Optimizing Heart Failure Management

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Heart Failure: Definition

- HF is a clinical syndrome, not a single disease
- This can result from any structural or functional cardiac disorder which impairs the ability of the ventricle to fill with or eject blood
- Fluid retention may lead to pulmonary and peripheral edema
Prognosis of CHF

Survival curves for HF and various forms of cancer among males and females aged 55-74 years

(Framingham Study and the Norwegian Cancer Registry, Oslo, 1980)
## Causes of Heart Failure (UK)

<table>
<thead>
<tr>
<th>Cause</th>
<th>Percentage</th>
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<tr>
<td>Coronary Heart Disease</td>
<td>52%</td>
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<tr>
<td>Chronic hypertension</td>
<td>4%</td>
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<tr>
<td>Idiopathic DCM</td>
<td>13%</td>
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<tr>
<td>Valvular dysfunction</td>
<td>10%</td>
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<tr>
<td>Cardiac arrhythmias</td>
<td>3%</td>
</tr>
<tr>
<td>Alcohol</td>
<td>4%</td>
</tr>
<tr>
<td>Other</td>
<td>4%</td>
</tr>
<tr>
<td>Undetermined</td>
<td>10%</td>
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Fox et al, European Heart Journal 2001
“Heart Failure” vs. “Congestive Heart Failure”

Because not all patients have volume overload at the time of initial or subsequent evaluation, the term “heart failure” is preferred over the older term “congestive heart failure.”
Heart Failure: A Difficult Cardiovascular Disease

- Heart failure is one of the most difficult cardiovascular disease to treat and a leading cause of hospitalisations.

- Why so difficult?
  - Symptoms non-specific
  - Clinical signs insensitive
  - Definition of heart failure disputed
  - Poor primary care access to cardiac investigations, e.g., BNPs and echo

Pathophysiology of HF

- Coronary artery disease
- Hypertension
- Diabetes
- Cardiomyopathy
- Valvular disease

Myocardial injury → Pathologic remodeling → Low ejection fraction

- Neurohormonal stimulation
- Myocardial toxicity

Symptoms: Dyspnea, Fatigue, Edema

Chronic heart failure

Death

Sudden Death

Pump failure

Stages in the Development of HF

Stage A
At high risk for HF but without structural HD or symptoms of HF

Stage B
Structural heart disease but without signs or symptoms of HF

Stage C
Structural heart disease with prior or current symptoms of HF

Stage D
Refractory HF requiring specialized interventions

At risk for Heart Failure

Heart Failure

ACC/AHA Heart Failure Guidelines, 2005

e.g., Patients with
- Hypertension
- CAD
- Diabetes
- Obesity
- Cardiotoxic medic
- FHx CM

e.g., Patients with
- Previous MI
- LV remodeling including LVH and low EF
- Asymptomatic valvular disease

e.g., Patients with
- Known structural heart disease and
- SOB and fatigue, reduced exercise tolerance

e.g., Patients
- Who have marked symptoms at rest despite maximal medical therapy
## Evolution of Heart Failure

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Cellular Pathophysiology</th>
<th>Ventricular Remodeling</th>
<th>Ventricular Dysfunction</th>
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<tr>
<td>Aging</td>
<td>Hypertrophy</td>
<td>LVH</td>
<td>Systolic</td>
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<td>Infarction</td>
<td>Dilatation</td>
<td>Diastolic</td>
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<tr>
<td>Smoking</td>
<td>Accelerated apoptosis</td>
<td>Both</td>
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<tr>
<td>Dyslipidemia</td>
<td>Fibrosis</td>
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<td></td>
</tr>
<tr>
<td>Diabetes</td>
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<td></td>
<td></td>
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<tr>
<td>Obesity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toxins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Genes</td>
<td></td>
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</table>

### High Risk for HF
- Structural heart disease without symptoms
- Symptomatic Heart Failure

### ACC/AHA Stages of Heart Failure
- Stage A
- Stage B
- Stages C and D

Circulation. 2008;117:2544-65
Stages of Heart Failure

Designed to emphasize preventability of HF

Designed to recognize the progressive nature of LV dysfunction
Stages of Heart Failure

COMPLEMENT, DO NOT REPLACE NYHA CLASSES

• NYHA Classes - shift back/forth in individual patient (in response to Rx and/or progression of disease)

• Stages - progress in one direction due to cardiac remodeling
Preventable Causes of CHF Readmissions are Present in >50% of Cases


Not Prev., 47%
Prev., 53%

1= Medical Noncompliance
2= Diet Noncompliance
3= Inadequate Discharge Planning
4= Inadequate F/U
5= Failed Social Support
6= Failure to Seek Medical Attention
Heart Failure Therapeutic Goal

Mild-Moderate Heart Failure

- Primary goal = Reduce mortality
- $\beta$-blockers + ACE inhibitors
- Prevent progression to symptoms
- Prevent progressive LV dysfunction
Heart Failure Therapeutic Goal

- Moderate-Severe Heart Failure
  - Primary goal = Reduce symptoms
  - Improve quality of life (QOL)
  - Reduce hospitalizations
  - Prevent sudden death
The treatment of CHF involves counteracting two related but largely independent process:

1. **LV dysfunction**; developed through ventricular remodeling (regardless of causes; CAD, HTN, VHD)

2. **Noncardiac factors**; contributing to the progressive process of cardiac remodeling
   a. Neurohumoral stimulation
   b. Endothelial dysfunction
   c. Vasoconstriction
   d. Renal dysfunction

**Pathophysiological Basis of Treatment**
Management Overview

- Management of HF requires
  - an accurate diagnosis
  - aggressive treatment of known risk factors (e.g. hypertension, diabetes)
  - rational combination drug therapy

- Care should be individualized for each patient based on:
  - symptoms
  - clinical presentation
  - disease severity
  - underlying cause
Stepwise approach in diagnosis and management of heart failure

- Step 1: Establish the presence of HF
- Step 2: Evaluation of the patient’s clinical status
- Step 3: Identify underlying aetiology
- Step 4: Identify precipitating factors
- Step 5: Prognostic evaluation
- Step 6: Treatment and follow-up
Three Basic Treatment Strategies

- Behavioral and Lifestyle management
- Pharmacologic management
- Devices and surgical management
Behavioral and lifestyle Management

- Weight reduction
- Discontinue smoking
- Avoid alcohol and other cardiotoxic substances
- Exercise training
Pharmacologic Therapy for HF

- Control of excessive fluid
  - Diuretics
- Prevention of deterioration of cardiac function
  - ACEIs and ARBs
  - Aldosterone antagonists
  - β-Blockers
- Enhancement of Myocardial contractility
  - Digitalis
  - Sympathomimetic Amines
  - Phosphodiesterase Inhibitors (Amrinone)
- Vasodilator Agents
- Antithrombotic Agents
- Anti-arrhythmics
Pharmacologic Therapy for HF

- Three main classes of drugs have been shown to improve mortality and symptoms:
  - Drugs affecting RAAS (ACEI, ARB)
  - β-blockers
  - Aldosterone antagonists

- A combination of the above drugs is now widely accepted as optimal medical treatment (OMT) for Heart Failure
ACE Inhibitor is the Cornerstone of HF Therapy

ACEI in post MI:
- Continue indefinitely if EF < 40% or clinical HF
- Rx for all asymptomatic patients with LVEF $\leq 35$
- Rx for all symptomatic patients with LVEF $\leq 35$
- Target dose used in clinical trials or max tolerated dose
Optimal Dosing of ACEI
(General Guidelines)

- Start low and titrate to the target dose used in the clinical trials or the **MAXIMUM TOLERATED DOSE**

- Captopril 6.25-12.5 mg ⇒ 50 mg BID-TID (SAVE)
- Enalapril 2.5 mg BID ⇒ 20 mg BID (SOLVD/X)
- Ramipril 2.5 mg BID ⇒ 5 mg BID (AIRE/EX)
- Lisinopril 10 mg OD ⇒ 30-40 mg OD (GISSI 3)
- Trandolapril 1 mg ⇒ 4 mg (TRACE)
Practical Tips for ACE-I/ARB Use

- Check supine and erect BP for symptomatic hypotension
- If symptomatic hypotension persists, separate timing of dose from other medications that could also lower BP
- Reduce dose of diuretic if patient stable and reassess need for other vasodilators (e.g., long-acting nitrates)
- An increase in creatinine of up to 30% is not unexpected after introduction of an ACE-I/ARB
- Adding spironolactone to an ACE-I plus an ARB is discouraged, unless followed closely in a specialist HF clinic

β-Blocker in Heart Failure?

β-blocker has evolved as an important therapy for Heart Failure in recent years.
Optimal dosing of β-adrenergic Blocking Agents

- Only Bisoprolol, Carvedilol and Metoprolol Succinate are approved
- Titrate to target dose
  - Bisoprolol 1.25 -10 mg OD
  - Carvedilol 3.125 - 25 mg BID
  - Metoprolol 12.5 - 50 to 75 mg /BID
- If unable to tolerate high dose β-blocker maintain highest tolerated dose
- Continue indefinitely
Patient Selection for Successful \( \beta \) - Blocker Initiation

- Stable symptoms
- Stable background heart failure medications
- No recent CV hospitalization
- Stable CV status (no hypotension or bradycardia)
- Euvolemic status
- Start low and titrate slowly:
  - Slowly up-titrate every 2-4 w over 3-4 m to achieve target doses
Patients With Heart Failure Who Should Not Be Started on β-blockers

- General Contraindications
  - Bronchospastic pulmonary disease
  - Severe bradycardia, high degree AV block, sinus node disease

- Heart Failure Considerations
  - Congestive symptoms at rest (NYHA Class IV)
  - Patients who require intravenous therapy for HF
  - Unstable symptoms or recent changes in background medications
Practical Tips for β - Blocker Use

- Dose of β-Blocker should be increased slowly, e.g., double dose every 2-4 weeks if stable
- If bradycardia or AV block is present, reduce or stop digoxin or amiodarone (where appropriate)
- If hypotensive, consider reducing other medications or change timing of doses
- Objective improvement in LV function may not be apparent for 6-12 months or longer
- Major reduction of β-Blocker dose or abrupt withdrawal should generally be avoided
- Consider using β-blocker proven effective in HF trials
  - Bisoprolol, carvedilol (or long-acting metoprolol)

Symptomatic Therapy

**Diuretics:**
- Titrate to euvolemic state
- Maintain Ideal Body Weight
  - (dry weight = JVP normal / trace pedal edema)
- Furosemide 20 mg. – 80 mg BID
- HCT/Metolozane for refractory congestion

**Digoxin:**
- For persisting symptoms in NSR (systolic dysfunction), or
- Symptoms and rate control in Afib.
  - Dose: 0.125 mg – 0.25 mg
  - (Lower dose in elderly: 0.0625 mg)
HF Pharmacotherapy: Summary

- Lots of drugs with good data, but challenges of polypharmacy
  - Compliance, cost, HF severity

- Priorities
  - B-blocker, ACE-I for all (aim for target doses)
  - ARB as ACE-I alternative or if congested/hypertensive
  - Hydralazine/nitrate if congested/hypertensive
  - Diuretic PRN and/or Aldosterone blocker
  - Digoxin if recurrent hospitalization
Devices and Surgical Management

- Devices
  - CRT/ICD
  - Ventricular assist devices
  - Total artificial heart

- Surgery: Transplantation

- Molecular approaches:
  - Cell and gene therapy
Acute Decompensated HF

- IV diuretics
  - Bolus or continuous
- IV vasodilators
  - Nitroglycerin, Nesiritide, Nitroprusside
- IV Inotropes
  - Milrinone, Dobutamine, Dopamine
- Optimize PO regimen

Heart Failure Pearls

- Use IV Lasix (instead of oral) for inpatients
  - Lowers pulmonary pressures, rapid symptom relief
- Use GTN in the ED
  - Lowers pulmonary pressures, rapid symptom relief
- Be aggressive in patients with normal EF, good BP and normal renal function
- Go slowly in patients with HCM, cor pulmonale, severe AS and low EF
  - Preload dependent
- Closely monitor renal function
- Don’t be afraid of beta-blockers
Heart Failure Pearls

- Titrate up quickly on ACE-I, ARB and hydralazine/ISDN while inpatient
- Titrate up slowly on beta-blockers as an outpatient
- Rate control is critical
- Stay ahead on electrolyte replacement
- Check weights, I/Os, of patients daily
- Review the echo assessment
- Review fluid, salt restrictions and medication compliance with patients at each outpatient visit
Tips for Non-Specialists 1

- If HF is suspected but clinical uncertainty remains test for BNP.

- Echo-Doppler is essential to determine whether the patient has impaired EF or preserved systolic function.

- Ask patients to weigh themselves at the same time each day. If the weight goes up more than 2 g in one to three days ask them to see their physician.

- Consider giving all patients an ACEI. Once the maximum dose is achieved add a β-blocker and increase to the maximum dose if possible.
Use spironolactone and digoxin cautiously, perhaps with cardiological advice. Monitor serum potassium.

Once patients are stable on an ACEI and β-blocker consider reducing the dose of diuretics and then cutting it out entirely if tolerated.

Patients with HF, low EF, and no complications can often be managed without cardiological advice.
Consider referral for patients with
- HF caused by valvular disease,
- severe HF,
- symptomatic arrhythmia,
- women who are pregnant or planning a pregnancy,
- CKD,
- poorly controlled angina, and
- those not improving with guideline advised treatment
A treatment Algorithm for Symptomatic HF and Reduced EF

ESC Guidelines, 2008

Symptomatic HF + Reduced EF

Diuretic + ACEI (or ARB) Titrated to clinical stability

β-Blocker

Persisting signs and symptoms?

Yes

ADD aldosterone antagonist OR ARB

Persisting symptoms?

Yes

QRS>120 ms?

Yes

Consider: CRT-P or CRT-D

No

Consider: Dig, hydral/nitr, LVAD, transplantation

No

LVEF<35%?

Yes

Consider ICD

No

No further Rx indicated
# Evolving Heart Failure Care

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<td>Dietary sodium restriction?</td>
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<td>Vasodilators</td>
<td>?Vasodilators</td>
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Harrison’s Principles of Internal Medicine 1st Edition (1950)
How can we amplify the impact of HF therapy?

- **Recognition-Initial Therapy**
- **Community Based Awareness/Understanding**
- **Dosing Optimization-Internist/Cardiologist**
- **Cardiologist: HF Clinic**
- **Cardiologist/HF Specialist: Inotropes, Devices, Transplant**

HF Awareness Program/CC

1° & 2°

General Practitioners

2° & 3°

3°
Multidisciplinary Care for HF Patients

Primary Care Provider/GP

General Cardiologist

Heart Failure Specialist

Cardiac Surgeon

EP Cardiologist
Conclusions

- Make an accurate and timely diagnosis
- Initiate treatment to
  - Reduce HF risk factors
  - Reduce HF symptoms
  - Reduce hospitalizations
  - Improve quality of life
  - Prolong survival
- Refer patients at higher risk to specialist or HF clinic
- Continue to translate new knowledge into practice
- Combine available healthcare resources to improve delivery of best care and practices to HF patients

Thank You for Your Attention