LVADs and Transplantation as a Therapy for Complex Valve Disease

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Disclosures:

None
LVADs will challenge conventional surgical and percutaneous therapy for treatment of advanced secondary cardiomyopathy

- Ischemic mitral regurgitation
- Low gradient aortic stenosis
- Any valve disease with severe LV or RV dysfunction
- Multiple reoperations
- Complications of acute myocardial infarction
- Recurrent or irreparable structural lesions
LVADs and transplantation as alternative to conventional high-risk surgical therapy

- Current Median survival
  - Destination LVAD – 5 years (and improving)
  - Heart Transplant – 11 years

- What is the median survival of your proposed high-risk conventional surgery?
Figure 2 Influence of MPG and CAD on Survival in LF/LGAS Patients Without CR on DSE Kaplan-Meier estimates of the probability of survival of the total population (n = 81) according to: (A) mean pre-operative transvalvular gradient (MPG) ≤20 and >20 mHg.

Outcome After Aortic Valve Replacement for Low-Flow/Low-Gradient Aortic Stenosis Without Contractile Reserve on Dobutamine Stress Echocardiography


http://dx.doi.org/10.1016/j.jacc.2009.02.026
LVAD as alternative to high risk surgery

- 64 Male
- Severe AS – AVA 0.7 cm²; moderate MR
- Severe LV dysfunction EF 15%, LVEDD 8cm
- Severe RV dysfunction
- RHC – PCW 27 mmHg, PA 43/25 mmHg, CI 1.9 l/min/m²
- Heartmate II LVAD placed in preference to AVR/MVR
- Subsequent heart transplant, survived 8 years
Many surgeons will claim low operative mortality and great outcomes in such very high-risk cases.....
Survival of surgery does not equate to success of surgery

- Many surgeons can achieve high operative success with advanced heart failure patients or complex surgical repair
- Surviving surgery does not mean surgery was successful
  - Symptoms may persist
  - Many patients who survive surgery may still die in the short or mid-term
Case 1 – Successful Surgery?

- 64 y Female
- PMH: Myocardial Infarction
- Shortness of breath walking inclines or climbing stairs
- No chest pain
- Echo Jan 2017 – LVEF 25%, Moderate to Severe MR
- Referred for Catheterization
- Moderate CAD (RCA, Cx)
- Severe LV dysfunction and dilatation
- Moderate MR
Echocardiogram

- LVEF 22%
- LVEDD 6.2 cm
- Severe MR
- Severe tethering
Summary (February 2017)

- 64 y Female
- Symptoms - Shortness of Breath, no chest pain
- Severe LV dysfunction EF <25%
- Severe LV dilatation and remodeling
- Angiogram: RCA and Cx disease
- No viability study done

- Referred for conventional surgery
February 2017 – Was Operated

- 29 mm Bio MV Replacement
- SVG – PDA
- Uncomplicated post-operative course
- LVEF 10 to 15% post surgery
- Surgical Success?
April 2017 – Two Months Post-op

- Worsening symptoms – NYHA III/IV
- Repeat hospitalizations for heart failure
April 2017 – Two Months Post-op

- Worsening symptoms – NYHA III/IV
- Repeat hospitalizations for heart failure
Cardiac Catheterization

- Patent graft, no progression of CAD
- Hemodynamics
  - LV 110/25
  - PCW 35
  - PA 55/30 (38)
  - RA 18
  - CO – 3.4 l/min (CI 1.9 l/min/m²)
  - sVO2 48%

- Cardiopulmonary Exercise Test – Peak VO2 8.2 ml/kg/min

- Started on Long-term Inotrope Therapy (Milrinone)
June 2017 – Four Months Post-op

- NYHA IV despite Milrinone infusion
- Admitted to hospital in cardiogenic shock in setting of SVT
- Multiorgan dysfunction with rising creatinine
- Underwent resternotomy and placement of Heartmate II LVAD
- Doing well. NYHA I awaiting transplant
Transcatheter Aortic-Valve Replacement with a Self-Expanding Prosthesis

Adams et al. NEJM 2014; 370(19):1790-8

Operative mortality
high-risk SAVR 4.5%

One year mortality
high-risk SAVR 19.1%
Transcatheter Aortic-Valve Replacement with a Self-Expanding Prosthesis

Operative mortality
high-risk SAVR 4.5%

One year mortality
high-risk SAVR 19.1%

Three year mortality
high risk SAVR 39.1%

Deeb et al. J Am Coll Cardiol. 2016 7;67(22):2565-74
LVADs and Transplantation for Complex Valve Problems

CASE EXAMPLES
Case 1 – Failed IMR Repair

- 60y M
- Prior CABG+MV repair
- Progressive symptoms since

- Presents in Class IV CHF
- Severe MR, Mean gradient 15 mmHg
- Severe RV dysfunction, Severe TR
- PA 70/35 PCW 35
- On continuous milrinone infusion
• 60y M  
• Prior CABG+MV repair  
• Progressive symptoms since  

• Now Class IV CHF  
• Severe MR, Mean gradient 15 mmHg  
• Severe RV dysfunction, Severe TR  
• PA 70/35 PCW 35

• Underwent reop sternotomy, MV replacement and Heartmate II LVAD implantation
• 65y M
• Restrictive mitral annuloplasty five years prior
• Progressive Heart Failure
• Underwent LVAD implantation and subsequent transplantation
Case Two – Repeat Failure of Surgery/Interventions

- 52 year old male s/p multiple valve surgeries now recurrent PVL
- Admitted with heart failure symptoms at rest
- Started on continuous inotropic infusion which could not be weaned
- Hepato-renal dysfunction
- Cultures negative
Previous Interventions

- 2003- AVR (AI)
- 2008- AVR/MVR (dehiscence ? endocarditis)
- 2009- MVR (dehiscence)
- 2009- Percutaneous closure of recurrent PVL (low EF)
- 2014- Percutaneous closure of recurrent PVL
- 2016- Recurrent Mitral and Aortic PVL, NYHA- IV
Transesophageal Echocardiogram
Transesophageal Echocardiogram
Transthoracic Echocardiogram
Fluoroscopy/ Right Heart Catheterization

- PAP - 50/30 mmHg
- PCW - 23 mmHg
- RAP - 10 mmHg
Operation

- Fourth time sternotomy
- Mitral valve re-replacement
- Aortic valve re-replacement
- Implantation of Heartware LVAD
Post-bypass TEE
Discharged home three weeks post-operation

Did well in NYHA Class I for eight months post operatively

Readmitted to hospital 5 weeks ago in heart failure. Severe MR due to Mitral PVL

Awaiting a heart transplant
Case 3 – Untreatable Endocarditis

35 M prior IV drug abuse

2008 MV MRSA endocarditis with abscess – MVR.
- Early failure with rocking prosthesis, pseudoaneurysm
- 2010 MRSA Endocarditis. Redo surgery.
- Dec 2011 Recurrent endocarditis, cerebral embolization, dehiscence of valve
- Feb 2012 Heart transplantation (alternate list)
Case 4 – Untreatable Endocarditis

54 M Aortic and Mitral Endocarditis

- AVR/MVR May 2013 complicated by early contained AV groove disruption
- Two unsuccessful attempts at repair June 2013 and August 2013
- Presents with class IV Heart Failure
- Underwent 4th sternotomy, cardiac excision and total artificial heart placement
Case Five – Ischemic MR with multiple comorbidity

- 76 Y established ischemic cardiomyopathy
- Extensive Peripheral Vascular Disease:
  - iliofemoral, fem-fem, fem-pop bypass
  - right carotid endarterectomy
- Presents with Class IV Heart Failure, leg swelling
  - BP 95/61, HR 71
  - frail cachectic elderly gentleman
- Admitted to hospital, progressed to cardiogenic shock, now inotrope dependent
Computed Tomography
Ischemic MR with multiple comorbidity

- 76 y male, ischemic cardiomyopathy prior CABG, patent LIMA close to sternum
- Severe MR, Severe TR, Mod AS
- Cardiac Comorbidities:
  - LVEF 23%
  - RV function severely decreased
  - RVSP 51mmHg
  - Inotrope dependent
- Non-cardiac comorbidities:
  - severe PVD, CVD, cachexia, frailty
Operative Risk for reoperative AVR/ MV repair/ TV repair

<table>
<thead>
<tr>
<th>Patient related factors</th>
<th>Cardiac related factors</th>
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<tbody>
<tr>
<td>Age 1 (years)</td>
<td>76</td>
</tr>
<tr>
<td>Gender</td>
<td>male</td>
</tr>
<tr>
<td>Renal impairment 2</td>
<td>severe (CC &lt;50)</td>
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<tr>
<td>Extracardiac arteriopathy 3</td>
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<tr>
<td>Poor mobility 4</td>
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<tr>
<td>Previous cardiac surgery</td>
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<tr>
<td>Chronic lung disease 5</td>
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<tr>
<td>Active endocarditis 6</td>
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<tr>
<td>Critical preoperative state 7</td>
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<tr>
<td>Diabetes on insulin</td>
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<tr>
<td>NYHA</td>
<td>IV</td>
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<tr>
<td>CCS class 4 angina 3</td>
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<tr>
<td>LV function</td>
<td>poor (LVEF 21%-30%)</td>
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<tr>
<td>Recent MI 9</td>
<td>no</td>
</tr>
<tr>
<td>Pulmonary hypertension</td>
<td>moderate (PA systolic 31-55 mmHg)</td>
</tr>
<tr>
<td>Operation related factors</td>
<td></td>
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<tr>
<td>EuroSCORE II</td>
<td>50.35%</td>
</tr>
</tbody>
</table>

Note: This is the 2011 EuroSCORE
Surgery

- Underwent Heartmate II LVAD, MVr, TVr, AVR
- Frailty reversed
- Now over 2 years post LVAD, NYHA I and no re-hospitalizations
Summary

• LVADs and Transplantation are viable options for selected patients with end-stage valvular cardiomyopathy or untreated complex valve disease

• Mid-term outcomes with LVAD and Transplantation will often be much better than that of conventional surgery

Thank You
Thank you