HEART FAILURE IN THE GERIATRIC POPULATION

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Our Aging Population

Projected Increases in the U.S. Population 65 Years of Age or Older.

Data are from the U.S. Census Bureau.

NEJM 2002;347:1349
Unique Aspects of Aging and Heart Failure

• Increased myocardial stiffness and diastolic dysfunction

• More exposure to standard comorbidities that lead to CAD and systolic dysfunction

• Less data based decision making (older population is under represented)

• More dangerous drug-drug-interactions

• More complex psycho-social issues

• Greater procedural/surgical risk
Identifying the Patient With Heart Failure

- Symptoms (more vague/difficult in the elderly)
  - Exertional dyspnea or fatigue
  - Orthopnea, paroxysmal nocturnal dyspnea

- Physical findings
  - Elevated jugular venous pressure, third heart sound, laterally displaced apical impulse, rales, edema, cardiomegaly on chest X-ray - findings may be minimal with more chronic disease
Identifying the Patient With Heart Failure

- Assess cardiac function
  - Echocardiography remains best assessment of EF/valve disease/pericardial disease
  - Role of BNP is expanding (although may be less helpful in the elderly)
BNP Levels of Patients Diagnosed Without CHF, With Baseline Left Ventricular Dysfunction, and With CHF

Left Ventricular Dysfunction

- **Systolic:** Impaired contractility/ejection
  - Approximately two-thirds of heart failure patients have systolic dysfunction

- **Diastolic:** Impaired filling/relaxation

![Pie Chart]

- (EF < 40%): 70%
- (EF > 40%): 30%

- **Diastolic Dysfunction**
- **Systolic Dysfunction**
Heart Failure/Hypertension - Lifestyle Modifications

- Reduce weight
- Moderate consumption of:
  - alcohol
  - sodium (less than 2g)
  - saturated fat/cholesterol
- Maintain adequate intake of dietary:
  - potassium
  - calcium
  - magnesium
- Avoid tobacco

(JNC VI. Arch Intern Med. 1997)
Diastolic Dysfunction with Heart Failure in the Elderly - Treatment

- Sodium restriction
- Diuretics
- Beta blockers
- ACE-Inhibitors or Angiotensin Receptor blockers
- Rate control of atrial fibrillation
CHARM-Preserved Summary

In patients with symptoms of HF and preserved LVEF (>40%)

- candesartan reduced the number of patients hospitalized for HF (P=.017) as well as the total number of HF hospitalizations (P=0.014)
- cardiovascular death did not differ between placebo and candesartan groups
- candesartan reduced the risk of new-onset diabetes by 40% (P=0.005)
- there was a greater incidence of permanent study drug discontinuations with candesartan due to hypotension (2.4% vs 1.1%), hyperkalemia (1.5% vs 0.6%) and increased creatinine (4.8% vs 2.4%)

HF, heart failure.
Systolic Dysfunction in the Geriatric Population - Etiology

- Coronary Artery Disease
- Hypertension
- Thyroid Disease
- Systemic causes (amyloid/sarcoid)
- Idiopathic
Heart Failure Pathophysiology

Myocardial Injury → Fall in LV Performance → Activation of RAAS, SNS, ET, and Others

- Myocardial Toxicity
- Hemodynamic Alterations
- Peripheral Vasoconstriction
- Remodeling and Progressive Worsening of LV Function
- Heart Failure Symptoms
- Morbidity and Mortality

Sites of Action of ACEIs and ARBs

Survival Rates in Patients Receiving ACE Inhibitors Across NYHA Classes

ACE inhibitor arms of CONSENSUS, V-HeFT, and SOLVD trials.
Placebo arms of PRAISE, PROMISE, and DIG trials (all receiving ACE inhibitors).
CHARM-Alternative

Primary Endpoint

<table>
<thead>
<tr>
<th>Time (years)</th>
<th>Candesartan</th>
<th>Placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1013</td>
<td>1015</td>
</tr>
<tr>
<td>1</td>
<td>929</td>
<td>887</td>
</tr>
<tr>
<td>2</td>
<td>831</td>
<td>798</td>
</tr>
<tr>
<td>3</td>
<td>434</td>
<td>427</td>
</tr>
<tr>
<td>3.5</td>
<td>122</td>
<td>126</td>
</tr>
</tbody>
</table>

CV death or HF hospitalization (%)

- **Candesartan**: 334 (33.0%)
- **Placebo**: 406 (40.0%)

23% risk reduction

HR 0.77 (95% CI 0.67-0.89), \( P=0.0004 \)

Adjusted HR 0.70, \( P<0.0001 \)

Carvedilol Reduces Hospitalizations

**Mild to Moderate CHF**

- **Placebo (n = 398)** (+ ACEI, diuretic)
- **Carvedilol (n = 696)** (+ ACEI, diuretic)

*Heart Failure Hospitalizations*

- **Duration of therapy: 6.5 months (median)**

**Severe CHF**

- **Placebo (n = 1133)** (+ ACEI, diuretic)
- **Carvedilol (n = 1156)** (+ ACEI, diuretic)

*Heart Failure Hospitalizations*

- **Duration of therapy: 10.4 months (mean)**

**P < .05**

**P = .0001**

Effect of $\beta$-Blockade on Outcomes in Heart Failure

<table>
<thead>
<tr>
<th>Study</th>
<th>Drug</th>
<th>HF Severity</th>
<th>Target Dosage (mg/day)</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>US Carvedilol</td>
<td>carvedilol</td>
<td>mild/moderate</td>
<td>6.25 to 25 bid</td>
<td>↓48% disease progression ($P=.001$)</td>
</tr>
<tr>
<td>CIBIS-II</td>
<td>bisoprolol</td>
<td>moderate/severe</td>
<td>10 qd</td>
<td>↓34% mortality ($P&lt;.0001$)</td>
</tr>
<tr>
<td>MERIT-HF</td>
<td>metoprolol</td>
<td>mild/moderate</td>
<td>200 qd</td>
<td>↓34% mortality ($P=.0062$)</td>
</tr>
<tr>
<td>COPERNICUS</td>
<td>carvedilol</td>
<td>severe</td>
<td>25 bid</td>
<td>↓35% mortality ($P=.0014$)</td>
</tr>
</tbody>
</table>

### Effects of Adding β-Blockers or Angiotensin Receptor Blockers vs Increasing ACE Inhibitor Dose in HF

<table>
<thead>
<tr>
<th></th>
<th>Symptoms</th>
<th>Morbidity</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase dose of ACE inhibitor(^1)</td>
<td>No effect</td>
<td>↓ 10-15%</td>
<td>NS</td>
</tr>
<tr>
<td>Add angiotensin receptor blocker(^2)</td>
<td>↓</td>
<td>↓ 10-15%</td>
<td>No effect</td>
</tr>
<tr>
<td>Add β-blockade(^3)</td>
<td>↓</td>
<td>↓ 20-35%</td>
<td>↓ 35%</td>
</tr>
</tbody>
</table>

DIGOXIN

Mortality %

Placebo
n=3403

Digoxin
n=3397

$\rho = 0.8$

N Engl J Med 1997;336:525
Randomized Aldactone Evaluation Study (RALES)

![Graph showing the comparison between Spironolactone and Placebo on probability of survival over months.](image)

- Spironolactone
- Placebo

*P < .001

Heart Failure - Procedural/Surgical Options in the Geriatric Population

• Biventricular Pacemaker
• ICD
• CABG
• MV Repair
• Aortic Valve Replacement
• Transplant (age maximum typically 65 years old)
• Destination Left Ventricular Assist Device
CARDIAC RESYNCHRONIZATION: Change in NYHA Functional Class *InSync III vs. MIRACLE Control*

- **Improved**: 38% (Control N=169), 73% (InSync III N=176)
- **No Change**: 59% (Control N=169), 26% (InSync III N=176)
- **Worsened**: 4% (Control N=169), 1% (InSync III N=176)

*P < 0.0001*
MADIT II – Secondary Prevention for SCD

P = 0.007

Defibrillator Group: 0.78
Conventional Group: 0.69

No. of patients:
- Defibrillator: 742
- Conventional: 490

Years
- Defibrillator: 503 (0.91) 274 (0.84) 110 (0.78) 9
- Conventional: 329 (0.90) 170 (0.78) 65 (0.69) 3
HeartMate II LVAS

- Small, advanced blood pump, designed to improve patient outcomes and quality of life.
- 60 percent smaller pocket requirement and 44 percent shorter surgical time than older model
- Electrically powered
  - Batteries and line power
- Home discharge
The Future of Ventricular Assist Devices

- Fully implantable rotary pump*
- Eliminate all skin penetrations
- Expand the benefits of implanted ventricular assistance to children and small adults

*Currently under development
Improving LVAD Outcomes

Late Experience June 2007 - April 2009 (n=55)
Overall Experience March 2005 - April 2009 (n=93)
Early experience March 2005 - May 2007 (n=38)
(Included in Slaughter, Rogers, Milano et al NEJM 2009)

Percent Survival

Remaining at Risk:
55
43
38
12
64
21
30
18

Months
Heart Failure: End-of-life issues

- Non cardiac problems, such as renal or cognitive dysfunction, often drive end of life decisions.
- Age may limit “aggressive” options such as surgery or dialysis, although cardiac transplant has been performed in 70 year old patients and aortic valve replacement surgery is offered to many in their 80s.
- Early discussion of code status and level of aggressiveness remains critical.
Case #1

• Mrs. B is an 84 year old woman living in an Assisted Living Home. She has a history of hypertension and diabetes and has a creatinine of 1.6. She smoked a pack of cigarettes a day until her children hid them from her.

• She has had progressive dyspnea over the last 3 months and was hospitalized once with lower extremity edema. Her echocardiogram revealed a normal ejection fraction.
Case #1

• What therapies should be considered in this patient?
  – Diuretics
  – Beta-Blockers
  – ACE-Inhibitors
  – All of the above
  – None of the above
Case #1

• What therapies have been proven to improve mortality in this patient?
  – Diuretics
  – Beta-Blockers
  – ACE-Inhibitors
  – All of the above
  – None of the above
Case #2

- Mr. B is a 71 year old gentleman with an aprior MI and progressive class III-IV heart failure with an ejection fraction of 20%.

- His creatinine is 1.6 and he is a non-smoker. He has a supportive wife and still works part time but is slowing down despite compliance with medications and diet.
Case #2

• What therapies should be considered in this patient?
  – Diuretics
  – Beta-Blockers
  – ACE-Inhibitors
  – Digoxin
  – All of the above
Case #2

• What therapies have been proven to improve mortality in this patient?
  – Diuretics
  – Beta-Blockers
  – ACE-Inhibitors
  – Beta-Blockers and ACE-inhibitors only
  – All of the above
Case #2

• What high-end options should be realistically evaluated that could potentially improve mortality?
  – Home Inotropes (milrinone)
  – Cardiac Transplantation
  – Destination Left Ventricular Assist Device
  – None of the above