CCHCS Care Guide: Chest Pain

GOALS - EVALUATION OF CHEST PAIN BY PHONE OR AT THE INSTITUTION

◊ Appropriately identify and refer patients when Acute Coronary Syndrome (ACS) or other life-threatening emergencies suspected

◊ Identify and manage patients with non-life threatening causes of chest pain

◊ Appropriately document clinical decision-making whether evaluating patient by phone or onsite

◊ Coordinate with cardiologist to appropriately evaluate, and manage patients with recurrent chest pain.

DIAGNOSTIC CRITERIA/EVALUATION

- History (description of CP, cardiac risk factors, prior cardiac hx), Brief PE, 12 lead EKG to be addressed with each patient with chest pain whether taking call from home or on-site evaluation.

- No single feature of a patient's history, risk factors, exam or EKG can rule out or rule in ACS

- Appropriately identify and refer patients when Acute Coronary Syndrome (ACS) or other life-threatening emergencies suspected

- Identify and manage patients with non-life threatening causes of chest pain

- Appropriately document clinical decision-making whether evaluating patient by phone or onsite

- Coordinate with cardiologist to appropriately evaluate, and manage patients with recurrent chest pain.

Contents

Diagnostic Criteria/Evaluation .............................................. 1
Treatment Options/Monitoring/likelihood ACS ......................... 2
Evaluation of Undiagnosed Acute Chest Pain ........................... 3
Follow-up of CP Patient (TTA/ED/Hosp) ................................. 4
Medications ............................................................................ 5
ACC/AHA Clinical Decision making ...................................... 6
Differential Diagnosis
  - Chest Pain Descriptors .................................................. 7
  - Alternative Diagnoses/Noncardiac CP .......................... 8
  - Esophageal/Musculoskeletal ......................................... 9
  - DDx life-threatening causes of chest pain ........................ 10
  - Important EKG changes ............................................. 11
  - Noninvasive risk stratification ..................................... 12
Patient Information ............................................................... 13

ASSESS CHEST PAIN

- Quality, location, radiation, duration, provoking or relieving factors or associated symptoms (See p.7)

ASSESS CARDIAC RISK FACTORS

- Traditional: DM, hyperlipidemia, HTN, Smoking, male, age >40 years, family history of premature CHD
- Nontraditional: Obesity, sympathomimetic drug use, coronary artery spasm, estrogen or Birth Control Pill use, collagen vascular disease, cardiomyopathy, H/O chest radiation, sickle cell, chronic kidney disease, rheumatoid arthritis/inflammatory arthritides

PRIOR CARDIAC HX

- History of ischemic heart disease and any previous treatment or investigations of chest pain

PHYSICAL EXAM

- Vital signs including oxygen saturation, cardiac (murmur, rubs, edema), pulmonary (rhonchi, rales, wheezes): per nursing report if not on-site evaluation

EKG

- A normal EKG markedly reduces the probability that chest pain is due to acute myocardial infarction, but it does not exclude a serious cardiac etiology (particularly unstable angina).

ACS MEDICAL DECISION MAKING

- No one chest pain descriptor, history or exam element, or EKG finding can rule in or rule out ACS.
- Use medical decision making/clinical judgment when evaluating a patient.
- Tools exist to assist in risk-stratifying patients, see pgs 2 and 6
- Document your medical decision-making including working diagnosis (if available) in the Assessment/Plan both when evaluating patient onsite or by phone

RULE OUT Non-ACS LIFE THREATENING CAUSES OF CHEST PAIN* (SEE PG 10)

- Consider serious non-ACS causes especially if co-morbidities and risk factors for disease are present
  - Consider aortic dissection if sudden onset ripping/tearing pain
  - Consider pulmonary embolus or pneumothorax with sudden onset pain and dyspnea
  - Consider pericarditis/pericardial tamponade if pleuritic or positional anterior pain
  - Consider esophageal rupture if recent vomiting or EGD or concomitant respiratory and GI symptoms

- Prompt (Code 3) transport to ED if above diagnoses suspected based on history and RN evaluation, especially if vital signs abnormal
- Consider CXR in addition to EKG and PCP physical exam (document heart sounds and breath sounds) if clinical suspicion lower for above life-threatening conditions, but no alternative diagnosis established.

*“Identifying Chest Pain Emergencies in the Primary Care Setting” in Primary Care Winters and Katzen 33(2006) 625-642

Information contained in the guidelines is not a substitute for a health care professional's clinical judgment. Evaluation and treatment should be tailored to the individual patient and the clinical circumstances. Furthermore, using this information will not guarantee a specific outcome for each patient.
**TREATMENT OPTIONS/MONITORING**

If ACS suspected:
- Call for immediate code 3 transport to higher level of care*
- Start patient on oxygen (generally 2L by nasal cannula), give 325 mg of ASA (chewed) if no contraindication
- Establish IV access
- SL NTG (0.3 or 0.4 mg).
  ◊ Watch for signs of hypotension. If not hypotensive may repeat if patient can tolerate doses.
  ◊ Relief of chest pain with NTG is **not specific for angina**; a similar response may be seen w/ GI problems
    - Conversely a GI “cocktail” does not reliably differentiate between ACS and GI etiologies, which may coexist
- Prepare pertinent records for transport including ECG’s, cardiology notes, procedure reports, and recent PC progress notes
- Monitor patients VS every 10 minutes prior to transfer. 12-lead EKG every 15-30 minutes while awaiting transfer.
- Cardiac monitor if available. Have AED and emergency response bag available.

*Alternate (Code 2) transfer of patient to a specific facility is sometimes indicated in cases such as:
- Patients who present with findings consistent with an established diagnoses (such as stable coronary heart disease) who have a relationship with outside hospital/cardiologists and whose cardiologist requests specific facility
- Discussion with accepting Emergency Department physician or cardiologist reveals anticipated care is best provided at a specific facility.
- Patients whose symptoms have resolved though index of suspicion remains increased for unstable angina/ACS

**Institution Support**
- Maintain 24-7 urgent-emergent cardiology consultation contact information in TTA
- Provide scanning capability in TTA. Scanned EKGs can be sent via email to CCHCS employees with CCHCS email addresses. Encryption should be used when available,
- Provide faxing capability in TTA. Patient information including EKGs can be sent to non-CCHCS consultants via fax if no protected health information is contained in the records sent. Patient care documents can also be scanned and sent to non-CCHCS consultants if the email is encrypted and no protected health information is contained in the documents sent.
- Provide access to prior EKGs in the TTA, limited to the minimum necessary information and those with a need to know

**ACS more likely when:**
- Primary symptom is pain/discomfort in chest
- Current pain similar to prior documented angina
- Patient has Coronary Heart Disease or equivalent:
  - H/O myocardial infarction, known CHD, AAA
  - Cerebrovascular or peripheral vascular disease
  - Diabetes or chronic renal disease
- Transient mitral regurgitation or hypotension or diaphoresis or pulmonary edema (rales)
- New (or presumably new) ST deviation (≥ 1 mm)
  - Either depression or elevation
- New T wave inversion in multiple precordial leads
- New left bundle branch block treated as ST elevation

**ACS less likely when:**
- Primary or sole location in the mid or lower abdominal region
- Any discomfort localized with one finger
- Any discomfort reproduced by movement or palpation
- Constant pain lasting for days
- Fleeting pains lasting for a few seconds or less
- Pain radiating into lower extremities or above the mandible
- Under Age 40
- No known Coronary Heart Disease or no equivalent:
  - No H/O myocardial infarction, known CHD, AAA
  - No cerebrovascular or peripheral vascular disease
  - No diabetes or chronic renal disease
- Pain not worsened during exercise
- Patient assumes pain is not cardiogenic
- Normal EKG

*“Identifying Chest Pain Emergencies in the Primary Care Setting” in Primary Care Winters and Katzen 33(2006) 625-642*
Evaluation of Undiagnosed Acute Chest Pain

Patient presents with chest pain

Chest: Can include upper abdomen, chest, back, throat, jaw, shoulders, upper arms
Pain: "Discomfort" or other abnormal sensation such as "gas", "indigestion", "fullness", "pressure", "tightness" or "heaviness"

Purpose of initial triage is to avoid delay in identification of ACS or other life threatening conditions not to diagnose common, non-emergent causes of chest pain.

Rapid assessment of patient-Vital Signs

"Chest Pain" quality, location, radiation, duration, provoking or relieving factors or associated sx
Assess usual cardiac risk factors: DM, HTN, Smoking, Lipids, FHx
Prior cardiac history, other significant PMHx, cocaine or meth use
Brief PE

ACS Suspected?

No

Further Risk Stratify Obtain ECG

Yes

Uncertain

Non ACS CP

Evidence of other life threatening etiologies of chest pain including:
- pulmonary embolus
- pericarditis
- cardiac tamponade
- aortic dissection
- tension pneumothorax
- esophageal rupture

(See pg 10)

Further evaluation as indicated. Follow up with PCP in 1-5 days.

If ED or outside admitting provider recommends further expedited evaluation, the institution should coordinate with outside facility to arrange appropriate testing location and timing.

Risk Characteristics of ACS

- Typical Pain severe or ongoing ≥20 minutes
  - Typical pain present in the last 2 days
  - New chest pain at rest or with minimal exertion
  - Severe epigastric pain (nontraumatic in origin)
  - Pain similar to prior documented MI/angina

- Associated symptoms: extreme fatigue, dyspnea, LOC, diaphoresis, N/V, weakness, dizziness, lightheadedness,

- Primary symptom is discomfort in chest or left arm
  - Patient has known hx of CHD or MI
  - Presence of cardiac risk factors: smoking, significant FHx
  - Male, age >40, DM, Extracardiac vascular disease

- ECG: Compare with old ECG if available
  - New (or presumably new) ST deviation (≥ 1 mm)
  - New T wave inversion in multiple precordial leads
  - New LBBB assume STEMI
  - Fixed Q waves
  - ST depression ≥ 5 mm or T wave inversion > 1 mm

Not Suspected

Further evaluation as indicated. Follow up with PCP in 1-5 days.

Follow up of TTA / ER / Hospital Evaluation of Chest Pain

PCP follow up within 5 days, or sooner based on recommendations from TTA / ED / hospital evaluation and clinical judgment of PCP

Has patient had cardiac evaluation (testing or evaluation by a specialist) of chest pain in last 12 months?

- Yes
  - Does patient have low risk* cardiac evaluation in last 12 months?
    - Yes
      - Urgent cardiology RFS
    - No
      - Are new objective findings suggestive of possible cardiac etiology?
        - Yes
          - Urgent cardiology RFS
        - No
          - Has patient had three or more similar episodes in the last six months?
            - Yes
              - Routine cardiology RFS and consider non-cardiac process
            - No
              - Does patient have medium or high risk* cardiac evaluation in last 12 months?
                - Yes
                  - Urgent cardiology RFS
                - No
                  - Note:

Subjective and objective findings suggestive of non-cardiac process?

- Chest Wall: Evaluate for musculoskeletal cause: Costochondritis - clinical evaluation;
  Skin and sensory nerves – clinical evaluation; consider imaging.
  Rheumatic and non-rheumatic systemic disease consider CBC, ESR, ANA, RF, HLA-B27, etc.

- GI: Evaluate for gastrointestinal causes of chest pain: Medication-induced esophagitis – review meds GERD – trial of acid-suppressive therapy;
  consider UGI vs. EGD;
  Esophageal rupture, mediastinitis, foreign body – consider imaging vs EGD;
  Esophageal hyperalgesia, abnormal motility, achalasia, other – see UpToDate

- Pulmonary: Evaluate for pulmonary causes of chest pain; Lung parenchyma, pleura and pleura space – review CXR; consider other imaging (e.g. high sensitivity CT)
  Pulmonary vasculature – consider echocardiography
  Mediastinal disease – consider imaging vs. pulmonary consultation

*None of the previous: Evaluate for psychosomatic causes of chest pain; consider mental health consultation.

*See page 12 for details
### Medications:

<table>
<thead>
<tr>
<th>Medication/Therapy</th>
<th>Adult Dosage</th>
<th>Indications/Precautions</th>
</tr>
</thead>
</table>
| **Aspirin**        | 160 mg to 325 mg tablet taken as soon as possible and then daily (chewing preferable to swallowing)  
- May use rectal suppository for patients who cannot take orally  
- Give within minutes of arrival.  
- Higher doses (1000 mg) interfere with prostacyclin production and may limit positive benefits. |  
- Administer to all patients with suspected ACS unless contraindicated  
- Blocks formation of thromboxane A2, which causes platelets to aggregate, arteries to constrict. This reduces overall AMI mortality, reinfarction, nonfatal stroke.  
- Any person with symptoms (pressure, heavy weight, squeezing, crushing) suggestive of ischemic pain.  
- Use with caution in patients with active ulcer disease.  
- Contraindicated in patients with known hypersensitivity to aspirin. |
| **Nitroglycerin**  | Sublingual Route  
1 tablet (0.3 to 0.4 mg); repeat every 5 minutes. |  
- Initial anti-anginal for suspected ischemic pain.  
- Hypertensive urgency with ACS.  
Precautions:  
- With evidence of AMI, limit systolic blood pressure to drop 10% if patient is normotensive, 30% drop if hypertensive, and avoid drop below 90 mm Hg.  
- Patient should sit or lie down with receiving this medication.  
Contraindications:  
- Hypotension  
- Concomitant phosphodiesterase inhibitor use  
- Severe bradycardia or severe tachycardia  
- RV infarction |
| **Oxygen**         | Device | Flow Rate | O2 (%) |  
Delivered from portable tanks or installed, wall-mounted sources through delivery devices.  
Nasal prongs | 1-6 L/min | 24-44  
Venturi mask | 4-8 L/min | 24-40  
Partial rebreather mask | 6-10 L/min | 35-60  
Bag-mask | 15 L/min | up to 100 |  
- Any suspected cardiopulmonary emergency, especially (but not limited to) complaints of shortness of breath and suspected ischemic chest pain.  
- Note: Pulse oximetry provides a useful method of titrating oxygen administration to maintain physiologic oxygen saturation (see precautions).  
Precautions:  
- Observe closely when using with pulmonary patients known dependent on hypoxic respiratory drive (rare).  
Pulse oximetry inaccurate in low cardiac output states or with vasoconstriction. |
| **Morphine**      | IV Infusion  
2 to 4 mg IV (over 1 to 5 minutes) every 5 to 30 minutes. |  
- Chest pain with ACS unresponsive to nitrates  
- Acute cardiogenic pulmonary edema (if blood pressure is adequate).  
Precautions:  
- Administer slowly and titrate to effect.  
- May compromise respiration; therefore, use with caution in the compromised respiratory state of acute pulmonary edema.  
- Causes hypotension in volume-depleted patients.  
- Reverse, if needed, with naloxone (0.4 to 2 mg IV). |
## AMERICAN COLLEGE OF CARDIOLOGY/AMERICAN HEART ASSOCIATION GUIDELINES: LIKELIHOOD THAT SIGNS AND SYMPTOMS REPRESENT AN ACUTE CORONARY SYNDROME SECONDARY TO CORONARY HEART DISEASE

<table>
<thead>
<tr>
<th>High Likelihood ACS</th>
<th>Intermediate Likelihood ACS</th>
<th>Low Likelihood ACS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any of the following features</td>
<td>Absence of high likelihood features and any of the following</td>
<td>Absence of intermediate likelihood features but may have</td>
</tr>
</tbody>
</table>

### HISTORY

- Chest or left arm pain or discomfort as chief symptom reproducing prior documented angina
- Known history of CHD including MI

### EXAMINATION

- Transient mitral regurgitation, hypotension, diaphoresis, pulmonary edema, or rales
- Extracardiac vascular disease
- Chest discomfort reproduced by palpation

### EKG

- New or presumably new transient ST segment deviation (≥0.05mV) or T wave inversion (≥0.2mV) with symptoms
- Fixed Q waves
- Normal EKG or T wave flattening or inversion in leads with dominant R waves

### Clinical Decision Rule for Identifying Patients with Chest Pain Caused by CHD

<table>
<thead>
<tr>
<th>Variable</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 55 years or older in men; 65 years or older in women</td>
<td>1</td>
</tr>
<tr>
<td>Known CHD or cerebrovascular disease</td>
<td>1</td>
</tr>
<tr>
<td>Pain not reproducible by palpation</td>
<td>1</td>
</tr>
<tr>
<td>Pain worse during exercise</td>
<td>1</td>
</tr>
<tr>
<td>Patient assumes pain is cardiogenic</td>
<td>1</td>
</tr>
</tbody>
</table>

### Total Points:

<table>
<thead>
<tr>
<th>Points</th>
<th>Patients with CHD</th>
<th>Patients without CHD</th>
<th>Likelihood ratio</th>
<th>Predictive value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 1</td>
<td>3</td>
<td>542</td>
<td>0.0</td>
<td>0.6</td>
</tr>
<tr>
<td>2 or 3</td>
<td>91</td>
<td>659</td>
<td>0.9</td>
<td>12.1</td>
</tr>
<tr>
<td>4 or 5</td>
<td>94</td>
<td>56</td>
<td>11.2</td>
<td>62.7</td>
</tr>
</tbody>
</table>


Mayo Clinic Proceedings March 2010;85(3):284-299 "The basic clinical tools of history, physical examination, and electrocardiography are currently widely acknowledged to allow early identification of low-risk patients who have less than 5% probability of acute coronary syndrome."
## Differential Diagnosis of Chest Pain

<table>
<thead>
<tr>
<th>Chest Pain Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Quality</strong></td>
</tr>
<tr>
<td>Cardiac pain: May be reported as discomfort rather than pain. Terms often used squeezing, tightness, pressure, constriction, strangling, burning, heart burn, fullness in the chest, band-like sensation, knot in the center of the chest, lump in throat, ache, heavy weight on chest (elephant sitting on chest), like a bra too tight.</td>
</tr>
<tr>
<td><strong>Location/Radiation</strong></td>
</tr>
<tr>
<td>Cardiac pain often diffuse discomfort that may be difficult to localize. Can radiate to upper abdomen (epigastric), shoulders, either or both arms (upper and forearm), wrist, fingers, neck and throat, lower jaw and teeth and rarely to the back (specifically the interscapular region).</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
</tr>
<tr>
<td>Angina generally lasts for 2-5 minutes, not a fleeting discomfort that lasts only for a few seconds or less than a minute. It generally does not last for 20 to 30 minutes, unless the patient is experiencing ACS, especially MI.</td>
</tr>
<tr>
<td><strong>Provoking/Relieving Factors</strong></td>
</tr>
<tr>
<td>Cardiac pain can be provoked by physical activity, cold, emotional stress, sexual intercourse, meals, or lying down. Patients should be questioned about cocaine use (risk of a MI ↑24x in the 60 minutes after cocaine use). Cardiac pain often relieved by rest. Other etiologies:</td>
</tr>
<tr>
<td>• Discomfort that reliably occurs with eating is suggestive of upper gastrointestinal disease.</td>
</tr>
<tr>
<td>• Pain made worse by swallowing is likely of esophageal origin.</td>
</tr>
<tr>
<td>• Body position or movement, or deep breathing, may exacerbate chest pain of musculoskeletal origin.</td>
</tr>
<tr>
<td>• Pleuritic chest pain is worsened by respiration and may be exacerbated when lying down.</td>
</tr>
<tr>
<td>• The pain of pericarditis typically improves with sitting up and leaning forward.</td>
</tr>
<tr>
<td><strong>Special Considerations</strong></td>
</tr>
<tr>
<td>• Women may present more frequently than men with atypical chest pain and symptoms.</td>
</tr>
<tr>
<td>• Diabetic patients may have atypical presentations due to autonomic dysfunction.</td>
</tr>
<tr>
<td>• Chronic kidney disease patients often have multiple risk factors for cardiovascular disease.</td>
</tr>
<tr>
<td>• Elderly patients may have atypical symptoms such as generalized weakness, stroke, syncope, or a change in mental status.</td>
</tr>
<tr>
<td>• Maintain objectivity: studies indicate patients who present in “histrionic” fashion are far less likely to be suspected of cardiac disease and are frequently misdiagnosed.</td>
</tr>
<tr>
<td>• Patients with new or presumably new left bundle branch block should be treated similarly to those with ST-segment elevation.</td>
</tr>
<tr>
<td>• Avoid over-reliance on an alternative diagnosis. In patients evaluated for chest pain, it was shown that those with a &quot;clear-cut&quot; alternative noncardiac diagnosis had a 4 % rate of ACS at 30 days.</td>
</tr>
<tr>
<td>• Certain populations also have increased risk for missed ACS. Four populations that are more likely to be discharged (from the emergency department) with ACS include: Women &lt;55 years old, nonwhite patients, dyspnea as the primary complaint, and patients with a normal EKG.</td>
</tr>
</tbody>
</table>

### Noncardiac chest pain

In two systematic reviews, the following characteristics were found to be more typical of nonischemic chest discomfort: however, some patients with ACS present with atypical types of chest pain:

- Pleuritic pain, sharp or knife-like pain related to respiratory movements or cough
- Primary or sole location in the mid or lower abdominal region
- Any discomfort localized with one finger
- Any discomfort reproduced by movement or palpation
- Constant pain lasting for days
- Fleeting pains lasting for a few seconds or less
- Pain radiating into the lower extremities or above the mandible
### Differential Diagnosis of Chest Pain

**Non-Ischemic Cardiovascular**
- Aortic dissection
- Myocarditis
- Pericarditis

**Pulmonary**
- Pleuritis
- Pneumonia
- Pulmonary embolus
- Tension pneumothorax

**Gastrointestinal**
- Biliary cholangitis
  - Cholecystitis
  - Choledocholithiasis
  - Colic
- Esophageal
  - Esophagitis
  - Spasm
  - Reflux Rupture
- Pancreatitis
- Peptic ulcer disease
  - Nonperforating
  - Perforating

**Chest Wall**
- Cervical disc disease
- Costochondritis
- Fibromyalgia
- Herpes zoster (before the rash)
- Neuropathic pain
- Rib fracture
- Sternoclavicular arthritis

**Psychiatric**
- Affective disorders (eg, depression)
  - Hyperventilation
  - Panic disorder
  - Primary anxiety
- Somatiform disorders
  - Thought disorders (eg, fixed delusions)

### Characteristics of Major Noncardiac Causes of Chest Pain

<table>
<thead>
<tr>
<th>Condition</th>
<th>Duration of Pain</th>
<th>Character of Pain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastroesophageal reflex</td>
<td>5 to 60 min</td>
<td>Visceral, substernal, worse with recumbency, no radiation, relief with food, antacids</td>
</tr>
<tr>
<td>Esophageal spasm</td>
<td>5 to 60 min</td>
<td>Visceral, spontaneous, substernal, associated with cold liquids, relief with nitroglycerin</td>
</tr>
<tr>
<td>Peptic ulcer</td>
<td>Hours</td>
<td>Visceral, burning, epigastric, relief with food, antacids, normal EKG</td>
</tr>
<tr>
<td>Biliary disease</td>
<td>Hours</td>
<td>Visceral, epigastric, interscapular colic, occurs after meals</td>
</tr>
<tr>
<td>Cervical disc</td>
<td>Variable</td>
<td>Superficial, positional, arm, neck</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>Variable</td>
<td>Superficial, positional, worse with movement, local tenderness</td>
</tr>
<tr>
<td>Hyperventilation</td>
<td>2 to 3 min</td>
<td>Visceral, substernal, tachypneic, anxious</td>
</tr>
<tr>
<td>Thyroiditis</td>
<td>Persistent</td>
<td>Aggravated by swallowing, neck, throat tenderness</td>
</tr>
</tbody>
</table>

Pathophysiology and clinical presentation of ischemic chest pain: Philip J. Podrid, MD, Author, UTD version 19.1: January 2011
### Characteristics of isolated musculoskeletal chest pain syndromes

<table>
<thead>
<tr>
<th>DISORDER</th>
<th>CLINICAL MANIFESTATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Costosternal syndromes (costochondritis)</td>
<td>Multiple areas of tenderness that reproduce the described pain, usually in the upper costal cartilages at the costochondral or costosternal junctions; there is no swelling.</td>
</tr>
<tr>
<td>Tietze's syndrome</td>
<td>Painful, nonsuppurative localized swelling of the costosternal, sternoclavicular, or costochondral joints, most often involving one joint in the area of the second and third ribs; rare, primarily affects young adults.</td>
</tr>
<tr>
<td>Sternalis syndrome</td>
<td>Localized tenderness over the body of the sternum or overlying sternalis muscle; palpation often causes radiation of pain bilaterally.</td>
</tr>
<tr>
<td>Xiphoidalgia</td>
<td>Localized discomfort over the sternum at the xiphoid process.</td>
</tr>
<tr>
<td>Spontaneous sternoclavicular subluxation</td>
<td>Most often occurs in the dominant side, associated with moderate to heavy repetitive tasks; almost exclusively occurs in middle-aged women.</td>
</tr>
<tr>
<td>Lower rib pain syndromes</td>
<td>Pain in the lower chest or upper abdomen with a tender spot on the costal margin; pain can be reproduced by pressing on the spot.</td>
</tr>
<tr>
<td>Posterior chest wall syndromes</td>
<td>May be caused by herniated thoracic disc, leading to band-like chest pain that may have a unilateral dermatomal distribution. Also induced by costovertebral joint dysfunction; tenderness over the affected area, worse with coughing or deep breathing.</td>
</tr>
</tbody>
</table>

**Pathophysiology and clinical presentation of ischemic chest pain:** Philip J. Podrid, MD, Author, UTD version 19.1: January 2011
### DIFFERENTIATION OF LIFE-THREATENING CAUSES OF CHEST PAIN

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Historical features</th>
<th>Examination findings</th>
<th>Electrocardiogram</th>
<th>Chest X-ray</th>
<th>Additional important information</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acute coronary syndrome</strong></td>
<td>• Substernal/left sided chest pressure or tightness is common</td>
<td>• Nonspecific</td>
<td>• ST segment elevations, Q waves, new left bundle branch block are evidence of AMI</td>
<td>• Nonspecific</td>
<td>• Assume symptoms of ACS within days or a few weeks of PCI or CABG is from an occluded artery or graft</td>
</tr>
<tr>
<td></td>
<td>• Onset is gradual</td>
<td>• May detect signs of HF</td>
<td>• Single EKG is not sensitive for ACS</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Pain radiating to shoulders or pain with exertion increases relative risk</td>
<td></td>
<td>• Prominent R waves with ST segment depressions in V₁ and V₂ strongly suggests posterior AMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• “Atypical” symptoms (eg, dyspnea, weakness) more common in elderly, women, diabetics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Elderly can present with dyspnea, weakness, syncope, or altered mental state alone</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aortic dissection</strong></td>
<td>• Sudden onset of sharp, tearing, or ripping pain</td>
<td>• Absent pulse in upper extremity or carotid pulse is suggestive</td>
<td>• Ischemic changes in 15 percent</td>
<td>• Wide mediastinum or loss of normal aortic knob contour is common (up to 76 percent)</td>
<td>• Can mimic many diseases depending on branch arteries involved (eg, AMI, stroke)</td>
</tr>
<tr>
<td></td>
<td>• Maximal severity at onset</td>
<td>• Discrepancy in systolic BP &gt;20 mmHg between R and L arm is suggestive</td>
<td>• Non Specific ST and T changes in 30 percent</td>
<td>• 10 percent have normal CXR</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Most often begins in chest, can begin in back</td>
<td>• Up to 30 percent with neurologic findings</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Can mimic: stroke, ACS, mesenteric ischemia, kidney stone</td>
<td>• Findings vary with arteries affected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pulmonary embolism</strong></td>
<td>• Many possible presentations, including pleuritic pain and painless dyspnea</td>
<td>• No finding is sensitive or specific</td>
<td>• Usually abnormal but nonspecific</td>
<td>• Great majority are normal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Often sudden onset</td>
<td>• Extremity exam generally normal</td>
<td>• Signs of right heart strain suggestive (eg, RAD, RBBB, RAE)</td>
<td>• May show atelectasis, ▲ hemidiaphragm, pleural effusion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dyspnea often dominant</td>
<td>• Lung exam generally nonspecific; focal wheezing may be present; tachypnea is common</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tension pneumothorax</strong></td>
<td>• Often sudden onset</td>
<td>• Ipsilateral diminished or absent breath sounds</td>
<td>• Ischemic changes in 15 percent</td>
<td>• Demonstrates air in pleural space</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Initial pain often sharp and pleuritic</td>
<td>• Subcutaneous emphysema is uncommon</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Dyspnea often dominant</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pericardial tamponade</strong></td>
<td>• Pain from pericarditis is most often sharp anterior chest pain made worse by inspiration or lying supine, leaning forward; relieved by sitting forward</td>
<td>• Severe tamponade creates obstructive shock, and causes jugular venous distension, pulsat paraoxus</td>
<td>• Decreased voltage and electrical alternans can appear with significant effusions</td>
<td>• May reveal enlarged heart</td>
<td>• Pericardial effusion/pericarditis is seen often in renal failure or dialysis patients</td>
</tr>
<tr>
<td></td>
<td>• Dyspnea is common</td>
<td>• Pericardial effusion can cause friction rub</td>
<td>• Diffuse PR segment depressions and/or ST elevations can appear with acute pericarditis</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mediastinitis</strong> (esophageal rupture)</td>
<td>• Forceful vomiting often precedes esophageal rupture</td>
<td>• Ill-appearing; shock, fever</td>
<td>• Large majority have some abnormality; pneumopericarditis, pleural effusion, pneumothorax</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Recent upper endoscopy or instrumentation increases risk of perforation</td>
<td>• May hear (Hamman’s) crunch over mediastinum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Odontogenic infection is possible cause</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Coexistent respiratory and gastrointestinal complaints may occur</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Important EKG Changes

Features of EKG changes that increase probability of ACS in patients with CP: New ST segment elevation, q waves, conduction defect, ST segment depression or T wave inversion

- Anteroseptal MI showing ST elevation
- Q waves in V1-V4
- ST segment depression I, V3-V6
- Left Bundle Branch Block

Conquering the EKG Cardiology Explained. Ashley EA, Niebauer J
### Noninvasive Risk Stratification:

#### High risk (greater than 3% annual mortality rate)
- Severe resting LV dysfunction (LVEF less than 0.35)
- High-risk treadmill score
- Severe exercise LV dysfunction (exercise LVEF less than 0.35)
- Stress-induced large perfusion defect (particularly if anterior)
- Stress-induced multiple perfusion defects of moderate size
- Large, fixed perfusion defect with LV dilation or increased lung uptake (thallium-201)
- Stress-induced moderate perfusion defect with LV dilation or increased lung uptake (thallium-201)
- Echocardiographic wall-motion abnormality (involving more than 2 segments) developing at low dose of dobutamine or at a low heart rate
- Stress echocardiographic evidence of extensive ischemia

#### Intermediate risk (1% to 3% annual mortality rate)
- Mild/moderate resting LV dysfunction (LVEF 0.35 to 0.49)
- Intermediate-risk treadmill score
- Stress-induced moderate perfusion defect without LV dilation or increased lung intake (thallium-201)
- Limited stress echocardiographic ischemia with a wall-motion abnormality only at higher doses of dobutamine involving less than or equal to 2 segments

#### Low risk (less than 1% annual mortality rate)
- Low risk treadmill score
- Normal or small myocardial perfusion defect at rest or with stress*
- Normal stress echocardiographic wall motion or no change of limited resting wall-motion abnormalities during stress*

---

*Although the published data are limited, patients with these findings will probably not be at low risk in the presence of either a high-risk treadmill score or severe resting LV dysfunction (LVEF)*

---

Chest Pain: What You Should Know

Q: Does all chest pain come from your heart?
A: No, chest pain can come from different parts of your body, including your muscles, bones, digestive tract, lungs, or heart.

• Chest pain often comes from injuries or strains to the muscles, ribs, and bones in your chest.
  - "Musculoskeletal" pain is more common after a lot of exercise or doing something physical you are not used to doing.
  - Musculoskeletal chest pain is usually in one spot in the chest and hurts more if you move that area.

• Your lungs can also cause chest pain. Lung or "pulmonary" chest pain can come from inflammation (irritation) of the lungs.
  - Often you may have cough, fever or you may be coughing up phlegm (sputum).

• Your digestive tract (including your esophagus-or food pipe which travels from your mouth to your stomach) can cause chest pain.
  - When chest pain is caused by a lot of acid in your stomach it is called GERD or heartburn.
  - Chest pain from your digestive tract is often felt under your breastbone (sternum) and gets better with antacid medication.
  - If you are short of breath or sweaty from the pain you should contact medical right away even if you think the pain is heartburn.

Q: Am I having a heart attack?
A: A heart attack occurs when heart muscle dies because of blockage of the blood supply to the heart, usually because of a build-up of cholesterol. Most people think a heart attack is sudden and intense, like a "movie heart attack". The fact is that many heart attacks start slowly as mild pain or discomfort, and those who experience it may not know what is wrong.

Warning Signs of a Heart Attack include:
• Chest pain or discomfort (pressure, squeezing, fullness, or pain in the center of the chest)
• Pain or discomfort in one or both arms, back, neck, jaw, or stomach
• Shortness of breath (often comes with or before chest discomfort)
• Breaking out in a cold sweat, nausea, or light headedness
• Waiting is dangerous. Minutes matter. Anyone with heart attack symptoms should not wait more than five minutes to get medical help

Q: What if I have a heart attack?
A: Most people do not die when they have a heart attack. New medications and treatments work well. The faster you get medical help the better chance you will live and will do well.

Coronary Heart Disease
Coronary heart disease (CHD) is the name for when your heart muscle does not get enough blood. CHD can give you chest pain. CHD comes from a blockage in the arteries of the heart. (Most often caused by cholesterol related blockages).

You likely have CHD if:
• You have had a heart attack
• You have angina (chest pain that comes from your heart)
• You have had a "balloon" reopen one of your coronary arteries
• You have had coronary bypass surgery