



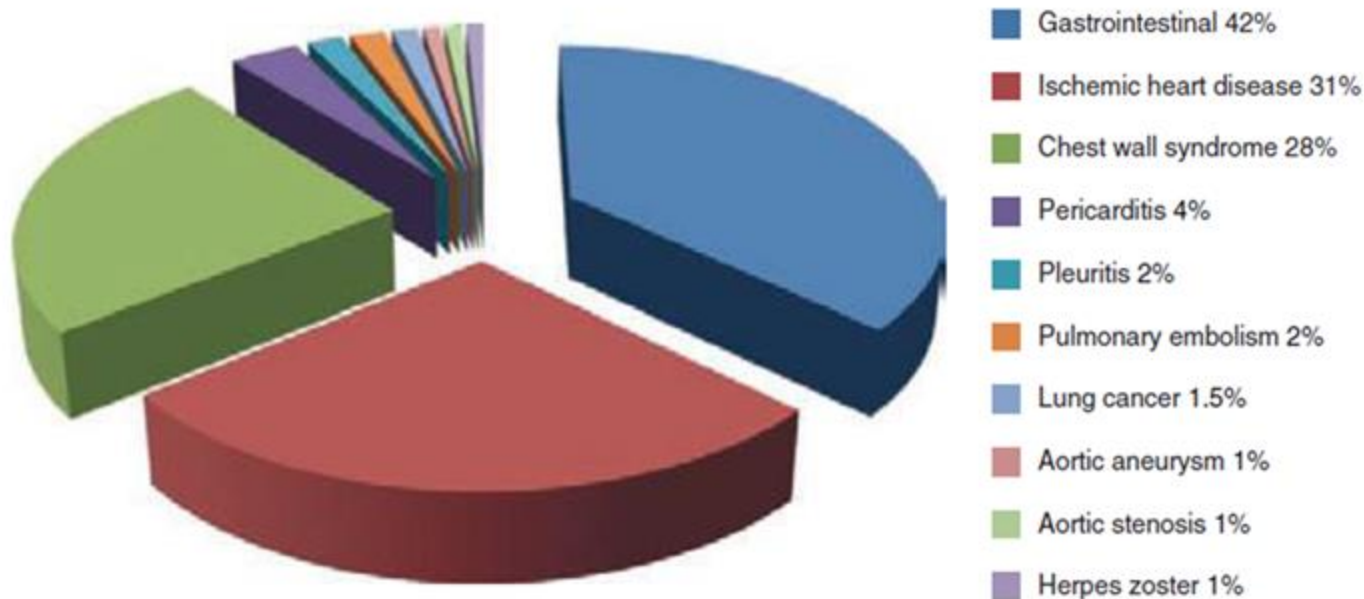
Approach to chest pain

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- ▶ Chest pain is among the most common reasons for which patients present for medical attention at either an emergency department or an outpatient clinic.
- ▶ 15% to 25% of patients with acute chest pain actually have ACS*.

* Annals of emergency medicine June 2005 Volume 45, Issue 6, Pages 581-585.

Distribution of final discharge diagnoses in patients with nontraumatic acute chest pain+



► *P Fruergaard et al: Eur Heart J 17:1028, 1996*

- 
- ▶ Chest pain may be caused by almost any condition affecting the thorax, abdomen or internal organs.
- 

Causes of Chest pain

▶ Cardiovascular

- Acute coronary syndrome
- Stable angina pectoris
- Aortic dissection
- Pericarditis

▶ **Pulmonary**

- Pulmonary embolism
- Pneumothorax
- Pneumonia
- Pleurisy

▶ **Gastrointestinal**

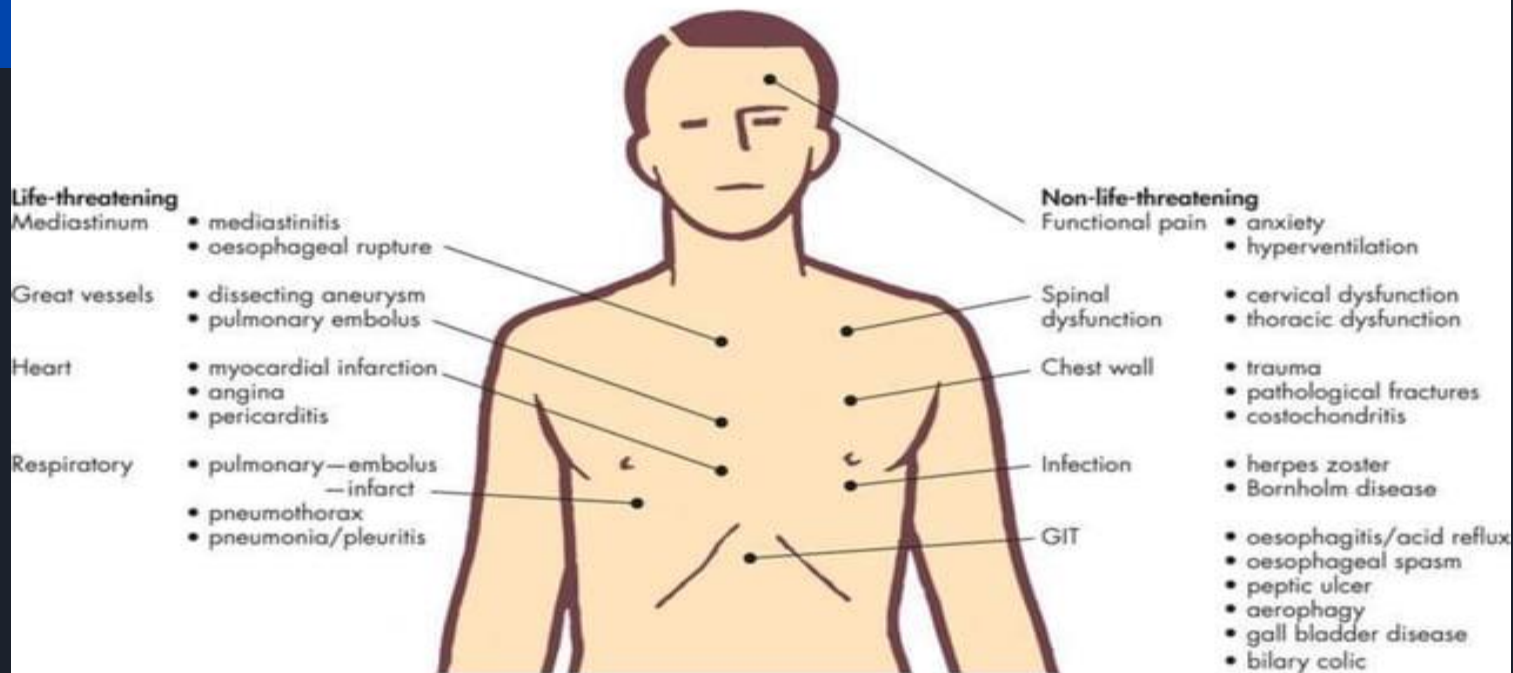
- Gastroesophageal reflux disease (GERD)
- Esophageal spasm
- Mallory Weiss syndrome
- Cholecystitis
- Peptic ulcer disease
- Pancreatitis

▶ Chest wall

- Costochondritis
- Tietze's syndrome
- Radiculopathy
- Herpes zoster

► **Psychological**

- Anxiety and panic disorders
- Hypochondriasis



Source: John Murtagh, Jill Rosenblatt: *John Murtagh's General Practice*, 6e: www.murtagh.mhmedical.com
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- ▶ The history and physical examination, complemented by selected tests, helps to reach an accurate diagnosis for most causes of chest pain and to judge which patients are likely to have a benign etiology.

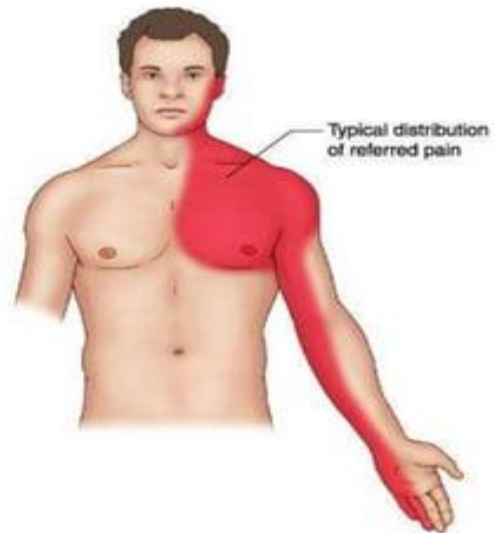
History and clinical findings

- ▶ Typical, atypical and noncardiac chest pain (AHA/ACC)
 1. Substernal chest pain squeezing, pressing, choking, or tightness lasting for 2 to 5 mins
 2. Provoked by exertion or emotional stress
 3. Relieved by rest or nitroglycerin

Stable angina pectoris

- Heberden coined the term angina means sense of strangling and anxiety
- Diffuse retrosternal chest pain crescendo–decrecendo in nature, typically lasts 2 to 5 min.
- Heaviness, pressure, tightness, squeezing, constricting, weight in the chest, smothering, bursting, choking type of pain.

- Radiate to either shoulder, both arms, back, interscapular region, root of the neck, jaw, teeth, and epigastrium
- Aggravated on exertion, emotion, after a heavy meal or exposure to cold
- Relieved on rest, nitrate.



- Typically places a hand over the sternum, sometimes with a clenched fist, to indicate a squeezing, central, substernal discomfort (Levine's sign).



▶ Angina equivalents

- Dyspnea
 - Faintness
 - Fatigue
 - Diaphoresis
 - Nausea
- History of risk factors
- 

- ▶ The physical examination is often normal in patients with stable angina when they are asymptomatic.
- ▶ Evidence of risk factors for atherosclerosis such as xanthelasmas and xanthomas.

- ▶ Aortic stenosis, aortic regurgitation, pulmonary hypertension and hypertrophic cardiomyopathy must be excluded, since these disorders may cause angina in the absence of coronary atherosclerosis.

Non-ST-Segment Elevation Acute Coronary Syndrome (NSTEMI and Unstable Angina)

- It occurs at rest (or with minimal exertion), lasting >10 minutes
- It is of relatively recent onset
- It occurs with a crescendo pattern

- ▶ The diagnosis of NSTEMI is established if patient develops evidence of myocardial necrosis, as reflected in abnormally elevated levels of biomarkers of cardiac necrosis.

ST-Segment Elevation Myocardial Infarction

- ▶ Pain is the most common presenting complaint in patients with STEMI.
- ▶ Heavy, squeezing, and crushing.
- ▶ Similar in character to the discomfort of angina pectoris but commonly occurs at rest, is usually more severe, and lasts longer.

- 
- ▶ Pain often accompanied by weakness, sweating, nausea, vomiting, anxiety, and a sense of impending doom.

PAIN DESCRIPTOR	POSITIVE LIKELIHOOD RATIO (95% CI)
Increased Likelihood of AMI	
Radiation to the right arm or shoulder	4.7 (1.9-12.0)
Radiation to both arms or shoulders	4.1 (2.5-6.5)
Associated with exertion	2.4 (1.5-3.8)
Radiation to the left arm	2.3 (1.7-3.1)
Associated with diaphoresis	2.0 (1.9-2.2)
Associated with nausea or vomiting	1.9 (1.7-2.3)
Worse than previous angina or similar to previous MI	1.8 (1.6-2.0)
Described as pressure	1.3 (1.2-1.5)
Decreased Likelihood of AMI	
Described as pleuritic	0.2 (0.1-0.3)
Described as positional	0.3 (0.2-0.5)
Described as sharp	0.3 (0.2-0.5)
Reproducible with palpation	0.3 (0.2-0.4)
Inframammary location	0.8 (0.7-0.9)
Not associated with exertion	0.8 (0.6-0.9)

Association of chest pain characteristics with the probability of acute myocardial infarction (AMI). JAMA 294:2623, 2005

Aortic Dissection

- ▶ Sudden onset of pain
- ▶ Very severe and sharp
- ▶ Stabbing tearing or ripping
- ▶ The pain may be localized to the front or back of the chest, often the interscapular region, and typically migrates with propagation of the dissection.

- ▶ Physical findings
- ▶ Hypertension or hypotension
- ▶ Loss of pulses
- ▶ Aortic regurgitation
- ▶ Neurologic findings (hemiplegia) or spinal cord ischemia (paraplegia)
- ▶ Bowel ischemia
- ▶ Myocardial ischemia

Pericarditis

- ▶ Pain is severe, retrosternal and left precordial and referred to the neck, arms or left shoulder (trapezius ridge).
- ▶ Frequently the pain is pleuritic.
- ▶ Relieved by sitting up and leaning forward
- ▶ Aggravated by lying supine.

- An antecedent history suggesting a viral illness is common.
- Associated symptoms can include dyspnea, cough, and occasionally hiccoughs.

- A pericardial friction rub is audible.
- High-pitched
- Rasping, scratching, or grating.
- Heard most frequently at end expiration with the patient upright and leaning forward.

Pulmonary embolism

- ▶ Dyspnea is the most frequent symptom and tachypnea is the most frequent sign of PE.
- ▶ H/o Immobilization or surgery within 4 weeks
- ▶ Previous DVT or PE
- ▶ Pain is of pleuritic type.

- 
- ▶ Tachycardia
 - ▶ Evidence of DVT
 - ▶ Signs of right heart failure
 - ▶ Tricuspid regurgitant murmur
 - ▶ Accentuated P2
- 

Pulmonary hypertension

- ▶ Exertional dyspnea or reduced exercise tolerance, chest pain, fatigue, light-headedness and syncope.
- ▶ Abdominal distention, and lower limb swelling
- ▶ Raised JVP
- ▶ Left parasternal lift

- ▶ Loud p2
- ▶ Holosystolic murmur that increases with inspiration (TR)
- ▶ In advance disease features of right ventricular failure

Pneumothorax

- ▶ Chest pain and dyspnea.
- ▶ Pain is usually sudden, localized to the side of the pneumothorax, and typically pleuritic.
- ▶ Tactile fremitus is reduced.
- ▶ The percussion note is hyperresonant.
- ▶ Breath sounds are absent or reduced on the side with the pneumothorax.

- 
- ▶ Severe tachycardia.
 - ▶ Hypotension, cyanosis, or shift of mediastinum suggests the possibility of a tension pneumothorax.
- 

Pneumonia

- ▶ Fever.
- ▶ Productive cough.
- ▶ Pleuritic type of chest pain.
- ▶ An increased respiratory rate and use of accessory muscles of respiration
- ▶ Palpation may reveal increased tactile fremitus.

- ▶ The percussion note is dull, reflecting underlying consolidated lung.
- ▶ Crepitations
- ▶ Bronchial breath sounds

GASTROESOPHAGEAL REFLUX DISEASE (GERD)

- ▶ Heartburn
- ▶ Discomfort or burning sensation behind the sternum
- ▶ Intermittent
- ▶ Aggravates after eating, during exercise, and while lying recumbent

- ▶ Sour or burning fluid in the throat
- ▶ Chronic cough, laryngitis and dental erosions
- ▶ Epigastric tenderness

DIFFUSE ESOPHAGEAL SPASM (DES)

- ▶ Chest pain
- ▶ Pressure type sensation in the mid chest
- ▶ Radiating to the mid back, arms, or jaws
- ▶ Nonexertional

- ▶ Meal-related
- ▶ Relieved with nitrates and calcium channel blockers

ACHALASIA

- ▶ Loss of ganglion cells within the esophageal myenteric plexus
- ▶ Impaired deglutitive LES relaxation and absent peristalsis

- ▶ Dysphagia
- ▶ Regurgitation
- ▶ Chest pain squeezing, pressure-like sensation
- ▶ Weight loss

MALLORY-WEISS SYNDROME

- ▶ Vomiting, retching, or vigorous coughing can cause a nontransmural tear at the gastroesophageal junction
- ▶ Chest pain and Hematemesis

ESOPHAGEAL PERFORATION

- ▶ Instrumentation of the esophagus or trauma
- ▶ Forceful vomiting or retching can lead to spontaneous rupture at the gastroesophageal junction (Boerhaave's syndrome)

- ▶ Pleuritic retrosternal pain
- ▶ Pneumomediastinum
- ▶ Subcutaneous emphysema

ESOPHAGITIS

- ▶ Odynophagia
- ▶ Dysphagia
- ▶ Chest pain
- ▶ Oral thrush in candida esophagitis
- ▶ Vesicles on the nose and lips in herpes

Peptic Ulcer Disease

- ▶ Burning epigastric pain
- ▶ 90 minutes to 3 hours after a meal
- ▶ Relieved by antacids or food in duodenal ulcer
- ▶ Precipitated by taking food in gastric ulcer

- ▶ Associated with nausea and vomiting
- ▶ Hemetamesis
- ▶ Tarry stools

CHOLECYSTITIS & BILIARY COLIC

- ▶ Pain in right lower part of the chest
- ▶ Right hypochondrium
- ▶ Radiating to interscapular region and right shoulder
- ▶ Aggravates on deep inspiration

- 
- ▶ Nausea and vomiting
 - ▶ Fever
 - ▶ Tenderness in right hypochondrium
 - ▶ Murphy's sign
- 

Pancreatitis

- ▶ Severe abdominal pain in the epigastrium
- ▶ Radiate to the back, chest, flanks, and lower abdomen
- ▶ Nausea and vomiting
- ▶ Low-grade fever

- 
- ▶ Tachycardia
 - ▶ Hypotension
 - ▶ Abdominal tenderness and muscle rigidity
 - ▶ Blue discoloration around the umbilicus (Cullen's sign)
 - ▶ Blue-red-purple or green-brown discoloration of the flanks (Turner's sign)
- 

Costochondritis

- ▶ Tietze's syndrome
- ▶ An acute inflammation of the costal cartilage.
- ▶ Chest pain is aching type
- ▶ Aggravates with coughing, deep breathing, or physical activity
- ▶ Tenderness to palpation usually occurs on the sides of the sternum

Herpes zoster

- ▶ Painful skin rash with blisters
- ▶ Burning pain, itching, hyperesthesia
paresthesia
- ▶ Confined to a dermatome
- ▶ Associated prodromal symptoms

Hypochondriasis

- ▶ A persistent belief, of at least six months' duration, of the presence of a maximum of two serious physical diseases
- ▶ Preoccupation with the belief and the symptoms
- ▶ Persistent refusal to accept medical advice

Panic attack

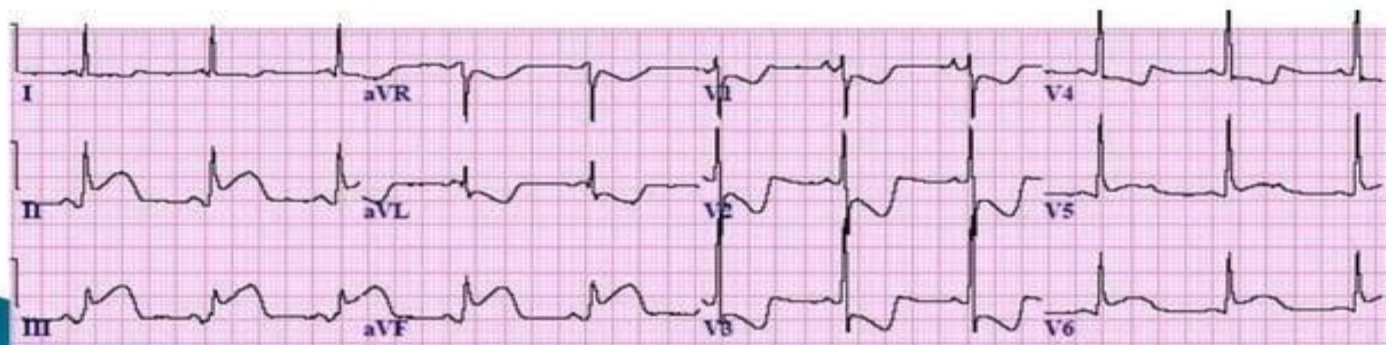
- ▶ Sudden periods of intense fear
- ▶ Chest pain, palpitations, sweating, shaking, shortness of breath or numbness
- ▶ Typically they last for about 30 minutes but the duration can vary from seconds to hours

Electrocardiography

- ▶ ECG should be done within 10 minutes of patient arrival
- ▶ ST-segment depression and symmetric T-wave inversions at least 0.2 mV in depth in US and NSTEMI
- ▶ ST-segment elevation with reciprocal depression in STEMI

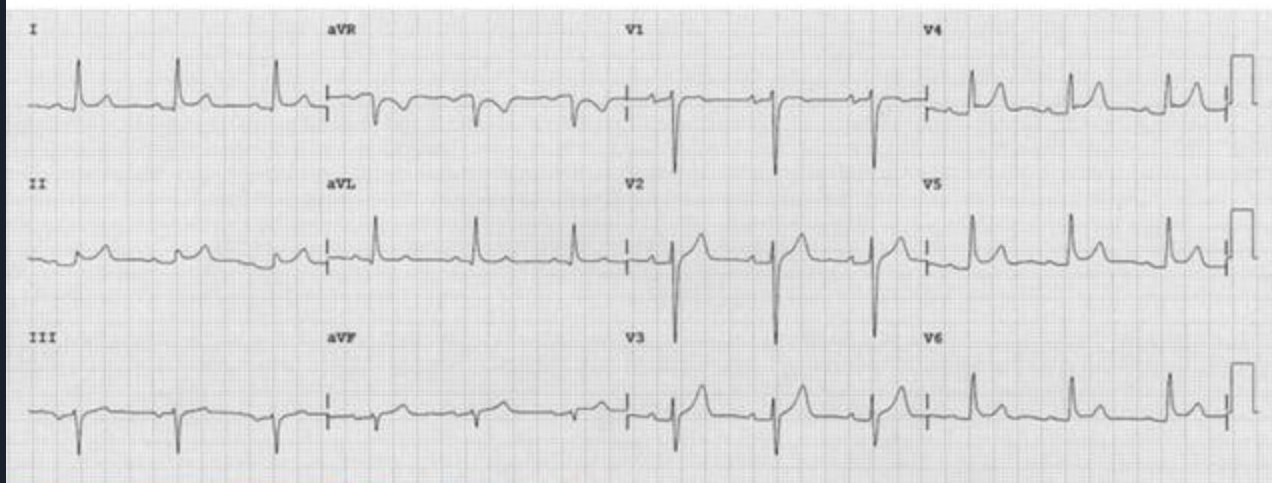
- ▶ STEMI – IWM

- ▶ Serial performance of ECGs (every 30–60 min) is recommended in the ED evaluation of suspected ACS

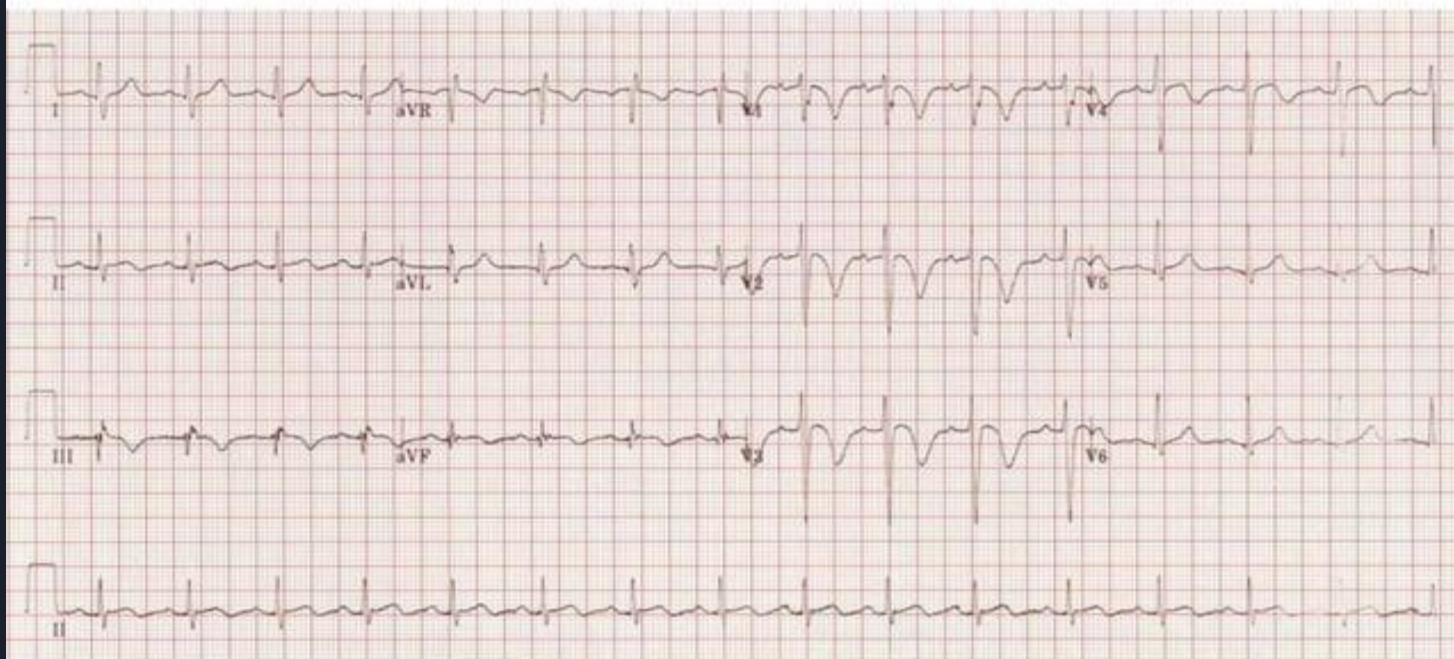


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- ▶ Diffuse ST-segment elevation and PR-segment depression suggest pericarditis
 - ▶ Right-axis deviation, right bundle branch block, T wave inversions in leads V1 to V4, and S1 Q3 T3 suggest PE.

► Pericarditis



► Pulmonary embolism



CHEST RADIOGRAPHY

- ▶ Pneumonia
- ▶ Pneumothorax
- ▶ Pulmonary edema
- ▶ Widening of mediastinum
- ▶ Westermak's sign
- ▶ Hampton hump

- ▶ Left lower lobe pneumonia



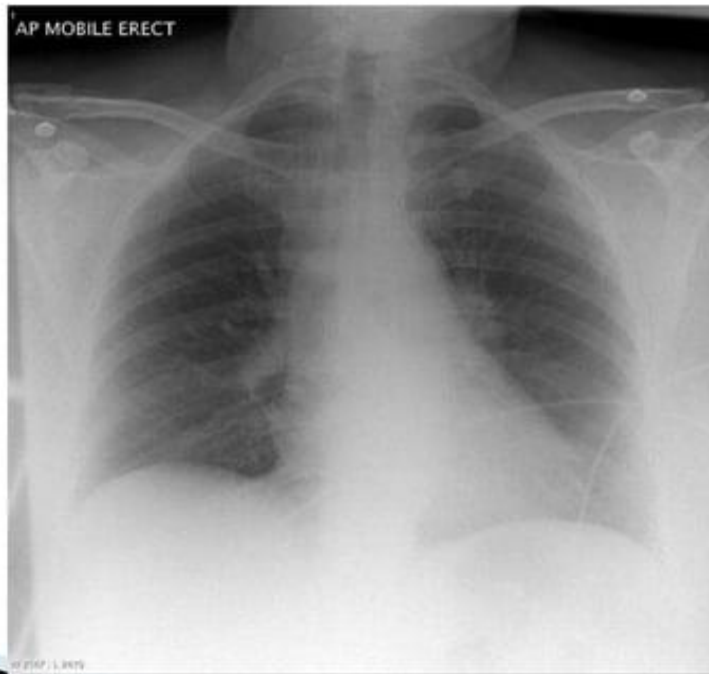
► Aortic dissection



Hampton hump



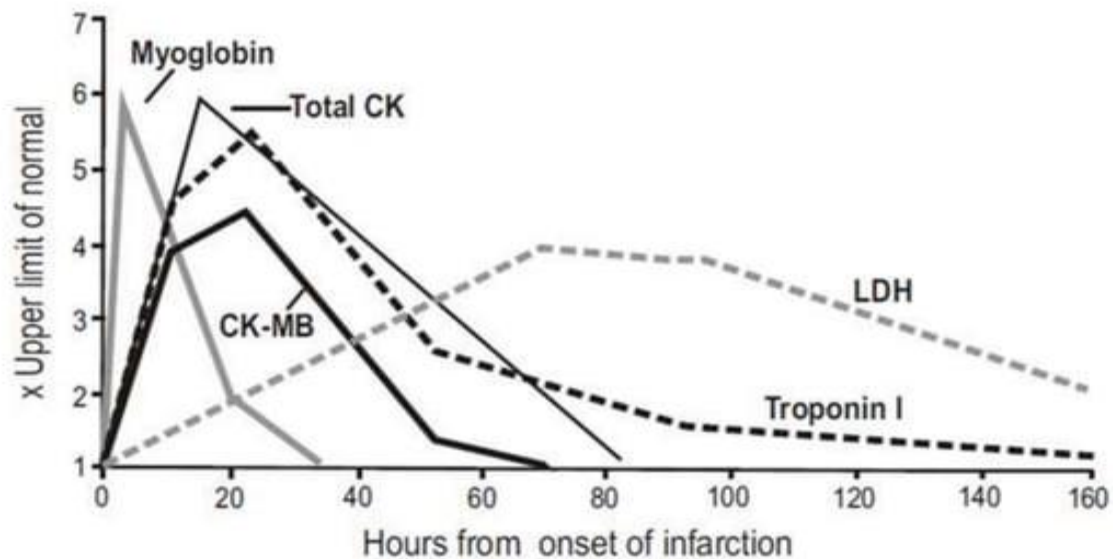
Westermak's sign



CARDIAC BIOMARKERS

- ▶ A rise and/or fall in cardiac biomarker values with at least one value above the 99th percentile of the upper limit for normal individuals
- ▶ Cardiac troponins are preferred over CKMB

Figure 1: Cardiac Marker Pattern Associated with Myocardial Infarction (5)



HEART Score		
History	Highly suspicious	2
	Moderately suspicious	1
	Slightly suspicious	0
ECG	Significant ST-depression	2
	Non-specific abnormality	1
	Normal	0
Age	≥65 y	2
	45–<65 y	1
	<45 y	0
Risk factors	≥3 risk factors	2
	1–2 risk factors	1
	None	0
Troponin (serial)	≥3 × 99th percentile	2
	1–<3 × 99th percentile	1
	≤99th percentile	0
	TOTAL	
	Low-risk: 0–3 Not low risk: ≥4	

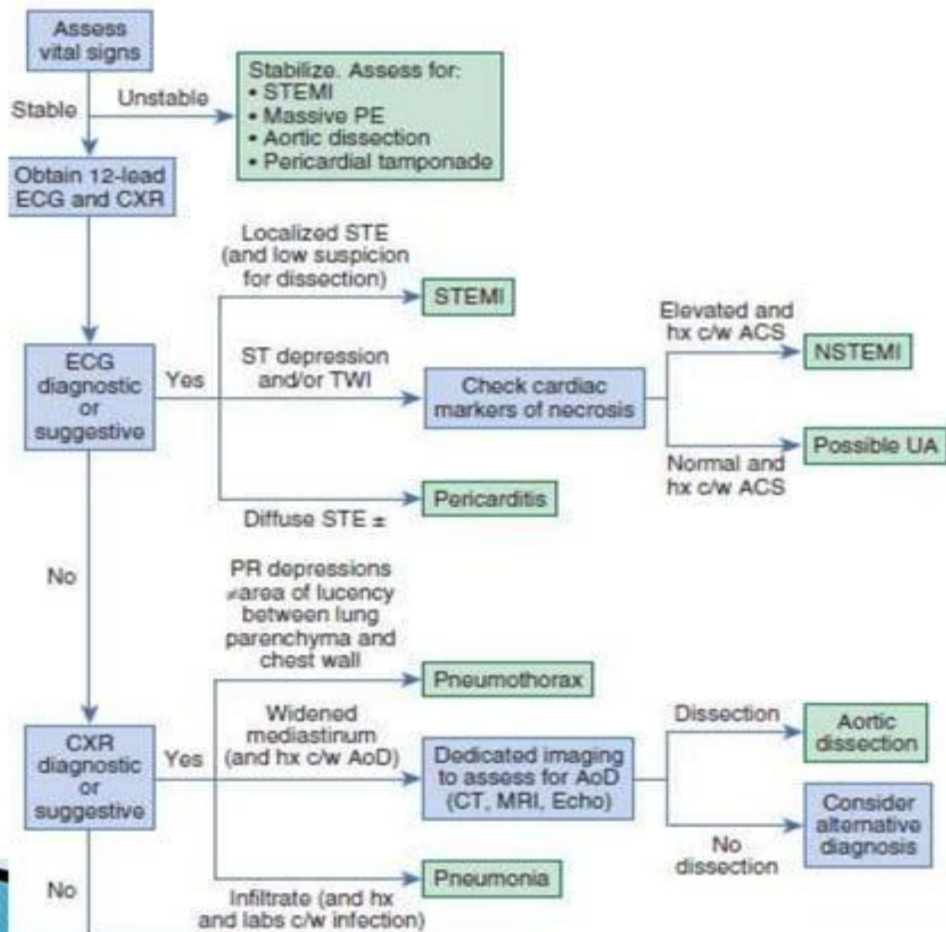
- Predicts 6-week risk of major adverse cardiac event

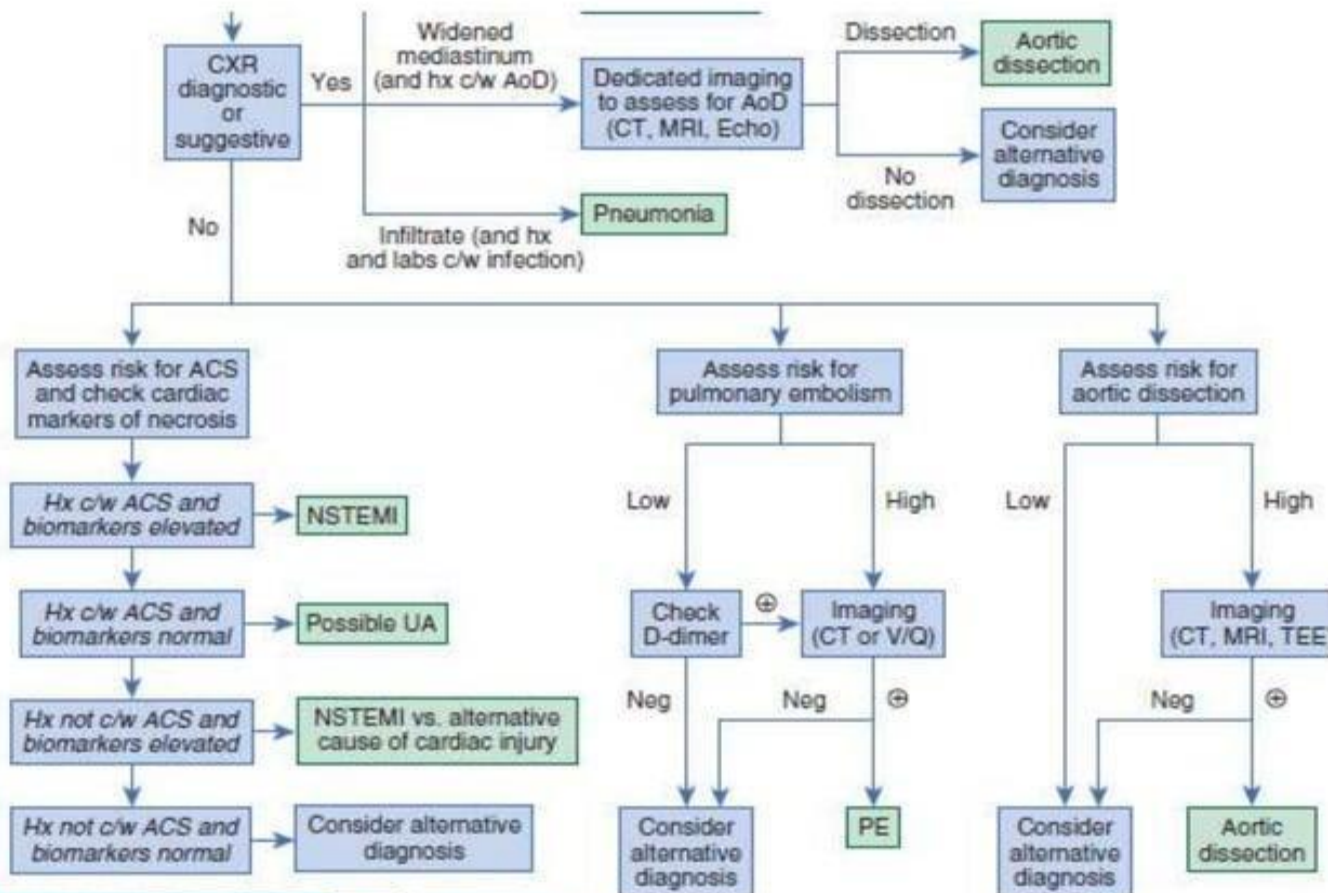
SA Mahler et al: Int J Cardiol 168:795, 2013

Classic Wells Criteria to Assess Clinical Likelihood of Pulmonary Embolism

CRITERION	SCORING
DVT symptoms or signs	3
An alternative diagnosis is less likely than PE	3
Heart rate > 100 beats/min	1.5
Immobilization or surgery within 4 weeks	1.5
Previous DVT or PE	1.5
Hemoptysis	1
Cancer treated within 6 months or metastatic	1

- ▶ >4 score points = high probability
- ▶ ≤4 score points = non-high probability.





Treadmill Electrocardiography

- ▶ A major goal of the initial short period of observation of low-risk patients in chest pain units is to determine whether performance of exercise testing or other noninvasive tests is safe.

- 
- ▶ Patients with low clinical risk can safely undergo exercise testing after 6 to 8 hours of an evaluation that reveals no evidence of myocardial ischemia.
 - ▶ Prognostic assessment
- 



► Indications

- Two sets of cardiac enzymes at 4-hr intervals should be normal
 - ECG at the time of arrival and preexercise 12-lead ECG show no significant abnormality
 - Absence of ischemic chest pain at the time of exercise testing
- 

- From admission to the time that results are available from the second set of cardiac enzymes: patient asymptomatic, lessening chest pain symptoms, or persistent atypical symptoms.

▶ Contraindications

- New or evolving electrocardiographic abnormalities on the rest tracing
- Abnormal cardiac enzyme levels
- Inability to perform exercise
- Worsening or persistent ischemic chest pain symptoms from admission to the time of exercise testing

- ▶ Low-risk patients who underwent exercise testing in the first 48 h after chest pain, those without evidence of ischemia in TMT had a 2% rate of cardiac events through 6 months, whereas the rate was 15% among patients with either clear evidence of ischemia or an equivocal result

Imaging Tests

- ▶ Echocardiography
 - Abnormal regional wall motion
 - Aortic dissection transesophageal echocardiography
- ▶ CT Angiography
 - Coronary CT angiography is a sensitive technique for detection of obstructive coronary disease, particularly in the proximal third of the major epicardial coronary arteries

▶ Triple-rule-out CTA

- Coronary artery disease
- Aortic dissection
- Pulmonary embolism

▶ Cardiac magnetic resonance (CMR)

- Gadolinium-enhanced CMR can provide early detection of MI
- 

Other investigations

► Endoscopy

Normal



(A)

Inflammation by Reflux

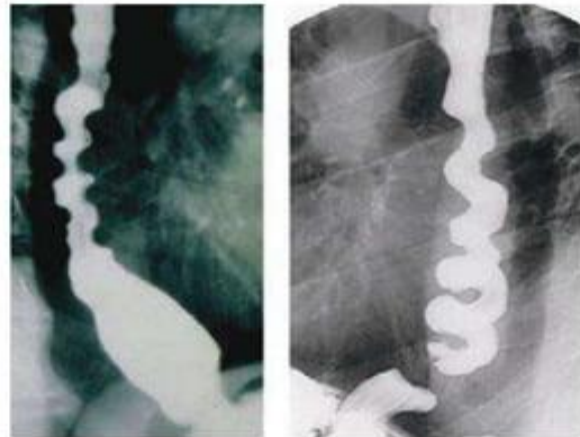


(B)

- ▶ Radiography
 - Beak-like appearance in achalasia



- Corkscrew esophagus or rosary bead esophagus in esophageal spasm



- 
- ▶ Esophageal manometry in esophageal spasm
 - ▶ Ambulatory 24- to 48-h esophageal pH recording in GERD
 - ▶ Serum amylase and lipase in pancreatitis
 - ▶ USG abdomen and CT abdomen in pancreatitis

CRITICAL PATHWAYS FOR ACUTE CHEST DISCOMFORT

- ▶ Rapid identification, triage, and treatment of high-risk cardiopulmonary conditions (STEMI)
- ▶ Accurate identification of low risk patients who can be safely observed in units with less intensive monitoring, undergo early exercise testing, or be discharged home