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## Key Aspects of Care

- **Assess left ventricular function (LVF)** before arrival, during hospitalization, or planned after discharge – or document reason for not doing this.
- **Provide an ACE-I or ARB and beta-blocker at discharge** to patients with LVEF < 40% (unless otherwise documented as contraindicated).
- **Give smoking cessation advice/counseling** to all current smokers during the hospital stay.
- **Provide written discharge instructions and educational materials** to all patients, including information on discharge medications, activity, weight, diet, symptom management, and follow-up instructions.
  - **Provide a hospital follow-up appointment** within 7-14 days. Timing of appointment is dependent on risk of early readmission.
- **Consider HF disease management for high-risk patients** (with >1 admission, numerous co-morbidities, or lack of social/financial support).
- **Transition of care** is an important aspect of patient management that promotes continuity of care and facilitates safe and timely transfer of patient from one level of care to another (See page 3).

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## Initial Evaluation

- **History and physical examination.**
- Assess for causative and precipitating factors (for example):
  - Exclude ischemia as etiology
  - Exclude hypertension as etiology
  - If ICD, exclude arrhythmia as etiology via ICD interrogation
  - Assess sleep-disordered breathing
  - Assess volume status and adequacy of peripheral perfusion
  - Assess for possible pulmonary embolism
- [The Seattle Heart Failure Model](#) Risk Scoring Tool can be useful to estimate subsequent risk of mortality

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## Labs (as ordered)

- CBC with differential
- Chem 7, magnesium, calcium
- Liver function
- Urinalysis - for possible renal failure
- Thyroid stimulation hormone
- B-type natriuretic peptide (BNP)
- Lipid panel with calculated LDL

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## Diagnostic Tests

- 12-lead ECG
- Chest x-ray
- Assessment of ventricular function (ECHO)

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## Admission Criteria

**Hospitalization is recommended** for the following:

- Evidence of severe acute decompensated heart failure (ADHF), including:
  - Hypotension
  - Worsening renal function
  - Altered mentation
- Dyspnea at rest which is typically reflected by resting tachypnea; less commonly reflected by oxygen saturation < 90%
- Hemodynamically significant arrhythmia, including new onset of rapid atrial fibrillation
- Acute coronary syndromes

**Hospitalization should be considered** for the following:

- Worsened congestion, even without dyspnea
- Signs and symptoms of pulmonary or systemic congestion, even in the absence of weight gain
- Major electrolyte disturbance
- Associated comorbid conditions:
  - Pneumonia
  - Pulmonary embolus
  - Diabetic ketoacidosis
  - Symptoms suggestive of TIA or stroke
- Repeated ICD firings
- Previously undiagnosed HF with signs and symptoms of systemic or pulmonary congestion

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## Consults

- Heart Failure for:
  - Refractory HF
  - Ultrafiltration for severe overload /diuretic resistance
  - Inotropic therapy
  - Ventricular Assist Devices

- CHF Educator
- Pain and Palliative Care
- Cardiac Rehabilitation
- Dietary for low-sodium diet
- Social Services (for financial, social, or transportation needs)
- Smoking Cessation (current user or has quit within the last 12 months)

## Pharmacologic Management

**Note:** See Appendix A, page 5, for additional dosing details.

### Emergency Department:

Drug/Intervention	Indication	Notes
<b>Intravenous (IV) Loop Diuretic</b> <i>furosemide</i>	<ul style="list-style-type: none"> <li>Volume Overload               <ul style="list-style-type: none"> <li>Majority of HF admissions are due to congestion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>If diuretic naïve, consider 40 mg IVP</li> <li>If on home diuretics, give 2 times oral equivalent dose, intravenously               <ul style="list-style-type: none"> <li>Max dose 80 mg IVP</li> </ul> </li> </ul>
<b>IV Vasodilators</b> <i>1<sup>st</sup> line: nitroglycerin (NTG)</i> <i>2<sup>nd</sup> line: nesiritide, nitroprusside</i>	<ul style="list-style-type: none"> <li>Severe dyspnea in presence of hypertension (would use with diuretic if congested)</li> </ul>	<ul style="list-style-type: none"> <li>NTG is preferred over nesiritide in the ED</li> <li>In general, NTG is more effective at higher doses and can be rapidly titrated to &gt; 100 mcg/min as BP allows</li> <li>Sublingual NTG may be given as NTG drip is titrated upwards</li> </ul>
<b>Noninvasive Ventilation</b>	<ul style="list-style-type: none"> <li>Severe dyspnea, in absence of hypotension, altered mental status or need for acute intervention</li> </ul>	<ul style="list-style-type: none"> <li>Use 5 to 10 mmHg CPAP by nasal or face mask as therapy to improve vital signs, and reduce the need for intubation, and possibly reduce in-hospital mortality</li> </ul>
<b>Additional vasodilators</b> <i>IV enalapril, IV hydralazine</i>	<ul style="list-style-type: none"> <li>Severe dyspnea in setting of severe hypertension</li> </ul>	<ul style="list-style-type: none"> <li><b>Caution:</b> monitor for first dose hypotension</li> </ul>
<b>IV Inotrope</b> <i>dobutamine</i>	<ul style="list-style-type: none"> <li>Signs/symptoms of low cardiac output</li> </ul>	<ul style="list-style-type: none"> <li>If considering inotropes, consult HF</li> </ul>

### Initial Inpatient Management: Decompensated Patients

- **IV loop diuretic** (furosemide) for volume overload
  - For synergistic effect, consider adding oral thiazide diuretic or metolazone.
- **IV vasoactive medications**
  - Consider Heart Failure consult if > 48 hours
  - Vasodilators for severe dyspnea +/- congestion (nesiritide, nitroglycerin, or nitroprusside)
  - Inotropes (dobutamine, milrinone) for signs/symptoms of low cardiac output
- **ACE inhibitor** (captopril, enalapril, lisinopril, ramipril)
  - If patient already taking prior to admission, adjust dose based on BP, renal function.
  - If patient not taking ACEI prior to admission, it should be initiated during transition to oral, evidence-based HF therapy.
- **Beta-blocker** (carvedilol, metoprolol extended release, bisoprolol)
  - If patient already taking prior to admission, consider maintaining current dose or possibly adjusting to a lower dose during treatment of decompensation.

- If patient not on beta-blocker prior to admission, it should be initiated at starting dose during transition to oral, evidence-based HF therapy with plans to titrate in outpatient setting.
- Do not stop beta-blocker suddenly during treatment of ADHF unless there is hypotension or cardiogenic syndrome.

### Transition to Evidence-Based Medications for Discharge: All Patients

- ACE inhibitor (captopril, enalapril, lisinopril, ramipril)
- Beta-blocker (carvedilol, metoprolol extended release, bisoprolol)
- Consider aldosterone antagonist (spironolactone, eplerenone)
- Hydralazine/nitrates (particularly in African Americans) if persistent symptoms despite optimal therapy

### Other Possible Medications

- Loop diuretic usually required:
  - Furosemide
  - Torsemide
- Digoxin if patient remains symptomatic:
  - Target serum levels of 0.5-1.0 mg/dL
- Potassium supplements to keep serum level 4.2-5.0 mEq/L; magnesium supplements as required

- Consider anticoagulation if history of thromboembolic events, required for atrial fibrillation
- If ischemic cardiomyopathy, use lipid-lowering therapy and aspirin.
  - If patient has angina, use nitrates.

### Medications Contraindicated for All Patients

- Non-steroid anti-inflammatory drugs
- Initiation of Class I anti-arrhythmic agents
- Calcium channel blockers:
  - Diltiazem
  - Nifedipine
  - Verapamil
- Thiazolidinediones:
  - Rosiglitazone
  - Pioglitazone

### Non-Pharmacologic Management

- Patient education to facilitate HF self-care
- Diet – 2-gram sodium diet. If serum sodium < 130 mg/dL, restrict fluids to < 2 liters/ day
- Daily weight monitoring and fluid status (I/O)
- CPAP / BIPAP for central or OSA
- Exercise training (or regular physical activity) / cardiac rehabilitation
- Evaluate for ICD (Implantable Cardioverter-Defibrillator) or CRT (Cardiac Resynchronization therapy)
  - For primary prevention, may occur in the outpatient setting, but at least 30 days after discharge (may consider LifeVest in the interim)
  - For secondary prevention, device implantation should occur prior to discharge
- Smoking cessation

### Discharge / Transition of Care

- **It is important to consult the CHF Educator for all heart failure admissions**
  - Educators can provide information on patient education, disease management, and telemonitoring programs
  - Heart failure is a key targeted diagnosis to help reduce readmissions and the CHF Educator can provide assistance with the following

### Discharge Planning and Patient Education

- Comprehensive discharge planning with detailed written instructions for the patient and caregivers to promote compliance and understanding of treatment and educational goals

### Recommended for all HF patients

- Exacerbating factors addressed
- Etiology identified
- Near optimal volume status observed
- Near optimal pharmacologic therapy achieved, including ACE inhibitor and beta-blocker (for patients with reduced LVEF), or intolerance documented
- Transition from IV to oral diuretic successfully completed
- Patient education completed with clear discharge instructions
- Follow-up clinic visit scheduled, usually for 7-14 days
- Routine procedures that require hospitalization should be scheduled at least 30 days after discharge

### Considerations for patients with advanced HF or recurrent HF admissions

- Oral medication regimen stable for 24 hours
- No IV vasodilator or inotropic agent for 24 hours
- Ambulation before discharge to assess functional capacity after therapy
- Plans for discharge management:
  - Scale present in home
  - Visiting nurse or telephone follow-up
    - Generally no longer than 3 days after discharge

### Detailed discharge instructions

- Comprehensive discharge planning and discharge instructions should address:
  - Medication regimen
  - Dietary instructions for sodium and fluid restriction recommendations
  - Activity level
  - Weight monitoring
  - What to do if symptoms return or worsen
  - A discharge follow-up appointment should be scheduled within 7-14 days

## Quality Measures

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- 30-day mortality rate
- 30-day readmission rate
- ACEI or ARB prescribed at discharge for left ventricular systolic dysfunction (ejection fraction < 40%), or, if neither ordered, clear documentation of contraindications/ reasoning for not ordering
- Discharge instructions- documentation that instruction was given on all of the following:
  - Activity
  - Diet
  - Medications
  - Follow-up
  - What to do if symptoms worsen
    - Instructions must be specific to HF symptoms
  - Weight monitoring
- Document left ventricular systolic function
- Smoking cessation counseling / advice

## References

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- ACCF/AHA Guideline for the Management of Heart Failure. *Circulation*, 2013;128:e240-e327.doi:10.1161/CIR.0b013e31829e8776
- Heart Failure Society of America (HFSA) 2010 Comprehensive Heart Failure Practice Guideline, Executive Summary. *J Cardiac Failure*,

## Appendix A Pharmacologic Heart Failure Therapy

Generic Name	Trade Name	Initial Daily Dose	Target Dose
<b>ACE-INHIBITORS</b>			
Captopril	Capoten	6.25 mg 3 times daily	50 mg 3 times daily
Enalapril	Vasotec	2.5 mg twice daily	10 mg twice daily
Fosinopril	Monopril	5-10 mg daily	40 mg daily
Lisinopril	Zestril, Prinivil	2.5-5 mg daily	20 mg daily
Quinapril	Accupril	5 mg twice daily	20 mg twice daily
Ramipril	Altace	1.25-2.5 mg daily	10 mg daily
Trandolapril	Mavik	1 mg daily	4 mg daily
<b>ANGIOTENSIN RECEPTOR BLOCKERS</b>			
Candesartan	Atacand	4-8 mg daily	32 mg daily
Losartan	Cozaar	12.5-25 mg daily	100 – 150 mg daily
Valsartan	Diovan	40 mg twice daily	160 mg twice daily
<b>BETA-BLOCKERS</b>			
Bisoprolol	Zebeta	1.25 mg daily	10 mg daily
Carvedilol	Coreg	3.125 mg twice daily	25-50 mg twice daily
Carvedilol	Coreg CR	10 mg daily	80 mg daily
Metoprolol succinate CR/XL	Toprol XL	12.5-25 mg daily	150- 200 mg daily
<b>ALDOSTERONE ANTAGONISTS</b>			
Spirololactone	Aldactone	12.5 - 25 mg daily	25 mg daily
Eplerenone	Inspra	25 mg daily	50 mg daily
<b>OTHER VASODILATORS</b>			
Fixed dose Hydralazine/ Isosorbide dinitrate	BiDil	37.5 mg hydralazine/ 20 mg isosorbide dinitrate 3 times daily	75 mg hydralazine/40 mg isosorbide dinitrate 3 times daily
Hydralazine	Apresoline	25-50mg 3 times daily	75 - 100 mg 3 times daily
Isosorbide dinitrate	Isordil	20 mg 3 times daily	40 mg 3 times daily
<b>INOTROPES / IV VASODILATORS*</b>			
Dobutamine	Dobutamine	2 mcg/kg/min	10 mcg/kg/min
Milrinone**	Primacor	0.25 mcg/kg/min	0.75 mcg/kg/min
Nesiritide	Natrecor	Bolus 2 mcg/kg (do not bolus if SBP is < 100 mm Hg); start infusion at 0.005 - 0.01 mcg/kg/min	No greater than 0.01 mcg/kg/min
Nitroglycerin		10 mcg/min. Consider starting at 40 mcg/min for hypertensive patients.	Titrate as tolerated. Rapidly titrate for hypertensive patients as tolerated.
Nitroprusside		0.5 mcg/kg/min	Titrate as tolerated; max. dose 10 mcg/kg/min. Hemodynamic monitoring required

\* If prolonged use (i.e., >48 hrs), consider a **Heart Failure consult**.

\*\* May require dose adjustment for renal failure patients.

Generic Name	Trade Name	Initial Daily Dose	Target Dose
<b>LOOP DIURETIC</b>			
Furosemide	Lasix	40-80 mg IV q8-12h or continuous infusion, Bolus, then start 5-40 mg/hr	Adjust dose based on patient's home regimen and renal function. Give IV dosage equal or exceeding chronic oral dose.

### Notes:

- For synergistic response, consider adding thiazide, HCTZ 25-50 mg daily prn , metolazone 2.5-5 mg daily prn or chlorothiazide 250-500 mg IVPB prn
- Furosemide 40 mg = torsemide 20 mg = bumetanide 1 mg
- Consider torsemide in setting of diuretic resistance
- Adjustments in dose will be based on clinical improvement and/or renal function.
- Aldosterone antagonist indicated for NYHA class II-IV heart failure.