

Approach to Chest Pain

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- Chest pain is one of the highest risk chief complaints you will see in the Emergency Department (ED).
- Approximately 6 million patients visit the emergency department (ED) each year with complaints of chest pain, constituting 9% of all patients seen in ED in USA.

Definition of Acute Chest Pain:

- It is the recent onset of pain, pressure, or tightness in the anterior thorax between the xiphoid, supra sternal notch, and both midaxillary lines.

Chest pain challenges:

- It can be caused by several life-threatening as well as non-life-threatening diseases and has a broad differential diagnosis.
- The diagnosis of chest pain in ED can be difficult because neither the quality nor intensity of the pain is specific to any organ or diagnosis.
- The presentations can vary significantly even amongst the most common life-threatening diseases.

Life Threatening Causes of Chest Pain

Acute Coronary Syndrome (ACS)

Acute Aortic Dissection (AAD)

Pulmonary Embolism (PE)

Cardiac Tamponade

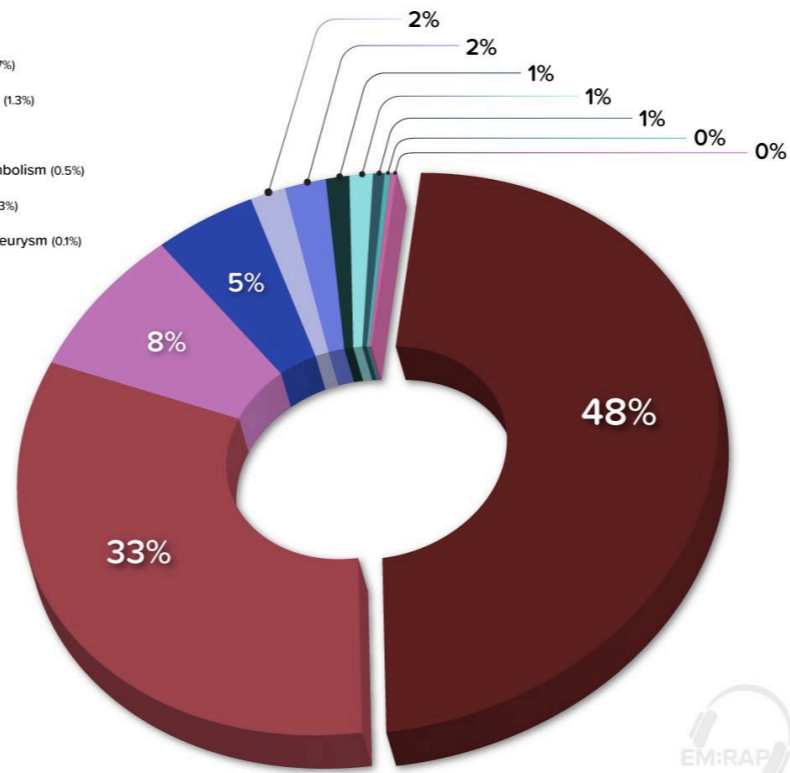
Esophageal Rupture

Tension Pneumothorax

Differential Diagnosis of Chest Pain

ORGAN SYSTEM	CRITICAL DIAGNOSES	EMERGENT DIAGNOSES	NONEMERGENT DIAGNOSES
Cardiovascular	Acute myocardial infarction Acute coronary ischemia Aortic dissection Cardiac tamponade	Unstable angina Coronary spasm Prinzmetal's angina Cocaine-induced pericarditis or myocarditis	Valvular heart disease Aortic stenosis Mitral valve prolapse Hypertrophic cardiomyopathy
Pulmonary	Pulmonary embolus Tension pneumothorax	Pneumothorax Mediastinitis	Pneumonia Pleuritis, tumor, pneumomediastinum
Gastrointestinal	Esophageal rupture (Boerhaave's syndrome)	Esophageal tear (Mallory-Weiss) Cholecystitis Pancreatitis	Esophageal spasm Esophageal reflux Peptic ulcer, biliary colic
Musculoskeletal			Muscle strain, rib fracture arthritis, tumor, costochondritis, nonspecific chest wall pain
Neurologic			Spinal root compression, thoracic outlet, herpes zoster, postherpetic neuralgia
Other			Psychological, hyperventilation

- Chest Pain NOS (48%)
- Other (33%)
- Unstable Angina (8.0%)
- CHF (4.6%)
- STEMI (1.9%)
- Pneumonia (1.7%)
- Stable Angina (1.3%)
- NSTEMI (1.1%)
- Pulmonary Embolism (0.5%)
- Pericarditis (0.3%)
- Dissecting Aneurysm (0.1%)



Pathophysiology:

- Afferent fibers from the heart, lungs, great vessels, and esophagus enter the same thoracic dorsal ganglia.
- Through these visceral fibers, each organ produces the same indistinct quality and location of pain.
- Because dorsal segments overlap three segments above and below a level, disease of a thoracic origin can produce pain anywhere from the jaw to the epigastrium.

- *Chest pain evaluation is challenging but very manageable.*
- *Most patients who present with chest pain are actually not that sick and many can be safely discharged from the ED.*

Initial Evaluation:

- Determine “Sick vs “Not Sick”.
- Assesses primary survey: ABC’s and vital signs (Stable vs unstable)
- Obtain focused history and exam.
- Obtain ECG.

History:

Character of the pain:

- Squeezing.
- Crushing
- Pressure like

Think of ACS

Sharp or stabbing more in pulmonary

- relation to exercise.
- onset.
- relation to food.
- severity.
- location.
- radiation

- Duration .
- aggravation factors.
- associated symptoms (diaphoresis).
- PMHx
- Risk Factors.

Risk Factors

ACS	Smoking, HTN, HLD, DM, premature FHx of CAD*, obesity, chronic cocaine/amphetamine use, inflammatory disease
PE	Stasis, endothelial injury, hypercoagulability, CHF, DVT
AAD	HTN, atherosclerosis, connective tissue disorder, pregnancy
Pericarditis or myocarditis	Infection, rheumatic fever, SLE, MI, surgery, uremia, toxic medications
Pneumothorax	Valsalva, COPD, tobacco abuse

Classical cardiac chest pain:

- Retrosternal left anterior chest crushing, squeezing, tightness, or pressure.
- Aggravated by exertion and relieved by rest.
- Radiation.
- Diaphoresis.

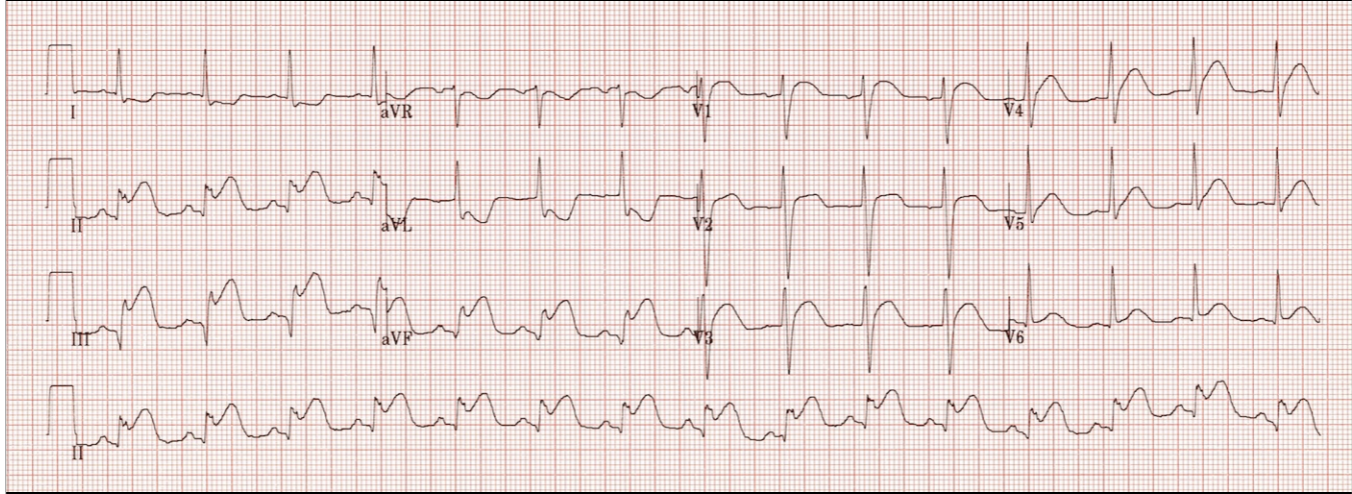
Examination:

- General appearance .
- V/S.
- Cardiac exam.
- Pulmonary exam.
- Abdominal exam.
- Extremities exam.
- Neurologic exam.

Diagnostic Testing:

Electrocardiogram (ECG):

- ECG within 10 minutes of arriving to ED.
- It can give the clinician a lot of information.
- A rapid screen is done to look for STEMI/ ischemia and arrhythmia.
- Serial ECGs.



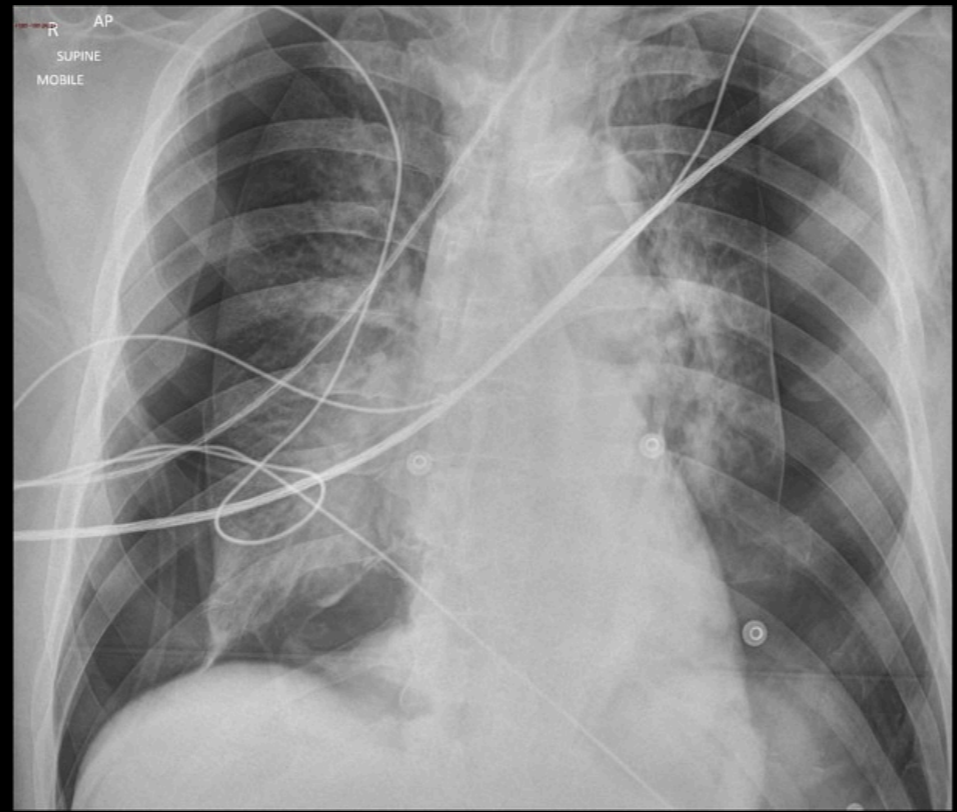
- ST-segment elevation also occurs in patients with pericarditis, myocarditis, early repolarization, left ventricular hypertrophy, and ventricular aneurysms.
- **A normal ECG lacks the sensitivity to exclude ACS.**

STEMI	<ul style="list-style-type: none">• ST-Elevation in 2 or more contiguous leads
Pericarditis	<ul style="list-style-type: none">• Diffuse ST Elevation• PR depressions• ST Depression in AVR
Cardiac Tamponade	<ul style="list-style-type: none">• Diminished QRS amplitude• Electrical Alternans
Pulmonary Embolism	<ul style="list-style-type: none">• S1Q3T3• Sinus Tachycardia• Right heart strain

Imaging:

- CXR is commonly performed in the evaluation of ED patients with chest pain.
- Most patients with ACS have a normal CXR.
- Useful to exclude other conditions such as pneumonia and pneumothorax.





Laboratory Studies:

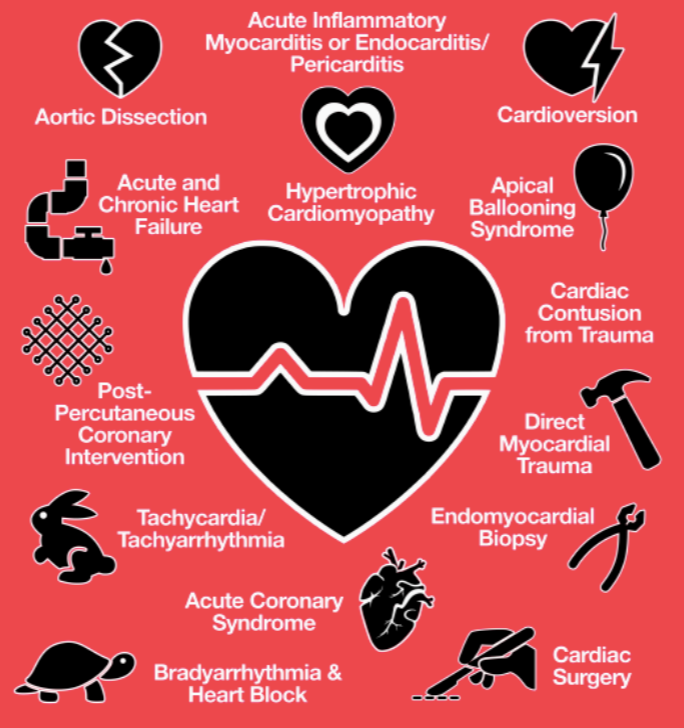
Cardiac troponins (cTn):

- They are regulatory proteins that control the calcium-mediated interaction of actin and myosin, producing myocardial contraction.
- Myocardial injury, including but not limited to ischemia, causes release of these proteins into blood.
- There are numerous non- ischemic causes of cTn elevations.

NON-CARDIAC PROBLEMS:



CARDIAC PROBLEMS:



Point of Care Ultrasound (POCUS):

- The ultrasound can assess for pericardial effusion as well as tamponade.
- It can assess the cardiac contractility to assess the left ventricular function.
- It can determine the presence of right ventricular strain.

ACS

- Incidence: ~12% of ED patients with Chest pain have ACS.
- ACS is comprised of ST-elevation myocardial infarction (STEMI), non-ST-elevation myocardial infarction (NSTEMI), and unstable angina (UA).

History:

- Classically associated with shortness of breath (SOB), nausea/vomiting, diaphoresis, and radiation to neck/arm/shoulder.
- Pain worsens upon exertion.
- Response to nitroglycerin has no predictive value for ACS.

Non-classic presentations of ACS occur more frequently in women, black race, diabetics, the elderly, and patients with psychiatric disease or altered mental status

Chest pain that significantly decreases the likelihood of ACS include:

- Pleuritic in nature.
- Positional pain.
- Pain described as sharp.
- Pain that is fully reproducible with palpation.
- Non-exertional

Diagnosis:

- In the absence of left ventricular hypertrophy (LVH) or left bundle branch block (LBBB), ST elevation (STE) is defined as follows:

≥1 mm STE in at least 2 contiguous leads except for V2-V3. If V2-V3, STE must be ≥2 mm in men ≥40 y old, ≥2.5 mm in men <40 y old, or ≥1.5 mm in women.

- In AMI, initial ECGs are often non-specific (40%-70%) or normal (<10%).

- Troponin is the test of choice for diagnosing MI. Along with the history and ECG, troponin plays an essential role in diagnosing MI.
- Elevated troponin is proportional to increased mortality in ACS.

Time course of Troponin:

- Rise 4-8 hours post onset of symptoms in MI
- Peaks at 18-24 hours.
- Levels stay elevated for 10 days.

Therapeutic Interventions:

- Address ABC.
- Start an IV, oxygen to maintain SpO₂ >90% and start cardiac monitoring.
- Aspirin 162-325 mg chewed. If the patient is unable to tolerate aspirin, clopidogrel 75 mg PO is an alternative.
- Nitroglycerin 0.4 mg SL q5min × 3 as needed for CP.

Contraindication to Nitroglycerin:

- Hypotension
- Inferior STEMI
- History of use phosphodiesterase inhibitors.

STEMI Patients:

- Percutaneous intervention (PCI).
- Fibrinolytics.

PE

- Incidence is 0.5% of ED patients with Chest pain.
- Presentation varies greatly, ranging from asymptomatic to shock.

Massive PE:

- Accounts for only 5% of acute PE.
- Mortality rate 25-65%
- Hypotension: SBP <90 mm Hg or decrease >40 mm Hg for 15 min.
- Signs of shock secondary to PE.

Submassive PE:

PE without hypotension but with either of the following:

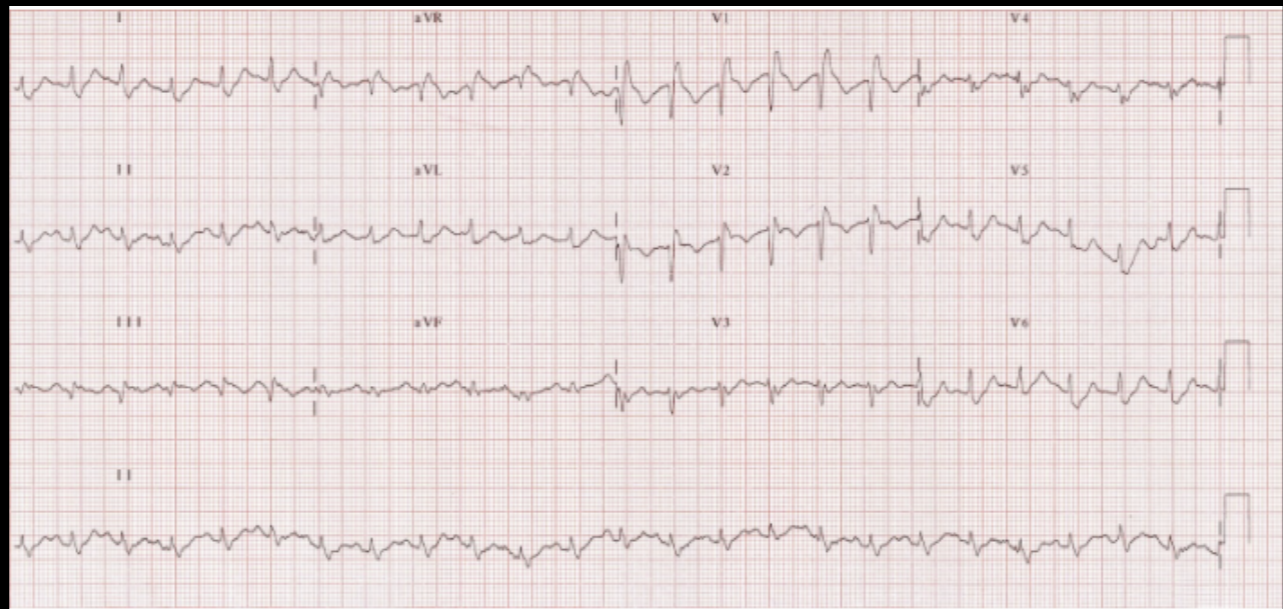
- Myocardial necrosis defined by elevation of troponin or
- Right ventricular (RV) dysfunction defined by RV dilation on imaging (echocardiographic or CT) and elevation of B-type natriuretic peptide (BNP) or ECG criteria.

Presentation:

- SOB is the most common symptoms followed by pleuritic chest pain.
- Look for risk factors.
- Tachypnea is the most common sign.
- Risk stratification by clinical rules ,e.g Wells Criteria.

Diagnosis:

- ECG and CXR: Often non-specific.
- Low to moderate risk of having PE → D-dimer.
- High risk of having PE → send directly to imaging.
- CT pulmonary angiogram is the test of choice.



Therapy:

- Anticoagulation is the main step of treatment.
- For massive PE, thrombolytics can be used if there is no contraindication.

AAD

- Incidence is approximately 5 cases/million population/y.
- Risk factors: HTN, atherosclerosis and connective tissue disease.

History:

- Classic presentation is severe tearing or ripping pain radiating to the back with severe distress and diaphoresis.
- May cause signs of infarction/ischemia anywhere along the aorta (arms, legs, bowels, kidneys, brain, spinal cord).
- Approximately a third of patients have neurologic complaints/findings.

Exam:

- Pulse deficit, caused by a hematoma or intimal flap, may unilaterally obstruct flow. This is observed in fewer than one-third of patients.
- Diastolic murmur may be due to aortic regurgitation.
- Abnormal neurologic exam may be due to stroke from cervical artery dissection or infarct of the spinal cord.

Diagnosis:

- ECG mostly non specific or may show a STEMI as a result of dissection of coronary ostia.
- CXR may shows widened mediastinum (61%) or abnormal aortic contour (50%).
- Normal x-ray does not rule out the diagnosis.
- CTA is the test of choice.

Therapy:

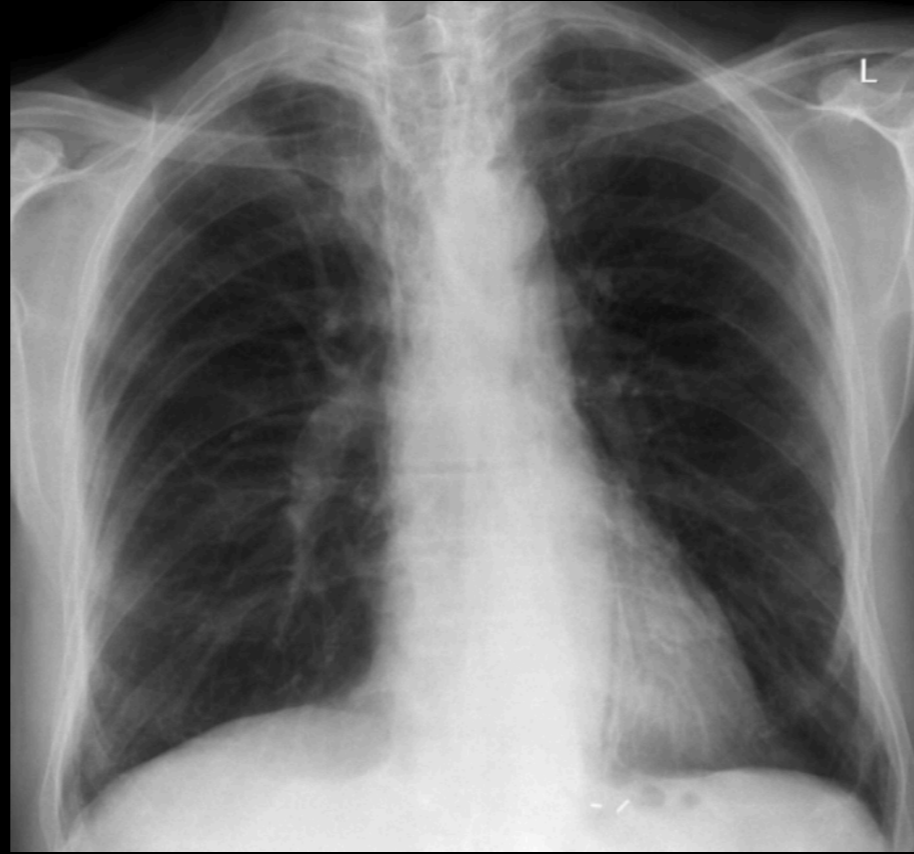
- Pain control.
- BP control
- Surgical consultation

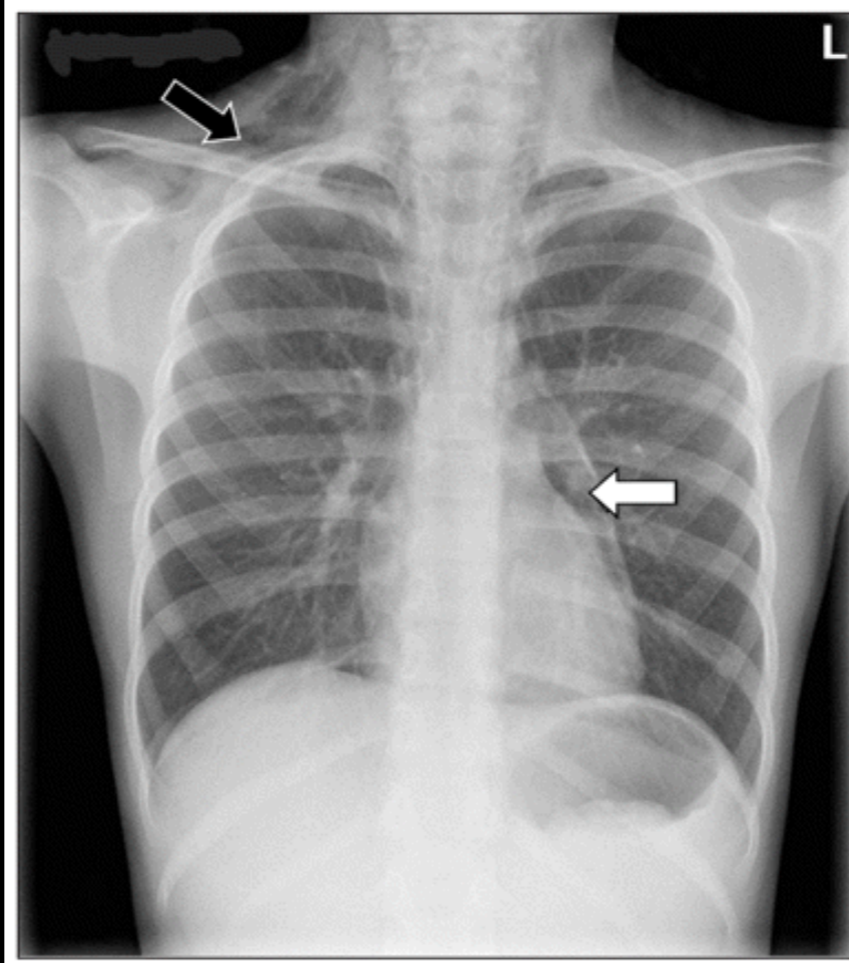
Esophageal Rupture

- Boerhaave's syndrome.
- Severe CP, usually following forceful vomiting.
- Often associated with subcutaneous crepitus.
- Think of this diagnosis in alcoholics or with history of recent procedures.

Diagnosis:

- Ill appearing, septic and febrile.
- CXR may show left side pleural effusion and mediastinal air.
- CT Chest will help in defining injury.





Therapy:

- IV antibiotics.
- Emergent surgical consultation

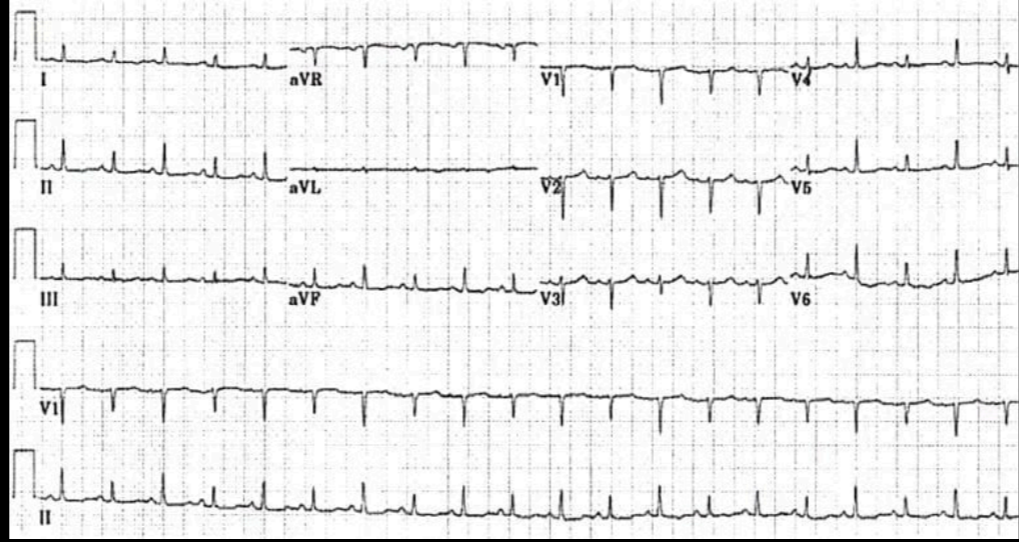
Pericardial Tamponade

- Can present acutely from trauma or aortic injury, or slowly from cancer and infection.
- Consider this diagnosis if the patient is in shock.

Diagnosis:

- Tachycardia.
- Pericardial rub.
- Muffled heart sounds.
- Jugular venous distention.
- POCUS is the test of choice and it usually show diastolic collapse of the cardiac chambers.

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- POCUS is the test of choice and it usually show diastolic collapse of the cardiac chambers.



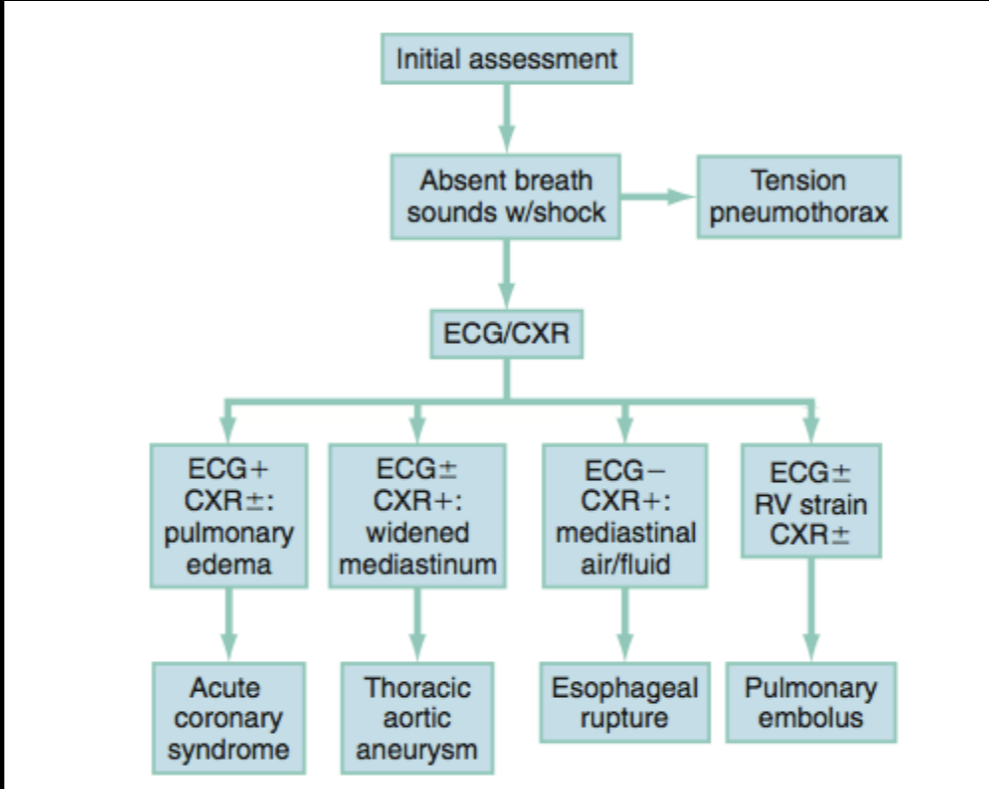
Therapy:

- The treatment is pericardiocentesis.

Tension Pneumothorax

- Can occur for many reasons including iatrogenic (e.g. from central lines).
- Shock and respiratory symptoms due to pneumothorax compressing the mediastinum, resulting in decreased venous return to the heart.
- Often secondary to thoracic trauma.

- It can also be caused by a simple spontaneous pneumothorax progressing to tension pneumothorax.
- Diagnosis is clinical, Don't wait for the X-ray to make the diagnosis .
- Treat with needle decompression while preparing for ED Thoracostomy.



Diagnosis	Key Historical features	Key Exam Features
ACS	Chest pain, weakness, nausea, and fatigue	Variable: possible diaphoresis, ill appearance, or rales
PE	Pleuritic chest pain, SOB, PE risk factors + Well's and/or PERC	Tachycardia, clear lungs, unilateral leg swelling
Aortic Dissection	Sudden onset severe ripping pain to back with paresthesia or paralysis	Unequal blood pressures, abnormal pulses, neurologic deficits
Tension Pneumothorax	Sudden onset severe unilateral pleuritic chest pain	Hypotension, unequal breath sounds, tracheal deviation (rare)
Esophageal Rupture	Intense substernal chest pain after vomiting or endoscopic procedure	Hamman's crunch (crackle sound heard or felt in time w/ heart beat)
Pericarditis/Tamponade	Pleuritic chest pain and dyspnea	Muffled heart sound, distended neck veins, hypotension