Update: Acute Decompensated Heart Failure

Beverly Carlson, PhD, RN, CNS, CCRN
Safe care of the patient with ADHF requires a comprehensive understanding of chronic heart failure & its management.

Outpatient Care

Inpatient Care
Heart Failure: Defined

“a complex clinical syndrome that results from any structural or functional impairment of ventricular filing or ejection of blood”

2013 ACCF/AHA Heart Failure Guideline
Heart Failure

- Cardinal Manifestations
  - Dyspnea
  - Fatigue
  - Fluid retention

  - activity intolerance

  - pulmonary, splanchnic, &/or peripheral
Updated Terms

Congestive Heart Failure
“In most patients, abnormalities of systolic and diastolic dysfunction coexist”
Updated Terms

- Heart Failure with Reduced EF (HF<sub>rEF</sub>)
  - HF with EF < or = 40%

- Heart Failure with Preserved EF (HF<sub>pEF</sub>)
  - HF with EF > or = 50%
  - Borderline: EF 41-49%
  - Improved: EF > 40%
## Classification of Heart Failure

<table>
<thead>
<tr>
<th>Stage</th>
<th>Patient Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>High risk for developing heart failure (HF)</td>
</tr>
<tr>
<td>B</td>
<td>Structural heart disease but no symptoms of HF</td>
</tr>
<tr>
<td>C</td>
<td>Structural heart disease with symptomatic HF</td>
</tr>
<tr>
<td>D</td>
<td>Refractory end-stage HF</td>
</tr>
</tbody>
</table>

### Stage A
- High risk for developing heart failure (HF)
  - Hypertension
  - CAD
  - Diabetes mellitus
  - Family history of cardiomyopathy

### Stage B
- Structural heart disease but no symptoms of HF
  - Previous MI
  - LV systolic dysfunction
  - Asymptomatic valvular disease

### Stage C
- Structural heart disease with symptomatic HF
  - Dyspnea
  - Fatigue
  - Fluid retention

### Stage D
- 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)

2013 ACCF/AHA Heart Failure Guideline

Hunt SA et al. *J Am Coll Cardiol.* 2001; 38
## Stages of Heart Failure

<table>
<thead>
<tr>
<th>ACCF/AHA Stages of HF (38)</th>
<th>NYHA Functional Classification (46)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>At high risk for HF but without structural heart disease or symptoms of HF</td>
</tr>
<tr>
<td>B</td>
<td>Structural heart disease but without signs or symptoms of HF</td>
</tr>
<tr>
<td>C</td>
<td>Structural heart disease with prior or current symptoms of HF</td>
</tr>
<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Refractory HF requiring specialized interventions</td>
</tr>
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</table>

ACCF indicates American College of Cardiology Foundation; AHA, American Heart Association; HF, heart failure; and NYHA, New York Heart Association.
Prognosis

- Absolute Mortality: 50% within 5 years

- Hospitalization
  - 83% at least once
  - 43% at least 4 times
  - > ½ related to non-CV causes

AHA: 2013 Update Heart Disease and Stroke Statistics
Hospital discharges for heart failure by sex
(United States: 1979-2009). Source: NHDS, NCHS and NHLBI.

> 1 million annual hospitalizations

Note: Hospital discharges include people discharged alive, dead and status unknown.

AHA: 2013 Update Heart Disease and Stroke Statistics
ADHF Hospitalizations

- ≈ 80% of ED presentations result in admission

- Mean cost $23,077 per patient

- Account for over ½ of healthcare costs for HF care in US

Total cost for 2013 = $32 Billion

Projected for 2030 = $70 Billion

2013 ACCF/AHA Heart Failure Guideline
AHA: 2010 - 2013 Update Heart Disease & Stroke Statistics
Steinberg et al., 2012, Circ 126:65
ADHF Hospitalizations

- A period of high risk
- In-hospital mortality: overall ≈ 2.6 - 4.1%
  - Varies significantly by risk factors

Classification and Regression Tree (CART) Model

- Admission BUN
- Admission SBP
- Serum Creatinine

Fonarow et al. 2005 JAMA 293:572
Steinberg et al., 2012, Circ 126:65
In-Hospital Mortality Based on Risk Factors

Figure 3. In-Hospital Mortality Based on the Logistic Regression Model

> 10 fold difference

Fonarow et al. 2005 JAMA 293:572
## Risk Stratification for In-Hospital Mortality in Patients with ADHF

<table>
<thead>
<tr>
<th>Risk Level</th>
<th>Admission BUN</th>
<th>Admission SBP</th>
<th>Serum Creatinine</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk</td>
<td>$\geq 43$ mg/dL (15.35 mmol/L)</td>
<td>$&lt; 115$ mm Hg</td>
<td>$\geq 2.75$ mg/dL (243.1 micromol/L)</td>
</tr>
<tr>
<td>Intermediate Risk 1</td>
<td>$\geq 43$ mg/dL (15.35 mmol/L)</td>
<td>$&lt; 115$ mm Hg</td>
<td>$&lt; 2.75$ mg/dL (243.1 micromol/L)</td>
</tr>
<tr>
<td>Intermediate Risk 2</td>
<td>$\geq 43$ mg/dL (15.35 mmol/L)</td>
<td>$\geq 115$</td>
<td>$&lt; 2.75$ mg/dL (243.1 micromol/L)</td>
</tr>
<tr>
<td>Intermediate Risk 3</td>
<td>$&lt; 43$ mg/dL (15.35 mmol/L)</td>
<td>$&lt; 115$ mm Hg</td>
<td>$&lt; 2.75$ mg/dL (243.1 micromol/L)</td>
</tr>
<tr>
<td>Low Risk</td>
<td>$&lt; 43$ mg/dL (15.35 mmol/L)</td>
<td>$\geq 115$</td>
<td>$&lt; 2.75$ mg/dL (243.1 micromol/L)</td>
</tr>
</tbody>
</table>

**ADHERE Classification and Regression Tree (CART) Model**
ADHF Hospitalizations

- Other factors associated with higher in-hospital mortality:
  - Atrial Fibrillation
  - Admission HR
  - ↑ creatinine ≥ 0.3 mg/dL

Bui et al, 2013, Am Heart J 165:567
Chen et al., 2013, Circ HF 6:1087
ADHF Hospitalizations

Post-Discharge Outcomes

- Readmission
  - 25% within 1 month
  - 16-50% within 3-6 months

- Mortality
  - 30 day: 10.4%
  - 1 year: 25-35%
  - 5 year: 42.3%

2013 ACCF/AHA HF Guideline
AHA: 2010 - 2013 Update Heart Disease & Stroke Statistics
ADHF Hospitalizations

Patient Characteristics: Demographics

- Median Age: 74-75 yrs
- Female: 47-51%
- White: 66-71% - Black: 20% - Hispanic 7%
- Prior Dx HF: 58-76%
- HFrEF: 50% - HFrpEF: 36% - borderline: 14%

ADHF National Registry, 2006
Steinberg et al., 2012, Circ 126:65
ADHF Hospitalizations

Patient Characteristics: Comorbidities

- 74-76% HTN
- 50-57% CAD
- 30-50% Chronic Kidney Disease
- 43-44% Diabetes
- 31% A. Fibrillation
- 30-31% Pul Disease

ADHF National Registry, 2006
Steinberg et al., 2012, Circ 126:65
WHY DID THIS PATIENT DECOMPENSATE?

The answer is critical to appropriate therapy

2013 ACCF/AHA HF Guideline
Common Factors that Precipitate ADHF

- Acute myocardial ischemia
- Concurrent infections
- AF & other arrhythmia
- Pulmonary embolus
- Other acute CV disorders (valve dx, endocarditis)
- Endocrine abnormalities
Common Factors that Precipitate ADHF

- Uncorrected HTN*
- Nonadherence with
  - medication regimen
  - Na$^+$ &/or fluid restriction

Inadequate Therapy
Common Factors that Precipitate ADHF

- Excessive ETOH or illicit drug use
- Initiation of drugs that ↑ salt retention (steroids, TZDs, NSAIDs)
- Recent addition of negative inotropic drugs
MEDICATION SAFETY FOR THE PATIENT WITH ADHF
Drugs to be Avoided (Harmful) in Patients with HF/HF

- Most antiarrhythmics
- Most CCBs (except amlodipine)
- NSAIDs*
- Thiazolidinediones (TZDs)
- Long-term use of IV inotropes except for palliative care

*Exception is low dose ASA for those with known CAD

2013 ACCF/AHA HF Guideline
Guideline-Directed Drug Therapy for Chronic HFrHF

- ACEI or ARB*
- Beta Blocker*
- Aldosterone antagonist for select pts*
- Diuretics for fluid retention
- Hydralazine/nitrate for persistently symptomatic AA pts*
- Digoxin to control symptoms*
- Anticoag for chronic AF

*Known to reduce HF hospitalizations

2013 ACCF/AHA HF Guideline
Beta-Blockers in the Hospitalized ADHF Patient

COMET (Carvedilol or Metoprolol European Trial)

- N=815 patients hospitalized for worsening HF who were on BBs before hospitalization
- Evaluated post-discharge BB dosing
- Mortality:
  - 47% when dose unchanged from pre-hospitalization
  - 58% when dose was reduced
  - 53% when BBs were discontinued
- Reduction in dose and discontinuation were independent predictors of mortality
Beta-Blockers in the Hospitalized ADHF Patient

Recommended that

- GDMT for HFrEF (ACEI/ARBs & BB) be continued in absence of hemodynamic instability or contraindications

- After optimization of volume status & discontinuation of IV diuretic & vasoactive agents, BB Tx be initiated in stable patients

2013 ACCF/AHA HF Guideline
Guideline-Directed Drug Therapy for Chronic HFpHF

- BB, ACEI, &/or ARB* to control BP
- Diuretics for relief of sx due to volume overload

Blood Pressure Control is the most important treatment for HFpHF & may reduce hospitalizations

*Might reduce HF hospitalizations
Biomarkers in ADHF

Usefulness of BNP or NT-proBNP

- Support clinical judgment for dx, especially in setting of uncertainty
- Establishing prognosis or disease severity
  - If no improvement with aggressive tx, risk for death/hospitalization is significant
- Not well-established for guiding therapy

2013 ACCF/AHA HF Guideline
Admission BNP Levels in ADHF (N=110,621)

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>HFP EF</th>
<th>HFR EF</th>
</tr>
</thead>
<tbody>
<tr>
<td>BNP</td>
<td>821 (386-1690)</td>
<td>551 (271-1081)</td>
<td>1161 (563-2229)</td>
</tr>
<tr>
<td>NT-proBNP</td>
<td>5413 (2189-12,134)</td>
<td>3401 (1389-8,046)</td>
<td>6847 (2888-14,019)</td>
</tr>
</tbody>
</table>

Median values (IQR) in pg/ml

Steinberg et al., 2012, Circ 126:65
Biomarkers in ADHF

- Troponin T or I
  - Abnormal levels often found in HF patients – indicates ongoing myocyte injury/necrosis
  - Elevations in ADHF: worse outcomes/mortality
  - Decrease over time: better prognosis

2013 ACCF/AHA HF Guideline
Figure 4. Classification of patients presenting with acutely decompensated HF.

Congestion at rest?
(e.g. orthopnea, elevated jugular venous pressure, pulmonary rales, S3 gallop, edema)

- No
  - No, Warm and Dry
  - Yes, Cold and Dry
- Yes, Cold and Wet

Low perfusion at rest?
(e.g. narrow pulse pressure, cool extremities, hypotension)

Adapted with permission from Nohria et al (306).

2013 ACCF/AHA HF Guideline
Hemodynamic Monitoring in ADHF (PA Catheter)

Recommended:

- “guide therapy in patients with resp. distress or clinical evidence of impaired perfusion in whom adequacy or excess of intracardiac filling pressures cannot be determined from clinical assessment”

2013 ACCF/AHA HF Guideline
Hemodynamic Monitoring in ADHF (PA Catheter)

“Useful” in carefully selected patients with persistent symptoms despite empiric adjustment of standard therapies &

- uncertain fluid status, perfusion, or systemic or pulmonary vascular resistance
- low or symptomatic SBP despite initial therapy
- worsening renal function
- need IV vasoactive agents
- need consideration for MCS or transplantation
Reducing Congestion (Significant Fluid Overload)

- IV Loop Diuretics
  - Initial dose = or greater than total daily oral dose
  - If sx unrelieved, ↑ dose or add 2nd diuretic
  - May combine with low-dose dopamine to better preserve renal function

- Ultrafiltration
  - May be considered
Reducing Congestion (Preload)

- IV Vasodilators for relief of dyspnea in absence of symptomatic hypotension:
  - NTG
  - Nitroprusside
  - Nesiritide
Update on Nesiritide

2010: ASCEND-HF results:

- No change in renal function
- No change in readmission/mortality
- Minimal improvement in dyspnea
- Greater incidence of hypotension

Hemodynamic (balanced vasodilation)
- veins

- lusitropic
- antifibrotic
- antiremodeling

\[ \uparrow \text{diuresis natriuresis} \]
Update on Nesiritide

- Dose may be the issue
- Preliminary studies: lower dose associated with decongestion w/o hypotension
- ROSE AHF: double-blind placebo-controlled multicenter RCT
  - All receive optimal diuretic dosing
  - Low dose nesiritide vs placebo
  - Low dose dopamine vs placebo

Chen et al, 2013, Circ HF; 6:1087
Update on IV Inotropes

Only recommended in:

- Cardiogenic shock to maintain perfusion & preserve end-organ function until definitive tx or resolution of precipitating problem
- Bridge therapy until mechanical circ. support or transplant
- Palliative therapy for symptom control

Even short-term use is potentially harmful in pts without shock or threatened end-organ function

2013 ACCF/AHA HF Guideline
Timing is Everything

- IV vasoactive (vasodilator/inotrope) treatment

<table>
<thead>
<tr>
<th></th>
<th>Admin &lt; 6 hr</th>
<th>Admin 6-48 Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOS</td>
<td>4.5</td>
<td>5.6</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>2.4</td>
<td>3</td>
</tr>
<tr>
<td>CPR</td>
<td>1.9</td>
<td>2.4</td>
</tr>
<tr>
<td>Mortality</td>
<td>5.1</td>
<td>6.6</td>
</tr>
</tbody>
</table>

All: $p < .0001$

Peacock et al., 2009
Update on Sodium Restriction

- Highly debated
- 2010 HFSA Guidelines: 2 Gm/day
- 2013 ACCF/AHA Guidelines: “reasonable” for use in symptomatic patients with congestion
Update on Fluid Restriction

- Highly debated
- 2010 HFSA: 2 L only if serum Na+ < 130
- 2013 ACCF/AHA: 1.5-2 L/day only to reduce congestive symptoms for Refractory End-Stage HF (Stage D), especially if hyponatremia present
SAFETY ISSUE: COGNITIVE IMPAIRMENT
Cognitive Impairment: Unrecognized

- Estimated incidence: 30-80%
- Unrecognized in more than 50%
- Affected Domains:
  - Executive function
  - Verbal learning
  - Immediate & delayed memory
- Associated with poor adherence to treatment recommendations

Hawkins, 2012, H&L,41:572
Davis, 2013, H&L,42:92
Assessing Cognitive Impairment

- 1st: r/o delirium with the CAM or CAM-ICU
- Montreal Cognitive Assessment (MoCA)
  - Takes about 10 minutes
- Clock drawing test component
  - Takes ≈ 2 min

CAM & Clock drawing – about 5 minutes
Clock Drawing Test

Directions: “Draw a clock. Put in all the numbers & set the time to 10 past 11.”

Scoring: 1 pt each
- Contour: clock face must be circle w only minor distortion
- Numbers: all present - no extra - correct order - placed in approx quadrants on clock face - can be outside circle - Roman numerals OK
- Hands: 2 hands indicating correct time - hour hand shorter than minute hand - hands centered within clock face w junction close to clock center

www.mocatest.org
Clock Drawing Test
Before Discharge

- Initiation of GDMT
- Address causes of HF, barriers to care & support limitations
- Assessment of volume status & BP with adjustment of therapy
- Optimization of chronic oral HF tx
- Renal function & electrolytes
- Management of comorbid conditions
- HF education, self-care, emergency plans, adherence
- Palliative or hospice care

Optimal SBP 120-139 mmHg

2013 ACCF/AHA HF Guideline
Discharge Plan: Transitional Care

- Multidisciplinary HF disease management for patients at high risk for readmission
- Telephone follow-up within 3 days
- Follow-up visit within 7-14 days

2013 ACCF/AHA HF Guideline
DO IT FOR THEM!
Guideline-Directed Drug Therapy

HFrEF Stage C NYHA Class I – IV
Treatment:

Class I, LOE A
ACEI or ARB AND Beta Blocker

For all volume overload, NYHA class II-IV patients

Add

Class I, LOE C Loop Diuretics

For persistently symptomatic African Americans, NYHA class III-IV

Add

Class I, LOE A Hydralazine

For NYHA class II-IV patients. Provided estimated creatinine >30 mL/min and K+ <5.0 mEq/dL

Add

Class I, LOE A Aldosterone Antagonist

Hydralazine and isosorbide dinitrate
Figure 2. Indications for CRT Therapy Algorithm.

Patient with cardiomyopathy on GDMT for ≥3 mo or on GDMT and ≥40 d after MI, or with implantation of pacing or defibrillation device for special indications

LVEF ≤35%

Evaluate general health status

Comorbidities and/or frailty limit survival with good functional capacity to <1 y

Continue GDMT without implanted device

Acceptable noncardiac health

Evaluate NYHA clinical status

NYHA class I
- LVEF ≤30%
- QRS ≥150 ms
- LBBB pattern
- Ischemic cardiomyopathy
- QRS ≤150 ms
- Non-LBBB pattern

NYHA class II
- LVEF ≤35%
- QRS ≥150 ms
- LBBB pattern
- Sinus rhythm
- LVEF ≤35%
- QRS 120-149 ms
- LBBB pattern
- Sinus rhythm
- LVEF ≤35%
- QRS ≤150 ms
- Non-LBBB pattern
- Sinus rhythm

NYHA class III & Ambulatory class IV
- LVEF ≤35%
- QRS ≥150 ms
- LBBB pattern
- Sinus rhythm
- LVEF ≤35%
- QRS 120-149 ms
- LBBB pattern
- Sinus rhythm
- LVEF ≤35%
- QRS ≤150 ms
- Non-LBBB pattern
- Sinus rhythm

Special CRT Indications
- Anticipated to require frequent ventricular pacing (>40%)
- Atrial fibrillation, if ventricular pacing is required and rate control will result in near 100% ventricular pacing with CRT