2018 Update on Heart Failure Management

Where we are today….

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Medical Director
Comprehensive Heart Failure and Transplant Program

HEART FAILURE
Current State of Heart Failure

- 5.7M Americans diagnosed with Heart Failure
- Overall spending of roughly $30.7 billion
- 68% of costs are attributed to direct medical expenditures
  - The majority being due to hospitalizations for decompensated heart failure
- Unplanned readmissions remain common with ~25% of patients being readmitted within 30 days of discharge

Bergethon et. al., Circulation: Heart Failure. 2016;9:e002594
Readmission Risk and Timing of Readmission

- High readmission rates persist...
  - 25% within 30 days
  - 50% within 6 months


Mortality

- For AHA/ACC stage C/D patients diagnosed with HF:
  - 30% mortality rate in the first year.
  - 60% mortality rate within 5 years.

Long-term mortality risk increases with multiple hospitalizations
Preventing HF hospitalizations improves survivability

Kaplan-Meier cumulative mortality curves for all-cause mortality after each subsequent hospitalization for HF.
Setoguchi S, Stevenson LW, Schneeweiss S Am Heart J 2007;154:260-264
PRO-ACTIVE CARE MANAGEMENT

Congestion and Outcome

1. Lala A, et al. JCF 2013
Decompensation events requiring more intensive therapy are associated with higher mortality risk

![Chart showing mortality risk associated with different types of events.](chart)


Do Daily Weight Measurements “Work”?

<table>
<thead>
<tr>
<th>Weight Gain</th>
<th>Sensitivity%</th>
<th>Specificity%</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 kg weight gain over 48-72 hrs</td>
<td>9%</td>
<td>97%</td>
</tr>
<tr>
<td>2% weight gain over 48-72 hrs</td>
<td>17%</td>
<td>94%</td>
</tr>
<tr>
<td>3 lbs in 1 day or 5 lbs in 3 days</td>
<td>22.5%</td>
<td>-</td>
</tr>
</tbody>
</table>

![Graph showing weight and RV diastolic pressure changes over time.](graph)

3. COMPASS HF Trial
Time Course of Decompensation

Physiologic Markers of Acute Decompensation


Strong relationship between baseline estimated PA diastolic (ePAD) pressure improvement and survival benefit

- Patients who have a high PA pressure have a higher probability of death
- A 5 mm HG reduction in ePAD is associated with a 30% survival benefit

MEMS-based hemodynamic monitoring system

PA Pressure Sensor on Catheter Delivery System

Patient Home Electronics Unit

PA Pressure Database

Wireless Power and Communication

Pressure

Radiofrequency powered
No battery
No leads

High fidelity
PA Pressure waveform
Sensor Physics

\[ f = \frac{1}{2\pi \sqrt{L \cdot C(P)}} \]

Provision of PA Pressures to Providers

Patient
- Takes pressure readings
- Reviews readings on website

Website
- Mediation changes
- Alerts

Physician
- Reviews readings on website
Patients managed with PA pressure data had **significantly fewer HF hospitalizations** as compared to the control group.

CardioMEMS Real World Experience:
Providers effectively treat pressures over time

Treatment effect in the real world (n=2,000) is greater than in CHAMPION

SURGICAL THERAPIES FOR ADVANCED HEART FAILURE
Quality of Life & Functional Outcome Improvement

- BBT 6-minute walk test
  - 16% of patients were capable of completing the test at baseline
  - 94% of HeartMate II recipients completed the test at 6 months

NYHA Class I or II

![Graph showing NYHA Class I or II outcomes](image)

81% Improved to NYHA Class I or II

Circ Heart Fail. 2012;5(2):241-248
Recommendations for Inotropic Support, MCS and Cardiac Transplantation

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>COR</th>
<th>LOE</th>
</tr>
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<tbody>
<tr>
<td><strong>Inotropic support</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac shock pending definitive therapy or resolution</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>BTT or MCS in stage D refractory to GDMT</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Short-term support for threatened end-organ dysfunction in hospitalized patients with stage D and severe HFrEF</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>Long-term support with continuous infusion palliative therapy in select stage D HF</td>
<td>IIb</td>
<td>B</td>
</tr>
<tr>
<td>Routine intravenous use, either continuous or intermittent is potentially harmful in stage D HF</td>
<td>III: Harm</td>
<td>B</td>
</tr>
<tr>
<td>Short-term intravenous use in hospitalized patients without evidence of shock or threatened end-organ performance is potentially harmful</td>
<td>III: Harm</td>
<td>B</td>
</tr>
<tr>
<td><strong>MCS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MCS is beneficial in carefully selected* patients with stage D HF in whom definitive management (eg, cardiac transplantation) is anticipated or planned</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Nondurable MCS is reasonable as a &quot;bridge to recovery&quot; or &quot;bridge to decision&quot; for carefully selected* patients with HF and acute profound disease</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td>Durable MCS is reasonable to prolong survival for carefully selected* patients with stage D HFrEF</td>
<td>IIa</td>
<td>B</td>
</tr>
<tr>
<td><strong>Cardiac transplantation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluation for cardiac transplantation is indicated for carefully selected patients with stage D HF despite GDMT, device and surgical management</td>
<td>I</td>
<td>C</td>
</tr>
</tbody>
</table>

*Circulation 128:e240, 2013

Destination Therapy Implants
June 2006 – December 2013 (n=3516)

JHLT 33(6):555, 2014
“Carefully Selected Patients”

✓ LVEF < 25%
✓ NYHA Class IIIb-IV functional status
✓ High risk of 1-2 year mortality
  – Reduced peak oxygen consumption
  – Dependence on continuous inotropes
  – ≥3 hospital admissions per year
✓ Sequelae of hypoperfusion
  – Hepatic and/or renal failure
  – Initial right ventricular dysfunction

ROADMAP and REVIVE-IT
Complementary Studies Exploring HeartMate II in Earlier-Stage HF

<table>
<thead>
<tr>
<th>NYHA Class</th>
<th>Class IIIB</th>
<th>Class IV (Ambulatory)</th>
<th>Class IV (On Inotropes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class III</td>
<td>7</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Class IIIB</td>
<td>6</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Class IV</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Class IV</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

INTERMACS Profiles

FDA Approval: Class IIIB / IV
CMS Coverage: Class IV

Currently Not Approved
Limited Adoption
Growing Acceptance
Primary Endpoint
Alive at 12 Months on Original Therapy
with Increase in 6MWD by 75m

<table>
<thead>
<tr>
<th>End point</th>
<th>OMM (n=81)</th>
<th>LVAD (n=85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alive at 12 months on original therapy with increase in 6MWD by 75m</td>
<td>17 (21%)</td>
<td>33 (39%)</td>
</tr>
<tr>
<td>First event that prevented success:</td>
<td>n=64 (79%)</td>
<td>n=52 (61%)</td>
</tr>
<tr>
<td>Death within 1 yr</td>
<td>17 (21%)</td>
<td>17 (20%)</td>
</tr>
<tr>
<td>Delayed LVAD</td>
<td>18 (22%)</td>
<td>NA</td>
</tr>
<tr>
<td>Delta 6MWT &lt;75m</td>
<td>29 (36%)</td>
<td>33 (39%)</td>
</tr>
<tr>
<td>Urgent Tx</td>
<td>0 (0%)</td>
<td>2 (2%)</td>
</tr>
</tbody>
</table>

P=0.017

OR = 2.4 [1.2-4.8]

Excluded OMM patients: 9 withdrawn, 13 missing 6MWD
Excluded LVAD patients: 3 withdrawn, 8 missing 6MWD, 1 elective HTx
Including 1 TAH

Jerry D. Estep, MD – Presented at ISHLT on April 17, 2015

Syncardia Total Artificial Heart

- Bridge to Transplant
- NYHA Class IV
- BSA 1.7-2.5
- 10 cm AP Dimension
- Hemodynamic impairment
  - CI ≤2.0 and
    - SBP ≤90
    - CVP ≥18
  - 2 inotropes or IABP
Mechanical Circulatory Assist Program

CARDIAC TRANSPLANTATION
The History Of Heart Transplantation

3rd December 1967
50 years and 69,000 transplants since 1988

Orthotopic Implantation

- Completed transplant
- Pacing wires on donor portion of right atrium and ventricle
- Pericardium left open
REGISTRY DATABASE:
Number of Centers Reporting Heart Transplants

Year of Transplant

Number of Centers Reporting

Others
Europe
North America

Adult Heart Transplants
Kaplan-Meier Survival by (Conditional on Survival to 1 yr)

1982-1991 (N=16,204)
1992-2001 (N=31,517)
2002-2008 (N=21,109)
2009-6/2015 (N=20,327)

Median survival (years):
Adult Heart Transplants
Diagnosis


Adult Heart Transplants
% of Patients Bridged with Mechanical Circulatory Support*

% of Patients

Year of Transplant

CONCLUSIONS
Triggers for Referral

- Very Low EF Patients (≤ 25%)
- Frequent Heart Failure admissions
- Cardio-Renal Syndrome
  - BUN > 40, Creat > 1.8
- Intolerance / Need to reduce GDMT
  - SBP < 100
- Electrical Instability (ICD Shock)
- Failure to improve with CRT
- Hyponatremia (Na < 135)

Take Home Points

- Heart Failure population continues to grow
- Increasing use of pro-active care strategies to reduce risk of hospitalization
- Rapid and ongoing growth in MCS therapies
- 50+ years of cardiac transplantation
- Froedtert and MCW:
  - Active Transplant and MCS programs with rapid growth
  - 15+ Transplants and 50+ MCS devices
  - Excellent outcomes
  - Strong community partnerships
How to reach us...

- **Access Center: 877-804-4700**
  - Referrals, transfers, doctor to doctor consultations, outpatient referrals

- **Mitchell T. Saltzberg, MD**
  - Cell: 302-757-9869

- **Lyle Joyce, MD**
  - Cell: 612-618-1556

- **David Joyce, MD**
  - Cell: 650-450-1685