Focus on Reducing Readmissions: How to Keep Your Heart Failure Patient Out of the Hospital

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Disclosures

- None
Reminders

- Cell phones to vibrate
Quality Measures

- Costs
- Morbidity, Mortality, Quality of Life and Death
History of Quality Movement

Ernest Amory Codman, MD (1869-1940)

- The common sense notion that every hospital should follow every patient it treats, long enough to determine whether or not the treatment has been successful, and then to inquire, “if not, why not?” with a view to preventing similar failures in the future.

- Worked with the American College of Surgeons
Committee for Hospital Standardization (Early 1900s)

- No medical records were produced for many patients
- Patients were admitted and treated, but all the care was kept inside the physician’s head
- When the first reviews of the American College of Surgeons were produced, only 89 of 692 hospitals passed
- Results were announced at the Waldorf Astoria in NY and the papers were burned after the meeting so that the public could not know which hospitals had failed
- The Committee morphed into the Joint Commission
Committee for Hospital Standardization
Guidelines for Hospitals

- Each hospital should have a medical staff
- Members of the medical staff should be chosen based on graduation from a medical school
- There should be regular staff meetings to review cases (forerunner of M & M conferences)
- Medical records should be written and filed for all cases
- Each hospital should have a clinical laboratory and radiology section
What is Quality?

“the degree to which healthcare systems, services and supplies for individuals and populations increase the likelihood for desired health outcomes in a manner consistent with current professional knowledge.”

Providing

- The right care
- By the right provider
- At the right level of care
- At the right time
Hospital Value-Based Purchasing Program (VBP)

- Started October 2012 by the Affordable Care Act
- Medicare rewards hospitals that provide high quality care for their patients
- Hospitals paid for inpatient acute care services based on care QUALITY not just the QUANTITY of the services provide.
- Incentive payments to hospitals based on
  - Core measure reporting
  - How much improvement is seen over baseline
  - 12 clinical process of care measures and 8 patient experience of care measures
Affordable Care Act

- Shifted focus of Medicare Payment from:
  - “How much did you do?”

- TO:
  - “How well did you do?” and more importantly, “How well did the patient do?”
Focus on Conditions and Diagnoses That Are:

- High risk
- Problem prone
- Prevalent
- Preventable
- Have evidence-based guidelines
- Coded data (easily extracted)
Barriers to Meeting Quality Indicators

- Defined by outside regulators
- Difference in care from what government prescribes
  - Must document reason why we don’t meet those indicators
- Our documentation system is not conducive to standardized treatment documentation
- Patients don’t follow a formula
Core Measures for Heart Failure

1. Heart function assessment done or documented in chart
2. ACE Inhibitor or ARB ordered if EF<40%
   - Or contraindication documented in chart for both medications
3. Discharge Instructions Given
   - Medications listed (not “As Previous”) –
     - Must match what is dictated in the Discharge Summary
   - Activity
   - Diet
   - Follow up visits
   - Signs and symptoms to report
   - Weight monitoring
Readmission Measures

- Heart Failure 30 day risk standardized readmission
- AMI 30 day risk standardized readmission
- Pneumonia 30 day risk standardized readmission
- 30 day risk standardized readmission after total hip/total knee arthroplasty
- Hospital wide all cause unplanned readmission
30 Day Readmissions for HF

- Readmissions within 30 days accounts for $15 to $18 billion of Medicare spending
- National 30 day readmission rate is 24.8%
- 25% of Medicare patients admitted to SNFs are readmitted within 30 days
- October 1, 2012 hospitals are penalized for higher than expected readmission rates for HF patients (1% payment)
Rationale for CMS Decision

Measuring and reporting readmission rates will create incentives for hospitals and health systems to:

- Evaluate the entire spectrum of care
- Identify systemic or condition-specific changes that will make care safer and more effective
- Invest in interventions that reduce complications of care
- Better assess the readiness of patients for discharge
- Improve discharge instructions
- Reconcile medications
- More carefully transition patients to outpatient care or other institutional care
Information is Publicly Reported

www.medicare.gov/hospitalcompare.gov

- General Information
- Patient Survey Results
- Timely and Effective Care
- Readmission, Complications and Deaths
- Use of Medical Imaging
- Medicare Payment
- Number of Medicare Patients
Hospital Admissions for Acute HF on the Increase Due to…

- Progression of disease (worsening heart function)
- Non-participation with diet and drugs
- Excess fluid intake
- Arrhythmia
- Heart disease
- Some other disease process
- Rising incidence of chronic heart failure
Why is there such a focus on HF?

- It’s common
  - 6.2 million people
- It has an important effect on individual and population health
  - >1 million hospitalizations as primary diagnosis
- It’s costly
  - 13% of Medicare patients account for 37% of costs
Epidemiology of HF

- 5 million symptomatic patients in 2001; estimated 10 million in 2037\(^1,2\)

- Incidence: about 550,000 new cases/year\(^2\)

- Morbidity:
  - More than 978,000 hospital discharges
  - Most freq cause of hospitalization in elderly (> 65)
  - Accounts for 5% to 10% of all hospital admissions

- Mortality:
  - Causes or contributes to \(\approx\) 285,000 deaths/year

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What is Heart Failure?

- Syndrome in which the heart fails to pump blood at a rate commensurate with metabolic requirements
- Clinical condition manifested as dyspnea and fatigue (and usually fluid retention)
- Impaired *pumping ability* of the heart (EF<40%)
- Impaired ability of the heart to *relax* (diastolic dysfunction or heart failure with preserved EF)
- Chronic, progressive disease
Heart Failure Characterized By

- High Mortality
- Frequent hospitalizations
- Reduced Quality of life
- Complex therapeutic regimens
- Multiple comorbidities
Pathophysiology

- Complex interactions among systems:
  - Molecular, Endocrine, Biodynamic

- Some injury causes:
  - Over-expression of neurohormones
  - Structural remodeling
  - Loss of contractile function

- Neurohormone: biologically active, from myocardium, direct cardiotoxin
  - NE, angiotensin II, aldosterone, endothelin
Sympathetic Activation in Heart Failure

↑ CNS sympathetic outflow

↑ Cardiac sympathetic activity

β₁-receptors
β₂-receptors
α₁-receptors

Myocardial toxicity
Increased arrhythmias

↓

Disease progression

↑ Sympathetic activity to kidneys + peripheral vasculature

α₁
β₁

Vasoconstriction
Sodium retention

Activation of RAS

Renin-Angiotensin-Aldosterone System (RAAS)

Angiotensinogen ➔ Renin ➔ C.O. ➔ Angiotensin I ➔ ACE ➔ Angiotensin II ➔ Aldosterone ➔ Vasoconstriction/ Systemic Vascular Resistance ➔ Afterload ➔ Sodium Retention/ Volume Expansion ➔ Preload
Heart Failure

- **Symptomatic disease**
  - Limits functional capacity and impairs quality of life
  - Caused by hemodynamic abnormalities (changes in cardiac function and peripheral hemodynamics)

- **Progressive disease**
  - Worsening symptoms and clinical deterioration, repeated hospitalization and death, even in the presence of minimal symptoms or the absence of progressive symptoms
  - Symptoms do not always correspond with EF
  - Caused by neurohormonal abnormalities (RAAS, SNS)
Causes

- Coronary artery disease/AMI
- Hypertension
- Valvular dysfunction
- Other (Alcohol, idiopathic, post-viral, drugs, methamphetamine, chemotherapies, amyloid, hemachromatosis, thyroid disease)
New York Heart Association Functional Class (NYHA)

Class I
No limitations of physical activity

Class II
Slight limitations of physical activity

Class III
Marked limitations of physical activity

Class IV
Inability to carry out physical activities without discomfort

Source: American Heart Association
Stages of Heart Failure

At Risk for Heart Failure

**Stage A**
At high risk for HF but without structural heart disease or symptoms of HF.

*e.g.: Patients with:*
- hypertension
- atherosclerotic disease
- diabetes
- metabolic syndrome
  or
- Patients using cardiotoxins
  - with HFx CM

**Therapy Goals**
- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- Control metabolic syndrome

**Drugs**
- ACEI or ARB in appropriate patients (see text) for vascular disease or diabetes
Stages of Heart Failure

At Risk for Heart Failure

Stage A
At high risk for HF but without structural heart disease or symptoms of HF.

- Hypertension
- Atherosclerotic disease
- Diabetes
- Metabolic syndrome

or

Patients
- Using cardiotoxins
- With HFx CM

Stage B
Structural heart disease but without symptoms of HF.

- Previous MI
- LV remodeling including LVH and low EF
- Asymptomatic valvular disease

Structural Heart Disease

Development of Symptoms of HF

Therapy Goals

- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- Control metabolic syndrome

Drugs

- ACEI or ARB in appropriate patients

Devices in Selected Patients

- Implantable defibrillators

Therapy Goals

- All measures under stage A

Drugs

- ACEI or ARB in appropriate patients (see text)
- Beta-blockers in appropriate patients (see text)
Stages of Heart Failure

**At Risk for Heart Failure**

**Stage A**
At high risk for HF but without structural heart disease or symptoms of HF.

- e.g.: Patients with:
  - hypertension
  - atherosclerotic disease
  - diabetes
  - metabolic syndrome
  - Patients using cardiotoxins with HFx CM

**Stage B**
Structural heart disease but without symptoms of HF.

- e.g.: Patients with:
  - previous MI
  - LV remodeling including LVH and low EF
  - asymptomatic valvular disease

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

- e.g.: Patients with:
  - known structural heart disease
  - shortness of breath and fatigue, reduced exercise tolerance

**Heart Failure**

**Therapy Goals**

- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- Control metabolic syndrome

**Drugs**

- ACEI or ARB in appropriate patients (see text)
- Beta-blockers in appropriate patients (see text)
- Devices in Selected Patients
  - Implantable defibrillators

**Development of Symptoms of HF**

**Therapy Goals**

- All measures under stages A and B
- Dietary salt restriction
- Drugs for Routine Use
- Diuretic for fluid retention
- ACEI
- Beta-blockers

**Drugs in Selected Patients**

- Aldosterone antagonist
- ARBs
- Digitalis
- Hydralazine/nitrates

**Devices in Selected Patients**

- Biventricular pacing
- Implantable defibrillators

**Refractory Symptoms of HF at Rest**
Stages of Heart Failure

**At Risk for Heart Failure**

- **Stage A**
  - At high risk for HF but without structural heart disease or symptoms of HF.
  - e.g.: Patients with:
    - hypertension
    - atherosclerotic disease
    - diabetes
    - metabolic syndrome
    - Patients using cardiotoxins with HFx CM

- **Stage B**
  - Structural heart disease but without symptoms of HF.
  - e.g.: Patients with:
    - previous MI
    - LV remodeling including LVH and low EF
    - asymptomatic valvular disease

**Heart Failure**

- **Stage C**
  - Structural heart disease with prior or current symptoms of HF.
  - e.g.: Patients with:
    - known structural heart disease
    - shortness of breath and fatigue, reduced exercise tolerance

- **Stage D**
  - Refractory HF requiring specialized interventions.
  - e.g.: Patients who have marked symptoms at rest despite maximal medical therapy (e.g., those who are recurrently hospitalized or cannot be safely discharged from the hospital without specialized interventions)

**Therapy Goals**

- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- Control metabolic syndrome

**Drugs**

- ACEI or ARB in appropriate patients (see text)
- Beta-blockers in appropriate patients (see text)

**Devices in Selected Patients**

- Implantable defibrillators

**Therapy Goals**

- All measures under stages A and B
- Dietary salt restriction
- Drugs for Routine Use
- Diuretic for fluid retention
- ACEI
- Beta-blockers
  - Drugs in Selected Patients
  - Aldosterone antagonist
  - ARBs
  - Digitalis
  - Hydralazine/nitrates
  - Devices in Selected Patients
  - Biventricular pacing
  - Implantable defibrillators

**Therapy Goals**

- Appropriate measures under stages A, B, C
- Decision re: appropriate level of care

**Options**

- Compassionate end-of-life care/hospice
- Extraordinary measures
  - heart transplant
  - chronic inotropes
  - permanent mechanical support
  - experimental surgery or drugs
Course of Heart Failure
ACC/AHA 2013 Guideline Update for the Diagnosis and Management of Chronic Heart Failure in the Adult

A Report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines (Writing Committee to Update the 2005 Guidelines for the Evaluation and Management

AND

2009 Focused Update Incorporated Into the ACC/AHA 2005 Guidelines for the Diagnosis and Management of Heart Failure in Adults

A Report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines Developed in Collaboration With the International Society for Heart and Lung Transplantation

AND

HFSA 2010 Comprehensive Heart Failure Practice Guidelines

A Report from the Heart Failure Society of America
### Applying Classification of Recommendations and Level of Evidence

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class IIa</th>
<th>Class IIb</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefit &gt;&gt; Risk</td>
<td>Benefit &gt;&gt; Risk Additional studies with focused objectives needed</td>
<td>Benefit ≥ Risk Additional studies with broad objectives needed; Additional registry data would be helpful</td>
<td>Risk ≥ Benefit No additional studies needed</td>
</tr>
<tr>
<td>Procedure/ Treatment SHOULD be performed/ administered</td>
<td>IT IS REASONABLE to perform procedure/administer treatment</td>
<td>Procedure/Treatment MAY BE CONSIDERED</td>
<td>Procedure/Treatment should NOT be performed/administered SINCE IT IS NOT HELPFUL AND MAY BE HARMFUL</td>
</tr>
</tbody>
</table>

#### Level of Evidence:

<table>
<thead>
<tr>
<th>Level A:</th>
<th>Data derived from multiple randomized clinical trials or meta-analyses</th>
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<tbody>
<tr>
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<td>Multiple populations evaluated</td>
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<tr>
<td>Level B:</td>
<td>Data derived from a single randomized trial or nonrandomized studies</td>
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<tr>
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<td>Limited populations evaluated</td>
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<tr>
<td>Level C:</td>
<td>Only consensus of experts opinion, case studies, or standard of care</td>
</tr>
<tr>
<td></td>
<td>Very limited populations evaluated</td>
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</tbody>
</table>
Stage A Patients
Identifying At-Risk Patients

- Hypertension
- Atherosclerotic Disease
- Diabetes
- Obesity
- Metabolic syndrome
- Patients using cardiotoxins
- Patients with family history of CM
- Sleep disordered breathing
- Sustained arrhythmias
- Abnormal ECG (LVH, LBBB, Q waves
- Cardiomegaly on CXR
Assessing Patients At Risk

- Thorough H&P to identify:
  - Cardiac and non-cardiac disorders
  - Alcohol, illicit drugs, current or past alternative therapies, chemotherapy drugs

- Noninvasive evaluation of LV function in patients with a strong family history of cardiomyopathy or in those receiving cardiotoxic interventions
Stage A Therapy
Treat Risk Factors as Recommended

- Treat hypertension and lipid disorders
- Control blood sugar
- Control thyroid disorders
- Encourage smoking cessation
- Discourage alcohol intake and illicit drug use
- Encourage regular exercise
- Encourage achieving and maintaining optimal weight
Periodic Evaluation for Heart Failure Symptoms

- Fatigue/decreased exercise tolerance
- Symptoms suggestive of volume overload and/or low cardiac output
- Dyspnea on exertion (often the earliest)
- Orthopnea (most common)
- Paroxysmal nocturnal dyspnea (PND)
- Wheeze &/or cough
Heart Failure Symptoms (cont.)

- Abdominal symptoms associated with ascites &/or hepatic and spleen engorgement
- Weight gain
- Lower extremity edema
- Hepato-jugular reflux
- Unexplained confusion, altered mental status, or fatigue in an elderly patient
Measuring Jugular Venous Pressure

- Measuring internal jugular vein (reflects RAP)
- Patient at 45 degree angle
- Shine a light tangentially across neck
- Measure from top of sternal angle to level of venous fullness
- Add 5 cm for distance from RA to sternum
- Normal 7-8 (lower part of neck)

http://www.youtube.com/watch?v=tJzBKdK6L3&feature=youtu.be
Assessing Patients At Risk

- Non-invasive testing
  - Serial 6 minute walk tests to assess functional impairment
  - 12 lead ECG
  - CXR
  - 2-D Echocardiogram with Doppler
    - Myocardium, valves, pericardium, hemodynamic data
Echocardiogram
Stage A Patients

Patients at Risk of Developing Heart Failure

- Treat known risk factors with therapies consistent with contemporary guidelines
- Avoid high risk behaviors
- Periodic evaluation for signs and symptoms
- Noninvasive evaluation of LV function
- Control ventricular rate or restore sinus rhythm with SVT (atrial fib/flutter)
- Drug therapy – ACE I or ARBs
Stage B Patients

- Patients with Asymptomatic LV Dysfunction
  - Previous MI
  - LV remodeling including LVH and low EF
  - Asymptomatic valvular disease
Laboratory Evaluation

- Electrolytes, BUN, Cr, Dig level, BNP
- Directed workup for secondary causes of heart failure
  - Thyroid function tests
  - Iron studies
  - ANA
  - Serum immune electrophoresis
  - Urine Bence Jones protein
  - Viral titers
Diagnostic Evaluation

- Functional capacity and activity level
- ECG and event monitors, if indicated
- Chest X-Ray
- Evaluation of myocardial ischemia
  - Exercise testing
  - Coronary angiography
Stage B Treatments

Therapy includes:

- All measures under Stage A
- ACE I or ARB in appropriate patients
- Beta Blockers in appropriate patients
- AICDs in selected patients
- Coronary revascularization and valve replacement or repair in appropriate patients
- Cardiac Rehab exercise program
Patients With Reduced Left Ventricular Ejection Fraction

It is reasonable to treat patients with atrial fibrillation and HF to maintain sinus rhythm or to control ventricular rate alone.
ACE Inhibitors

- Work in lungs
- Prevent conversion of angiotensin I to angiotensin II
- Decrease sympathetic tone
  - Vasodilation
  - Decrease preload, afterload, BP
  - Increase CO
- Reduce cardiac hypertrophy
- Attenuate ventricular remodeling post MI

*Bothrops jararaca* venom inhibits angiotensin converting enzymes; basis for captopril
ACE Inhibitors

- Beneficial long term effects:
  - Modify the progression of chronic CHF
  - Improved survival (30-35%)
  - Decreased hospitalizations
  - Improved quality of life

- Captopril (Capoten), enalapril (Vasotec), lisinopril (Zestril), benazepril (Lotensin), perindopril (Aceon), ramipril (Altace), quinapril (Accupril)
Angiotensin II Receptor Blockers (ARB)

- Work in the tissues
- Similar effect to ACE I, but decreased cough
- Blocks actions of Angiotensin II
- Losartan (Cozaar), valsartan (Diovan), candesartan (Atacand), irbesartan (Avapro), telmisartan (Micardis), eprosartan (Teveten)
Stage B Therapy
ACE Inhibitors

ACEIs should be used in all patients with a recent or remote history of MI *regardless of EF or presence of HF.*

ACEI should be used in patients with a *reduced EF and no symptoms of HF,* even if they have not experienced MI.

ACEI or ARBs can be beneficial in patients with *hypertension and LVH* and no symptoms of HF.
Stage B Therapy
Angiotensin Receptor Blockers (ARBs)

An ARB should be administered to post-MI patients without HF who are intolerant of ACEIs and have a low LVEF.

ARBs can be beneficial in patients with low EF and no symptoms of HF who are intolerant of ACEIs.
Beta-Blockers

- Blocks harmful hormonal activation
- Improves heart function, symptoms, and quality of life
- Start at very low dose and increase slowly
- Take with food and separate from ACE I if BP low
- Make sure patient is euvolemic
- Little improvement for 3-6 months
- Side effects include low BP and slow HR
- Carvedilol (Coreg) – blocks $\beta_1$, $\beta_2$, $\alpha_1$-receptors
- Metoprolol (Toprol XL) and Bisoprolol (Zebeta)–block $\beta_1$ only
- Not a class effect
Stage B Therapy
Beta Blockers

Beta-blockers should be used in all patients with a recent or remote history of MI regardless of EF or presence of HF.

Beta-blockers are indicated in all patients without a history of MI who have a reduced LVEF with no HF symptoms.
Stage B Therapy
Internal Cardioverter Defibrillator (ICD)

Placement of an ICD is **reasonable** in patients with:
- **ischemic cardiomyopathy**
- greater than 40 days post-MI
- LVEF of < 30%
- NYHA class I on chronic optimal medical therapy
- expectation of survival with a good functional status for >1 yr

Placement of an ICD might be **considered** in patients w/:
- **nonischemic cardiomyopathy**
- LVEF < 30%
- NYHA class I on chronic optimal medical therapy
- expectation of survival with good functional status for >1 yr
Stage B Therapy
Coronary Revascularization

Coronary revascularization should be recommended in appropriate patients without symptoms of HF in accordance with contemporary guidelines.
Coronary Angiogram
Angioplasty and Stenting
Coronary Artery Bypass Grafting

- Aorta
- Internal mammary artery bypass
- Saphenous vein bypass
- Cholesterol build-up
- Sites of Blockage
Stage B Therapy
Valve Replacement/Repair

Valve replacement or repair should be recommended for patients with hemodynamically significant valvular stenosis or regurgitation and no symptoms of HF.
Stage B Therapy

**Therapies NOT Recommended**

Digoxin should not be used in patients with low EF, sinus rhythm, and no history of HF symptoms, because in this population, the risk of harm is not balanced by any known benefit.

Use of nutritional supplements to treat structural heart disease or to prevent the development of symptoms of HF is not recommended.

Calcium channel blockers with negative inotropic effects may be harmful in asymptomatic patients with low LVEF and
Stage C Patients

- Patients with reduced LVEF with symptoms:
  - Known structural heart disease
  - Shortness of breath, fatigue, reduced exercise tolerance
Evaluation of Stage C Patients

- History and physical to assess severity
- Assess cardiac structure and function
- Determine etiology, particularly reversible causes
- Evaluate for CAD and myocardial ischemia
- Evaluate risk of life-threatening arrhythmias
- Identify any exacerbating factors
- Identify comorbidities which influence therapy
- Identify barriers to adherence
Stage C Therapy

- All measures under Stages A and B
- Dietary salt restriction
- Diuretics for fluid retention
- ACE I
- Beta-blockers
- Selected Patients:
  - Aldosterone antagonist
  - ARBs
  - Digitalis
  - Hydralazine/nitrates
  - Biventricular pacing and AICDs
Goals of Heart Failure Therapy

- Improve clinical status/quality of life by alleviating symptoms
- Reduce the risk of mortality and morbidity
- Slow disease progression
Management of Heart Failure

- Strict attention to sodium intake (2000 mg/day)
- Attention to fluid intake
- Daily morning weights
- Physical activity
- Compliance with medications
- Flu and Pneumo vax
- Treatment of sleep disordered breathing
- Screening and treatment for depression
Chronic Medication Management

- ACE Inhibitors
- ARBs
- Beta Blockers
- Aldosterone Inhibitors
- Hydralazine/Nitrates
- Diuretics
- Digoxin
ACEIs are recommended for all patients with current or prior symptoms of HF and reduced LVEF, unless contraindicated.

Routine combined use of an ACEI, ARB, and aldosterone antagonist is not recommended for patients with current or prior symptoms of HF and reduced LVEF.
ARBs approved for the treatment of HF are recommended in patients with current or prior symptoms of HF and reduced LVEF who are ACEI-intolerant.

ARBs are reasonable to use as alternatives to ACEIs as first-line therapy for patients with mild to moderate HF and reduced LVEF.
Beta-blockers (using 1 of the 3 proven to reduce mortality) are recommended for all stable patients with current or prior symptoms of HF and reduced LVEF, unless contraindicated.
**Inhibitors of the Renin-Angiotensin-Aldosterone System and Beta-Blockers Commonly Used for the Treatment of Patients With Heart Failure With Low Ejection Fraction** (Slide 1 of 2)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial Daily Dose(s)</th>
<th>Maximum Dose(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE Inhibitors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captopril</td>
<td>6.25 mg 3 times</td>
<td>50 mg 3 times</td>
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<tr>
<td>Enalapril</td>
<td>2.5 mg twice</td>
<td>10 to 20 mg twice</td>
</tr>
<tr>
<td>Fosinopril</td>
<td>5 to 10 mg once</td>
<td>40 mg once</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>2.5 to 5 mg once</td>
<td>20 to 40 mg once</td>
</tr>
<tr>
<td>Perindopril</td>
<td>2 mg once</td>
<td>8 to 16 mg twice</td>
</tr>
<tr>
<td>Quinapril</td>
<td>5 mg twice</td>
<td>20 mg twice</td>
</tr>
<tr>
<td>Ramipril</td>
<td>1.25 to 2.5 mg once</td>
<td>10 mg once</td>
</tr>
<tr>
<td>Trandolapril</td>
<td>1 mg once</td>
<td>4 mg once</td>
</tr>
<tr>
<td><strong>Angiotensin Receptor Blockers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candesartan</td>
<td>4 to 8 mg once</td>
<td>32 mg once</td>
</tr>
<tr>
<td>Losartan</td>
<td>25 to 50 mg once</td>
<td>50 to 100 mg once</td>
</tr>
<tr>
<td>Valsartan</td>
<td>20 to 40 mg twice</td>
<td>160 mg twice</td>
</tr>
</tbody>
</table>

ACE indicates angiotensin converting enzyme; mg, milligrams; and kg, kilograms.
Inhibitors of the Renin-Angiotensin-Aldosterone System and Beta-Blockers Commonly Used for the Treatment of Patients With Heart Failure With Low Ejection Fraction (Slide 2 of 2)

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<tr>
<td><strong>Aldosterone Antagonists</strong></td>
<td></td>
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<tr>
<td>Spironolactone</td>
<td>12.5 to 25 mg once</td>
<td>25 mg once or twice</td>
</tr>
<tr>
<td>Eplerenone</td>
<td>25 mg once</td>
<td>50 mg once</td>
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<tr>
<td><strong>Beta-Blockers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisoprolol</td>
<td>1.25 mg once</td>
<td>10 mg once</td>
</tr>
<tr>
<td>Carvedilol</td>
<td>3.125 mg twice</td>
<td>25 mg twice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50 mg twice for patients over 85 kg</td>
</tr>
<tr>
<td>Metoprolol succinate extended release (metoprolol CR/XL)</td>
<td>12.5 to 25 mg once</td>
<td>200 mg once</td>
</tr>
</tbody>
</table>

ACE indicates angiotensin converting enzyme; mg, milligrams; and kg, kilograms.
Diuretics

- Integral part of symptom management
- Helps fluid to move into vascular space
  - Out of the interstitium
- Helps heart to work better
  - Decreases preload
  - LV becomes smaller
Diuretics

- Important to prevent and treat fluid congestion
- But, no known effect on survival
- Dose adjusted based on daily weights
- SE: hearing disturbances, dehydration, kidney failure, electrolyte disturbances
- Diuretics and salt restriction are indicated in patients with current or prior symptoms of HF and reduced LVEF who have evidence of fluid retention.
Digoxin

- Enhances inotropy of cardiac muscle
- Reduces activation of SNS and RAAS
- Controlled trials have shown long-term digoxin therapy:
  - Reduces symptoms
  - Increases exercise tolerance
  - Improves hemodynamics
  - Does not improve survival
- Beneficial in patients with current or prior symptoms of HF and reduced LVEF to decrease hospitalizations.
Aldosterone Inhibitors

- Reduces progression of HF
- Improved patient well-being
  - Less need for hospitalization
  - Fewer symptoms
  - Longer life
- Moderately severe to severe symptoms and preserved renal function (Cr < 2.5 in men and < 2 in women and K+ <5.0)
- Monitor BMP at 3 days, 1 week, monthly x 3 months
- Spironolactone (Aldactone), epleronone (Inspra)
Addition of an aldosterone antagonist is recommended in patients with moderately severe to severe symptoms of HF and reduced LVEF who can be carefully monitored for renal function and potassium.
The addition of a combination of hydralazine and nitrate is reasonable for patients with reduced LVEF who are already taking an ACEI and beta-blocker for symptomatic HF and who have persistent symptoms.

Combination of hydralazine and nitrates is recommended to improve outcomes for patients self-described as African-Americans, with moderate-severe symptoms on optimal therapy with ACE I, Beta blockers, and diuretics.
Antiarrhythmics

- Patients have frequent and complex ventricular arrhythmias & high risk for sudden death
- Most antiarrhythmics have negative inotropic effects and increased risk of serious arrhythmias
- Therefore, in general, they are not recommended for asymptomatic or non-sustained ventricular arrhythmias
- Use for sustained or hemodynamically destabilizing VT or VF and in recurrent or sustained atrial arrhythmias with symptoms
- Amiodarone drug of choice
  - Does not increase risk of death
  - Toxicity issues (Watch digoxin dose)
Stage C Therapy
Implantable Cardioverter-Defibrillators (ICDs)

ICD is recommended as *secondary prevention* in patients with current or prior symptoms of HF and reduced LVEF who have a history of cardiac arrest, v fib, or hemodynamically destabilizing ventricular tachycardia.

ICD recommended for *primary prevention* in patients with *non-ischemic cardiomyopathy* or *ischemic heart disease*
* at least 40 days post-MI
* LVEF <35%
* NYHA functional class II or III on chronic OMT
* expectation of survival with a good functional status for >1 yr
Cardiac Resynchronization (CRT) or BiV Pacing

- Improved Contraction Pattern
- AV Interval Optimization
- Transvenous approach for left ventricular lead via coronary sinus
Patients With Reduced LVEF

CRT and ICDs

CRT with or without ICD is reasonable for patients with
* LVEF < 35%
* QRS duration > 0.12 seconds, and
* atrial fib
* NYHA III or IV HF symptoms
* on optimal medical therapy

CRT is reasonable for patients with
* LVEF of < 35%
* NYHA III or IV symptoms
* on 0220 medical therapy
* have frequent dependence on ventricular pacing
Stage C Therapy
Unproven/Not Recommended Drugs and Interventions

- Long-term use of a positive inotropic drug infusion, except as palliation
- Use of nutritional supplements
- Calcium channel blocking drugs
- Hormonal therapies other than to replete deficiencies
- Routine combined use of an ACEI, ARB, and aldosterone antagonist

Also avoid:
- NSAIDs – increased risk of renal dysfunction
- Antiarrhythmics
- TZDs – Actos, Avandia
Stage D Patients

- Patients with severe refractory HF requiring specialized interventions
- Patients who have marked symptoms at rest despite maximal medical therapy
- Those who are recurrently hospitalized or cannot be safely discharged from the hospital without specialized interventions
Stage D Therapy

- Appropriate measures under Stages A, B and C
- Decision regarding appropriate level of care
- Compassionate end-of-life care/hospice
- Extraordinary measures
  - Heart transplant
  - Chronic inotropes
  - Permanent mechanical support
  - Experimental surgery or drugs
Hospitalized When:

- Hypoxia
- Pulmonary edema/anasarca
- Symptomatic hypotension
- Altered mental status
- Refractory to outpatient management
- Low CO with low systolic BP
- Congestion in the presence of acute ischemia
- Symptomatic or sustained vent. arrhythmias
- Severe electrolyte imbalance
- Increasing renal dysfunction
Medications for Acute Care

- Inotropes
- Preload and afterload reducers
  - Diuretics
  - Vasodilators
  - Nesiritide
- Antiarrhythmics
Continuous IV infusion of a positive inotropic agent may be considered for palliation of symptoms.

Routine intermittent infusions of positive inotropic agents are not recommended.
Stage D Therapy

Surgical Therapy

Referral for cardiac transplantation in potentially eligible patients is recommended.

The effectiveness of mitral valve repair or replacement is not established for severe secondary mitral regurgitation in refractory end-stage HF.
Cardiac Transplantation

- Remains the most effective Tx for end-stage heart disease, although donor shortage limits use
- Approx. 2,000 hearts available each year
- 1-year survival: 86%
- 5-year survival: 71%
- 10-year survival: 46%

## Contraindications for Cardiac Transplantation

<table>
<thead>
<tr>
<th>General</th>
<th>Specific</th>
<th>Relative</th>
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<tbody>
<tr>
<td>Any condition limiting a successful transplant outcome</td>
<td>Elevated pulmonary vascular resistance</td>
<td>Age</td>
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<tr>
<td></td>
<td>Active infection</td>
<td>Peripheral vascular disease</td>
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<td>Renal or pulmonary disease</td>
<td>Malignancy</td>
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<td></td>
<td>Diabetes with end-organ damage</td>
<td>Age</td>
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<td>Cross-match incompatibility</td>
<td>Size/Obesity</td>
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<td>Active psychiatric disease</td>
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<td>Substance abuse</td>
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<td>Smoking</td>
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Patients with implantable defibrillators should receive information about the option to inactivate defibrillation.

Consideration of an LV assist device as permanent “destination” therapy is reasonable in selected patients with an estimated 1-year mortality > 50% on medical therapy.

Pulmonary artery catheter placement may be reasonable to guide therapy in patients with persistent severe symptoms.
Ventricular Assist Device

- Near total unloading to myocardium
- May be used as a bridge to transplant or as destination therapy
- Increasing evidence of VADs may lead to myocardial recovery in nonischemic cardiomyopathy
  - 5-24% explanted
  - However, relatively high incidence of early recurrence
HeartMate II® Left Ventricular Assist System

- A surgically implanted, rotary continuous-flow device in parallel with the native left ventricle
- Left ventricle to ascending aorta
- Percutaneous driveline
- Electrically powered
- Batteries and line power
- Home discharge
Stage D Therapy

Meticulous control of fluid retention.

Referral of patients with refractory end-stage HF to a HF program.

Options for end-of-life care should be discussed with the patient and family when severe symptoms persist despite application of all recommended therapies.
Goals of Advanced Heart Failure End of Life Care

- Improve quality of life
- Symptom management
- Maximize functional ability
- Psychosocial/spiritual support
- Support hope for recovery
- However, if recovery not possible, redirect to hope for relief of symptoms and comfort at end of life
- Appropriate and timely hospice referral:
  - A Good Death
Discussion with Patient and Family

- Patient’s prognosis
- Options other than device withdrawal
- What will happen if device is withdrawn
- Is death imminent or can the patient leave the hospital and be referred to home palliative and hospice care
- Should additional interventions be withheld (i.e., dialysis, CPR, etc.)?
- Should interventions be stopped or withdrawn (i.e., IABP, ventilation)?
- When is the right time to withhold and/or withdraw life-sustaining interventions?

Wingate & Wiegand, 2008, End-of-life care in the critical care unit for patients with heart failure, CCN
Goals of End of Life Care

- May continue aggressive treatments for a period of time
- Use drugs that provide benefit in shortest amount of time

Suggestions:
- Stop warfarin, if used for AFib
- Stop statins
- If hypotensive, stop or lower vasodilators and beta blockers

Consider deactivation of ICD/CRT-D
- Patient/family request
- Irreversible cognitive failure
- Imminent death
- DNR order
- Withdrawal of antiarrhythmic drugs
An effort to reduce cardiovascular-related hospital readmissions and improve the transition from inpatient to outpatient status for individuals hospitalized with cardiovascular disease.

**Goal**: To reduce all-cause readmission rates among patients discharged with heart failure or acute myocardial infarction by 20%

**Areas for Improvement**: H2H focuses on 3 evidence-based areas for improvement:

- **1. Early Follow-Up**
  Does the patient have a follow-up visit scheduled or cardiac rehabilitation referral within 1 week of hospital discharge?

- **2. Post-discharge Medication Management**
  Are the caregiver and patient teams working together to ensure optimal medication management?

- **3. Signs and Symptoms**
  Is the patient self-activated to recognize and appropriately act on warnings signs and symptoms
Prevention of Readmission

- Identify primary caregiver
  - Who manages meds
  - Who should be included in teaching and DC plans
- Medication reconciliation on admission and at discharge
- Use evidence based guidelines for care
- Educate patient and caregiver
  - Teach Back method
  - Standardized materials
Improve the Discharge Process

- Encourage home care services if appropriate
- Schedule follow up visit prior to discharge
- Instruct patients to take medications and list to FU visit
- Provide written information, weight logs and medication plans
- Make sure patient has prescriptions before they leave
- Post discharge phone calls
Conclusions

- Heart failure therapies now offer the possibility of improving survival as well as alleviating symptoms
  - Titrate to goal doses
  - Consider 3rd line meds
  - Consider ICD/CRT if EF < 35%
- Greater understanding of HF pathophysiology has led to rational and effective therapies which provide long-term benefit
- Prevention of the progression of heart failure can make a big impact on patient’s QOL
- Patient teaching and follow-up is key to success
The End