Angina, Acute Coronary Syndrome and Heart Failure

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Chest Pain Syndromes

- Non-Cardiac Chest Pain

- Cardiac Chest Pain
  - Non-Ischemic
  - Ischemic not due to CAD
  - Ischemic due to CAD

Non-Cardiac Chest Pain

- Esophageal Spasm
- GERD
- Musculoskeletal
- Pulmonary Embolism
- Pneumothorax/pneumomediastinum
- Mediastinitis

Cardiac Chest Pain: Non-Ischemic

- Aortic Dissection
- Pericarditis
Non-CAD Ischemic Chest Pain

- Tachycardia
- Aortic Valve Disease (Stenosis)
- Hypertension
- Dilated Cardiomyopathy
- Hypertrophic Cardiomyopathy
- Coronary Artery Dissection
- Cocaine
- Syndrome X (Chest pain, positive treadmill, normal arteries on angiography)-Possibly microvascular angina. Reversible defects on nuclear testing. May be up to 25% of patients with stable angina

Ischemic Chest Pain due to CAD

- Stable Angina:
  - >3 months of a predictable pattern of frequency and precipitating factors
- Crescendo Angina:
  - Angina more frequent, lasts longer, less exertion to trigger
- Unstable Angina
- Non-ST Elevation MI (NSTEMI)
- ST Elevation MI (STEMI)

Ischemic Chest Pain due to CAD

- Stable Angina
- Crescendo Angina
- Unstable Angina: Much higher short term risk of a coronary event
  - Rest angina, severe new onset angina or significant progression of sx pattern
  - Often not possible or necessary to separate patients with US from NSTEMI during initial assessment
- Non-ST Elevation MI (NSTEMI)
- ST Elevation MI (STEMI)
Angina

- Symptoms caused by inadequate oxygenation of the myocardium
- In most situations, symptoms reflect underlying atherosclerosis involving at least 50% luminal diameter of the culprit vessel

Anginal Equivalents

- Dyspnea
- Weakness
- Fatigue
- Syncope

Stable Angina

- Typical angina: chest discomfort
  - lasts minutes
  - precipitated by activity and relieved by rest
- Canadian Classification of Angina
  - I. Angina with strenuous activity
  - II. Angina with moderate activity (more than one flight of stairs)
  - III. Angina with mild activity (< 1 flight of stairs)
  - IV. Angina with any activity and with rest.

CLINICAL ASSESSMENT IN PATIENTS WITH STABLE ANGINA

- Hx suggests intermediate to high probability of CAD
- No
- Low probability of CAD
- Yes
- Hx and dx tests demonstrate noncardiac cause of chest pain?
- Yes
- Reconsider probability of CAD
- Initiate 1st prevention
- No
- Intermediate or high-risk unstable angina?
- Yes
- No
- Recent MI, PTCA, CABG
- Yes
- No
- Conditions present that could cause angina (e.g., severe anemia, hyperthyroidism)
- No
- Yes
- Angina resolves with Rx of underlying condition?
- Yes
- No
- Hx and/or exam suggests valvular, pericardial disease or LV dysfunction?
- No
- Yes
- Echo
- LV abnormality
- Yes
- No
- Severe primary valvular lesion
- Cath
- LV abnormality
- Yes
- No
- High probability of CAD by Hx, Pt, ECG
- Yes
- Echo
- Severe primary valvular lesion
- Cath
- LV abnormality
- Yes
- No
- Indication for prognostic risk assessment?
- Yes
- No
- Empiric Rx
- Yes
The Essentials of Stable Angina Treatment

- A. Aspirin and anti-anginal therapy
- B. Beta blocker and Blood Pressure
- C. Cigarette Smoking and Cholesterol
- D. Diet and Diabetes
- E. Education and Exercise

Is This Chest Pain due to ACS?

- Quality
- Radiation
- Severity
- Location
- Duration
- Precipitating factors
- Response to NTG

Is This Chest Pain due to ACS?

- Hx: Known hx of CAD?
- Hx: If no known CAD, what are risks?
  - Hypertension
  - Hyperlipidemia
  - Diabetes: Remember silent ischemia in 15-60% of diabetics
  - Smoker
  - Family Hx early CAD

Rx OF STABLE ANGINA

<table>
<thead>
<tr>
<th>Anti-anginal drugs</th>
<th>Chest Pain</th>
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<tbody>
<tr>
<td></td>
<td>Intermediate to high probability CAD</td>
</tr>
<tr>
<td></td>
<td>High-risk CAD unlikely</td>
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<tr>
<td></td>
<td>Risk stratification complete or not required</td>
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History suggests vasospastic angina

Meds or conditions that provoke or exacerbate angina?

β-blocker Rx if no contraindication

Ca++ channel blocker if no contraindication

Consider revascularization

Successful Rx?

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No

Yes

No
Short-term Risk of Death or MI in Patients with ACS

**HIGH RISK**: At least 1 present

**INTERM. RISK**: No high risk, but at least 1

**LOW RISK**: No high or intern. risk but at least 1

**HX**
- Age > 75 years
- > 20 min rest pain, ONGOING

**Pain**
- Nontypical angina
- New onset CCSC III or IV angina in the past 2 weeks with mild or high likelihood of CAD
- Nocturnal angina
- New onset CCSC III or IV angina in the past 2 weeks with moderate or high likelihood of CAD
- Increased anginal frequency, severity or duration
- New onset CCSC III or IV angina with onset 2 weeks to 2 months before presentation

**Exam**
- Pulmonary Edema
- Angina with new or worsening mitral regurgitation murmur, new S3, worsening rales or hypotension

**EKG**
- Angina at rest with dynamic ST changes > 0.1mm
- Pathologic Q waves or resting ST depression > 0.1mm
- Normal or unchanged EKG

**Cardiac Marker**
- Troponin > 0.1 ng/mL
- Troponin > 0.01 but < 0.1 ng/mL
- Normal Troponin

Cardiac Markers in ACS

<table>
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<tr>
<th>Cardiac Specific Affected by Renal Function</th>
<th>Initial Detection</th>
<th>Duration of elevation</th>
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<tbody>
<tr>
<td>TnI</td>
<td>TnT</td>
<td>CK-MB</td>
</tr>
<tr>
<td>+++</td>
<td>+++</td>
<td>++</td>
</tr>
<tr>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>4-6 h</td>
<td>4-6 h</td>
<td>3-4 h</td>
</tr>
<tr>
<td>7-10 d</td>
<td>10-14 d</td>
<td>24-36 h</td>
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</table>

Algorithm for Evaluation and Management of Patients Suspected of Having ACS

**Symptoms Suggestive of ACS**

**Noncardiac Diagnosis**
- Chronic Stable Angina
- Possible ACS
- Definite ACS

Algorithm for Evaluation and Management of Patients Suspected of Having ACS

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Algorithm for Evaluation and Management of Patients Suspected of Having ACS

**Symptoms Suggestive of ACS**

**Noncardiac Diagnosis**
- Chronic Stable Angina
Algorithm for Evaluation and Management of Patients Suspected of Having ACS

**SYMPTOMS SUGGESTIVE OF ACS**

Definite ACS

Possible ACS

See Guidelines for ST-Elevation Myocardial Infarction

ST-Elevation

Evaluate for reperfusion therapy

Definite ACS

Possible ACS

See Guidelines for ST-Elevation Myocardial Infarction

ST-Elevation

Evaluate for reperfusion therapy

Possible ACS

Definite ACS

No ST-Elevation

Observe 12 hours or more from symptom onset

ST and/or T wave changes

Ongoing pain

Positive cardiac biomarkers

Hemodynamic abnormalities

Admit to hospital

Manage via acute ischemia pathway

**TIMI Risk Score: UA and NSTEMI**

- **Hx:** Points
  - Age $\geq 65$ 1
  - $\geq 3$ CAD RF 1
  - Known CAD 1
  - ASA in past 7 d 1

- **Presentation:**
  - Severe angina w/in 24 hrs 1
  - Elevated cardiac markers 1
  - $\geq 0.5$ mm ST depress. 1

- **Score**
  - Death/MI/Urgent Revasculariz. 0-1 47
  - 14-day risk of Cardiac Events (%) 2 8.3 3 13.2 4 19.9 5 26.2 6-7 40.9

**Selection of Initial Treatment Strategy: Invasive Versus Conservative Strategy**

**Preferred Strategy**

**Invasive**
- Patient Characteristics
  - Recurrent angina or ischemia at rest or with low-level activities despite intensive medical therapy
  - Elevated cardiac biomarkers
  - New or presumably new ST-segment depression
  - Signs or symptoms of HF or new or worsening mitral regurgitation
  - High-risk findings from noninvasive testing
  - Hemodynamic instability
  - Sustained ventricular tachycardia
  - PCI within 6 months
  - Prior CABG
  - High risk score (e.g., TIMI, GRACE)
  - Reduced left ventricular function (LVEF less than 40%)
  - Low risk score (e.g., TIMI, GRACE)
  - Patient or physician preference in the absence of high-risk features

**Conservative**
- Patient Characteristics
  -.....
Algorithm for Patients with UA/NSTEMI Managed by an Initial Invasive Strategy

Invasive Strategy
- Initiate anticoagulant therapy
  - Acceptable options: enoxaparin or UFH, bivalrudin or fondaparinux

Prior to Angiography
- Initiate at least one or both of the following:
  - Clopidogrel
  - IV GP IIb/IIIa inhibitor
- Factors favoring administration of both clopidogrel and GP IIb/IIIa inhibitor include:
  - Delay to Angiography
  - High Risk Features
  - Early recurrent ischemic discomfort
- Diagnostic Angiography

Algorithm for Patients with UA/NSTEMI Managed by an Initial Conservative Strategy

Conservative Strategy
- Initiate anticoagulant therapy
  - Acceptable options: enoxaparin or UFH or fondaparinux, but enoxaparin or fondaparinux are preferable
- Initiate clopidogrel therapy
- Consider adding IV eptifibatide or tirofiban
- Any subsequent events necessitating angiography?
  - Yes
  - No

TIMI Risk Score for STEMI

<table>
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<tr>
<th>Hx</th>
<th>Points</th>
<th>Risk Score</th>
<th>30 day mortality (%)</th>
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<tbody>
<tr>
<td>Age ≥ 75</td>
<td>3</td>
<td>0</td>
<td>0.8</td>
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<tr>
<td>Age 55-74</td>
<td>2</td>
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<tr>
<td>DM, HTN, angina</td>
<td>1</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Exam</td>
<td>4</td>
<td>3</td>
<td>4.4</td>
</tr>
<tr>
<td>SBP &lt; 100</td>
<td>3</td>
<td>4</td>
<td>7.3</td>
</tr>
<tr>
<td>HR &lt; 100</td>
<td>2</td>
<td>5</td>
<td>12.4</td>
</tr>
<tr>
<td>Killip II/IV</td>
<td>1</td>
<td>6</td>
<td>16.1</td>
</tr>
<tr>
<td>Weight &lt; 67 kg</td>
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<td>7</td>
<td>23.4</td>
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<tr>
<td>Weight &gt; 67 kg</td>
<td>4</td>
<td>8</td>
<td>26.8</td>
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<tr>
<td>EF 0.40 or less</td>
<td>8</td>
<td>8</td>
<td>35.9</td>
</tr>
<tr>
<td>EF &gt; 0.40</td>
<td>5</td>
<td>6</td>
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<tr>
<td>LVEF greater than 0.40</td>
<td>0</td>
<td>7</td>
<td>23.4</td>
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<tr>
<td>EF 0.40 or less</td>
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<td>26.8</td>
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<tr>
<td>EF &gt; 0.40</td>
<td>8</td>
<td>8</td>
<td>35.9</td>
</tr>
<tr>
<td>Diagnostic Angiography</td>
<td></td>
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</tbody>
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Cardiogenic Shock or Killip Class IV

- NO
  - Treat with: ASA
  - IV heparin
  - Consider anti-GPIIb/IIIa
  - Time since pain onset ≤ 12 h
  - Reperfusion tx eligible
  - Persistent sx or ST elevation
  - Thrombolysis or 1° PTCA
  - Medical Tx

- YES
  - Treat with: ASA
  - IV heparin
  - CATH LAB
  - 1° PTCA, IABP
  - Time since pain onset > 12 h
  - Reperfusion tx eligible
  - Persistent sx or ST elevation
  - Thrombolysis or 1° PTCA
  - Medical Tx
**STEMI Treatment: PCI Capable Hospital**

- Patients presenting to a hospital with PCI capability should be treated with primary PCI within 90 min of first medical contact as a systems goal.

**STEMI Treatment: Not PCI Capable**

- Patients presenting to a hospital without PCI capability, and who cannot be transferred to a PCI center and undergo PCI within 90 min of first medical contact, should be treated with fibrinolytic therapy within 30 min of hospital presentation as a systems goal, unless fibrinolytic therapy is contraindicated.

**Thrombolysis in STEMI**

- If cardiac catheterization lab not available or patient declines
- Alteplase, reteplase, streptokinase, tenecteplase
- Indication:
  - Presenting within in 12 hrs of symptom onset
  - 1mm ST elevation in 2 ≥ contiguous leads
  - new LBBB
  - 2mm ST depression in V1-V4 consistent with posterior MI

**Thrombolysis Contraindications**

- Absolute:
  - Prev. cerebral hemorrhage
  - Known cerebral aneurysm or AVM
  - Known intracranial neoplasm
  - Ischemic CVA < 3 months
  - Aortic dissection
  - Active bleeding
  - Significant closed head or facial trauma < 3 months
Thrombolysis Contraindications

• Relative contraindications:
  – Severe uncontrolled HTN >180/100
  – Prior ischemic CVA >3 months
  – Dementia
  – >10 minutes CPR
  – <3 weeks out from major surgery
  – Internal bleeding within 4 weeks
  – Puncture of a non-compressible vessel
  – Active PUD

Diagnostic Testing in CAD

• Exercise treadmill test (ETT)
• Pharmacologic Stress Tests
• Scintigraphy
• Stress Echocardiography
• Coronary Angiogram

Diagnostic Evaluation of Chest Pain: Exercise Treadmill Test

• Exercise is always the preferred method of stress
• Must be able to exercise to at least 85% MPHR
• EKG must be interpretable: Can’t be paced ventricular rhythms, LBBB, preexcitation (WPW), LVH with repolarization abnormalities, >1mm ST depression at baseline

Contraindications to Exercise Stress Testing

Absolute
• MI within 48 hrs
• High-risk Unstable angina
• Decompensated HF
• Uncontrolled dysrhythmia
• Acute PE/DVT
• Acute Aortic Dissection

Relative
• Left main stenosis
• Symptomatic HF
• Severe HTN
• Significant Pulm HTN
• Hypertrophic CM
• Mod. Valvular dz
• Fixed-atrial pacemaker
• Advanced AV block
• Drug or electrolyte induced EKG abnormalities
ETT: Indications

- Indicated in the evaluation of chest pain syndromes
- Assessment of effort tolerance in post-MI, post-revascularization and in patients with valvular disease
- Evaluation of rate control in atrial fibrillation
- Evaluation of response to CAD therapy
- Risk stratification in patients at high risk for CAD
- Risk stratification and exercise prescription in Post-MI patients
- Detection of exercise induced arrhythmias

Exercise Treadmill Test: Halting the Test

- Absolute Indications to Halt Test:
  - ST elevation suspicious for AMI
  - Moderate to severe angina
  - Drop in systolic BP
  - Severe dyspnea
  - Serious arrhythmias: High grade heart block, VT, AF with RVR
- Relative Indications:
  - Pronounced (>2mm) horizontal or downsloping ST depression
  - BP > 250/115
  - Less serious arrhythmias: Exercise induced BBB

Exercise Treadmill Test

- Non-diagnostic: MPHR below 85%
- 1mm of horizontal or downsloping ST depression seen during or after exercise indicates ischemia.
- Duke Score = (exercise time in mins) - (5x the ST segment deviation in mm) - (4x angina index)
  - angina index: 0 is no angina, 1 if angina occurs and 2 is angina is reason for stopping test
  - Duke score ≥ 5 is low risk (0.25% annual mortality), -10 to +4 is intermediate risk (1.25% annual mortality) and ≤-10 denotes high risk for CV events (5% annual mortality)

ETT

- High-Risk Test Results:
  - Inability to perform 6 minutes on Bruce protocol
  - Ischemia early in test
  - >2mm ST depression
  - Sustained ST depression after cessation of exercise
  - Ischemia at low heart rates
  - Flattened or lowered BP response to exercise
  - Angina that limits exercise
  - Serious ventricular arrhythmia
Indications for Stress Scintigraphy

- Exercise ECG uninterpretable for diagnosis of ischemia
  - LBBB
  - WPW
  - LVH
  - Baseline ST-T abnormalities
  - Paced ventricular rhythm
- Exercise ECG of known low sensitivity
  - Post myocardial infarction
  - Single vessel CAD
- Exercise ECG of possible low specificity
  - Vasoregulatory abnormalities
  - ? Women
- Risk stratification

Pharmacologic Stress Tests

- For patients unable to exercise
- Uninterpretable baseline EKG
- Vasodilating Agents: Normal arteries vasodilate and shunt blood from chronically maximally vasodilated diseased vessels
- Dipyridamole (Persantine): Longer half-life
  - Side effects: flushing, AV block, headache, nausea and chest pain
- Adenosine (Adenocard)
  - Contraindications: Mod-severe reactive airway disease, AV block, allergy to aminophylline. No caffeine or theophylline for 24-48 hrs before test

Pharmacologic Stress Tests

- Dobutamine and arbutamine: Positive inotropic agents also affecting HR, increase MVO2.
- Good for patients unable to exercise with mod-severe COPD or asthma and patients with AV block

Imaging with Stress Tests

- Nuclear Imaging: Helps localize and quantify the ischemic myocardium
  - Thallium-201
  - Technetium-99m (sestamibi)
- Echocardiography: Used with Exercise or pharmacologic stress
  - High-risk features: diminished EF with stress, diminished resting EF, 2 or more segmental wall motion abnormalities, failure to augment contractility at low heart rate or after dobutamine dose
Angiography

• Selective coronary angiography remains the gold-standard diagnostic test for evaluation of CAD

Coronary Angiography: Complications and Contraindications

• Complications
  – Mortality 0.11%
  – MI 0.05%
  – CVA 0.07%
  – Arrhythmia 0.38%
  – Vascular 0.43%
  – Contrast Rxn 0.37%
  – Hemodynamic 0.26%
  – Perf. Heart 0.03%
  – Other 0.28%
  – Total 1.7%

• Contraindications:
  – Coagulopathy
  – Renal Failure: Pre-treatment with NAC, bicarbonate
  – Dye Allergy
  – Infection
  – Uncontrolled HTN
  – Decompensated Heart Failure

Anti-Platelet Therapy after PCI

• Bare Metal Stent (BMS): Clopidogrel + ASA for a minimum of 1 month and ideally up to 12 months.
  – If at high risk for bleeding: Dual therapy for a minimum of 2 weeks

• Drug Eluting Stent (DES): Clopidogrel + ASA for at least 12 months
  – Therapy beyond one year may be considered

Indications for CABG

• Class I Recommendations for CABG
• Significant stenosis (>70%) of:
  – Left Main Coronary Artery
  – Left Main Equivalent = Proximal LAD + proximal left circumflex
  – 3 vessel disease
Heart Failure

- 5.2 million Americans with heart failure
- >500,000 new diagnoses per year
- Leading cause of hospitalization in people >65 years
- High Mortality

New Classification System

2001 ACC and AHA

- **Stage A:** At high risk for HF but without structural heart disease or HF symptoms
- **Stage B:** At risk for heart failure with structural heart disease without signs or symptoms
- **Stage C:** Structural heart disease with prior or current symptoms of HF
- **Stage D:** Refractory HF requiring specialized interventions

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
NHYA Stages

- Schema based on functional capacity, varies with time
- **Class I**: Cardiac disease but with virtually no limitation on physical activity
- **Class II**: Cardiac disease that causes slight reduction of physical activity (dyspnea with overt exertion)
- **Class III**: Cardiac disease that causes marked reduction of physical activity (dyspnea with activities of daily living)
- **Class IV**: Cardiac disease that causes inability to perform any physical activity (dyspnea at rest)

Heart Failure Etiologies

- CAD
- HTN
- Dilated Cardiomyopathies
- Valvular
- Tachycardias (Most commonly Afib, Aflutter)
- Idiopathic/Familial
- Substance abuse (Cocaine, ETOH, amphetamine)
- Hyperthyroidism
- Infiltrative (amyloid, Chagas, hemochromatosis)
- HIV
- Peripartum
- Sleep disorders
- Rheumatologic

Reduced EF vs Normal EF HF

- 1/3 to 1/2 of heart failure patients have a normal EF
- HF with normal EF more common in the elderly and women
- Vast majority of RCTs performed in patients with systolic dysfunction (EF <45%)
- Little evidence based treatment for HF with normal EF.
- Class I Recommendations:
  - Control of HTN and ventricular rate in atrial fibrillation
  - diuretics to control pulmonary congestion and peripheral edema

Differential Diagnosis in Patient with HF and Normal LVEF with Symptoms

- Incorrect diagnosis of HF
- Inaccurate measurement of LVEF
- Primary valvular disease
- Restrictive (infiltrative) cardiomyopathies
- Amyloidosis, sarcoidosis, hemochromatosis
- Pericardial constriction
- Episodic or reversible LV systolic dysfunction
- Severe hypertension, myocardial ischemia
- HF associated with high metabolic demand (high-output states)
- Anemia, thyrotoxicosis, arteriovenous fistulae
- Chronic pulmonary disease with right HF
- Pulmonary hypertension associated with pulmonary vascular disorders
- Atrial myxoma
- Diastolic dysfunction of uncertain origin
- Obesity
Symptoms and Signs of HF

- **Symptoms**
  - Orthopnea
  - PND
  - Fatigue
  - Decreased exercise tolerance
  - Nocturnal cough

- **Signs**
  - Elevated JVP
  - S3 gallop
  - Displaced PMI
  - Rales
  - Narrow pulse pressure
  - Pulsatile hepatomegaly
  - Ascites
  - Peripheral edema

Precipitating Factors in HF Exacerbations

- Myocardial Ischemia or infarction
- Atrial fibrillation or other SVT
- Uncontrolled HTN
- Valvular Disease
- Ventricular Tachycardia
- Anemia
- Sepsis
- Medication or diet noncompliance
- Thyroid Dz
- Adverse Drug Effects (NSAIDs)
- Substance Abuse

Laboratory testing in HF

- **BNP:** Elevated in HF (low EF>1%), not specific. >100 helpful in distinguishing cardiac from pulmonary source of dyspnea
- **Serum Na:** Often decreased, indicating poor perfusion
- **Serum creatinine:** May be elevated, indicating poor perfusion
- **TFTs**
- **Consider HIV test**
- **Serum Fe:** If suspect hemochromatosis
- **Hgb/Hct:** Anemia may lead to high output failure

At Risk for Heart Failure

- **Stage A:** High risk for HF without structural heart disease or symptoms of HF
  - **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)

- **Stage B:** Structural heart disease without symptoms of HF
  - **Goals:** All measures under stage A
  - **Drugs:** ACEI or ARB in appropriate patients (see text), beta-blockers in appropriate patients
  - **Devices in Selected Patients:** Implantable defibrillators

- **Stage C:** Structural heart disease with prior or current symptoms of HF
  - **Goals:** All measures under stages A and B
  - **Drugs:** Diuretics for fluid retention, ACEI, beta-blockers
  - **Devices in Selected Patients:** Biventricular pacing, Implantable defibrillators

- **Stage D:** Refractory HF requiring specialized interventions
  - **Goals:** Appropriate measures under stages A, B, C
  - **Options:** Compassionate care, hospice, end-of-life care, heart transplant, mechanical support, experimental surgery or drugs

Heart Failure

- **Stage A:** High risk for HF without structural heart disease or symptoms of HF
  - **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)

- **Stage B:** Structural heart disease without symptoms of HF
  - **Goals:** All measures under stage A
  - **Drugs:** ACEI or ARB in appropriate patients (see text), beta-blockers in appropriate patients
  - **Devices in Selected Patients:** Implantable defibrillators

- **Stage C:** Structural heart disease with prior or current symptoms of HF
  - **Goals:** All measures under stages A and B
  - **Drugs:** Diuretics for fluid retention, ACEI, beta-blockers
  - **Devices in Selected Patients:** Biventricular pacing, Implantable defibrillators

- **Stage D:** Refractory HF requiring specialized interventions
  - **Goals:** Appropriate measures under stages A, B, C
  - **Options:** Compassionate care, hospice, end-of-life care, heart transplant, mechanical support, experimental surgery or drugs
Stage A: Treatment

- Treat underlying risk factors
- Control ventricular rate or restore sinus rhythm in patients with SVTs
- Echocardiogram in:
  - strong family history of cardiomyopathy
  - those receiving cardiotoxic interventions
  - routine periodic echocardiogram not recommended in other asymptomatic patients
- ACE inhibitors or ARB

Stage B: Treatment

- Therapy: All measures under Stage A PLUS
- Drugs for routine use:
  - ACE Inhibitors (ARB if ACEI intolerant)
  - Beta blockers (any prior MI, no prior MI but with reduced LVEF)
- CABG if Left Main, left main equivalent and or 3V CAD and low EF
- Valve replacement in accordance with contemporary guidelines
- ICD (See ICD specific guidelines)

Stage C: Treatment

- All measures under Stage A and Stage B PLUS
- Dietary salt restriction, weight monitoring, exercise training
- Drugs for routine use:
  - ACE I (ARB if intolerant),
  - Beta Blocker,
  - add Diuretics for fluid retention
- Selected patients: Aldosterone antagonist, Digitalis, Hydralazine/nitrates
- Selected patients: Biventricular pacing/Resynchronization, ICDs

Stage D

- Therapy: Appropriate tx from Stages A-C +
- Decision regarding goals of care:
  - End of life/hospice care
  - Heart transplantation
  - chronic inotropes
  - permanent mechanical support
  - experimental protocols
**Heart Failure Therapies: Acute Pulmonary Edema**

- Nitroglycerin: Avoid if SBP < 90
- Morphine: May cause hypotension
- Diuretics: IV furosemide
- Nitroprusside: Not in acute MI due to coronary steal
- Inotropes: dobutamine or milrinone
- Neseritide: Synthetic BNP, caution with renal dz, only for inpatient use. $$

**Specific HF Therapies: ACEI and ARB**

- All patients in Stages A-D
- Decrease morbidity and mortality
- ARB if can not tolerate ACEI due to cough

**Specific HF Therapies: Beta Blockers**

- Stages B-D
- Mortality benefit (ARR 5.5%)
- Avoid in acute decompensation
- Start low dose and double dose every 2-4 weeks until target reached
- Not a class effect (Atenolol without benefit)
- Drugs and doses:
  - Carvedilol goal 25mg daily
  - Metoprolol Succinate (Toprol XL) 200mg daily
  - Bisoprolol 10mg daily

**Specific HF Therapies: Aldosterone Antagonists**

- Stage C and D
- Spironolactone (Aldactone) and eplerenone (Inspra)
- ARR 11% over 2 years
- Side effects: Hyperkalemia--requires close monitoring of potassium, caution with CKD
- Increased mortality outside of study protocols due to hyperkalemia
### Specific HF Therapies: Isosorbide dinitrate and hydralazine

- Stage C and D
- Isosorbide dinitrate (Isordil) and hydralazine combination noted effective in African Americans in post-hoc analysis
- Not meant to replace usual therapies
- Class IIa-B recommendation for patients already on ACEI and beta blocker with persistent symptoms
- Class IIb-C recommendation for patients who cannot tolerate ACEI or ARB

### Specific HF Therapies: Diuretics

- Stages C and D
- No large RCTs, no known mortality benefit
- Usual drugs:
  - furosemide: PO, IV intermittent therapy, continuous infusion for severe/refractory exacerbations
  - bumetanide: IV or PO
  - metolazone: PO, enhanced sodium excretion when combined with loop diuretics
  - ethacrynic acid: PO, IV ototoxicity

### Specific HF Therapies: Digoxin

- Stage C and D Systolic Failure
- Decreases hospitalization rate in patients already on ACEI, beta blockers and diuretics
- Dose 0.125 to 0.25mg daily
- Serum digoxin level goal of 0.5 to 1.0mg/L

### ICDs: Class I Recommendations

- Cardiac Arrest due to VF or VT not due to reversible cause
- Spontaneous sustained VT with structural heart dz or w/o structural heart dz who fail medical therapy
- NSVT with CAD, prior MI, LV dysfunction and inducible VF or sustained VT at EPS that is not suppressible with class I anti-arrhythmics
- Syncope with hemodynamically significant sustained VT or VF induced at EPS
Resynchronization

• Class I A Recommendation: LVEF<35%, sinus rhythm, NYHA III or ambulatory IV despite optimal medical therapy with cardiac dyssynchrony defined by QRS duration > 120ms should receive cardiac resynchronization via a biventricular pacemaker.

References


References

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• Gutierrez C and Blanchard DG, Diastolic Heart Failure: Challenges of Diagnosis and Treatment. American Family Physician, June 1, 2004; Vol. 69, Number 11: 2609-2615.