

Chest Pain

(See also *Harrison's Principles of Internal Medicine*, 17th Edition, Chapter 13)

Definition

- Discomfort or pain felt between the neck and upper abdomen
- One of the most common challenges for clinicians in the office or emergency department
- Angina pectoris: chest discomfort of myocardial ischemia

Epidemiology

- Prevalence
 - 39% of the population report having chest pain at some point.
 - 5% of all visits to emergency departments are for chest pain.
 - 15% of these are acute myocardial infarction (MI).
 - 30–35% are unstable angina.

Mechanism

- Chest pain is caused by excitation of visceral or somatic nerves.
 - Somatic pathways
 - Stimulation of nerves of the skin and superficial structures
 - By trauma
 - By neuromuscular conditions
 - Visceral pathways
 - Stimulation of visceral afferent nerves by ischemia, inflammation, hollow-organ distention, muscle spasm, or traction
 - Visceral afferents convey nociceptive information to dorsal root ganglia in the spinal cord.
 - Here, both visceral and somatic primary sensory nerves converge onto common spinal neurons.
 - Cause activity in ascending spinal pathways that is misconstrued as originating from somatic structures

Symptoms & Signs

- History should focus on:
 - Quality, location, and radiation of pain
 - Nature of onset and duration
 - Factors that precipitate, exacerbate, and improve symptoms
 - Risk factors for coronary artery disease
- Focused physical examination
 - Evaluation of blood pressure in both arms and pulses in both legs

- Chest auscultation may reveal:
 - Diminished breath sounds
 - Pleural rub
 - Inspiratory crackles
- Cardiac examination should seek:
 - Pericardial rubs
 - Systolic and diastolic murmurs
 - Third or fourth heart sounds
- Pressure on the chest wall
 - May reproduce symptoms of musculoskeletal chest pain

Differential Diagnosis

Acute chest pain

- Hospitalized patients with acute chest pain from causes other than MI
 - Gastroesophageal disease (42%); in descending order of frequency:
 - Gastroesophageal reflux
 - Esophageal motility disorders
 - Peptic ulcer
 - Gallstones
 - Ischemic heart disease: 31%
 - Chest-wall syndromes: 28%
 - Pericarditis: 4%
 - Pleuritis/pneumonia: 2%
 - Pulmonary embolism: 2%
 - Lung cancer: 1.5%
 - Aortic aneurysm: 1%
 - Aortic stenosis: 1%
 - Herpes zoster: 1%

Myocardial ischemia and injury

- Stable angina pectoris
 - Duration: lasts 2 to 10 minutes
 - Quality: pressure, tightness, squeezing, heaviness, burning, aching
 - "Sharp" sometimes used by patients to describe intensity rather than quality
 - Some patients deny "pain" but admit to dyspnea or a vague sense of anxiety.
 - Occasional patients report epigastric distress.
 - Location: retrosternal, often with radiation to or isolated discomfort in neck, jaw, shoulders, or arms—frequently on the left
 - Radiation to left arm is common, but radiation to right arm is also consistent with diagnosis.
 - Less common is radiation to below the umbilicus or to the back.
 - Some present with aching in sites of radiated pain as the only symptoms.
 - Precipitating factors
 - Exertion
 - Emotional excitement
 - Heavy meals
 - Exposure to cold
 - Fever
 - Compromised oxygen delivery due to anemia, hypoxia, or hypotension

- Relief of pain in several minutes with rest or treatment with sublingual nitroglycerin
- Physical findings: S₄ gallop or mitral regurgitation murmur during pain
 - Physical examination may be completely normal.
- Pain that is rarely ischemic
 - Fleeting pain, lasting only a few seconds
 - Pain that lasts for several hours, particularly if electrocardiography (ECG) shows no evidence of ischemia
- Unstable angina and MI
 - Symptoms usually similar to angina pectoris, but pain is more prolonged and severe
 - Onset may occur with patient at rest or awakened from sleep.
 - Sublingual nitroglycerin
 - May lead to transient or no relief
 - Possible accompanying symptoms
 - Diaphoresis
 - Dyspnea
 - Nausea
 - Lightheadedness
- Aortic stenosis
 - Duration, quality, precipitants, and location similar to stable angina due to coronary artery disease
 - Physical findings: late-peaking systolic murmur radiating to carotid arteries
- Syndrome X
 - Angina-like chest pain and ischemic-appearing ST-segment depression during stress despite normal coronary arteriograms

Pericarditis

- Infectious pericarditis
 - Duration: hours to days; may be episodic
 - Quality: sharp
 - Location: retrosternal or toward cardiac apex; may radiate to left shoulder
 - Aggravated by coughing, deep breaths, or changes in position
 - Relieved by sitting up and leaning forward
 - Physical findings: pericardial friction rub
- Conditions that cause only local inflammation (e.g., MI or uremia) and cardiac tamponade tend to result in mild or no chest pain.

Diseases of the aorta

- Aortic dissection
 - Abrupt onset of unrelenting pain
 - Quality: tearing or ripping sensation; knifelike
 - Location: anterior chest, often radiating to back, between shoulder blades
 - Associated with hypertension and/or underlying connective tissue disorder, e.g., Marfan syndrome
 - Poor perfusion of a limb may be due to aortic dissection that has compromised flow to an artery branching from the aorta.
- Thoracic aortic aneurysm
 - Frequently asymptomatic
 - Can cause chest pain and other symptoms by compressing adjacent structures
 - Pain tends to be steady, deep, and sometimes severe.

Pulmonary embolism

- Abrupt onset; several minutes to a few hours
- Quality: pleuritic
- Location:
 - Smaller emboli: lateral, on the side of embolism
 - Massive emboli: substernal pain similar to angina
- Associated symptoms: dyspnea, hemoptysis
- Physical findings: tachycardia, tachypnea, hypotension, evidence of venous thromboembolism or coagulation abnormalities
- See Pulmonary Thromboembolism

Pneumothorax

- Sudden onset; lasts several hours
- Quality: pleuritic
- Location: lateral to side of pneumothorax
- Physical findings: tachypnea, decreased breath sounds on side of pneumothorax
 - Tension pneumothorax: shift in trachea from midline, away from side of pneumothorax
- See Pneumothorax

Pneumonia or pleuritis

- Variable duration
- Quality: pleuritic
- Aggravated by inspiration or coughing
- Location: unilateral, often localized
- Physical findings: tachypnea, cough, fever, rales, occasional rub
- See Community Acquired Pneumonia, Pleuritis

Gastrointestinal conditions

- Esophageal reflux
 - Duration: 10–60 minutes
 - Quality: burning
 - Location: substernal, epigastric
 - Worsened by postprandial recumbency, alcohol, aspirin
 - Relieved by antacid or other acid-reducing therapies
- Esophageal spasm
 - Duration: 2–30 minutes
 - Quality: pressure, tightness, burning; closely mimics angina
 - Location: retrosternal
 - Prompt relief with antianginal therapies, such as sublingual nifedipine
- Peptic ulcer
 - Occurs 60–90 minutes after meals and early morning
 - Quality: burning
 - Location: epigastric, substernal
 - Relieved with food or antacids
- Gallbladder disease
 - Duration: prolonged
 - Quality: aching, burning, pressure

- Location: epigastric, right upper quadrant, substernal; radiation to right shoulder
- May follow a meal

Neuromusculoskeletal conditions

- Costochondral and chondrosternal syndromes
 - Most common causes of anterior chest musculoskeletal pain
 - Physical signs of costochondritis, such as swelling, redness, and warmth (Tietze's syndrome), only occasionally present
 - Pain is usually fleeting and sharp.
 - Some experience a dull ache that lasts for hours.
 - Direct pressure on chondrosternal and costochondral junctions may reproduce pain.
- Herpes zoster
 - Variable duration
 - Quality: sharp or burning
 - Location: dermatomal distribution
 - Physical findings: vesicular rash in area of discomfort (may not be present initially)
- Cervical disk disease
 - Chest pain caused by compression of nerve roots
- Arthritis of the shoulder and spine and bursitis
 - Some patients who have these conditions and myocardial ischemia blur and confuse symptoms of these syndromes.

Emotional and psychiatric conditions

- Panic disorder or other emotional conditions
 - Account for as many as 10% of patients who present to emergency departments with acute chest pain
- Symptoms are highly variable.
 - Frequently, discomfort is described as visceral tightness or aching.
 - Lasts > 30 minutes
 - Some patients offer atypical descriptions, such as pain that is fleeting, sharp, and/or localized to a small region.
- ECG may be difficult to interpret if hyperventilation causes ST-T-wave abnormalities.
- A careful history may elicit clues of:
 - Depression
 - Prior panic attacks
 - Somatization
 - Agoraphobia or other phobias

Diagnostic Approach

Evaluation of acute chest pain

- Goals
 - Determine diagnosis.
 - Identify patients who require urgent interventions.
- Considerations
 - Could pain be caused by an acute, potentially life-threatening condition that warrants immediate hospitalization and aggressive evaluation?
 - Acute ischemic heart disease
 - Aortic dissection

- Pulmonary embolism
 - Spontaneous pneumothorax
 - If not, could it be due to an acute condition that warrants specific treatment?
 - Pericarditis
 - Pneumonia/pleuritis
 - Herpes zoster
 - If not, could it be due to a chronic condition likely to lead to serious complications?
 - Stable angina
 - Aortic stenosis
 - Pulmonary hypertension
 - If not, could it be due to another treatable chronic condition?
 - Esophageal reflux
 - Esophageal spasm
 - Peptic ulcer disease
 - Gallbladder disease
 - Other gastrointestinal conditions
 - Cervical disk disease
 - Arthritis of the shoulder or spine
 - Costochondritis
 - Other musculoskeletal disorders
 - Anxiety state
- Assess the patient's respiratory and hemodynamic status.
 - If either is compromised, stabilize patient before diagnostic evaluation is pursued.
- If the patient does not require emergent interventions, assess for life-threatening conditions.
 - Perform focused history, physical examination, and laboratory evaluation.
 - Order ECG for virtually all patients without an obvious noncardiac cause of pain.
 - Measure laboratory markers of myocardial injury.
 - Order chest radiography for patients with signs or symptoms consistent with:
 - Congestive heart failure
 - Valvular heart disease
 - Pericardial disease
 - Aortic dissection or aneurysm
- If there is no evidence of life-threatening conditions, focus on serious chronic conditions with potential to cause major complications.
 - Stable angina
 - Early use of exercise ECG for low-risk patients, defined as follows:
 - Having 2 sets of cardiac enzymes or troponins at 4-hour intervals that are normal
 - ECG at presentation and pre-exercise ECG that show no significant change
 - Absence of rest ECG abnormalities that preclude accurate interpretation of exercise ECG
 - Absence of ischemic chest pain at the time of exercise testing or during observation period after admission to emergency department
 - Exercise testing is not appropriate for patients who:
 - Report pain that is believed to be ischemic occurring at rest
 - Have ECG changes that are consistent with ischemia and are not known to be old
- Patients who do not require admission to hospital or who no longer require inpatient observation
 - Seek to identify cause of symptoms and likelihood of major complications.

- Gastrointestinal causes of chest pain can be evaluated via endoscopy or radiology studies, or with trials of medical therapy.
- Emotional and psychiatric conditions warrant appropriate evaluation and treatment.
 - Randomized trial data indicate that cognitive therapy and group interventions lead to decreases in symptoms for such patients.

Laboratory Tests

- Markers of myocardial injury
 - Should be obtained in emergency department evaluation for acute chest discomfort
 - Most commonly used markers
 - Creatine kinase, creatine kinase–MB, and the cardiac troponins (I and T)
 - Rapid bedside assays of the cardiac troponins are sufficiently accurate to predict prognosis and guide management.
 - Single negative values of any of these markers
 - Do not have high sensitivity for acute MI or for prediction of complications
 - Decisions to discharge patients should not be made on the basis of single negative values.
 - 2 negative tests > 6 hours apart are useful for excluding myocardial necrosis.
 - Some data support use of other markers.
 - Serum myoglobin
 - C-reactive protein
 - B-type natriuretic peptide
 - Their roles are the subject of ongoing research.
- D-Dimer for pulmonary embolism
 - Negative enzyme-linked immunosorbent assay for D-dimer safely rules out pulmonary embolism in patient with a low pretest probability.

Imaging

- Chest radiography
 - Helpful for diagnosing various causes of chest pain
 - Pneumonia
 - Pneumothorax
 - Pneumomediastinum
 - Congestive heart failure
 - May be suggestive in aortic dissection
- Aortic dissection
 - Imaging studies to evaluate the aorta must be pursued promptly because of the high risk of catastrophic complications.
 - Appropriate tests include:
 - Chest CT with contrast
 - MRI in patients who are hemodynamically stable
 - Transesophageal echocardiography in patients who are less stable
 - Aortic angiography is no longer a first test at most institutions.
 - Chest radiography is not sufficient to exclude the diagnosis.
- Coronary artery disease
 - Provocative tests not appropriate for patients with ongoing chest pain
 - In such patients, rest myocardial perfusion scans can be considered.
 - Normal scan
 - Reduces likelihood of coronary artery disease
 - Can help avoid admission of low-risk patients to hospital

- Acute pulmonary embolism
 - Initial test should be helical CT of the chest.

Diagnostic Procedures

- ECG
 - Essential for adults with chest discomfort not due to an obvious traumatic cause
 - Prevalence of MI and unstable angina among subsets of patients with acute chest pain in the emergency department
 - ST elevation (≥ 1 mm) or Q waves on ECG not known to be old
 - MI: 79%
 - Unstable angina: 12%
 - Ischemia or strain on ECG not known to be old (ST depression ≥ 1 mm or ischemic T waves)
 - MI: 20%
 - Unstable angina: 41%
 - None of the preceding ECG changes, but a history of angina or MI (history of heart attack or nitroglycerin use)
 - MI: 4%
 - Unstable angina: 51%
 - None of the preceding ECG changes and no history of angina or MI (history of heart attack or nitroglycerin use)
 - MI: 2%
 - Unstable angina: 14%

Treatment Approach

- Hospital admission is required for:
 - Possible or probable acute MI
 - Unstable angina
 - Pulmonary embolism
 - Aortic dissection
- Work-up and treatment of other disorders depend on severity of presentation and risk of life-threatening complications.

Specific Treatments

- Treatment depends on the underlying cause of chest pain.
- See specific disorders.
 - Myocardial Infarction
 - Unstable Angina and Non-ST-Elevation Myocardial Infarction
 - Chronic Stable Angina
 - Pulmonary Thromboembolism
 - Pneumothorax
 - Aortic Dissection
 - Aortic Stenosis
 - Acute Pericarditis
 - Community-Acquired Pneumonia
 - Gastroesophageal Reflux Disease

Monitoring

- Need for monitoring depends on the underlying cause of chest pain.

Complications

- Complications depend on the underlying cause of chest pain.

Prognosis

- Prognosis depends on the underlying cause of chest pain.

Prevention

- Prevention strategies depend on the underlying cause of chest pain.

ICD-9-CM

- 786.5_ Chest pain, (specific types and locations are specified by fifth digit)
- 786.50 Chest pain, unspecified

See Also

- Acute Pericarditis
- Aortic Dissection
- Aortic Stenosis
- Chronic Stable Angina
- Community-Acquired Pneumonia
- Gastroesophageal Reflux Disease
- Myocardial Infarction
- Pneumothorax
- Pulmonary Thromboembolism
- Unstable Angina and Non–ST-Elevation Myocardial Infarction

Internet Sites

- Professionals
 - Homepage
American Heart Association
 - Homepage
American Thoracic Society
- Patients
 - Chest pain
MedlinePlus

General Bibliography

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PEARLS

- When a patient presents with chest pain and diaphoresis, suspect acute MI.