Heart Failure
By Brad Fedor, MD

Definition: Failure of heart to pump blood forward at sufficient rate to meet metabolic demands of peripheral tissues

Epidemiology: 5.1 Million people in US, 23 million people worldwide

Left sided HF:
- Systolic Dysfunction (↑LVEDV, ↑ESV):
  - Contractility: Ischemia/MI, Dilated CM, Chronic Aortic Insufficiency/MR
  - Afterload: AS, HOCM, HTN crisis, Coartation
- High Output HF (↑LVEDV, ↑SV): AV fistula, Paget's Sepsis, Beriberi, Anemia, Thyrotoxicosis
- Decreased Forward Flow: (normal LVEDV): MR, Aortic Insufficiency, VSD
- Diastolic Dysfunction: (normal LVEDV): LVH (HCM 2° to HTN), Ischemia
- Pericardial Disease: (normal LVEDV): R-Sided HF, Tamponade, Constriction

Pathophysiology: Decreased Cardiac Output → Activation of RAAS system + Activation of sympathetic nervous system → Systemic vasoconstriction and volume retention → ↑Venous return → maintenance of CO

Hx: Low Output: Fatigue, weakness, and exercise intolerance
  Congestive: L-sided → dyspnea, orthopnea, paroxysmal nocturnal dyspnea / R-sided → Peripheral edema, RUQ discomfort, bloating, satiety

Framingham Criteria for Heart Failure (2 Major + 1 minor, Sensitivity 97%, Specificity 79%)

<table>
<thead>
<tr>
<th>Major</th>
<th>Minor</th>
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<tbody>
<tr>
<td>Paroxysmal Nocturnal Dypsnea</td>
<td>Bilateral ankle edema</td>
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<tr>
<td>Neck-Vein Distention</td>
<td>Nocturnal cough</td>
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<tr>
<td>Rales</td>
<td>Dyspnea on exertion</td>
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<tr>
<td>Radiographic Cardiomegaly</td>
<td>Hepatomegaly</td>
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<tr>
<td>Acute Pulmonary Edema</td>
<td>Pleural Effusion</td>
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<td>S3 gallop</td>
<td>Decrease in Vital Capacity by 1/3</td>
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<td>Increased Central Venous Pressure (&gt;16cm H2O @ RA)</td>
<td>Tachycardia (HR &gt;120 bpm)</td>
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<tr>
<td>Positive Hepatojugular Reflux</td>
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NYHA Classes
I. No limitation on physical activity, No overt symptoms
II. Comfortable at rest, but ordinary physical activity causes symptoms of heart failure (can’t climb stairs)
III. Comfortable at rest, but ADLs cause symptoms of heart failure
IV. Presence of symptoms even at rest

Stages of HF
A. At high risk for HF, but without structural heart disease or symptoms of HF
   a. Patients with: HTN, Atherosclerotic disease, DM, Obesity, Metabolic syndrome, Cardiotoxin exposure, FHx of CM
B. Structural Heart Disease without signs or symptoms of HF
   a. Patients with: Previous MI, LV remodeling (LVH + low EF), Ax valvular disease
C. Structural Heart Disease with prior or current symptoms of HF
   a. Patients with: Known structural heart disease + HF signs and symptoms
D. Refractory HF
   a. Patients with: Recurrent hospitalizations despite max med treatments, Marked HF symptoms at rest

Diagnosis:
- CXR: Pulm. Edema, pleural effusions → Cardiomegaly, Kerley B-lines (short horizontal lines near periphery of lung near the costophrenic angles)
- BNP/NT-proBNP: Can help exclude HF. Levels ↑ w/ Age, ↓ w/ Obesity or renal function
- Evidence of Decreased organ perfusion: ↑Cr, ↓Na, abnormal LFTs
- EKG: Evidence for CAD, LVH, Heart block
- Echo: ↓EF, ↑Chamber size → Systolic Dysfunction, hypertrophy, abnormal: MV inflow, tissue Doppler, valves, or pericardium
- PA catheterization: ↑PCWP, ↓CO, ↑SVR (low output failure)
Management of HF w/ reduced ejection fraction (HFrEF)

- β-blockers
  - Carvedilol (COMET/COPERNICUS): Non-selective β agonist & α-1 blocker
    - Carvedilol reduces risk of death or HF hospitalization by 31% compared to placebo in class III-IV HF with EF <35%.
    - Caution: DM’s prone to hypoglycemia (masking) & bronchospastic disease
  - Metoprolol XL (MERIT-HF): β-1 selective
    - In patients with symptomatic HFrEF with EF ≤40%, long-acting metoprolol led to a 34% reduction in all-cause mortality

- ACE-Inhibitors/ARBs
  - Enalapril
    - (CONSENSUS) 40% reduction in mortality at 6 months with a NNT of 6
    - (SOLVD) Reduces 4-year mortality by 16% & reduces HF hospitalizations
  - Valsartan
    - (VAL-HEFT) Valsartan improved symptoms & mortality in NYHA2, no benefit with ACE-I

- Mineralocorticoid Receptor Antagonists
  - Eplerenone:
    - (EMPHASIS-HF) Reduced the risk of death & hospitalization in patients with moderate systolic dysfunction and NYHA class II symptoms
    - (EPHESUS) Reduced the rate of mortality among patients with AMI complicated by LV dysfunction & HF symptom
  - Spironolactone (RALES):
    - Patients with HFrEF (EF<35%) and NYHA III-IV symptoms, spironolactone led to a 30% reduction in all-cause mortality

- Special Populations
  - African-American:
    - Isosorbide dinitrate + Hydralazine (A-HEFT) Isosorbide dinitrate plus hydralazine improves survival and reduces hospitalization among black patients with HFrEF
  - High Heart Rate (HR > 70bpm on optimal medical therapy):
    - Ivabradine (SHIFT) Resulted in a 5% absolute reduction in heart failure mortality or hospitalization at 2 years

- Device Therapy - Cardiac Resynchronization Devices (CRT-D):
  - Current AHA/ACC/HRS Implantation Recommendation: LVEF ≤ 35% and QRS duration ≥150 msec with LBBB morphology, NYHA Class II-IV, on GDMT
  - (MADIT-CRT): Patients with LVEF ≤ 30% and QRS duration ≥130 msec, placement of an ICD with cardiac resynchronization therapy reduces the rate of mortality or HF events when compared to ICD placement alone
  - (SCD-HEFT): ICDs reduced mortality compared to conventional therapy or amiodarone among patients with HFrEF