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Chest Pain: Differentiating Cardiac from Noncardiac Causes

Bernard Karnath, MD

Mark D. Holden, MD

Nasir Hussain, MD

Chest pain is one of the most common complaints in the acute care setting. Major causes of acute chest pain include cardiac, gastroesophageal, musculoskeletal, and pulmonary conditions. Because heart disease is the leading cause of death in the United States,¹ it is important to diagnose a cardiac etiology in patients presenting with acute chest pain. In addition, noncardiac causes of chest pain may be serious. Conducting a thorough history and physical examination remain the most important component in evaluating a patient presenting with acute chest pain despite the advances in medical technology. It is essential to obtain the characteristics of the pain, including its location, duration, radiation, and quality as well as any accompanying symptoms. This article discusses the key clinical signs that will help to differentiate the common causes of acute chest pain; an emphasis is placed on the history and physical examination.

CARDIAC CAUSES OF ACUTE CHEST PAIN

Cardiac causes of acute chest pain include ischemic and nonischemic conditions (**Table**). Ischemic causes include coronary artery disease, aortic stenosis, coronary artery spasm, and hypertrophic cardiomyopathy. Nonischemic causes include pericarditis, dissecting aortic aneurysm, and mitral valve prolapse. While taking the medical history for a patient presenting with acute chest pain, it is important to identify cardiac risk factors, such as hypertension, diabetes, hyperlipidemia, smoking, and a family history of early heart disease.

Coronary Artery Disease

Angina pectoris is chest pain of cardiac origin due to insufficient myocardial oxygen supply on demand.² Patients frequently describe a heavy pressure or squeezing sensation that occurs after exertion or with emotional upset. Associated symptoms include diaphoresis,

TYPES OF CHEST PAIN

Cardiac causes

Ischemic
Nonischemic

Noncardiac causes

Gastroesophageal
Pulmonary
Musculoskeletal
Herpes zoster

nausea, vomiting, and weakness. Chest pain and diaphoresis are the 2 most common symptoms of acute myocardial infarction (MI).³ The Levine sign, which is the patient placing a clenched fist on the sternum when describing his or her chest pain, also may be an indication of ischemic pain.^{4,5}

A study that evaluated the frequency of symptoms among 88 patients who presented with acute MI found that 78% reported diaphoresis, 64% reported chest pain, 52% reported nausea, and 47% reported shortness of breath.³ However, it should be noted that up to 25% of all MIs may go unrecognized by the patient, only to be discovered during routine electrocardiographic examinations.⁶ These unrecognized infarctions may be either silent (asymptomatic) or may present with atypical symptoms that are unfamiliar to the patient as anginal equivalents.⁶

Many patients are delayed in their presentation to the

The authors all are assistant professors of internal medicine, University of Texas Medical Branch, Galveston, TX.

emergency department. A delay in presentation is more likely when the patient experiences a complex range of symptoms (rather than typical symptom of chest pain).³ One study found a mean delay of 7.3 hours to presentation among patients admitted with a first MI.³ The presenting symptoms and site of acute MI have been shown to be correlated.⁷ The 3 main sites of infarction are anterior, lateral, and inferior. Chest pain is the most common symptom regardless of infarction site. Anterior infarctions are more often associated with dyspnea due to left ventricular impairment. Inferior infarctions are more often associated with nausea, vomiting, diaphoresis, and singultus. The vagus nerve may play a role in the development of nausea and vomiting in patients with inferior MIs. Lateral infarctions are more often associated with left arm pain.

Aortic Stenosis

Causes of aortic stenosis include a congenital bicuspid valve, aortic sclerosis, and rheumatic fever. Coronary artery disease frequently coexists in patients with aortic sclerosis. The chest pain of aortic stenosis is typically exertional. Signs and symptoms of heart failure also may be present. Syncope is a late symptom and is typically exertional. Physical examination reveals a loud systolic ejection murmur that is best heard at the right second intercostal space and that radiates to the carotid regions of the neck. Paradoxical splitting of the secondary heart sounds exists in severe stenosis. The carotid pulse pattern is delayed in upstroke and low in amplitude. There also is a palpable left ventricular heave at the apex and a palpable thrill over the right second intercostal space.

Hypertrophic Cardiomyopathy

Hypertrophic cardiomyopathy causes outflow obstruction of the left ventricle as the interventricular septum is hypertrophied. The most common symptoms of hypertrophic cardiomyopathy are dyspnea and chest pain. The dyspnea results from diastolic dysfunction due to reduced compliance of the left ventricle. Syncope also is a symptom and is typically postexertional. Physical examination findings include a loud systolic murmur that increases with Valsalva maneuver, a loud S₄, a bifid carotid pulse, and a triple apical impulse due to a palpable presystolic S₄ and a midsystolic dip in left ventricular pressure. The chest pain associated with hypertrophic cardiomyopathy may be similar to angina in presentation.

Coronary Vasospasm

Prinzmetal's angina, also known as variant angina,

Table. Cardiac and Noncardiac Causes of Chest Pain

Cardiac causes

Ischemic

- Angina
- Myocardial infarction
- Aortic stenosis
- Hypertrophic cardiomyopathy
- Coronary vasospasm

Nonischemic

- Pericarditis
- Aortic dissection
- Mitral valve prolapse

Noncardiac causes

Gastroesophageal

- Reflux esophagitis
- Esophageal spasm
- Esophageal perforation
- Gastritis
- Peptic ulcer disease

Pulmonary

- Pneumothorax
- Pulmonary embolism
- Pleuritis
- Neoplasm
- Bronchitis

Musculoskeletal

- Costochondritis
- Rib fracture
- Compression radiculopathy

Dermatologic

- Herpes zoster

occurs as a result of coronary vasospasm. It is more common in women younger than 50 years and typically occurs early in the morning, even awakening patients from sleep. The patient may have recurrent ischemic-type chest pain that differs from typical angina in that it is more likely to occur at rest than with exertion. Coronary spasm may be evident during angiography.⁸

When patients with no or few risk factors for atherosclerosis present to the emergency department with nontraumatic chest pain, the examiner should inquire about the use of cocaine.⁹ Cocaine can induce marked vasoconstriction of the coronary arteries and the risk of

MI is unrelated to the amount of cocaine ingested.⁹ Most patients with MI or myocardial ischemia related to cocaine present within 1 hour of its use.⁹

Dissecting Aortic Aneurysm

Patients with aortic dissection typically complain of acute severe anterior chest pain that radiates to the upper back region. It is frequently associated with Marfan's syndrome. Hypertension frequently is present and is a risk factor. Type A dissection occurs in the ascending aorta, whereas type B dissection occurs just distal to the left subclavian artery. Physical examination may reveal a murmur of aortic insufficiency. Radial pulses may be unequal in intensity.

Pericarditis

Pericarditis can occur as a result of viral infection, tuberculosis, autoimmune diseases, malignancy, uremia, radiation, and post-MI (Dressler's syndrome). The viruses most commonly implicated are the coxsackieviruses and the echoviruses. The chest pain of pericarditis often is pleuritic in nature. The pain usually is alleviated by sitting forward and exacerbated by lying down. Fever is a common accompanying symptom. A friction rub on cardiac auscultation is the hallmark finding of pericarditis.

Mitral Valve Prolapse

Patients with mitral valve prolapse can present with chest pain. The pain is usually sharp in quality and located at the apex. Other associated symptoms include dyspnea, fatigue, and palpitations. The pain is reduced when lying down. Physical examination will reveal a late systolic murmur preceded by a midsystolic click heard best at the apex. The murmur is accentuated in the standing position. Most patients with mitral valve prolapse are thin females.

GASTROESOPHAGEAL CAUSES OF CHEST PAIN

According to Fruergaard et al,¹⁰ gastroesophageal disease is the most common cause for patients admitted to the coronary care unit in whom MI was ruled out, roughly accounting for 42% of all cases of chest pain. The gastroesophageal causes of acute chest pain include esophageal perforation, esophageal spasm, reflux esophagitis, peptic ulcer, pancreatitis, and cholecystitis.

Esophageal Disorders

Esophageal perforation may be caused by iatrogenic instrumentation damage, forceful vomiting, and diseases of the esophagus (eg, esophagitis or neoplasm).

Patients with esophageal perforation complain of sudden, severe, constant pain from the neck to the epigastrium that is worsened by swallowing. Physical examination may reveal neck swelling and subcutaneous emphysema evident as palpable cutaneous crepitations as free air enters the mediastinum and surrounding tissues. Pleural effusions also may be present.

Esophageal spasm often is confused with ischemic cardiac chest pain because it, too, is relieved with nitrates. Unlike cardiac chest pain, the chest pain of esophageal spasm is not related to exertion. Swallowing extremely hot or cold substances often precipitates spasm, which leads to episodes of chest pain.

Reflux esophagitis often is described as a burning sensation, a symptom referred to as heartburn or pyrosis. Pyrosis is aggravated by lying recumbent and is worse after meals. Other associated symptoms of reflux esophagitis include chronic cough and dysphagia. Patients also may report the regurgitation of bitter gastric contents into the mouth.

Esophagitis also can be associated with infectious organisms such as *Candida albicans*. A history of infection with HIV or recent chemotherapy increases the likelihood of developing *Candida* esophagitis. Thrush may or may not be evident on physical examination of the oral cavity. In addition to chest pain, the patient may complain of pain upon swallowing (odynophagia).

Other causes of esophagitis include certain medications such as nonsteroidal anti-inflammatory drugs and alendronate.¹¹ Although any pill can induce esophagitis if not swallowed properly with enough water, alendronate has received the most attention with recommendations to swallow the pill with 6 to 8 oz of water and remain upright for at least 30 minutes.¹² Chemical esophagitis from accidental ingestion of caustic substances is also a possibility.

Conditions of the Upper Abdomen

Upper abdominal conditions, including acute cholecystitis, acute pancreatitis, and perforated peptic ulcer, can mimic the signs and symptoms of an acute inferior MI or myocardial ischemia. It is essential to consider upper abdominal conditions in patients presenting with lower chest pain. Murphy's sign, which identifies patients with acute cholecystitis, can be elicited by having the patient inhale deeply while the physician palpates the right subcostal area. Abrupt cessation of inspiration due to pain is considered a positive Murphy's sign. Acute pancreatitis results in constant, boring pain in the epigastric region. A history of alcohol abuse, cholelithiasis, and hypertriglyceridemia

should raise the suspicion for acute pancreatitis. Patients with a perforated peptic ulcer commonly experience sudden onset of severe epigastric pain. Patients with perforated peptic ulcer soon develop a rigid, board-like abdomen due to peritonitis. (Acute abdominal pain is reviewed in a previous *Review of Clinical Signs*.¹³)

PULMONARY CAUSES OF CHEST PAIN

Chest pain associated with pulmonary diseases frequently is described as pleuritic in nature. The term pleuritic implies that the pain varies with the respiratory cycle and is exacerbated during inspiration and coughing. Pleuritic chest pain is typically sharp and unilateral. Pleuritis, the classic condition causing pleuritic chest pain, results from acute pleural inflammation. Pleuritis usually is caused by lower respiratory infections, although other causes, such as autoimmune diseases, are possible. The pain is sharp and made worse by coughing, deep breathing, or movement. A pleural friction rub commonly is heard on auscultation. Other pulmonary causes of acute chest pain include spontaneous pneumothorax, pulmonary embolism, pneumonitis, bronchitis, and intrathoracic neoplasm.

Spontaneous pneumothorax results in sharp chest pain that may radiate to the ipsilateral shoulder. Spontaneous pneumothorax can occur in persons with underlying pulmonary diseases such as emphysema. The typical patient is a tall, thin male smoker. Physical examination reveals absence of breath sounds and hyperresonance of the affected hemithorax.

Pulmonary embolism is suggested by the acute onset of dyspnea, pleuritic chest pain, severe hypoxia, and risk factors such as recent surgery, underlying malignancy, and a bedridden or sedentary state. Most pulmonary embolisms arise from venous thromboembolisms of the lower extremity. Stein et al¹⁴ found that the most common symptoms include dyspnea (73%), pleuritic pain (66%), cough (37%), lower extremity edema (28%), and hemoptysis (13%). Physical signs included crackles on lung auscultation (51%) and tachycardia (30%).¹⁴

OTHER CAUSES OF CHEST PAIN

Musculoskeletal Causes

According to Fruergaard et al,¹⁰ chest wall pain accounted for 28% of all causes of chest pain in patients admitted to a coronary care unit in whom MI was ruled out. Musculoskeletal (chest wall) causes of acute chest pain include costochondritis (Tietze's syndrome), caused by inflammation of the costochondral junction; rib fracture; and myalgia. For patients with

chest wall pain, palpation of the chest may reproduce the symptoms. Passive spinal movements, such as flexion, extension, and rotation of the thoracic and cervical spine, also are helpful in reproducing musculoskeletal pain.¹⁵

Herpes Zoster

Herpes zoster can present as acute chest pain. The pain associated with herpes zoster usually is described as a burning sensation and is located in a unilateral dermatomal distribution. Physical examination findings may be lacking as the pain often occurs before the onset of vesicular lesions, thus making the diagnosis difficult.¹⁶

CONCLUSION

Chest pain is a common presenting problem in an acute care setting and is caused by both cardiac and noncardiac etiologies. The life-threatening causes of chest pain must be quickly differentiated from other less serious causes of chest pain. Not all life-threatening causes are of cardiac origin. Gastrointestinal and pulmonary etiologies must be considered. The history and physical examination remain the front line of evaluation as they help to distinguish among the potential causes of chest pain and lead to appropriate and potentially life-preserving therapy. **HP**

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