Destination Therapy For Advanced Heart Failure

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Current HF Estimates

300 Million Population

HF=2.5% of Population
6.5-7 Million Patients

45-50% Preserved Systolic Function
3.0-3.5 Million Patients

50-55% Systolic HF
3.0-3.5 Million Patients

Class IIIB 300-350,000

Class IV 150-200,000

Class IIIB + IV <75 y.o.
250-300,000 Patients
Risk Stratification for Mortality with HF

Seattle Heart Failure Model (SHFM) Score

Diuretic Dose
BP < 100mmHg
Uric Acid
Lymphocyte Count
Hgb < 12
Low Cholesterol
Sodium < 136

Levy et al, Circulation 2006 Mar 21;113(11):1424-33
### Who is Dying with HF

N=160, 2000-2004

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Peak creatinine past 6 mos</td>
<td>3.1</td>
</tr>
<tr>
<td>Peak BUN / past 6 mos</td>
<td>62</td>
</tr>
<tr>
<td>Lowest serum Na</td>
<td>128</td>
</tr>
<tr>
<td>RV dysfunction</td>
<td>53%</td>
</tr>
<tr>
<td>0 / 1 / ≥ 2 hosp / 6 mos</td>
<td>26 / 32 / 42</td>
</tr>
<tr>
<td>LVEF</td>
<td>20%</td>
</tr>
<tr>
<td>50% deaths at home</td>
<td>74% recent Class IV</td>
</tr>
</tbody>
</table>

Teuteberg, Stevenson et al, J. Cardiac Failure, 2006; 12: 47-53
Risk Stratification in Advanced HF

HF Survival Score

components

MAP
HR
QRS >120
Pk VO2
CAD
LVEF
PCW
Na+

Death, Urgent Tx, LVAD

Low Risk
Medium
Hi Risk

Aaronson, Mancini, Circ 1997; 95:2660-7
Candidate Selection for LVAD Therapy

Prognosis with advanced HF - Lack of trial data for class IIIb-IV
Selecting the Right Patient

The obvious and the less ill
UNOS Transplant Status

- **Status 1A or ‘urgent need’**
  Requiring intensive care hospitalization, life support measures, inotropes or ventricular assist device (VAD).

- **Status 1B**
  Dependent on inotropes or a VAD – in the hospital or at home.

- **Status 2**
  Stable on oral medications and able to wait at home.
The Obvious

Discharged home on inotropes: Cleveland Clinic experience: “the obvious”

Survival

47% alive at 6-months

Years

Gorodeski, Chu, Starling
The “Less ill”

What is best for a Status 2 patient or the “less ill”
US Heart Transplants By Status

The change from 2000 to 2008

<table>
<thead>
<tr>
<th>Status</th>
<th>2000</th>
<th>2008</th>
<th>%change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>870</td>
<td>1100</td>
<td>+26%</td>
</tr>
<tr>
<td>1B</td>
<td>755</td>
<td>714</td>
<td>-5%</td>
</tr>
<tr>
<td>2</td>
<td>573</td>
<td>188</td>
<td>-67%</td>
</tr>
<tr>
<td>ALL</td>
<td>2199</td>
<td>2002</td>
<td>-9%</td>
</tr>
</tbody>
</table>

In 2008, 91% of transplants were inotropic or VAD dependent

Source: UNOS published data to 11/30/2008
## UNOS Waiting List Mortality

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Status 1A</td>
<td>4.37</td>
<td>4.77</td>
<td>5334</td>
<td>8.44</td>
<td>8.80</td>
<td>10.5</td>
<td>13.05</td>
<td>17.16</td>
<td>16.29</td>
</tr>
<tr>
<td>Heart Status 1B</td>
<td>3.77</td>
<td>5.16</td>
<td>5.48</td>
<td>7.85</td>
<td>9.44</td>
<td>10.74</td>
<td>8.05</td>
<td>9.12</td>
<td>10.03</td>
</tr>
<tr>
<td>Heart Status 2</td>
<td>14.47</td>
<td>9.75</td>
<td>7.21</td>
<td>8.77</td>
<td>12.08</td>
<td>12.65</td>
<td>16.91</td>
<td>16.04</td>
<td>15.50</td>
</tr>
<tr>
<td>Heart Status 7 (inactive)</td>
<td>26.45</td>
<td>24.48</td>
<td>34.46</td>
<td>36.00</td>
<td>32.04</td>
<td>36.16</td>
<td>36.25</td>
<td>43.31</td>
<td>38.79</td>
</tr>
</tbody>
</table>
**REMATCH Trial**

**Randomized Evaluation of Mechanical Assistance for the Treatment of Congestive Heart Failure**

- **Background**
  - Implantable left ventricular assist devices have benefited patients with end-stage heart failure as a bridge to cardiac transplantation, but their long-term use for the purpose of enhancing survival and the quality of life has not been evaluated.

- **Methods**
  - Randomly assigned 129 patients with end-stage heart failure who were ineligible for cardiac transplantation to receive a left ventricular assist device (68 patients) or optimal medical management (61). All patients had symptoms of New York Heart Association class IV heart failure.
REMATCH Trial

• Results
  – The rates of survival at one year were 52 percent in the device group and 25 percent in the medical-therapy group (P=0.002), and the rates at two years were 23 percent and 8 percent (P=0.09), respectively. The frequency of serious adverse events in the device group was 2.35 (95 percent confidence interval, 1.86 to 2.95) times that in the medical-therapy group, with a predominance of infection, bleeding, and malfunction of the device. The quality of life was significantly improved at one year in the device group.

• Conclusions
  – The use of a left ventricular assist device in patients with advanced heart failure resulted in a clinically meaningful survival benefit and an improved quality of life. A left ventricular assist device is an acceptable alternative therapy in selected patients who are not candidates for cardiac transplantation.
## Baseline Characteristics Of the Patients in REMATCH

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Continuous-Flow LVAD (N=134)</th>
<th>Pulsatile-Flow LVAD (N=66)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age — yr</td>
<td>62±12</td>
<td>63±12</td>
<td>0.81</td>
</tr>
<tr>
<td>Mean</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (range)</td>
<td>64 (26–79)</td>
<td>65 (29–81)</td>
<td></td>
</tr>
<tr>
<td>Male sex — no. (%)</td>
<td>108 (81)</td>
<td>61 (92)</td>
<td>0.04</td>
</tr>
<tr>
<td>Body-surface area — m²</td>
<td>2.0±0.3</td>
<td>2.1±0.3</td>
<td>0.54</td>
</tr>
<tr>
<td>Ischemic cause of heart failure — no. (%)</td>
<td>88 (66)</td>
<td>45 (68)</td>
<td>0.75</td>
</tr>
<tr>
<td>Left ventricular ejection fraction — %</td>
<td>17.0±5.5</td>
<td>16.8±5.4</td>
<td>0.81</td>
</tr>
<tr>
<td>Arterial blood pressure — mm Hg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>104±14</td>
<td>104±18</td>
<td>0.93</td>
</tr>
<tr>
<td>Diastolic</td>
<td>61±13</td>
<td>61±12</td>
<td>0.94</td>
</tr>
<tr>
<td>Pulmonary-capillary wedge pressure — mm Hg</td>
<td>24±8</td>
<td>24±9</td>
<td>0.82</td>
</tr>
<tr>
<td>Cardiac index — liters/min/m² of body-surface area</td>
<td>2.0±0.6</td>
<td>2.1±0.6</td>
<td>0.36</td>
</tr>
<tr>
<td>Pulmonary vascular resistance — dynsec·cm⁻¹</td>
<td>264±128</td>
<td>264±152</td>
<td>0.98</td>
</tr>
<tr>
<td>Central venous pressure — mm Hg</td>
<td>13±6</td>
<td>13±8</td>
<td>0.67</td>
</tr>
<tr>
<td>Serum sodium — mmol/liter</td>
<td>134.7±4.3</td>
<td>133.9±6.0</td>
<td>0.31</td>
</tr>
<tr>
<td>Serum creatinine — mg/dl</td>
<td>1.6±0.6</td>
<td>1.8±0.7</td>
<td>0.08</td>
</tr>
<tr>
<td>History of stroke — no. (%)</td>
<td>21 (16)</td>
<td>11 (17)</td>
<td>0.84</td>
</tr>
<tr>
<td>Concomitant medication or intervention — no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intravenous inotropic agent</td>
<td>103 (77)</td>
<td>55 (83)</td>
<td>0.36</td>
</tr>
<tr>
<td>Diuretic</td>
<td>123 (92)</td>
<td>57 (86)</td>
<td>0.32</td>
</tr>
<tr>
<td>ACE inhibitor</td>
<td>43 (32)</td>
<td>22 (33)</td>
<td>0.87</td>
</tr>
<tr>
<td>Angiotensin II–receptor antagonist</td>
<td>12 (9)</td>
<td>3 (5)</td>
<td>0.39</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>71 (53)</td>
<td>38 (58)</td>
<td>0.55</td>
</tr>
<tr>
<td>Biventricular pacemaker</td>
<td>85 (63)</td>
<td>39 (59)</td>
<td>0.64</td>
</tr>
<tr>
<td>ICD</td>
<td>111 (83)</td>
<td>52 (79)</td>
<td>0.56</td>
</tr>
<tr>
<td>IABP</td>
<td>30 (22)</td>
<td>15 (23)</td>
<td>1.00</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>9 (7)</td>
<td>6 (9)</td>
<td>0.57</td>
</tr>
<tr>
<td>Destination therapy risk score†</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>10.4±5.4</td>
<td>9.9±4.7</td>
<td>0.78</td>
</tr>
<tr>
<td>Score denoting high or very high risk — no. (%)</td>
<td>24 (18)</td>
<td>5 (8)</td>
<td>0.06</td>
</tr>
</tbody>
</table>
## Functional Status and QOL Of The Patients in REMATCH

<table>
<thead>
<tr>
<th>End Point</th>
<th>Continuous-Flow LVAD</th>
<th>P Value for Treatment over Time†</th>
<th>P Value for Treatments at 12 mo</th>
<th>Pulsatile-Flow LVAD</th>
<th>P Value for Treatment over Time†</th>
<th>P Value for Treatments at 12 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
<td>3 Mo</td>
<td>12 Mo</td>
<td>24 Mo</td>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>NYHA class</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients tested</td>
<td>126</td>
<td>91</td>
<td>72</td>
<td>50</td>
<td></td>
<td>55</td>
</tr>
<tr>
<td>Class I — no. (%)</td>
<td>0</td>
<td>30 (33%)</td>
<td>30 (42%)</td>
<td>21 (42%)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Class III — no. (%)</td>
<td>0</td>
<td>38 (42%)</td>
<td>25 (35%)</td>
<td>19 (38%)</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Class IIIA — no. (%)</td>
<td>4 (3)</td>
<td>16 (18%)</td>
<td>13 (18%)</td>
<td>6 (12%)</td>
<td></td>
<td>1 (2)</td>
</tr>
<tr>
<td>Class IIIB — no. (%)</td>
<td>27 (21%)</td>
<td>5 (5%)</td>
<td>4 (6%)</td>
<td>1 (2%)</td>
<td></td>
<td>11 (20%)</td>
</tr>
<tr>
<td>Class IV — no. (%)</td>
<td>95 (75%)</td>
<td>2 (2%)</td>
<td>0</td>
<td>3 (6%)</td>
<td></td>
<td>43 (78%)</td>
</tr>
<tr>
<td>Patients with class I or II — no. (%)</td>
<td>0</td>
<td>68 (75%)</td>
<td>55 (76%)</td>
<td>40 (80%)</td>
<td>&lt;0.001</td>
<td>0</td>
</tr>
<tr>
<td>6-Minute walk test</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients tested</td>
<td>50</td>
<td>77</td>
<td>61</td>
<td>36</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>Distance walked — m</td>
<td>182±140</td>
<td>319±191</td>
<td>318±164</td>
<td>372±191</td>
<td>&lt;0.001</td>
<td>172±108</td>
</tr>
<tr>
<td>Minnesota Living with Heart Failure questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients tested</td>
<td>116</td>
<td>89</td>
<td>76</td>
<td>44</td>
<td></td>
<td>49</td>
</tr>
<tr>
<td>Score</td>
<td>75.4±17.7</td>
<td>37.4±22.2</td>
<td>34.1±22.4</td>
<td>29.6±22.4</td>
<td>&lt;0.001</td>
<td>76.1±18.0</td>
</tr>
<tr>
<td>Kansas City Cardiomyopathy questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of patients tested</td>
<td>115</td>
<td>89</td>
<td>76</td>
<td>47</td>
<td></td>
<td>47</td>
</tr>
<tr>
<td>Overall summary score</td>
<td>27.4±16.3</td>
<td>63.4±18.5</td>
<td>65.9±20.0</td>
<td>69.9±18.7</td>
<td>&lt;0.001</td>
<td>26.5±17.4</td>
</tr>
<tr>
<td>Clinical summary score</td>
<td>35.1±18.5</td>
<td>67.2±17.4</td>
<td>68.6±21.8</td>
<td>72.9±19.3</td>
<td>&lt;0.001</td>
<td>31.6±18.4</td>
</tr>
</tbody>
</table>
REMATCH Trial

<table>
<thead>
<tr>
<th></th>
<th>NO. AT RISK</th>
<th>Months</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LV assist device</td>
<td>68</td>
<td>38</td>
<td>22</td>
</tr>
<tr>
<td>Medical therapy</td>
<td>61</td>
<td>27</td>
<td>11</td>
</tr>
</tbody>
</table>
Poor 2 Year Survival

• More device related than therapy related
  – HeartMate XVE life of device only 18-24 months before expected failure
  – Valve and bearing failures
  – Higher incidence of percutaneous lead infections
HeartMate XVE For DT

Large percutaneous lead and mechanical valves
Need A Better Mousetrap
HeartMate II
Size Comparisons

HeartMate II is much smaller
Anatomical Placement
HeartMate II LVAS
System Components

• HM II Components:
  – Implantable titanium blood pump
  – System Controller

• Shared Components:
  – System Monitor
  – Display Module
  – Power Sources
    • Power Base Unit
    • Batteries & Clips
    • Emergency Power Pack
  – Accessories
Battery Powered Operation

HeartMate battery worn externally in holster

Percutaneous lead exiting body

HeartMate II LVAD or “heart pump”

Power lead

Aorta

Heart

Power lead

HeartMate II LVAS System Controller

MultiCare Cardiovascular & Thoracic Surgical Associates
HeartMate II LVAS
Key Design Features

• Relatively Simple Design
  – Valveless
  – Only one moving part, the rotor
  – Blood immersed bearings designed for minimization of blood damage
  – All motor drive and control electronics are outside of the implanted blood pump

• Speed range: 6,000 to 15,000 rpm

Flow range: 3 – 10 L/min
HM II Pump External View

- **Outflow Graft (16 mm)**
   - Bend Relief
   - Percutaneous lead (8 mm)
   - Blood Pump

- **Inflow Conduit (20 mm)**
  - Flex Section
    - Woven polyester graft
    - Titanium ring
    - Preclotting slots
    - Silastic sleeve
HM II Pump Motor

• Pump is powered by a brushless DC motor
  – Motor has 3 phases
  – Percutaneous lead has 6 electric wires attached to motor stators – 3 primary with a backup for each.

• Rotor contains a magnet

• System controller, by forcing current through the coils of the motor, generates a moving magnetic field which causes the rotor magnet to spin
HeartMate II LVAS Pump

- Flexible inflow conduit
- Textured surfaces
  - Inlet cannula, inflow and outflow elbows
  - Thrombo-resistant
- Outflow graft with bend relief
- Anastomosed to LV apex and ascending aorta
- Pump output varies over cardiac cycle
  - Follows native pulse
  - Afterload sensitive
Flow Waveforms for Pulsatile and Axial Pumps
(Both have average flow between 4-5 L/min)

Pump speed = 10,000 RPM
# HeartMate II vs XVE for DT

## Table 2. Primary End Point and Hazard Ratios, According to Treatment Group.∗

<table>
<thead>
<tr>
<th>End Point</th>
<th>Continuous-Flow LVAD (N=134)</th>
<th>Pulsatile-Flow LVAD (N=66)</th>
<th>Hazard Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival free from disabling stroke and reoperation to repair or replace LVAD at 2 yr (primary composite end point)</td>
<td>62 (46 [38–55])</td>
<td>7 (11 [3–18])</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>First event that prevented patient from reaching the primary end point</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disabling stroke†</td>
<td>15 (11 [6–17])</td>
<td>8 (12 [4–20])</td>
<td>0.78 (0.33–1.82)</td>
<td>0.56</td>
</tr>
<tr>
<td>Reoperation to repair or replace pump‡</td>
<td>13 (10 [5–15])</td>
<td>24 (36 [25–48])</td>
<td>0.18 (0.09–0.37)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Death within 2 yr after implantation</td>
<td>44 (33 [25–41])</td>
<td>27 (41 [29–53])</td>
<td>0.59 (0.35–0.99)</td>
<td>0.048</td>
</tr>
<tr>
<td>Any</td>
<td>72 (54 [45–62])</td>
<td>59 (89 [82–97])</td>
<td>0.38 (0.27–0.54)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

* Hazard ratios were calculated with the use of Cox regression, and the P value for the primary end point with the use of Fisher’s exact test. CI denotes confidence interval, and LVAD left ventricular assist device.

† Disabling stroke was defined as stroke with a Rankin score of more than 3.

‡ Reoperation to repair or replace pump included urgent heart transplantation or device explantation.
Thoratec HeartMate II for DT

HeartMate XVE vs HeartMate II

P=0.008 by the log-rank test

No. at Risk
Continuous-flow LVAD 133 95 82 69 62
Pulsatile-flow LVAD  59 32 19 5 2
HM II System Controller

Microprocessor that:
• Delivers power to the pump
• Controls pump speed and power
• Monitors, interprets & responds to system performance
• Performs diagnostic monitoring
• Indicates hazard and advisory alarms
• Provides complete backup system
• Event recording capability
System Controller Screen

- Once connected to a powered controller, the pump will automatically start if the fixed speed is ≥ 8,000 rpm.
- If fixed speed is < 8,000 rpm, to start the pump, firmly press either the silence alarm or test select button on the keypad.
HeartMate II Power Sources

- AC power from Power Module (PM)
- DC power from a pair of 14-volt lithium-ion batteries and clips
- UBC – rapidly charges batteries
- DC power from the Emergency Power Pack (EPP)
System Monitor & Display Module
Clinical Screen

- Displays:
  - Primary operating parameters
  - 2 highest priority alarm message banners
  - Information updated every second
- Default screen
Key Points

• Valveless pump - backward flow will occur if the pump stops
  – Degree of retrograde flow is determined by pressure differential across the pump

• At low speeds, flow can be a combination of forward and backward flow
  – An average flow does not mean that flow throughout the cardiac cycle is forward
  – Retrograde flow can occur on a beat by beat basis

• Significant negative pressures can be produced when insufficient blood is provided to the pump

• Pump rotor can continue to spin while the inlet, outlet or both are obstructed
  – If blood does not enter or exit the pump, the rotor can continue to operate in stagnant blood causing severe hemolysis to the trapped blood volume
  – Displayed output is inaccurate
Ventricular assist device (VAD) candidate evaluation process

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Interagency Registry for Mechanically Assisted Circulatory Support
INTERMACS Categories

1. Critical cardiogenic shock
2. Progressive decline
3. Stable, but inotrope dependent
4. Recurrent advanced HF
5. Exertion intolerant
6. Exertion limited
7. Advanced NYHA III

INTERMACS: Distribution of patient profiles (n=420)

Percent of patients

INTERMACS profile

Hypothesis

• LVAD’s should be implanted into patients with the greatest likelihood of benefit in terms of survival

• LVAD patients less ill at implant (with higher INTERMACS Class) should:
  – Have shorter LOS post VAD
  – Have greater survival to discharge
  – Have greater long term survival on mechanical support
Survival to D/C Based on INTERMACS

Group 1: INTERMACS 1: crash and burn
Group 2: INTERMACS 2 and 3: hospitalized and inotrope-dependent
Group 3: INTERMACS 4 – 7: poor functional capacity

Lengths of Stay Based on INTERMACS

Group 1: INTERMACS 1: crash and burn
Group 2: INTERMACS 2 and 3: hospitalized and inotrope-dependent
Group 3: INTERMACS 4 – 7: poor functional capacity

Survival on MCS Based on INTERMACS

Group 3 vs Group 1: HR 0.11 (0.01-0.90)
Group 3 vs Group 2: HR 0.60 (0.24-1.5)

How Do We Identify Appropriate Patients

Include Class IIIb and IV, exclude “futile” Implants

Modified from Bristow M, in Braunwald, ed: Heart Disease, chap 24, 2005
Goal: Better Survival and Functional Capacity

- LVAD’s in Less Severe HF
  - Referral for DT therapy remains very late in most patients-based on belief that this therapy is a desperation only
  - Chose a new therapy when the outcomes are better
  - Patient selection most important determinant
  - Current outcomes with continuous flow LVAD’s now provides the basis for equipoise in moving to patients with less severe HF

- New trials are now being planned to prove this
Case Study

- Medical History
  - 76 y.o. Caucasian male
  - CAD
  - Hyperlipidemia
  - DVT-Warfarin anticoagulation
  - Prior CVA without residual
  - Severe pulmonary hypertension
Case Study

• Surgical History
  – CABG X 5 in 2003, St. Joseph Hospital
  – CRTD for LBBB in 2003, replacement BiV/ICD generator in May 2009
  – AVR in February 2009, St. Joseph Hospital
Case Study

• Recent history
  – Followed by CHF center at St. Joseph’s
  – June 17, 2009
    • Admitted at St. Joseph for acute decompensation of CHF
    • Repeat readmissions, 5/15/09, 5/28/09, 6/2/09
    • Worsening fluid retention
    • SOB at rest
    • Ascities
    • Hypoalbuminemia
Cardiovascular & Thoracic Surgical Associates

Case Study

• Diagnosis
  – Dilated ischemic cardiomyopathy
  – Severe systolic dysfunction
    • EF of 10% on July 18, 2009 by Echo
    • Home dobutamine infusion
    • NYHA Functional Class IV
  – Renal insufficiency-BUN 41, creatinine 3.47
  – Hepatic congestion with total bilirubin 1.5
  – LBBB
Case Study

• RHC-July 24, 2009
  – Pre Dobutamine infusion
    • RAP 20, RV 55/13, PA 54/26/38, PCWP 20
    • CI 1.3
  – Post Dobutamine infusion
    • RAP 14, RV 67/11, PA 68/30/46, PCWP 24
    • CI 1.68, improvement of 26% with 5mcg/kg/min
Hospital Course

• Admitted 8/18/09
  – IABP inserted
  – Milrinone 0.25 infusion started
• Implant of HeartMate II 8/20/09
  – Device flows of 5-6 L/min
  – Milrinone 0.25
  – iNO 40ppm
  – Epinephrine
  – Vasopressin
Hospital Course

• POD #1
  – Weaned off iNO
  – Extubated
  – Weaned off epinephrine and vasopressin

• POD #2
  – IABP removed
  – Ambulated to chair
Hospital Course

- POD #3
  - Creatinine normal
  - Ambulating
  - Began low dose anticoagulation
- POD #7
  - Developed pericardial effusion, R pleural effusion
- POD #8
  - Taken to IR for CT guided drainage of effusions
Hospital Course

• POD #10
  – Transferred to CCU
POD # 19

Excursion to bowling alley for 77th Birthday
Hospital Course

- POD #24
  - D/C’d to home
Today

- 36 months post op
- Independent
  - Lives at home alone
  - Drives
  - Cooks for himself
- Attends cardiac rehab
- Avid Golfer
Thank You!