Advanced Heart Failure: What next?

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Overview

- Heart failure as a chronic, often progressive disease
- What is advanced heart failure?
- How do I recognize it?
- What are the available therapies?
  - Heart transplantation
  - Mechanical circulatory support
  - Palliative care
A chronic, progressive disease

- NYHA Class
  - No limitations (I)
  - Slight limitations (II)
  - Marked limitations (III)
  - Severe limitations / symptoms at rest (IV)

- Myocardial infarction
- Hospitalization
- CRT

Time
## Heart Failure Stages

<table>
<thead>
<tr>
<th>Stage</th>
<th>NYHA I</th>
<th>NYHA II-III</th>
<th>NYHA IV</th>
</tr>
</thead>
</table>
| Stage A | Internists 
Primary Care Practitioners | Lifestyle changes  
Medications | Cardiologists  
Heart Failure Specialists |
| Stage B | | | Medications  
Mechanical Support  
Surgery & Transplant  
Palliative Care |
| Stage C | | | |
| Stage D | | | |

- **NYHA I**
  - Internists
  - Primary Care Practitioners

- **NYHA II-III**
  - Lifestyle changes
  - Medications

- **NYHA IV**
  - Cardiologists
  - Heart Failure Specialists

- **Stage A**
  - Lifestyle changes
  - Medications

- **Stage B**

- **Stage C**

- **Stage D**

### Management
- Internists and Primary Care Practitioners
- Lifestyle changes and medications
- Cardiologists and Heart Failure Specialists
- Medications, mechanical support, surgery, transplant, and palliative care
Advanced heart failure: what is it?

- Generally, requires **longitudinal** perspective.
- **NYHA Class III or IV** despite optimally treated medical and device (CRT) therapy.
  - Symptoms limiting daily life
- Typically, **systolic heart failure**
  - LVEF <25%
- **Intolerant of medications** (ACE-I, ARB, beta-blockers)
  - Hypotension
  - Renal dysfunction
- 2 or more HF-related **hospitalizations** within the past year
Prognosis in advanced HF

REMATCH Population:
1. NYHA Class IV
   - 60 days
   - Optimal meds
2. NYHA Class III-IV
   - 28 days and
   - Inotropes (14 d)
   - IABP (14 d)
3. LVEF ≤ 25%
4. VO2 ≤ 14 cc/kg/min

No. at risk
LV assist device  68  38  22  11  5  1
Medical therapy  61  27  11  4  3  0

Rose et al., NEJM 2001
Therapies for Advanced Heart Failure

**Advanced therapies**

**Disease management**

**Medications**

**Salt & fluid intake**

**Aerobic activity**

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**Disease Severity**

- Asymptomatic
- Symptomatic
- Advanced
- Refractory

- **Transplantation/Mechanical Assist Devices**
- **Reevaluate Diagnosis and Therapy to Relieve Persistent Congestion:**
  - More Diuresis? Nitrates + Hydralazine?

**Heart Failure Disease Management Programs**

- **If Needed, Use Torsemide, Intermittent Metolazone**
- **Add Spironolactone if Normal Potassium-Handling**
- **Diuretics to Treat Fluid Retention**
- **Digoxin for Persistent Symptoms**

- **β-Blockers**

**ACE Inhibitor or Angiotensin II Receptor Blocker if Severe Cough or Angioedema With ACE Inhibitor**

- **May Need to Withdraw**
  - Consider 2000 mL Fluid Restriction

- **No Added Salt**
  - 2 g Na+

- **As Tolerated**
  - Exercise Training

*Stevenson et al., JAMA 2008*
Age of Heart Transplant Recipients

1982-1991 (N = 21,149)
1992-2001 (N = 40,752)
2002-6/2009 (N = 25,185)

p < 0.0001

J Heart Lung Transplant. 2010 Oct; 29 (10): 1083-1141
Heart Transplant Recipient Selection

**Indications**

- Advanced systolic heart failure
  - NYHA Class III or IV
  - VO₂ max ≤12 cc/kg/min (on β-blockers) and ≤14 cc/kg/min (intolerant β-blockers)
- Incessant VT
- Refractory, severe angina
- Cardiogenic shock
  - When condition not predicted to improve
- Hypertrophic or restrictive CM
- Congenital heart disease
  - Failed Fontan conduit
  - Failing systemic ventricle
- Cardiac tumors
  - Low likelihood of metastasis

**Contra-indications (most relative)**

- Advanced age (>70)
- Active systemic infection
- Irreversible pulmonary hypertension
- Severe renal*, hepatic*, or pulmonary disease
- Obesity (BMI > 30 or >140% IBW)
- Severe peripheral vascular disease
- Diabetes mellitus
  - End-organ damage
  - Poor glycemic control (HbA1c >7.5)
- Active or recent malignancy
- Recent pulmonary infarction
- Ongoing substance abuse
- Psychosocial:
  - Poor compliance
  - Inadequate social support
Functional Status of Heart Transplant Recipients

- No Activity Limitations
- Performs with Some Assistance
- Requires Total Assistance

1 Year (N = 6,537) 3 Years (N = 6,537) 5 Years (N = 6,537)

J Heart Lung Transplant. 2010 Oct; 29 (10): 1083-1141
Organ Procurement and Allocation

Transplant Center:
Stanford University Medical Center (SHC, VAPAHCS, Kaiser)

Organ Procurement and Transplant Network (OPTN/UNOS)
National policies
11 Geographic Regions
Waiting List

Organ Procurement Organization (OPO)
Northern Cal: CTDN
Donor selection
Donor management
Organ procurement
Bicaval Surgical Technique

From Hurst, The Heart 13rd Edition
Post-Transplant Follow-Up

PRIMARY PROVIDER (CARDIOLOGIST OR PCP)
- Medication refills
- Identify and treat metabolic derangements
- Cancer screening
- Primary care
  - “First line”

TRANSPLANT CENTER
- Patient education
- Rejection surveillance
- Detect and treat early infection
- Detect and treat cardiac complications
- Titrate immunosuppression
- Primary → Consultative
Taking care of a transplant patient

- Immunocompromised due to anti-rejection medications
  - Bacterial, fungal, viral, atypical organisms
  - Private room
  - Usual precautions (wash hands), masks not necessary
- Sinus tachycardia (HR 110-120 may be normal)
- Abnormal ECG
- Subtle symptoms (lethargy, nausea) may be the only signs of rejection or infection
- Patients can have fevers and get sick very fast!
- Beware of medication timing
### Post transplant complications

<table>
<thead>
<tr>
<th>Cardiac</th>
<th>Metabolic</th>
<th>Infections</th>
<th>Neoplastic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Acute rejection</td>
<td>• Hypertension (94%)</td>
<td>• Bacterial</td>
<td>• Skin cancers (67%)</td>
</tr>
<tr>
<td>• Bradycardia</td>
<td>• Renal dysfunction (33%)</td>
<td>• Fungal</td>
<td>• Lymphomas (10%)</td>
</tr>
<tr>
<td>• Atrial arrhythmias</td>
<td>- SCr &gt; 2.5 (9%)</td>
<td>- Aspergillus</td>
<td>• Prostate, lung, breast, cervical, colon (13%)</td>
</tr>
<tr>
<td>• Pericardial effusions</td>
<td>- ESRD (3%)</td>
<td>- Candida</td>
<td></td>
</tr>
<tr>
<td>• Valvular insufficiency</td>
<td>• Dyslipidemia (86%)</td>
<td>- PCP</td>
<td></td>
</tr>
<tr>
<td><strong>Late</strong></td>
<td>• Diabetes (34%)</td>
<td>• Viral</td>
<td></td>
</tr>
<tr>
<td>• Cardiac allograft vasculopathy</td>
<td></td>
<td>- CMV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- HSV</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>- VZV</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Atypical</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Mycobacterium</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Nocardia</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Parasitic</td>
<td></td>
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</tbody>
</table>
Causes of Death after Heart Transplantation

J Heart Lung Transplant. 2010 Oct; 29 (10): 1083-1141
Mechanical circulatory support (MCS)

What is it?

- A ventricular assist device (VAD) is implanted to help boost the heart’s pumping ability and to decrease the pressures inside the heart.
- The implant can be:
  - Surgical (sternotomy, thoracotomy)
  - Percutaneous (groin)
- This helps to:
  - Supply adequate blood flow to other organs
  - Promote recovery of the heart (occasionally)

What are the categories of MCS?

- Left ventricular assist device (LVAD)
- Right ventricular assist device (RVAD)
- Biventricular assist device (BiVAD)
- Total artificial heart (TAH)
When is MCS used?

- **Bridge to transplant**
  - Too sick to await a suitable heart donor
    - Cardiogenic shock
    - Malnutrition and cachexia, deconditioning, poor organ function
  - Expected wait for a suitable donor is too long
    - Recipient weight (too big)
    - Blood Type O
    - Antibodies against many potential donors

- **Bridge to recovery**
  - Acute myocarditis
  - Post cardiotomy

- **Bridge to eligibility or decision**
  - Cardiogenic shock with unclear neurologic status
  - Drug use, marginal psychosocial support

- **Destination therapy**
  - Exhausted medical therapy
  - Not a candidate for cardiac transplantation or palliative care
Types of devices

Short Term Devices
- TandemHeart Percutaneous Ventricular Assist Device
- Abiomed BVS 5000
- BioMedicus Perfusion System
- Thoratec Centrimag

Pulsatile Devices
- Abiomed AB 5000
- Heartmate XVE
- Thoratec PVAD
- Thoratec IVAD

Axial Flow Devices
- DeBakey VAD
- Jarvik 2000
- Heartmate II

Total Artificial Hearts
- AbioCor Implantable Replacement Heart
- Cardiowest TAH

From Hurst, The Heart, 13th Edition
Extracorporeal VADs

Tandem Heart

Thoratec® PVAD™
Intracorporeal VADs

HeartMate II (2nd Generation, Continuous Flow Pump)
Criteria for Destination Therapy

- Not a candidate for cardiac transplantation
- NYHA Class IV despite optimal medical and device therapy for 45 of the past 60 days
- LVEF < 25%
- VO2 max <14 cc/kg/m² or need for continuous infusion of inotropes
- Absence of any major non-cardiac co-morbidity that may seriously compromise recovery or reduce two-year survival.
### Causes of Death after VAD

INTERMACS Registry June 2006 – March 2009

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>Total (N=191)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. Deaths</td>
</tr>
<tr>
<td>Cardiac failure</td>
<td>41</td>
</tr>
<tr>
<td>Infection</td>
<td>29</td>
</tr>
<tr>
<td>CNS event</td>
<td>27</td>
</tr>
<tr>
<td>Multi-organ failure</td>
<td>20</td>
</tr>
<tr>
<td>Respiratory failure</td>
<td>10</td>
</tr>
<tr>
<td>All other causes</td>
<td>64</td>
</tr>
</tbody>
</table>

*Kirklin et al., JHLT 2010*
Most patients with advanced HF are not eligible for advanced therapies.

- Too sick
- No access (geography, costs)
- They don’t want it!

Fang JC NEJM 2009
Palliative care (from Latin *palliare*, to cloak) is a specialized area of healthcare that focuses on relieving and preventing the suffering of patients.

Unlike hospice care, palliative medicine is appropriate for patients in all disease stages, including those undergoing treatment for curable illnesses and those living with chronic diseases, as well as patients who are nearing the end of life.

Palliative medicine utilizes a multidisciplinary approach to patient care, relying on input from physicians, pharmacists, nurses, chaplains, social workers, psychologists, and other allied health professionals in formulating a plan of care to relieve suffering in all areas of a patient’s life.

This multidisciplinary approach allows the palliative care team to address physical, emotional, spiritual, and social concerns that arise with advanced illness.

http://en.wikipedia.org/wiki/Palliative_care
Unique aspects of Palliative Care

- Provides relief from physical symptoms: pain, shortness of breath, nausea
- Affirms life and regards dying as a normal process
- Is applicable early in the course of illness, in conjunction with other therapies that are intended to prolong life, such as dialysis, heart failure medications, and home inotropic support
- Integrates the psychological and spiritual aspects of patient care
- Offers a emotional support to help patients
- Offers a support system to help the family cope.

http://en.wikipedia.org/wiki/Palliative_care
### A subtle but important distinction

<table>
<thead>
<tr>
<th>Palliative Care</th>
<th>Hospice</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Available at any point in a serious illness.</td>
<td>- For patients with terminal diagnosis (&lt;6 months).</td>
</tr>
<tr>
<td>- Can be combined with life-prolonging treatment (hemodialysis, defibrillator)</td>
<td>- Some life-prolonging treatments are not recommended or supported</td>
</tr>
<tr>
<td>- Focus on symptom relief and emotional support</td>
<td>- Focus on symptom relief, emotional support, and end-of-life care</td>
</tr>
<tr>
<td>- Can be inpatient or outpatient</td>
<td>- Can be inpatient or outpatient</td>
</tr>
<tr>
<td>- Coordinated by PCP or specialist</td>
<td>- Coordinated by PCP</td>
</tr>
<tr>
<td>- Often available but coverage varies</td>
<td>- Typically available, covered by Medicare/Medicaid</td>
</tr>
</tbody>
</table>
Summary

- Advanced heart failure represents the end stages of a chronic, often progressive disease (heart failure).
- The prognosis is poor. 1-2 year survival is worse than most cancers.
- Treatment options include:
  - Lifestyle changes, medications, and disease management but with **different emphasis**
  - Heart transplantation for a limited subset of patients (~2,000/year in the United States).
  - Mechanical circulatory support (VAD)
- Palliative care should not be a separate treatment option but rather should complement existing treatment and should be introduced early in disease course.