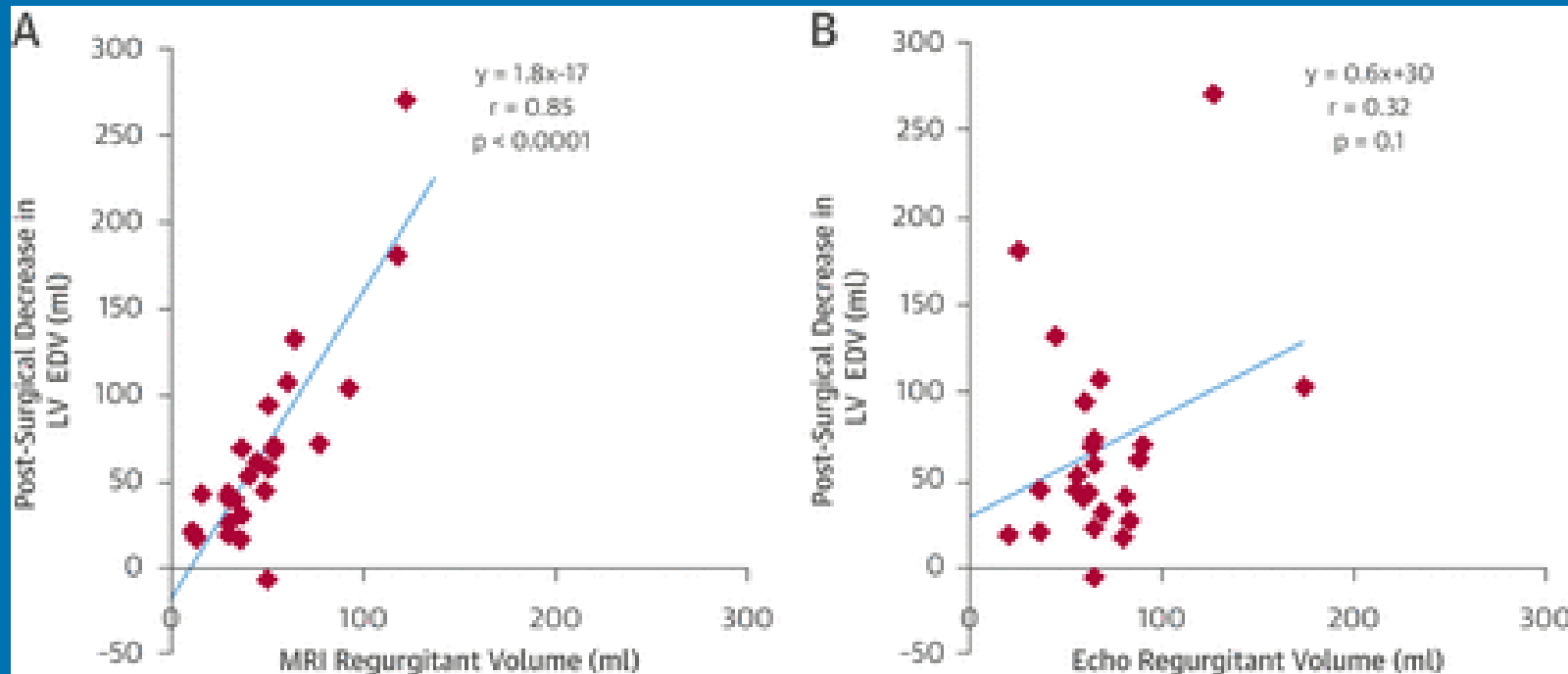
# Valvular Disease and Heart Failure

- Vast Array of Conditions
  - Stenosis
  - Regurgitation
  - Acute vs. Chronic
  - Primary vs. Secondary
  - Symptomatic vs Asymptomatic
- Will focus on Symptomatic MR and AS with depressed EF

# Defining MR in the Low EF Ventricle

- Traditional Echocardiographic Techniques
  - Vena Contracta
  - RVol and Fraction Measurements
  - PISA (EROA, RVol, RF) and Anatomic Regurgitant Orifice Area
- CMR
- CCT

# Discordance Between Echocardiography and MRI in the Assessment of Mitral Regurgitation Severity

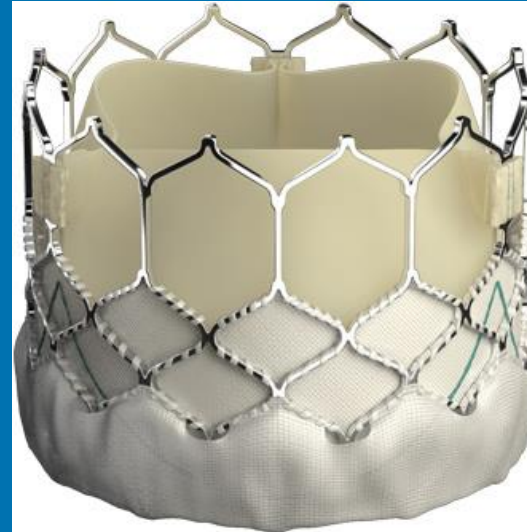


# 2017 AHA/ACC Focused Update of Valvular Heart Disease Guideline

- *Primary MR:*
  - Among asymptomatic patients with severe primary MR with preserved left ventricular (LV) systolic function (LV ejection fraction [LVEF] >60%, LV end-systolic dimension <40 mm [stage C1]), mitral valve surgery is reasonable in the setting of serial imaging studies that reveal a progressive increase in LV size or decrease in LVEF (Class IIa, LOE C-LD).
- *Secondary MR:*
  - The definition of severe secondary MR is now the same as for severe primary MR (effective regurgitant orifice area  $\geq 0.4$  cm<sup>2</sup>, regurgitant volume  $\geq 60$  ml, regurgitant fraction  $\geq 50\%$ ).
  - It is reasonable to choose chordal-sparing mitral valve *replacement* over reduction annuloplasty mitral valve repair among patients operated for severe, symptomatic (New York Heart Association class III or IV) secondary MR (stage D) (Class IIa, LOE B-R).
  - After a randomized trial showed no clinical benefit of mitral valve repair among patients with chronic, moderate ischemic MR undergoing coronary artery bypass grafting, the LOE was changed from C (consensus) to B-R (moderate quality evidence from  $\geq 1$  randomized controlled trial [RCT] or meta-analyses of moderate-quality RCT) for the Class IIb recommendation for mitral valve repair in this population.

# Aortic Valvular Cardiomyopathy

- AS
  - Low Output, Low Gradient
- AI
- Bicuspid Valves
- Aneurysmal disease



# Operative Pitfalls

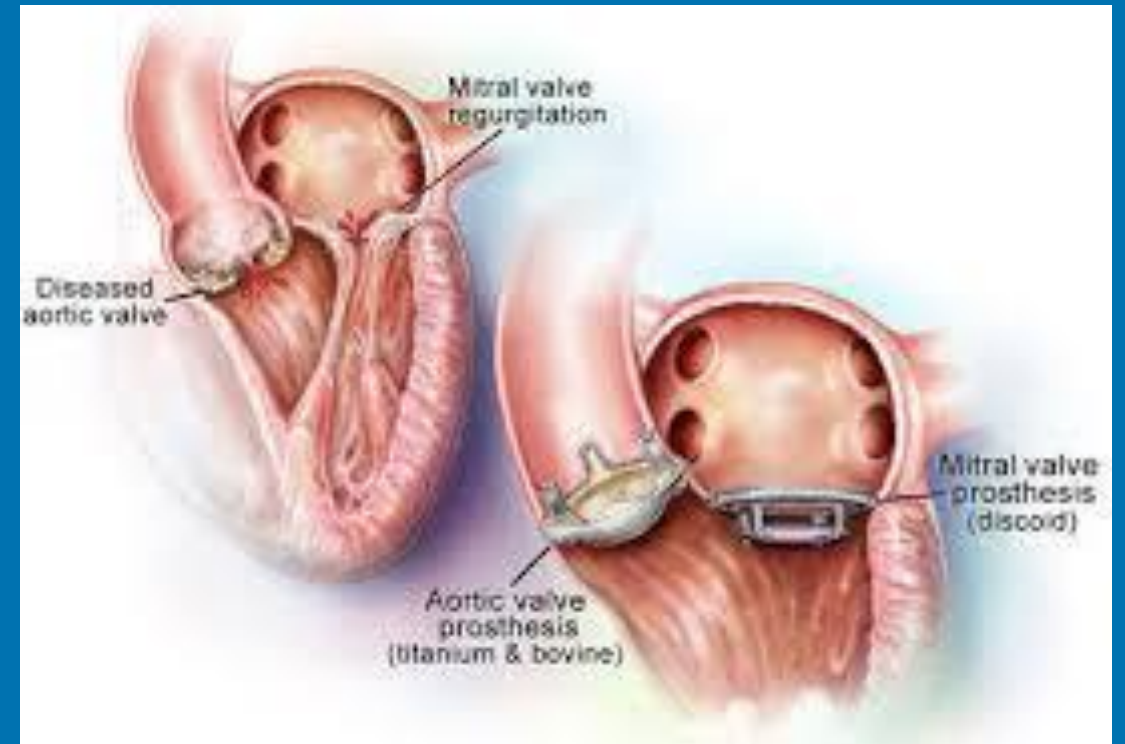
- Pre-procedure “steam” prediction
- Cannulation Strategies
- “Protection”
- Inotropic Support
- RV failure/management
- “Bailout” strategies





# Multivalve Procedures

- Sum Total of above
- “Steam” Prediction
- Surgeon and Team Experience
- “One Shot” strategy

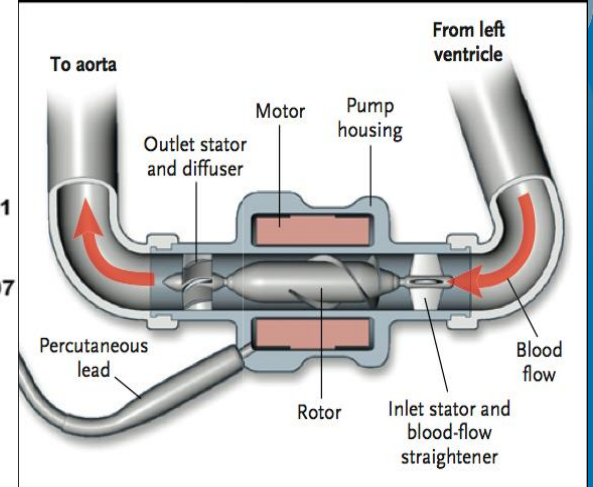
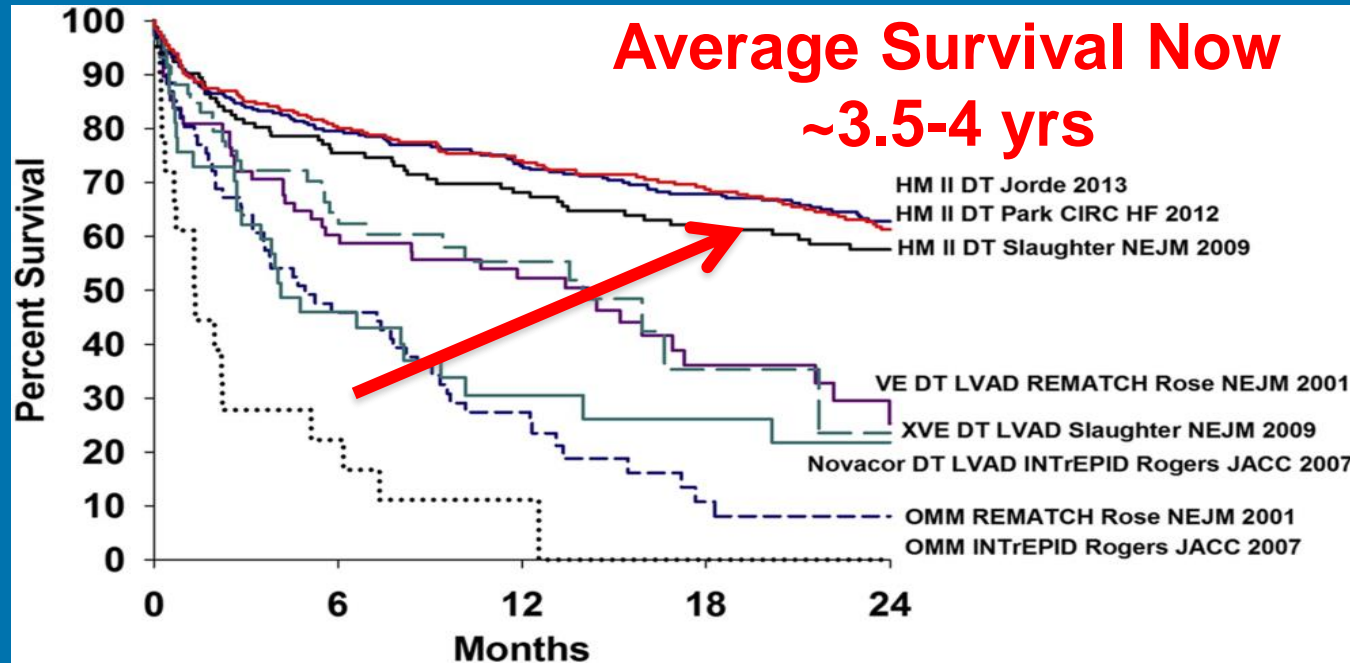


# Advanced Heart Failure

- LVAD and Transplant
  - ReMatch Trial Verified that LVAD was superior to OMT
  - HMII DT study verified that in a “non-transplant” population
  - Stigma Remains
  - New Technology will only grow the VAD population
    - Endurance, Momentum 3, ect.
  - OHT will remain the goal in appropriate pts for the foreseeable future.

# Left Ventricular Assist Device (LVAD) Therapy

- Bridge to Transplant (BTT)
- Destination Therapy (DT)





# Who to Refer for “Advanced HF Eval”



# When to Refer

- EARLY, EARLY, EARLY.....
- Repeated Heart Failure Related Admissions
- Cardiogenic Shock
  - Obviously a diverse population
- Pre-surgical Risk Stratification
- Pre-surgical Risk Optimization

## Who should have an advanced heart failure therapy evaluation?

- + New York Heart Association Class III or IV patients on maximal medical/device heart failure therapy and some of these warning signs:
  1. Intolerant or refractory to ACE inhibitors/Angiotensin receptor blockers or beta-blockers
  2. Heart failure-related hospitalization in the past year
  3. Rising BUN or creatinine for no other clear reason (evidence of cardio-renal syndrome)
  4. Declining sodium levels despite maximally tolerated diuretics
  5. Cardiac Resynchronization Therapy (CRT) non-responders

## What does OhioHealth offer?

- + The advanced heart failure program at OhioHealth can comprehensively evaluate patients for cardiac transplantation and list them in collaboration with a transplanting center. We have placed LVADs at Riverside Hospital, an OhioHealth Hospital, as both DT and BTT since program inception. We currently follow a number of LVAD and transplant patients in our advanced heart failure clinic at Riverside Hospital.



# References

- 1.) Coronary Artery Surgery Study (CASS): a randomized trial of coronary artery bypass surgery: survival data. *Circulation* 1983; 68:939-950
- 2.) The Veterans Administration Coronary Artery Bypass Surgery Cooperative Study Group. Eleven-year survival in the Veterans Administration randomized trial of coronary bypass surgery for stable angina. *N Engl J Med* 1984; 311:1333-1339
- 3.) Morice MC, Serruys PW, Kappetein AP, et al. Five-Year Outcomes in Patients With Left Main Disease Treated With Either Percutaneous Coronary Intervention or Coronary Artery Bypass Grafting in the SYNTAX Trial. *Circulation* 2014; 129:2388-94
- 4.) Velazquez EJ, Lee KL, Jones RH, et al., on behalf of the STICH Investigators. Coronary-Artery Bypass Surgery in Patients with Ischemic Cardiomyopathy. *New Engl J Med* 2011; 364:1607-1616
- 5.) Coronary-Artery Bypass Surgery in Patients with Ischemic Cardiomyopathy. *N Engl J Med* 2016; 374:1511-1520
- 6.) 2013 ACCF/AHA Guideline for the Management of Heart Failure. *Circulation*. 2013;128:e240-e327
- 7.) Myocardial viability testing and impact of revascularization on prognosis in patients with coronary artery disease and left ventricular dysfunction: a meta-analysis. *J Am Coll Cardiol*. 2002 Apr 3;39(7):1151-8.
- 8.) Hibernating Myocardium: Diagnosis and Patient Outcomes, Stunning, hibernation, and assessment of myocardial viability. *Circulation*. 2008 Jan 1;117(1):103-14.
- 9.) Mitral Valve Surgery in Advanced Heart Failure, *Journal of the American College of Cardiology*, Volume 55, Issue 4, 26 January 2010, Pages 271-282
- 10.) 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *J Am Coll Cardiol* 2017;Mar 15:[Epub ahead of print].
- 11.) Uretsky S, Gillam L, Lang R, et al. Discordance between echocardiography and MRI in the assessment of mitral regurgitation severity: a prospective multicenter trial. *J Am Coll Cardiol*. 2015;65:1078–88
- 12.) Grayburn PA, Carabello B, Hung J, et al. Defining “severe” secondary mitral regurgitation: emphasizing an integrated approach. *J Am Coll Cardiol*. 2014;64:2792–801.