

The Patient History: An Evidence-Based Approach to Differential Diagnosis, 2e □

Chapter 27. Chest Pain

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Case Scenario

A 56-year-old man presents to the emergency department (ED) with a complaint of chest pain that began 60 minutes earlier and has not resolved. He states he has never had a heart attack before. He is a current smoker and has smoked 1 pack per day for 30 years. He has been having intermittent episodes of chest pain off and on for the last 4 months, but today was the first time that the chest pain persisted prompting him to visit the ED.

- **What additional questions would you ask to characterize the chest pain?**
- **What associated features would suggest that chest pain is due to a serious underlying cause?**
- **What associated features would indicate a benign cause for the patient's symptoms?**
- **With additional history, can you reasonably determine the underlying probability of coronary artery disease in this patient?**
- **Can you arrive at a diagnosis to guide further management?**

Introduction

Chest pain is a commonly encountered symptom in both the emergency department (ED) and the outpatient clinic, resulting from a spectrum of etiologies from minor illness to life-threatening disease. Perhaps the most pressing determination is whether chest pain is due to acute cardiac ischemia or to nonischemic cardiovascular or noncardiac causes. Each of these categories encompasses etiologies that are potentially serious. The initial evaluation, consisting of the history, physical examination, and electrocardiogram (ECG), is exceedingly important for determining the severity and acuity of the clinical presentation and for guiding the proper selection of additional diagnostic and therapeutic modalities. Of these, the history remains the cornerstone of patient assessment.

Key Terms

Angina pectoris	Discomfort in the chest and/or adjacent areas (jaw, shoulder, back, arm), usually, but not always, due to myocardial ischemia.
Typical angina	Substernal chest discomfort with the following features: <ul style="list-style-type: none"> ● Characteristic oppressive quality (described as "pressure," "squeezing," or "heaviness," but almost never sharp or stabbing) and duration (typically minutes). ● Provoked by exertion or emotional stress. ● Relieved by rest or nitroglycerin (within several minutes).
Atypical angina	Chest discomfort that meets 2 of the typical angina characteristics.
Noncardiac chest pain	Chest pain that meets 1 or none of the typical angina characteristics.
Pleuritic chest pain	Sharp chest pain that increases with inspiration or cough.
Canadian Cardiovascular Society (CCS) Angina Classification System	Clinical grading system based on degree of limitation of ordinary physical activity: Class I: No limitation Class II: Slight limitation Class III: Marked limitation Class IV: Angina occurs with any physical activity or at rest
Myocardial infarction (MI)	Prolonged severe anginal discomfort associated with myocardial necrosis.
Unstable angina (UA)	Angina presenting as rest angina, severe new-onset angina (CCS class III or IV), or acceleration of previously diagnosed effort angina (to at least CCS class III).
Acute coronary syndrome (ACS)	Any clinical presentation compatible with acute myocardial ischemia (encompassing MI and UA).

See Reference 1

Etiology

Chest pain may arise from cardiac, noncardiac, or psychogenic causes. Cardiovascular causes may be subdivided into ischemic and nonischemic etiologies. Myocardial ischemia results from an imbalance between myocardial [oxygen](#) supply and demand, such that demand exceeds supply. Ischemic chest pain or angina is most often secondary to obstructive atherosclerotic coronary artery disease (CAD). However, angina may also result from critical aortic stenosis, severe hypertension, hypertrophic cardiomyopathy, severe pulmonary hypertension (with right ventricular ischemia), and coronary spasm. Angina may also be precipitated by extracardiac conditions, such as severe anemia, hypoxia, hyperthyroidism, and hyperviscosity. In all of these conditions, chest pain occurs due to a perturbation of the normal [oxygen](#) supply/demand relationship (ie, increased demand and/or decreased supply), even in the absence of CAD. Nonischemic cardiovascular chest pain may accompany aortic dissection, pericarditis, or mitral valve prolapse. Noncardiac chest pain may occur with esophageal and other gastrointestinal (GI) conditions, pulmonary disease, and musculoskeletal and psychiatric disorders. Esophageal pain often resembles angina in quality and frequently is challenging to distinguish from cardiac ischemia. Given the diversity of etiologies for chest pain and the extent of testing required to exclude each possibility, it is difficult to determine the prevalence of every cause.

The prevalence of various disorders is highly dependent on the patient care setting (eg, ED, primary care physician [PCP] office, chest pain observation unit) and the inclusion criteria of the relevant study. In patients presenting to the ED with chest pain, the reported frequency of acute ischemia ranges

from 8% to 45%.²⁻⁶ In patients discharged from the ED without a clear diagnosis (ie, acute undifferentiated chest pain), 8% were ultimately found to have ACS.⁵ In patients discharged from the coronary care unit with noncardiac chest pain, more than 75% had evidence of esophageal disorders.⁷

Differential Diagnosis

	Prevalence in ED	Prevalence in PCP Office
Cardiovascular		16% ⁸
Ischemic		
ACS (UA, MI)	8%–45% ²⁻⁶	
Coronary atherosclerosis		
Coronary artery spasm		
Aortic stenosis		
Hypertrophic cardiomyopathy		
Dilated cardiomyopathy		
Tachycardia (ventricular/supraventricular)		
Sympathomimetic toxicity (eg, cocaine)		
Severe hypertension		
Severe pulmonary hypertension		
Severe anemia, hypoxia, hyperviscosity		
Hyperthyroidism, hyperthermia		
Nonischemic		
Aortic dissection	0.003% ⁹	
Pericarditis		
Mitral valve prolapse		
Noncardiovascular	55%–92% ²⁻⁶	
Gastrointestinal (GI)		8% ⁸
Esophageal (spasm, reflux, esophagitis)		

Biliary disease (cholecystitis, choledocholithiasis)		
Peptic ulcer		
Pancreatitis		
Pulmonary		10%⁸
Pulmonary embolism (PE)		
Pneumothorax		
Pneumonia		
Pleuritis		
Musculoskeletal		51%⁸
Sternoclavicular arthritis		
Costochondritis		
Cervical spine disorders		
Herpes zoster		
Psychogenic		11%⁸
Anxiety disorders (hyperventilation, panic attacks)		
Depression		
Somatoform disorders		
Secondary gain		
No diagnosis (undifferentiated)	23%⁵	4%⁸

Getting Started with the History

- Remember, acute chest pain may result from potentially life-threatening conditions. Thus, obtain the history in a targeted and expeditious fashion.
- With stable, intermittent chest pain, assess the bedside predictors that distinguish chest pain secondary to cardiovascular disorders versus noncardiovascular disorders.
- Initially, ask open-ended questions so the patient can describe the chest pain. Once a primary description is obtained, quickly move on to more focused questioning for possible underlying etiologies.
- Definitive diagnosis often requires a physical examination, ECG, and additional laboratory testing. However, the history serves as the primary guide for medical decision making.

Questions	Remember
Are you having chest pain right now? If not, when was the last time you had it? How long has this been going on?	Determine whether symptoms are acute or chronic and recurring.
Describe your current chest pain (or a typical prior episode) to me.	Listen to the patient's description.
Does the chest pain prevent you from doing things you would normally do?	Assess the impact of chest pain on the patient's physical activity.

Interview Framework

- Determine whether symptoms represent an ongoing acute episode, which is more likely to be unstable disease, or chronic and recurring episodes, which more often reflect stable disease.
- Characterize the chest pain using the following components:
 - Quality
 - Location
 - Radiation
 - Duration
 - Time course
 - Precipitating/relieving factors
 - Associated symptoms
- Ascertain the presence of associated conditions and risk factors for CAD:
 - Diabetes
 - Smoking
 - Hypertension
 - Hyperlipidemia
 - Family history of premature CAD
 - Postmenopausal status
 - Peripheral vascular disease
 - Cocaine abuse
- Predict the probability of underlying CAD using pain type, age, gender, and risk factors (see below).

Identifying Alarm Symptoms

Chest pain by itself is an alarm symptom because it can be due to serious causes that require prompt attention. By far, the most common serious cause is acute cardiac ischemia, which includes stable angina, UA, and MI. Albeit less common, other serious conditions to be considered include aortic dissection, PE, spontaneous pneumothorax, pneumonia, and acute GI processes (eg, cholecystitis, pancreatitis) with referred pain.

In general, the suspicion for these serious diagnoses is raised by the results of careful questioning regarding the character and pattern of the pain, associated symptoms, and associated medical conditions. A primary distinction is the differentiation of anginal pain from noncardiac chest pain.

Serious Diagnoses

	Prevalence in ED ^a	Prevalence in PCP Office ^a
Acute myocardial ischemia	8%–45% ^{2–6}	
• MI	5%–17% ^{2,4–6}	
• UA	9%–24% ^{2,4–6}	
• Stable angina and other cardiac conditions	2%–34% ^{2,4,5}	16% ⁸
Aortic dissection	0.003% ⁹	
PE		
Spontaneous pneumothorax		
Pneumonia		
Acute GI pathology		

^aPrevalence is unknown when not indicated.

Alarm Symptoms	If Present, Consider Serious Causes...	Likelihood Ratio (LR) ^a	However, Other Causes for This Feature Include...
Typical angina that is prolonged or occurs at rest OR atypical angina that is prolonged or occurs at rest, with high probability of CAD (see below)	MI UA	1.8– 5.86, ^{10,11}	Esophageal disease Musculoskeletal chest pain, nonischemic chest pain (eg, mitral valve prolapse), psychogenic chest pain
New-onset or acceleration of effort chest pain (to at least CCS III), typical or atypical with high CAD probability	UA		Esophageal disease Musculoskeletal chest pain Nonischemic chest pain Psychogenic chest pain
Chest pain with prior history of MI	MI UA	2.3–3.8 ^{10,11}	Nonischemic chest pain
Chest pain with diaphoresis (especially profuse diaphoresis)	MI UA PE Aortic dissection	2.0–2.96, ¹⁰	

Chest pain with nausea/vomiting	MI UA	1.4– 3.55,6,10	Acute GI pathology
Burning chest pain/indigestion	MI UA	2.35	Gastroesophageal disease
Chest pain radiation to left arm/shoulder	MI UA	1.5–2.36,10	Pericarditis Cervical spine disorders
Chest pain radiation to right arm/shoulder	MI UA	2.4– 3.85,6,10	Pericarditis Biliary colic Cervical spine disorders
Chest pain radiation to both arms	MI UA	2.4–7.16,10	Pericarditis Cervical spine disorders
Sudden-onset chest pain and acute dyspnea	PE MI Spontaneous pneumothorax	3.612	Pleuritis Musculoskeletal chest pain
Chest pain with hemoptysis	PE Pneumonia	2.412	Tracheobronchitis
Chest pain with fever	Pneumonia Acute GI pathology		Pleuritis Tracheobronchitis Pericarditis
Chest pain with syncope (hypotension)	MI PE Arrhythmia Pericardial tamponade	3.110	Vasovagal syncope
Chest pain with palpitations	MI Tachyarrhythmia		
Chest pain with history of Marfan syndrome	Aortic dissection	4.19	
Sudden onset of severe "tearing" or "ripping" chest pain	Aortic dissection	10.89	
Severe persistent chest pain radiating to the back	Aortic dissection Aortic aneurysm		Pericarditis Pancreatitis Peptic ulcer
Severe migrating chest and back pain	Aortic dissection	7.69	

^aEach LR applies to the adjacent serious cause.

The following features significantly *decrease* the likelihood of MI^{6,10,11}:

- Pleuritic chest pain (LR, 0.2)
- Chest pain reproduced by palpation (LR, 0.2–0.4)
- Sharp or stabbing chest pain (LR, 0.3)
- Positional chest pain (LR, 0.3)

The *absence* of sudden-onset chest pain *decreases* the likelihood of acute aortic dissection (LR, 0.3).¹³

As evident from these data, CAD prevalence increases with age. Men with typical angina generally have a high likelihood of CAD, even without risk factors in the older age groups. Women with nonanginal chest pain generally have a low prevalence of CAD.

Estimating the Pretest Probability (%) of CAD ^{1,14}						
	Nonanginal Chest Pain		Atypical Angina		Typical Angina	
Age	Men	Women	Men	Women	Men	Women
30–39 years	3–35	1–19	8–59	2–39	30–88	10–78
40–49 years	9–47	2–22	21–70	5–43	51–92	20–79
50–59 years	23–59	4–25	45–79	10–47	80–95	38–82
60–69 years	49–69	9–29	71–86	20–51	93–97	56–84

NOTE. First number within each range is the probability or prevalence of CAD in patients without risk factors (diabetes, smoking, and hyperlipidemia). Second number is the probability with risk factors. All groups have normal ECGs.

Focused Questions

Chest pain should be characterized according to the components listed below, and alarm symptoms should be assessed. The pain can be labeled as typical or atypical angina or as noncardiac chest pain. The pain type and the patient's age, gender, and cardiac risk factors allow a reasonable estimation of the probability of underlying CAD.

QUESTIONS	THINK ABOUT...
Quality	
<i>Does it feel like:</i>	
• Pressure, squeezing, burning, or strangling?	Myocardial ischemia
• Tightness or heaviness, "a band across the chest"?	Esophageal disease (spasm, reflux) (Pulmonary hypertension [with right ventricular ischemia] can present with chest pressure.)

• <i>Deep, heavy aching (visceral pain)?</i>	Herpes zoster (prior to rash) can present as a tight band around chest.
• <i>Indigestion, a need to belch?</i>	Myocardial ischemia Esophageal disease, peptic ulcer
• <i>Severe tearing or ripping pain?</i>	Aortic dissection
• <i>Sharp and stabbing?</i>	Pericarditis, pleuritis PE, pneumothorax Musculoskeletal pain Psychogenic pain
• <i>Dull, persistent ache lasting hours or days localized (< 3 cm) to cardiac apex (inframammary area)?</i>	Psychogenic pain
Location	
<i>Is the pain diffuse, poorly localized, or retrosternal?</i>	Myocardial ischemia PE
<i>Is pain localized over skin or superficial structures, such as costochondral joints, and reproduced by palpation?</i>	Musculoskeletal pain Costochondritis, chest wall syndrome
<i>Is pain localized (< 3 cm) in the region of the left nipple (circumscribed by 1 finger)?</i>	Noncardiac pain (musculoskeletal, psychogenic, gaseous distention of the stomach)
Radiation	
<i>Does pain radiate to the medial aspect of the left shoulder/arm, right shoulder/arm, or both arms?</i>	Myocardial ischemia Pericarditis Cervical spine disease Cholecystitis (to right shoulder)
<i>Does pain radiate to the lower jaw, neck, or teeth?</i>	Myocardial ischemia
<i>Does pain radiate to the interscapular region or back?</i>	Aortic dissection Thoracic aortic aneurysm Pericarditis Esophageal disease Pancreatitis Peptic ulcer Myocardial ischemia
<i>Does pain radiate to the epigastrium?</i>	Esophageal disease Pancreatitis Peptic ulcer Biliary tract disease Myocardial ischemia
Duration and time course	

<i>How long does it last?</i>		
• <i>Brief (2–20 minutes)</i>	Angina pectoris Esophageal disease Musculoskeletal pain Psychogenic pain	
• <i>Very brief (< 15 seconds)</i>	Noncardiac pain Musculoskeletal pain Hiatal hernia Psychogenic pain	
• <i>Prolonged (> 20 minutes to hours)</i>	UA/MI Esophageal disease Pulmonary disorders Pericarditis Aortic dissection Musculoskeletal disease Herpes zoster Acute GI pathology Psychogenic pain	
Precipitating factors		
<i>What brings the pain on?</i>		
• <i>Exertion (classically in the cold or against a wind, especially after a heavy meal)</i>	Angina pectoris	
• <i>Emotional stress or fright</i>	Angina pectoris Psychogenic pain	
• <i>Eating, meals</i>	Esophageal pain Peptic ulcer Angina pectoris	
• <i>Lying down or bending after meals</i>	Esophageal reflux	
• <i>Bending or moving the neck</i>	Cervical/upper thoracic spine disease	
• <i>Respiration or cough (pleuritic pain)</i>	PE Pneumothorax Pericarditis, pleuritis Musculoskeletal pain	
• <i>Changes in body position (positional pain)</i>	Pericarditis Musculoskeletal pain Pancreatitis	
Relieving factors		

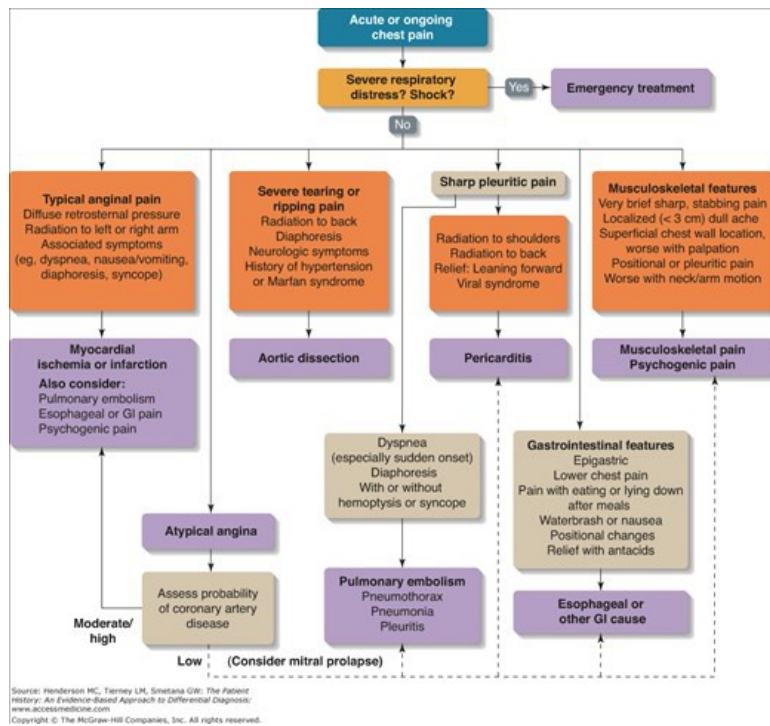
What relieves the pain?	
• Rest or sublingual <i>nitroglycerin</i> (usually within 1–5 minutes)	Angina pectoris Esophageal spasm
• Sitting up and leaning forward	Pericarditis Pancreatitis
• Antacids or food	Esophagitis, peptic ulcer
• Holding the breath at deep expiration	Pleuritis
Associated symptoms	
Do you have any of the following symptoms?	
• Nausea and vomiting	Acute myocardial ischemia or MI Acute GI pathology
• Diaphoresis	Acute myocardial ischemia or MI PE Aortic dissection
• Dyspnea	Acute myocardial ischemia or MI PE Pneumothorax Pneumonia
• Syncope/hypotension	Acute myocardial ischemia or MI Massive PE Aortic stenosis Arrhythmia
• Waterbrash (acid reflux into the mouth)	Esophageal disease
• Hemoptysis	PE, pneumonia
• Fever	Pneumonia Pleuritis Pericarditis

Diagnostic Approach (Including Algorithm)

The first step is to determine the acuity of the symptoms. Although there may be overlap, chronic and recurring episodes without any change in symptom pattern are less likely to be emergent and may be evaluated in the outpatient setting. Such diagnoses will include stable angina, GI pain, and musculoskeletal pain. In contrast, an acute or ongoing chest pain episode is more likely to represent an urgent situation and should be evaluated in the ED or inpatient setting. These diagnoses will include UA, MI, aortic dissection, PE, pericarditis, and pneumothorax. In both situations, it is important to assess for alarm symptoms and the probability of underlying CAD. Keep in mind, however, that in addition to the history, proper decision making will also necessitate a targeted physical examination, ECG, and other laboratory testing, as appropriate. See [Figure 27–1](#) for the diagnostic algorithm

for chest pain.

Figure 27-1



Diagnostic algorithm: Chest pain. GI, gastrointestinal.

Caveats

- Angina is often precipitated by effort or physical activity. Thus, it is important to determine whether functional limitations preclude proper assessment of effort-related chest pain or, conversely, whether effort-related chest pain is limiting the patient's physical activity.
- In clinical practice, myocardial ischemia is the most common serious cause of chest pain encountered. In the majority of patients, this is due to obstructive epicardial CAD.
- Angina is almost never sharp or stabbing, pleuritic, or positional. The following features suggest causes other than angina: (1) very brief pain lasting less than 15 seconds; (2) dull, localized (< 3 cm) pain, especially in the inframammary region; (3) localized, superficial chest pain reproduced by palpation; and (4) radiation to the upper jaw or below the umbilicus.
- In patients with typical angina but low probability of CAD, consider conditions that can produce myocardial ischemia in the absence of significant CAD (eg, systemic or pulmonary hypertension, aortic stenosis, hypertrophic cardiomyopathy, severe anemia, hyperthyroidism).
- Typical angina in an otherwise healthy athlete should raise the possibility of hypertrophic cardiomyopathy, especially if associated with dizziness or presyncope.
- Chest pain associated with PE, although typically pleuritic, may resemble angina due to associated pulmonary hypertension and attendant right ventricular ischemia.
- Be aware of gender differences in chest pain presentation. Atypical angina is more common in women than men. Women with chronic stable angina are more likely to have pain at rest, at sleep, or during mental stress than men.

Prognosis

The prognosis of the patient with chest pain is highly variable and depends on the underlying etiology. Obviously, patients with chest pain due to potentially life-threatening illnesses such as MI, PE, and aortic dissection have a much more guarded prognosis than do patients with esophageal, musculoskeletal, or psychogenic pain. Thus, prompt and targeted evaluation of all patients presenting with chest pain is essential. Specialized chest

pain centers with protocol-driven assessment and short-stay observation units can help risk-stratify such patients and efficiently identify those with acute myocardial ischemia versus patients with nonischemic causes.

Case Scenario | Resolution

A 56-year-old man presents to the emergency department (ED) with a complaint of chest pain that began 60 minutes earlier and has not resolved. He states he has never had a heart attack before. He is a current smoker and has smoked 1 pack per day for 30 years. He has been having intermittent episodes of chest pain off and on for the last 4 months, but today was the first time that the chest pain persisted prompting him to visit the ED.

Additional History

The patient initially noticed the chest pain a few months ago while walking or climbing stairs. These episodes would resolve a few minutes after stopping and resting. In the last month, he has noticed that less effort would bring on the pain and has even noticed it while sitting watching television. Today, he awoke from sleep with chest pain that did not go away and so he came to the ED. Today's pain is a diffuse precordial burning and pressure that radiates to both shoulders and arms. Prior episodes have been felt in his lower jaw. Right now he feels nauseous and as if he cannot quite catch his breath; this is something he has never felt previously. On further questioning, some time ago, he was told his cholesterol was high but he never sought further follow-up. He has been under a great deal of stress at work during the last few months.

Question: What Is the Most Likely Diagnosis?

- A. Acute coronary syndrome
- B. Pericarditis
- C. Pulmonary embolism
- D. Gastroesophageal reflux

Correct answer: A

The patient presents with acute coronary syndrome. He describes a prodrome of typical exertional angina that has progressed to rest symptoms over the last month (unstable angina). On presentation, the pain is prolonged and exhibits several features consistent with acute myocardial ischemia including an oppressive nature, radiation to the arms and shoulders, and associated dyspnea. These alarm symptoms are occurring on the backdrop of a high probability for coronary artery disease (CAD)—a 56-year-old man with typical angina and risk factors of smoking and high cholesterol has an estimated CAD prevalence of greater than 90%. An electrocardiogram and cardiac biomarkers should be obtained without delay in this patient.

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