Evaluation of Chest Pain in the Young Adult

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Outline

- **Case Presentation**
- **Chest Pain & Etiologies**
  - Cardiovascular Disorders
  - Pulmonary Disorders
  - Gastro-intestinal Disorders
  - Chest Wall Disorders
  - Psychiatric/Psychogenic Disorders
- **Case Review**
- **Summary**

Cases

Case 1

- **General**
  - 22yo, Man c/o L-sided chest pain x 1 day
- **Present Illness**
  - Yesterday, c/o CP after standing up to leave class.
    - *Pain was sharp and severe but did not affect his breathing except if he took a deep breath.*
    - *No sweating or dizziness. No prior episodes.*
    - *Took a cab home to Bronx and slept.*
  - Today, feels a little better but still has the L-sided chest pain.

Case 1

- **Pertinent History**
  - Medications: none
  - Past Medical/Mental Health: none
  - Surgery/Procedures/Hospitalization: none
  - Social History
    - *Denies smoking, drug-use*
    - *Alcohol use - couple/month*
    - *Exercise - Does not do much exercise. 6-8 hours/day on computer.*

Case 1

- **Physical Examination**
  - Vital Signs:
    - *BP = 106/64 Right Arm; Pulse rate =73/min; RR = 16/min*
    - *Temp = 96.1 F*
    - *Pulse Oximetry/O2 Sat = 98%*
    - *Height = 5' 11.5"; Weight = 140lbs; BMI = 19.3*
  - Chest/Lung
    - *Normal, no reproducible tenderness*
  - Heart/Vascular:
    - *Regular rate and rhythm, No murmur*
    - *Full symmetric pulses*

Case 2

- **General**
  - 24yo Woman c/o ear problem (“clogged”) x 1 month and “muscle ache in my heart” x 1 day
- **Present Illness**
  - 2 days ago, c/o L-sided chest achy sensation after biking fast.
  - Yesterday, c/o SOB, cough and then chest pain.
    - *Anterior to posterior over left chest, sometimes left shoulder pain.*
    - *Constant but exacerbated with deep inspiration (pleuritic) and when lying on either side.*
    - *Worse with exertion.*
    - *No palpitations.*

Case 2

- **Pertinent History**
  - Past Medical/Mental Health: none
  - Past Surgery:
    - *R knee arthroscopic surgery (2010)*
  - Medications:
    - *Desogestrel-EE (0.15/.02, 0/0.01) for years; resumed 4 months ago*
  - Family History:
    - *Breast, ovarian and bone CA (grandparents); high cholesterol (father); MI (grandparents); hypertension (grandparents)*
    - *No h/o blood clots*

Case 2

- **Pertinent History**
  - Social History
    - *Denies smoking or drug use*
    - *Alcohol use - rare*
    - *Travel - to/from CA over last weekend*
    - *Exercise - rides bike to get around town daily*
  - ROS:
    - *Right ear feels "clogged" for past several days*

Case 2

- **Physical Examination**
  - Vital Signs:
    - *BP= 102/70 Left Arm*
    - *Pulse Rate = 74/min; RR=16/min*
    - *Temp = 97.2 F*
    - *Pulse Oximetry/O2 Sat = 98%*
    - *Height = 5' 3", Weight = 134, BMI = 24*
  - Peak Flows (L/min, expected 418):
    - *#1. 245 (59%), #2. 230 (55%), #3. 226 (54%)*

Case 2

- **Physical Examination**
  - Chest/Lungs:
    - *No reproducible tenderness; Normal auscultation & percussion*
  - Heart/Vascular:
    - *Regular rate and rhythm without murmur; pulses full and symmetric*
  - Abdomen:
    - *No tenderness, rebound, organomegaly*
  - Extremities:
    - *No edema, swelling, cords; Negative Homan's sign*
- **ECG Normal**

Case 3

- **General**
  - 21yo Male c/o L-sided chest pain x 3 days
- **Present Illness**
  - 3 days c/o CP on and off
    - *Mild, sharp-dull, worse with deep breath and body movement (avoiding exertion)*
    - *Started after lifting weights*
    - *No SOB, nausea, vomiting, diaphoresis*

Case 3

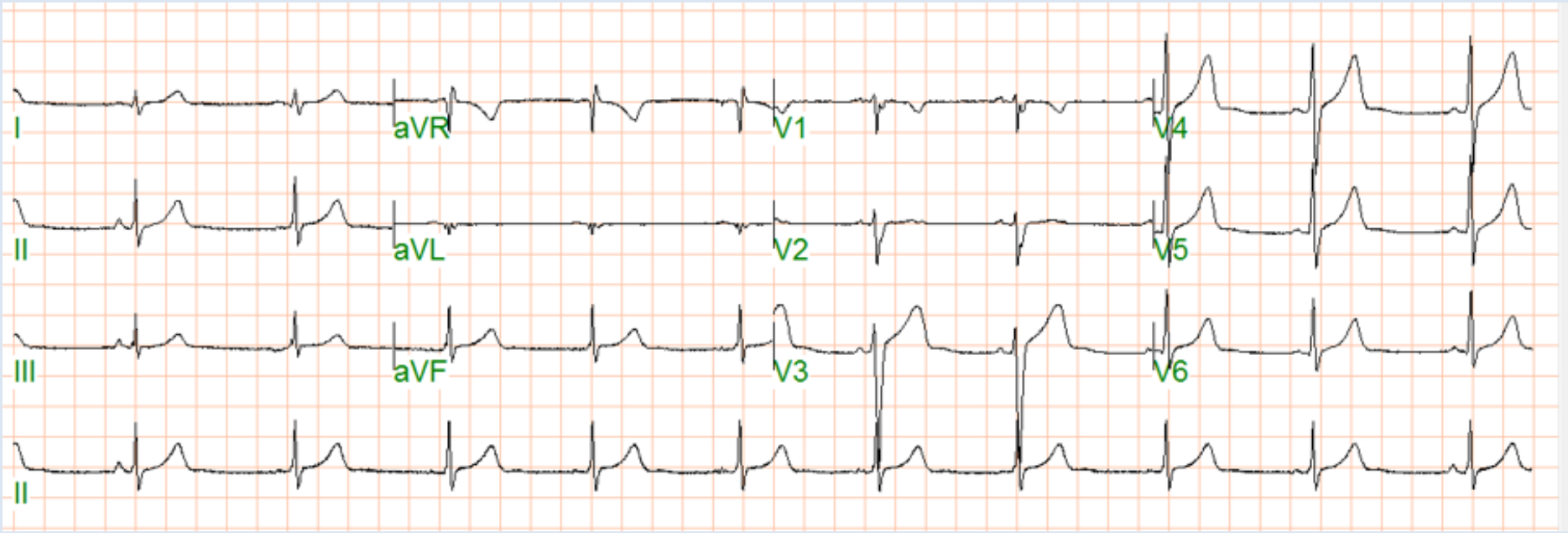
- **Pertinent History**
  - Past Medical:
    - *Bicuspid aortic valve, mild AR; migraines*
  - Past Mental Health:
    - *Anxiety/Panic disorder*
  - Medications:
    - *Citalopram*
    - *Zolmitriptan as needed*

Case 3

- **Physical Examination**
  - Vital Signs:
    - *BP= 123/81 Left Arm*
    - *Pulse Rate = 83/min; RR=12/min*
    - *Temp = 97.2 F*
    - *Pulse Oximetry/O2 Sat = 99%*
    - *Height = 5' 11", Weight = 177, BMI = 24*
  - Chest/Lungs:
    - *Dffuse but mild L sided upper chest tenderness on palpation*
  - Heart/Vascular:
    - *2/6 diastolic murmur; normal bilateral pulses*

Case 3

- **ECG (old)**
  - NSR, Normal ECG



Chest Pain & Etiologies

Chest Pain

- **1% Primary Care office visit**
- **Challenging: A symptom of many causes**
  - Commonly (relatively) benign conditions
  - Can be life-threatening
- **Diagnosis can often be derived from history, physical examination, and specific ancillary studies**

Etiologies

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
30-50%	**15-20%**	**15%**	**5-10%**	**5-10%**
Musculo-skeletal (muscle, rib, joints) Dermatome	Esophagus Stomach Abdominal viscera	Heart Aorta	Lungs Bronchus Pleura Mediastinum	
Chest wall pain Costochondritis Arthritis Fibromyalgia Contusion Rib fracture Referred pain Herpes zoster	*Reflux/GERD Motility disorder Esophagitis Gastritis/PUD Gallbladder disease Biliary colic*	*CAD Heart failure Pericarditis/myo-pericarditis Mitral valve disease Aortic dissection*	*Pulmonary embolism Pneumothorax Bronchitis Pneumonia Pleuritis Malignancy*	*Anxiety Panic disorder Hyperventilation Depression Somatoform disorder*

Etiologies

- **Specific Causes of Chest pain (Outpatient)**

Cause	%
Musculoskeletal pain	20%
Costchondritis	15%
GERD	15%
Psychogenic	5-10%
Non-specific	15%
	70-75%
…	
Stable angina	10%
Acute MI/Unstable angina	2%
Pulmonary embolism	0.3%

Etiologies

- **Life-threatening Causes of Chest Pain**
  - Acute coronary syndrome ACS
  - Pulmonary embolism
  - Tension pneumothorax
  - Pericardial tamponade
  - Aortic dissection
  - Mediastinitis (eg, esophageal rupture)

Chest Pain

- **Outpatient Evaluation**

Chest Pain	Suggested Questions
Onset	When did it start? Sudden or gradual? Maximal pain at onset?
Location	Generalized or localized? Can you point with one finger to where?
Duration	Frequency? Constant or intermittent? If intermittent, is there a trigger, or is it random?
Character	Intensity? Sharp? Dull? Ache? Indigestion? Pressure? Tearing? Ripping?
Associated symptoms	"Dizzy", presyncopal? Diaphoresis? Palpitations? SOB or dyspnea? Cough? URI? Nausea or vomiting? Dysphagia or odynophagia? Reflux or acid taste? Epigastric or RUQ pain? Panic attack or depressed mood? Systemic symptoms?
Alleviating/Aggravating	Food association? Belching? Exertion? Deep breathing? Coughing? Position? Chest movement? Palpation?
Radiation	To the back? Jaw? Throat? Arm? Neck? Abdomen?

Chest Pain

- **Outpatient Evaluation**

History	
Medical	CAD, PVD, stroke, hypertension, cardiac (valvular and aortic) disease Lung disease (e.g. COPD, asthma), sickle cell, sarcoidosis, vasculitis/CT disease, malignancy DVT, pulmonary embolism, hypercoagulable state GERD, PUD
Mental Health	Anxiety disorder, panic attack, depression
Medications	Estrogen
Surgery	Cardiac surgery, immobilization
Social	Smoking, drug-use
Family	Clotting disorder, premature CAD, inherited cardiac (valvular and aortic) disease

Chest Pain

- **Outpatient Evaluation**

Physical Examination	
VS	BP, HR, RR, O2 saturation
Cardiovascular	Rhythm, murmurs, rub, and extra heart sounds; pulses
Pulmonary	Breath sounds, wheezing, crackles, evidence of consolidation
Skin	Lesions, hyperesthesia
Musculoskeletal	Reproducible chest wall pain on palpation
Abdominal	RUQ, epigastrium, abdominal aorta
Other	Based on history

Chest Pain

- **Outpatient Evaluation**

Work-up	
ECG	Most patients with new onset or different from previous episodes except with obvious cause (e.g. pneumonia, bronchitis, chest wall pain)
Chest X-ray	Based on initial evaluation
D-dimer	Based on initial evaluation

Statistics

	With Disease	W/o Disease	
Positive Test	True Positive TP	False Positive FP	→ Total Positive Tests TPT
Negative Test	False Negative FN	True Negative TN	→ Total Negative Tests TNT
	↓ Total with Disease TWD	↓ Total w/o Disease TWoD	

Statistics

- **Sensitivity & Specificity**
  - Sensitivity (positivity in disease)

*Positive test with Disease (**True Positive**)*
---------- **= TP/TWD**
*All tested with Disease (**True Positive + False Negative**)*

  - Specificity (negativity in health)

*Negative test without Disease (**True Negative**)*
---------- **= TN/TWoD**
*All tested w/o Disease (**True Negative + False Positive**)*

Statistics

- **Predictive Value**
  - Positive Predictive Value

$$\frac{\textit{Positive test with Disease (}\textbf{\textit{True Positive}}\textit{)}}{\textit{Total Positive Tests (}\textbf{\textit{True Positive + False Positive}}\textit{)}} = \textbf{\textit{TP/TPT}}$$

  - Negative Predictive Value

$$\frac{\textit{Negative test w/o Disease (}\textbf{\textit{True Negative}}\textit{)}}{\textit{Total Negative Tests (}\textbf{\textit{True Negative + False Negative}}\textit{)}} = \textbf{\textit{TN/TNT}}$$

Statistics

- **Likelihood Ratio***
  - Positive Likelihood Ratio (LR+) : Sensitivity/1-Specificity
  - Negative Likelihood Ratio (LR-): 1-Sensitivity/Specificity

LR	Effect on Probability of Disease
>10	**Large increase (often conclusive)**
5-10	Moderate increase
2-5	Slight increase
1-2	Minimal increase
1	**No change**
0.5-1.0	Minimal decrease
0.2-0.5	Slight decrease
0.1-0.2	Moderate decrease
<0.1	**Large decrease (often conclusive)**

*Best use of clinical test results to establish diagnoses

Statistics

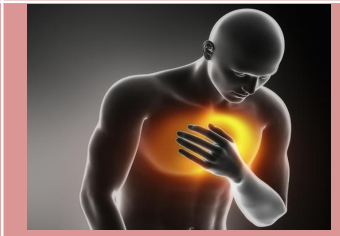
- **10,000 Suspect but Low Prob for PE Tested for D-dimer**

	With PE	W/o PE	
Positive D-dimer	True Positive 126	False Positive 5,429	→ Total Positive Tests 5,555
Negative D-dimer	False Negative 4	True Negative 4,441	→ Total Negative Tests 4,445
	↓ Total with PE 130	↓ Total w/o PE 9,870	

Statistics

- **10,000 Suspect but Low Prob for PE Tested for D-dimer**
  - *Sensitivity of D-dimer*
    - TP/TWD x100 = 126/130 x100 = 97%
  - *Specificity of D-dimer*
    - TN/TWoD x100 = 4441/9870 x100 = 45%
  - *Positive Predictive Value for PE*
    - TP/TPT x100 = 126/5555 x100 = 2%
  - *Negative Predictive Value for PE*
    - TN/TNT x100 = 4441/4445 x100 = 99%
  - *Positive Likelihood Ratio*
    - SN/1-SP = 0.97/1-0.45 = 1.7
  - *Negative Likelihood Ratio*
    - 1-SN/SP = 1-0.97/0.45 = 0.07

Etiologies

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
30-50%	**15-20%**	**15%**	**5-10%**	**5-10%**
				
Chest wall pain *Costochondritis* *Arthritis* *Fibromyalgia* *Contusion* *Rib fracture* *Referred pain* *Herpes zoster*	*Reflux/GERD* *Motility disorder* *Esophagitis* *Gastritis/PUD* *Gallbladder disease* *Biliary colic*	*CAD* *Heart failure* *Pericarditis/myo-pericarditis* *Mitral valve disease* *Aortic dissection*	*Pulmonary embolism* *Pneumothorax* *Bronchitis* *Pneumonia* *Pleuritis* *Malignancy*	*Anxiety* *Panic disorder* *Hyperventilation* *Depression* *Somatoform disorder*

Cardiovascular Disorders

Cardiovascular Disorders

- **Cardiovascular Causes**
  - 15%
  - Ischemic
    - *Stable angina*
    - *ACS (MI/Unstable angina)*
  - Non-ischemic
    - *Aortic dissection*
    - *Heart failure*
    - *Pericarditis/myopericarditis*
    - *Mitral valve disease*
    - *Cardiomyopathy (Stress/takotsubo)*

Cardiovascular Disorders

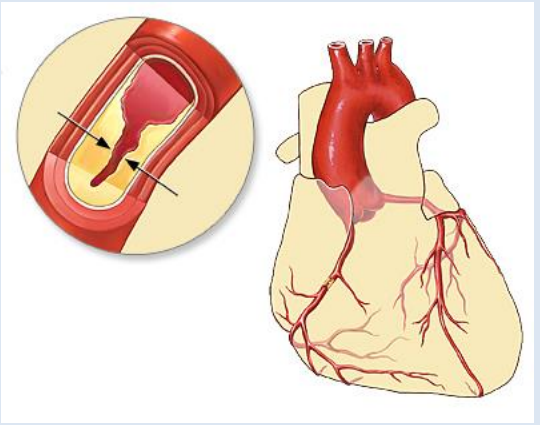
- **Coronary Artery Disease**
  - Validated Clinical Decision Rule to Predict CAD as a Cause

Component	Points
Men 55 years or older Women 65 years or older	1
Known vascular disease (CAD, PVD, Stroke)	1
Pain worse with exercise	1
Pain not elicited with palpation	1
Patient assumes pain is of cardiac origin	1
Total	**5**

Score	Positive Likelihood Ratio (LR+)	Positive Predictive Value (%)
0 - 1 point	1.09	0.6%
2 - 3 points	1.83	12%
4 - 5 points	4.52	63%

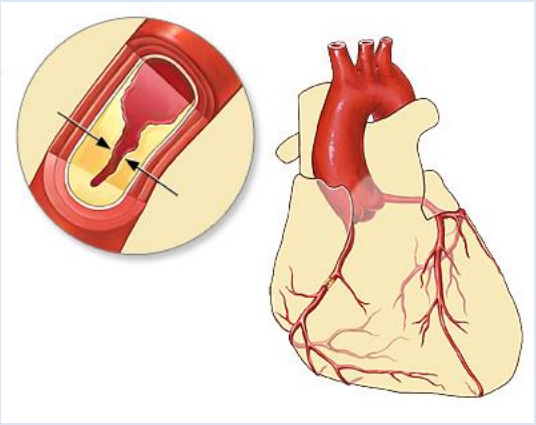
Adapted from Bösner S, Haasenritter J, Becker A, et al.
Ruling out coronary artery disease in primary care: development and validation of a simple prediction rule.
CMAJ. © 2010; 182(12):1298-1299

Cardiovascular Disorders



- **Myocardial ischemia**
  - Stable Angina pectoris
    - *Classic Angina symptoms*
      - Pressure, heaviness, tightness, or constriction
      - Center or left of the chest
      - Precipitated by exertion and relieved by rest or NTG
    - *Associated symptoms*
      - Onset with emotional stress or cold
      - Radiation (to the neck, jaw, and shoulder)
      - Dyspnea, nausea and vomiting, diaphoresis, pre-syncope, or palpitations

Cardiovascular Disorders



- **Myocardial ischemia**
  - ACS (MI and unstable angina)
    - *Characteristics*
      - Male sex >55 years; Female >65
      - Chest pain as pressure
      - Diaphoresis
      - Pain that radiates to the shoulder, neck, arm, or jaw
      - History of angina or acute myocardial infarction
    - *Angina symptoms*
      - At rest
      - New onset angina that is not stable and predictable (eg, with exertion)
      - Progressive symptoms (angina that is more frequent, longer in duration, or occurs with less exertion than previously)

Cardiovascular Disorders

- **Myocardial ischemia**
  - ACS (MI and unstable angina)
    - *More likely ACS*

Findings	LR+	LR-
Chest pain radiates to both arms	7.1	0.67
Third heart sound on auscultation	3.2	0.88
Hypotension	3.1	0.96
Exertional pain	2.4	

    - *Less likely ACS*

Findings	LR+
Sharp or stabbing pain	0.3
Chest wall tenderness	0.3
Reproducible by palpation	0.2
Pleuritic chest pain	0.2

Panju AA, Hemmelgarn BR, Guyatt GH, Simel DL.
The rational clinical examination. Is this patient having a myocardial infarction?
JAMA. 1998;280(14):1256-1263.

Cardiovascular Disorders

- **Myocardial ischemia**
  - ACS (MI and unstable angina)
    - *ECG Changes*

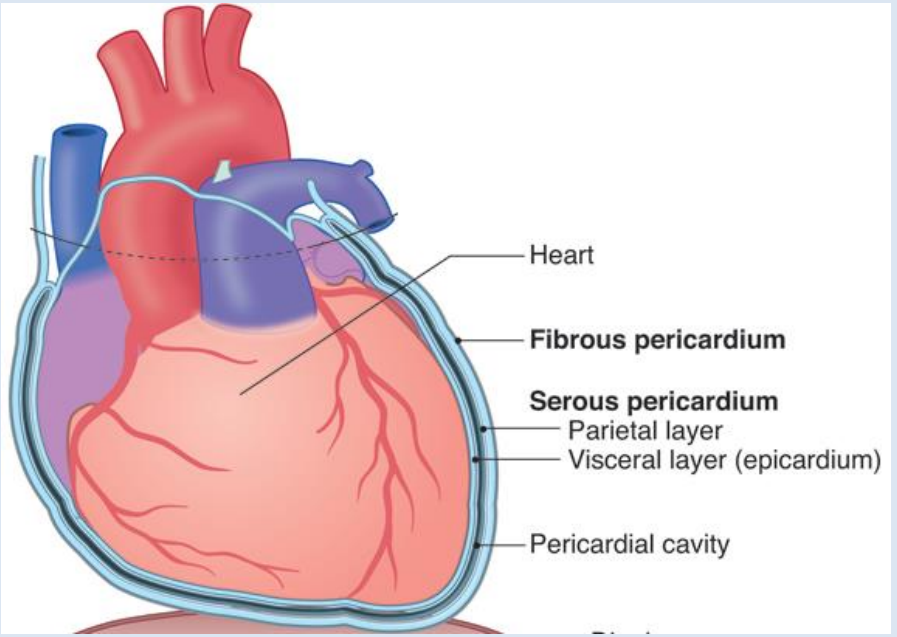
Findings	LR+
New-onset ST segment elevation	16
New-onset Q waves	8.7
New-onset LBBB	6.3
New-onset T wave inversions	2.5
Normal	0.3

  - Refer immediately to an emergency department

Tierney WM, Fitzgerald J, McHenry R, Roth BJ, Psaty B, Stump DL, et al. Physicians' estimates of the probability of myocardial infarction in emergency room patients. *Med Decis Making*. 1986;6:12-7.

Cardiovascular Disorders

- **Pericarditis**
  - Acute pericarditis
    - *Inflammation of the pericardial sac*
  - Etiologies
    - *Idiopathic* *85-90%*
    - *Infections*
    - *Medications*
    - *Autoimmune disorders*
    - *Malignancy*



Cardiovascular Disorders

- **Pericarditis**
  - Findings
    - *Clinical triad*

Findings	LR+	LR-
Pleuritic chest pain Pericardial friction rub ECG changes	NA	NA

Cardiovascular Disorders

- **Pericarditis**
  - Pleuritic chest pain
    - *Increases with inspiration or reclining*
    - *Improved by sitting up and leaning forward*
  - Others
    - *Pulsus paradoxus, pericardial effusion, cardiac tamponade*

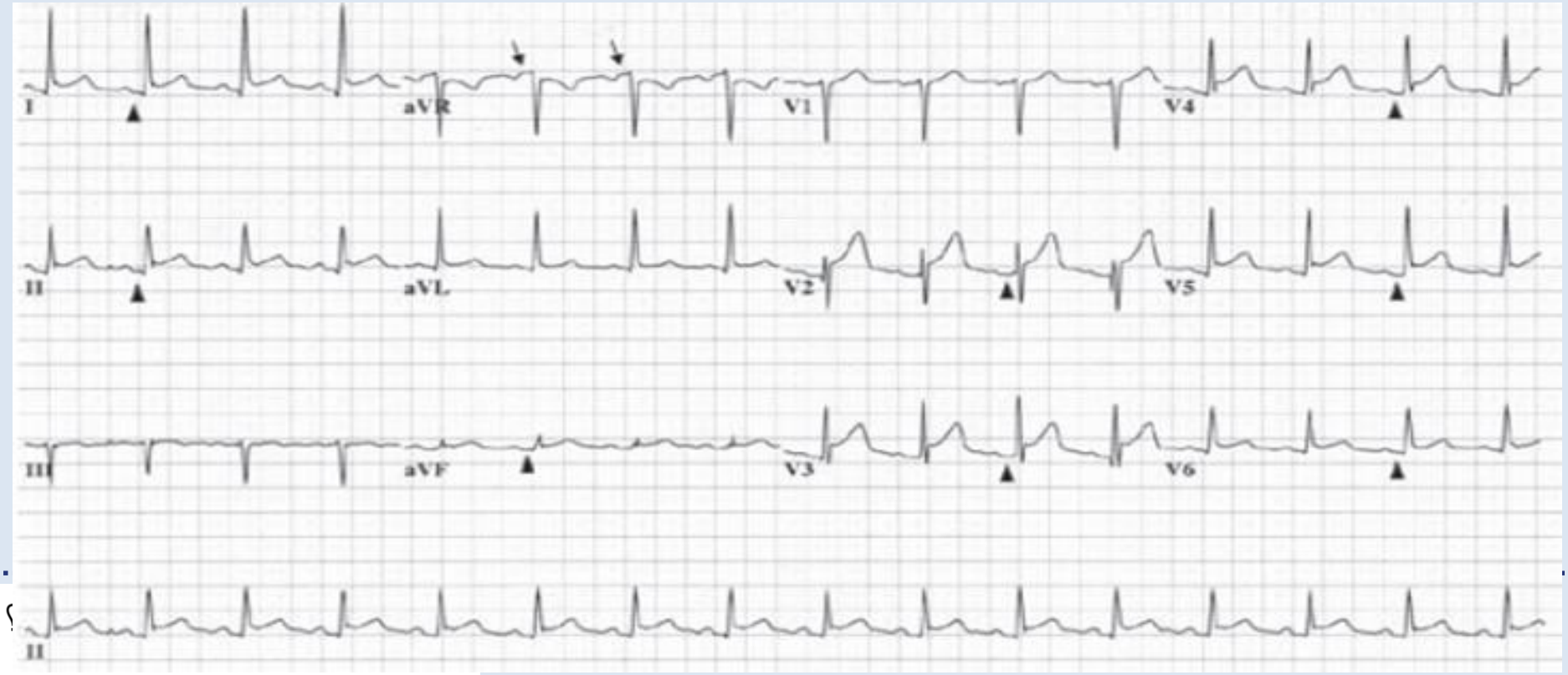
Cardiovascular Disorders

- **Pericarditis**
  - Pericardial Friction Rub
    - *Mechanism*
      - Between 2 inflamed pericardial layers
    - *Characteristics*
      - High pitched
      - Scratchy or squeaky
      - Best at L sternal border, end of expiration, patient leaning forward

Pericardial rub.mp3

Cardiovascular Disorders

- **Pericarditis**
  - ECG Changes
    - *Diffuse ST segment elevation & PR interval depression*



Cardiovascular Disorders

- **Aortic Dissection**
  - Incidence: low at 3-6 per 100,000 patient years
  - Mortality: high 50%
  - Increased risk
    - *Inherited connective tissue diseases*
      - Marfan's syndrome (younger patients/<40 years of age)
      - Bicuspid aortic valve, other valvular diseases
    - *Diseases that weaken structural architecture of the aortic wall*
      - Advanced age
      - Systemic hypertension
      - Previous aortic surgery, recent cardiac surgery or catheterization
      - Acquired valvular disease
      - Cocaine use, pregnancy

Cardiovascular Disorders

- **Thoracic Aortic Dissection**
  - History
    - *Abrupt onset of thoracic or abdominal pain*
    - *Sharp, tearing and/or ripping character*
  - Examination
    - *Pulse variation (absence - proximal extremity or carotid pulse) and/or*
    - *BP variation (>20 mmHg difference - R and L arm)*

Findings	LR+	LR-
Acute chest or back pain PLUS Pulse differential in the upper extremities	5.3	NA

  - Refer immediately to an emergency department

von Kodolitsch Y, Schwartz AG, Nienaber CA.
Clinical prediction of acute aortic dissection.
Arch Intern Med. 2000;160(19):2977-2982

Cardiovascular Disorders

- **Thoracic Aortic Dissection**
  - Chest radiograph (CXR)
    - *Mediastinal and/or aortic widening 61%*

Cardiovascular Disorders

- **Other Cardiovascular Causes**
  - Heart Failure
    - *Acute decompensated heart failure may present with chest discomfort*
    - *Usually along with progressive dyspnea, cough, fatigue, and peripheral edema*

Findings	LR+	LR-
Pulmonary edema on chest radiography	11.0	0.48
Clinical impression/judgment	9.9	0.65
History of heart failure	5.8	0.45
History of acute MI	3.1	0.69

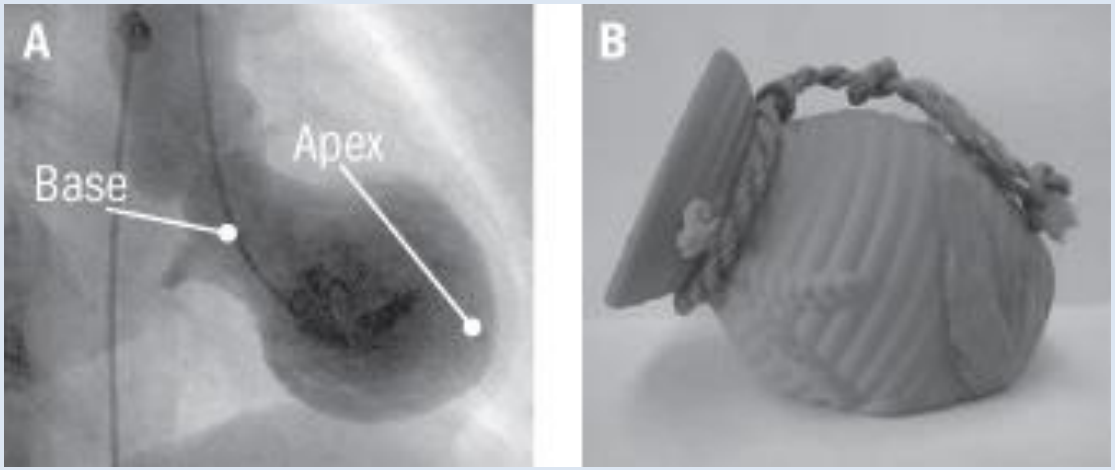
Wang CS, FitzGerald JM, Schulzer M, Mak E, Ayas NT.
Does this dyspneic patient in the emergency department have congestive heart failure?
JAMA. 2005;294(15):1944-1956

Cardiovascular Disorders

- **Other Cardiovascular Causes**
  - Mitral Valve Disease
    - *Infrequently presents with chest pain*
    - *Often from pulmonary hypertension and RV hypertrophy*
  - Mitral Valve Prolapse
    - *May present with chest pain*
    - *Generally mild and not typical for angina*

Cardiovascular Disorders

- **Other Cardiovascular Causes**
  - Stress Cardiomyopathy
    - *Takotsubo cardiomyopathy*
    - *Often in the setting of physical or emotional stress or critical illness.*
    - *Substernal chest pain similar to acute MI*



Cardiovascular Disorders

- **Other Cardiovascular Causes**
  - Substance-related
    - *Cocaine use is associated with cardiac conditions*
      - Myocardial ischemia most common
      - Other cardiac complications include aortic dissection, coronary artery aneurysm, myocarditis and cardiomyopathy, and arrhythmias
    - *Methamphetamine intoxication may mimic cocaine intoxication and cause similar cardiac problems*

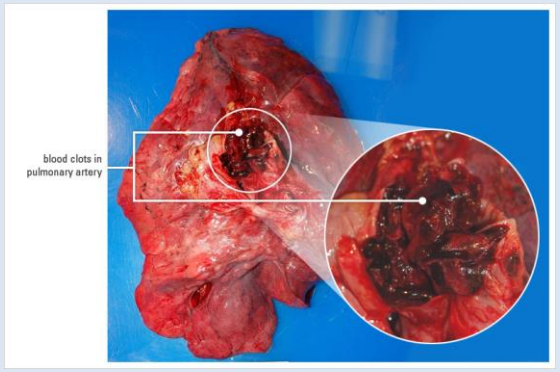
Pulmonary Disorders

Pulmonary Disorders

- **Pulmonary Causes**
  - 5-10%
  - Generally with respiratory symptoms, may be hypoxemic
  - Life-threatening
    - *Pulmonary embolism*
    - *Pneumothorax*
  - Others
    - *Pneumonia, Bronchitis*
    - *Asthma and COPD*
    - *Pleuritis*
    - *Acute chest syndrome*
    - *Malignancy*
    - *Sarcoidosis*
    - *Pulmonary hypertension*

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Incidence
    - *>1 case per 1,000 persons per year*
    - *100 ,000 deaths per year*
    - *Diagnosis often missed and incidence may be higher*



  - Characteristics
    - *Dyspnea, most common presenting symptom, followed by pleuritic pain and cough*
      - Onset of dyspnea is frequently (but not always) rapid, usually within seconds (46%) or minutes (26%)
    - *Symptoms may be mild or absent, even in large PE*
      - One-third with DVT had asymptomatic PE

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - History and Physical Examination

Symptom	%
Dyspnea rest/exertion	**73%**
Pleuritic pain	**66%**
Cough	37%
Orthopnea	28%
Calf-thigh	24%
Wheezing	21%
Hemoptysis	13%

Physical Examination	%
Tachypnea	**54%**
Calf-thigh	**47%**
Tachycardia	24%
Rales	18%
Dec breath sounds	17%
Inc P2 heart sound	15%
JVD	14%
Fever (pneumonia-like)	3%

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - History and Physical Examination
    - *Clinical impression for PE Diagnosis*
      - Sensitivity 85%
      - Specificity 51%
    - *Highly Suspicious and Ominous*
      - Tachycardia to bradycardia
      - New broad complex tachycardia (ie, RBBB)
      - Hypotension and elevated CVP
      - Hypoxia (<95% O2 Saturation)

Pulmonary Disorders

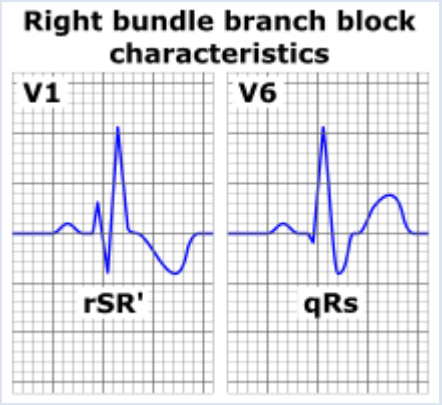
- **Pulmonary Embolism (PE)**
  - ECG Changes
    - *Abnormalities common but nonspecific*
      - Limited value diagnostically
    - *Most common findings (70 percent)*
      - Tachycardia
      - Non-specific ST-segment and T-wave changes
    - *Abnormalities suggestive of PE (<10%)*
      - S1Q3T3 pattern
      - RV strain, new incomplete RBBB

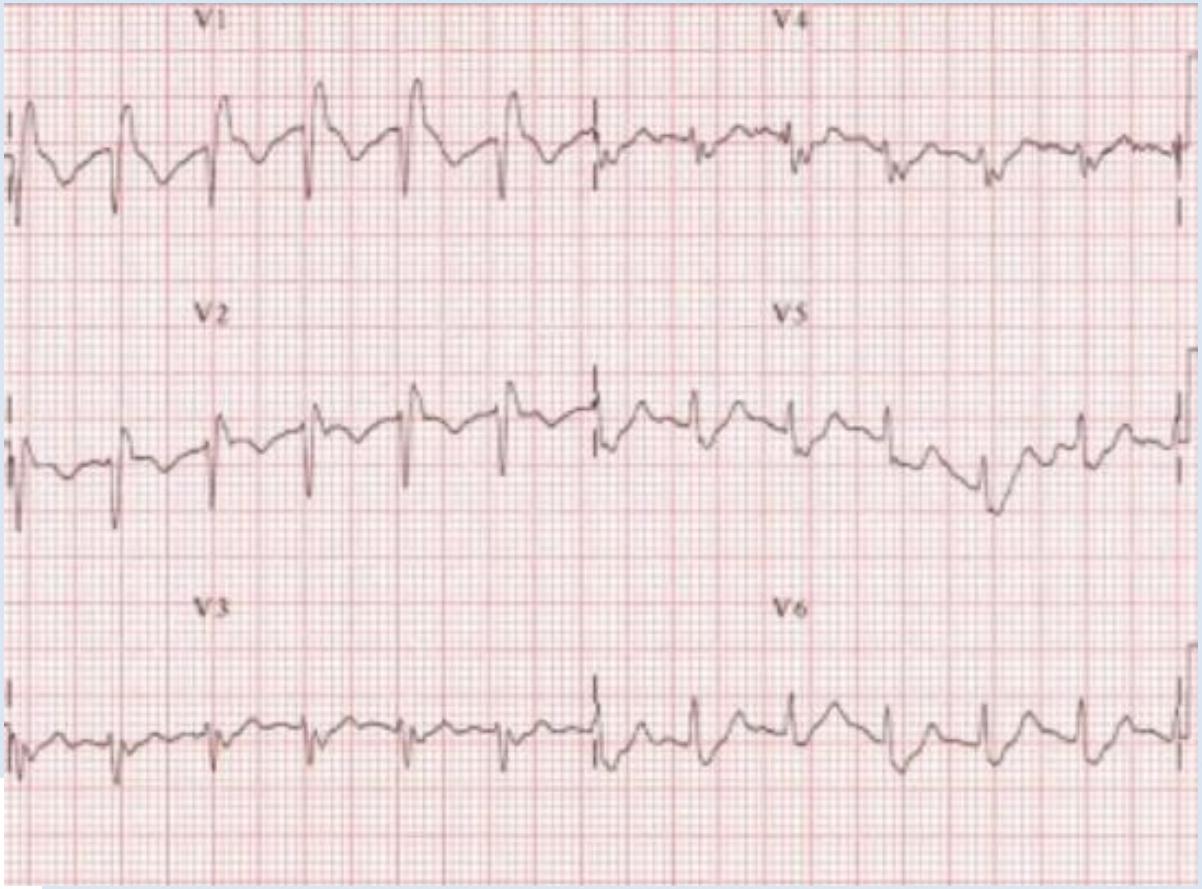
Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - ECG Changes
    - *Abnormalities associated with poor prognosis*
      - S1Q3T3 pattern
      - New incomplete RBBB
      - Atrial arrhythmias (eg, atrial fibrillation)
      - Bradycardia (<50 beats per minute) or tachycardia (>100 beats per minute)
      - Inferior Q-waves (leads II, III, and aVF)
      - Anterior ST-segment changes and T-wave inversion

Pulmonary Disorders

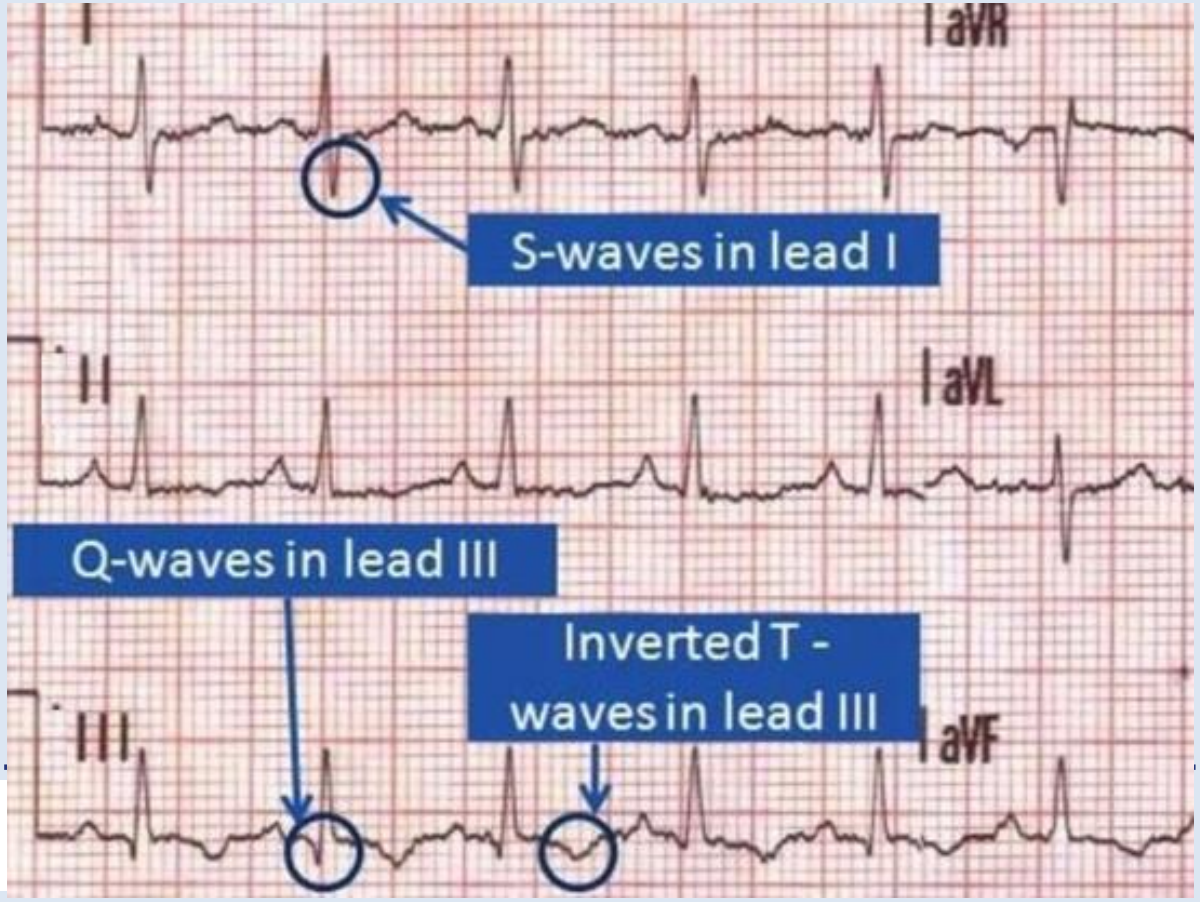
- **Pulmonary Embolism (PE)**
  - Electrocardiography (ECG): **RBBB**





Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Electrocardiography (ECG): **S1-Q3-T3 pattern**



Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Wells Criteria

Criteria	Points
Clinical symptoms of deep vein thrombosis (DVT)	3
Other diagnoses less likely than PE	3
Heart rate >100	1.5
Immobilization three or more days or Surgery in previous four weeks	1.5
Previous DVT/PE	1.5
Hemoptysis	1
Malignancy	1
Total	**12.5**

Score	Risk Stratification	LR+	% Probability
0-1	Low pretest probability	1.1	1.3%
2-6	Moderate pretest probability	1.8	16%
>6	High pretest probability	6.8	>41%

Wells PS, Anderson DR, Rodger M, et al.
Derivation of a simple clinical model to categorize patients probability of pulmonary embolism
Thromb Haemost. 2000;83(3):418

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - PERC (Pulmonary Embolism Rule-out Criteria)

Criteria	
Age ≥ 50	No
HR ≥ 100	No
O2 Sat on Room Air < 95%	No
Prior History of VT	No
Trauma or Surgery within 4 weeks	No
Hemoptysis	No
Exogenous Estrogen	No
Unilateral Leg Swelling	No

Finding	Management
All (8) No Low pretest probability	No need for further workup

Kline JA, Courtney DM, Kabrhel C, et al.
Prospective multicenter evaluation of the pulmonary embolism rule-out criteria.
J Thromb Haemost. 2008;6(5):772–780

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Management (Wells Criteria)

Score	Risk Stratification	Management
>6	**High pretest probability**	**ER for Treatment and Work-up**
2-6	**Moderate pretest probability**	**ER for Work-up: CTPA or VQ scan** • If positive → Treat • If negative → LE DVT work-up
0-1	**Low pretest probability**	**Work-up: D-dimer** • If positive → CTPA or VQ scan • If negative → Other diagnosis

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Management (Simplified Wells Criteria)

Score	Risk Stratification	Management
>6	**High pretest probability**	**ER for Treatment and Work-up**
5-6	**Moderate pretest probability**	**ER for Work-up: CTPA or VQ scan** • If positive → Treat • If negative → LE DVT work-up
2-4		**Work-up: D-dimer**
0-1	**Low pretest probability**	**Work-up: D-dimer** • If positive → CTPA or VQ scan • If negative → Other diagnosis

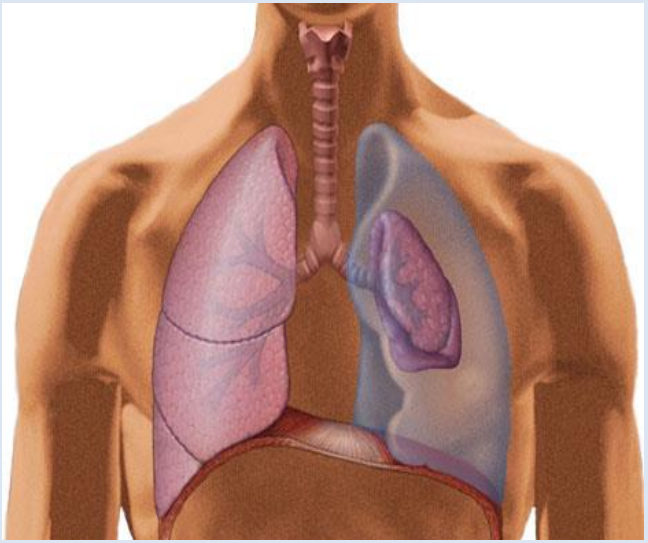
Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Management (Simplified Wells Criteria)

Score	Risk Stratification	Management
5 or more	PE likely	Work-up: CTPA or VQ scan
0-4	PE less likely	Work-up: D-dimer
0-1 & PERC negative	PE unlikely	No further PE work-up

Pulmonary Disorders

- **Pneumothorax**
  - Types
    - *Spontaneous/Primary*
      - Thin, tall, young male
      - Smoking
      - Family history
    - *Secondary*
      - Older
      - Underlying lung disease (COPD, PCP, others)
    - *Iatrogenic/Traumatic*



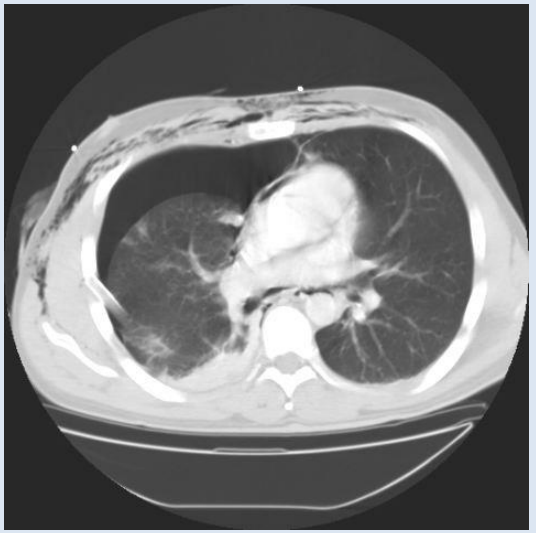
Pulmonary Disorders

- **Pneumothorax**
  - Incidence
    - *Men: 14/100,000 patient years*
    - *Women 3/100,000 patient years*
  - Characteristics

Findings	
Clinical	Sudden onset of pleuritic chest pain and dyspnea Tachycardia, tachypnea, hypoxia
Physical Examination	Decreased or absent breath sounds Hyper-resonance

    - *Hemodynamic instability suggests a tension pneumothorax*

Pulmonary Disorders

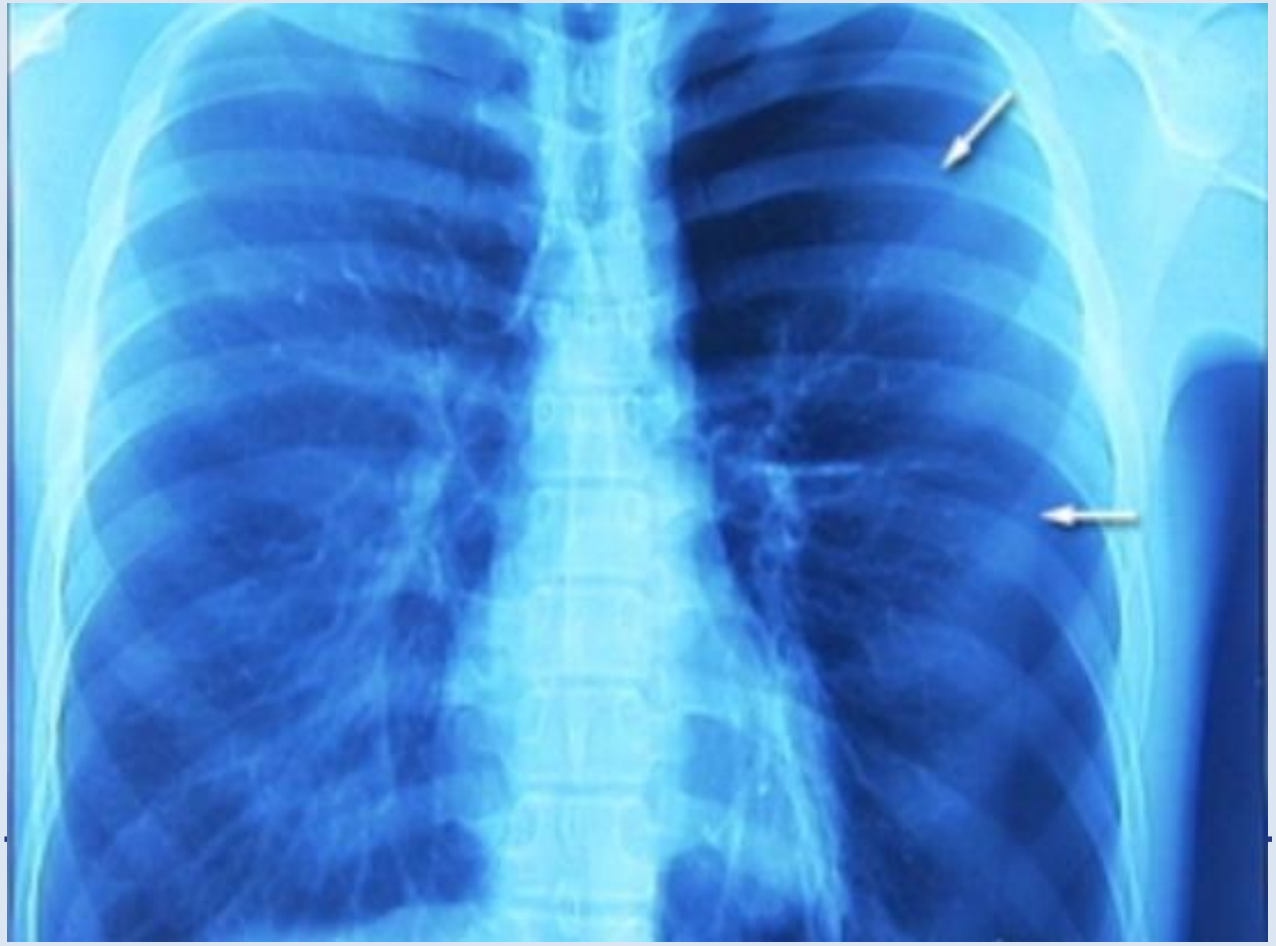


- **Pneumothorax**
  - ECG Changes
    - *Mechanisms*
      - Presence of air between heart and chest wall
      - Rotation or displacement of heart
      - Ischemic changes (tension pneumothorax)
    - *Findings*

Findings	
ECG	Decreased amplitude of precordial R waves Precordial T waves inversion Decreased QRS amplitude Rightward shift

Pulmonary Disorders

- **Pneumothorax**
  - Chest X-ray



Pulmonary Disorders

- **Pneumothorax**
  - Management of Primary Spontaneous Pneumothorax

Size and Clinical Symptoms	Management
<2 cm on chest radiograph **Minimal symptoms**	**ER for observation, 3-6 hours** Supplemental oxygen Repeat chest x-ray Outpatient management if easy access to medical care is available if clinical symptoms change Follow-up 2 days
>2 cm on chest radiograph **Breathlessness and chest pain**	**ER for needle aspiration** Repeat chest x-ray Thoracostomy tube insertion if re-accumulation
Clinical instability regardless of size	**ER for emergent needle decompression** Followed by thoracostomy tube insertion

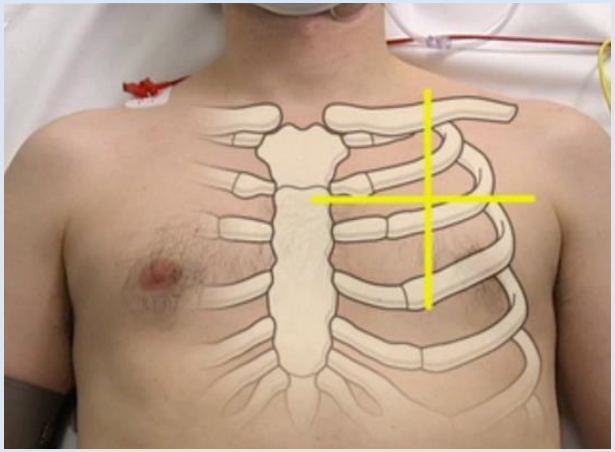
Pulmonary Disorders

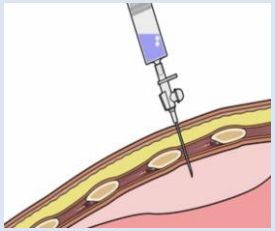
- **Pneumothorax**
  - Management of Secondary Pneumothorax or Recurrence

Size and Clinical Symptoms	Management
<2 cm on chest radiograph **Minimal symptoms**	**ER/Hospitalization for observation** Supplemental oxygen
>2 cm on chest radiograph **Breathlessness, chest pain**	**ER for thoracostomy tube insertion**
Clinical instability regardless of size	**ER for emergent needle decompression** Followed by thoracostomy tube insertion

Pulmonary Disorders

- **Pneumothorax**
  - Needle Aspiration
    - *Indication*
      - First episode of primary spontaneous
      - No underlying lung disease
      - Breathlessness, >2cm (measured at hilum)
    - *Procedure*
      - Semi-supine (30-40 degree angle)
      - Sterilize area 2nd ICS MCL
      - Local lidocaine anesthesia above 3rd Rib MCL
      - Large bore needle catheter above 3rd Rib MCL
      - 3-way stopcock and 60ml syringe





Pulmonary Disorders

- **Other Pulmonary Causes**
  - Pneumonia
    - *May have chest pain (often pleuritic), fever, productive cough, exertional dyspnea, syncope; leukocytosis*

Findings	LR+	LR-
Egophony	8.6	0.96
Dullness to percussion	4.3	0.79
Fever	2.1	0.71
Clinical impression	2.0	0.24

    - *Chest imaging: consolidation*
    - *Suspect PE*
      - Presence of risk factors for PE
      - Persisting symptoms or poor response to antibiotics

Diehr P, Wood RW, Bushyhead J, Krueger L, Wolcott B, Tompkins RK. Prediction of pneumonia in outpatients with acute cough–a statistical approach. *J Chronic Dis*. 1984;37(3):215-225.

Pulmonary Disorders

- **Other Pulmonary Causes**
  - Asthma and COPD
    - *Often associated with chest tightness along with dyspnea*
    - *Triggers for exacerbation may also cause chest pain (eg, pneumonia)*
  - Acute Bronchitis
    - *Associated cough, phlegm, URI symptoms*
  - Pleuritis
    - *Inflammation of the lung pleura and causes pleuritic chest pain*
    - *Causes include autoimmune diseases (eg, SLE, RA) and drugs*

Pulmonary Disorders

- **Other Pulmonary Causes**
  - Lung cancer
    - *May have chest pain, typically on the same side*
    - *Other symptoms can include cough, hemoptysis, hoarseness, dyspnea*
  - Mediastinal tumors
    - *Most are asymptomatic; incidental findings on chest imaging*
    - *Symptoms are due to compression of surrounding structures or systemic symptoms (lymphoma)*
  - Sarcoidosis
    - *Chest pain (common manifestation), cough and dyspnea*
    - *Cardiac sarcoidosis can cause arrhythmias (including heart block), chest pain, palpitations, syncope, or dizziness*

Pulmonary Disorders

- **Other Pulmonary Causes**
  - Acute chest syndrome
    - *Patients with sickle cell anemia*
    - *Chest pain, fever, tachypnea, cough, and decreased oxygen saturation*
    - *Infiltrate on chest radiograph*
  - Substance-related
    - *Cocaine use cause chest pain associated with respiratory symptoms*
      - Acute pulmonary toxicity ("crack lung"), acute eosinophilic pneumonia, pneumothorax and pneumo-mediastinum, and pulmonary vascular disease
  - Pulmonary hypertension
    - *May have exertional chest pain , exertional dyspnea and syncope*

Gastrointestinal Disorders

Gastrointestinal Disorders

- **GI Causes**
  - 10-20%
  - Esophageal pain
    - *GERD (common)*
    - *Esophagitis (e.g. pill, eosinophilic esophagitis)*
    - *Hiatal hernia*
    - *Esophageal motility disorder*
    - *Perforation- rare but life-threatening*

Gastrointestinal Disorders

- **GI Causes**
  - Gastric pain
    - *Gastritis, PUD (mostly epigastric location)*
  - Visceral pain
    - *Radiation/referred pain from abdominal organs*
    - *Gallbladder, biliary (mostly RUQ pain)*

Gastrointestinal Disorders

- **Esophageal Pain**
  - Characteristics (usually)

Findings
Persistent pain
Lack of radiation
Post-prandial
Associated dysphagia
Associated heartburn or reflux and relieved with antacid

Gastrointestinal Disorders

- **GERD**
  - Characteristics
    - *Common, can mimic angina pectoris*
    - *Squeezing or burning, located sub-sternally and radiating to back, neck, jaw, or arms*
    - *May occur after meals, awaken patients from sleep, and be exacerbated by emotional stress*
    - *Lasts minutes to hours; resolves spontaneously or with antacids*

Findings	LR+	LR-
Burning retrosternal pain, acid regurgitation, sour or bitter taste in the mouth → One-week trial of high-dose PPI relieves symptoms	3.1	0.30

Wang WH, Huang JQ, Zheng GF, et al.
Is proton pump inhibitor testing an effective approach to diagnose gastroesophageal reflux disease.
Arch Intern Med. 2005;165(11):1222-1228.

Gastrointestinal Disorders

- **Esophageal Pain**
  - Other Causes
    - *Pill esophagitis*
      - Sudden onset retrosternal chest pain, dysphagia, odynophagia
      - Doxycycline, tetracycline, NSAIDS, iron, ascorbic acid
    - *Eosinophilic Esophagitis*
      - Heartburn, dysphagia (intermittent solid) , food impaction, chest pain
      - Mild peripheral eosinophilia
      - May be resistant to GERD treatment
      - Managed with swallowed inhaled steroids
    - *Infectious esophagitis*
      - Fungal, CMV in AIDS/HIV patients

Gastrointestinal Disorders

- **Esophageal Pain**
  - Other Causes
    - *Hiatal Hernia*
      - May cause chest pain in addition to reflux symptoms
    - *Esophageal motility disorders*
      - Generally manifest with dysphagia but some with chest pain
    - *Esophageal rupture*
      - Spontaneous perforation of the esophagus (Boerhaave syndrome)
      - Sudden increase in intra-esophageal pressure usually caused by straining or vomiting/retching
      - Presents with excruciating retrosternal chest pain. May have subcutaneous emphysema (27%). Deteriorates rapidly thereafter.

Findings
Excruciating retrosternal chest pain after straining or vomiting

Chest Wall Disorders

Chest Wall Disorders

- **Chest Wall Pain**
  - 30-50%
  - Causes
    - *Musculoskeletal chest wall pain*
    - *Costochondritis*
    - *Others*

Chest Wall Disorders

- **Musculoskeletal Pain**
  - Characteristics
    - *Commonly seen in primary care*
    - *Isolated musculoskeletal chest pain syndrome*
    - *Local or regional chest tenderness without other symptoms*

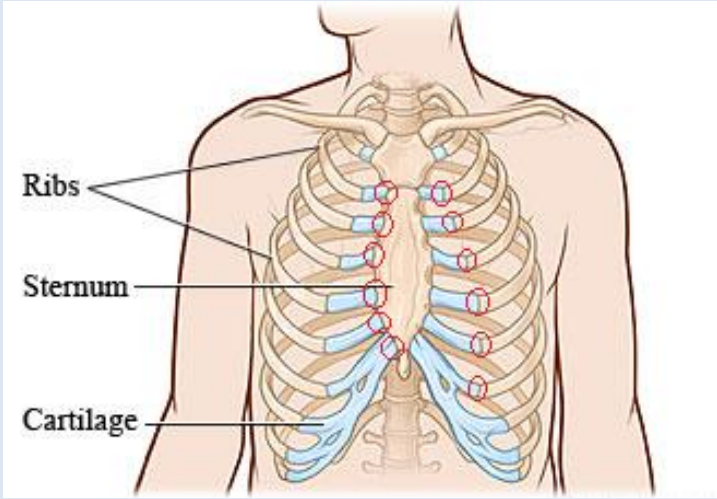
Findings	LR+
Pain reproducible by palpation	5.72
Not squeezing or oppressive	2.53
Well localized on the chest wall	2.10
Not exercised-induced	1.58
Influenced by movement or posture	1.54

Bösner S, Becker A, Hani MA, et al.
Chest wall syndrome in primary care patients with chest pain: presentation and diagnosis.
Fam Pract. 2010;27(4):363-369.

Chest Wall Disorders

- **Costochondritis**
  - Characteristics
    - *Subset of musculoskeletal chest wall pain*
    - *Sometimes called Tietze syndrome (swelling of associated joints)*
    - *No specific diagnostic testing unless with concomitant cardio-pulmonary symptoms or risk factors.*
    - *Self limited condition*

Findings
Pain reproducible by palpation in the parasternal/costochondral joints



Chest Wall Disorders

- **Other Chest Wall Causes**
  - Trauma
    - *Localized pain and tenderness*
    - *History of direct trauma or repetitive trauma*
  - Rib fractures
    - *Associated with pleuritic chest pain (localized and reproducible with palpation)*
    - *Often with associated injury*
    - *Some may occur without trauma (repetitive coughing, osteoporosis, neoplasm and sickle cell anemia)*

Chest Wall Disorders

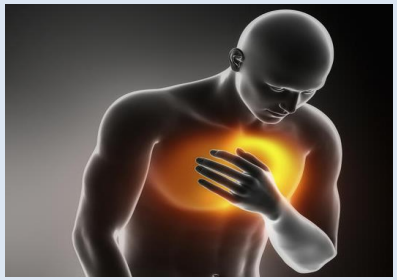
- **Other Chest Wall Causes**
  - Rheumatic diseases (thoracic joint arthritis)
    - *Generally not isolated chest wall pain and have other symptoms of rheumatic disease.*
  - Fibromyalgia pain
    - *Increased sensitivity to ordinarily non-painful stimuli*
    - *Widespread chronic muscle pain*
    - *Tenderness in multiple discrete points*

Chest Wall Disorders

- **Other Chest Wall Causes**
  - Dermatomal Pain
    - *Referred pain*
      - Same spinal cord segments supplying chest wall dermatomal areas
      - Parietal pleura or peritoneum, abdominal organs (eg, from biliary colic, gallbladder), cervical disc disease
    - *Herpes zoster*
      - Chest pain as presenting symptom preceding characteristic rash
      - Dysesthesia usually present in affected dermatome
      - Post-herpetic neuralgia may also cause chest pain

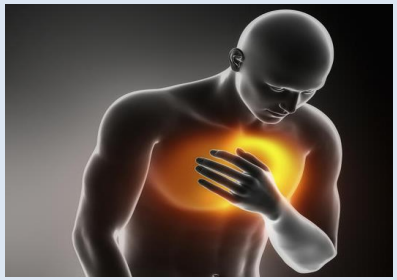
Psychiatric/Psychogenic Disorders

Psychiatric/Psychogenic Disorders



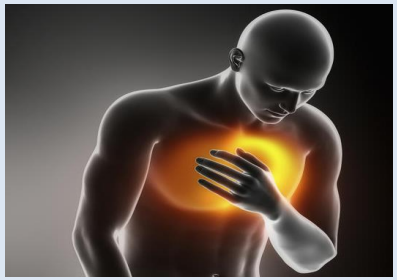
- **Psychiatric/Psychogenic Causes**
  - 5-10%
  - Chest pain common complaint in pts with psychiatric disorder
  - Patients with psychiatric disorders may however develop or have coexisting CHD
  - Causes
    - *Panic attack/Anxiety disorder*
    - *Depression, somatization, or factitious disorder (cardiac factitious disorder)*

Psychiatric/Psychogenic Disorders



- **Panic Attack/Anxiety Disorder**
  - Characteristics
    - *Spontaneous, discrete episodes of intense fear that begin abruptly and last for several minutes to an hour*
    - *Hyperventilation during a panic attack can result in*
      - Non-anginal chest pain
      - Occasionally ECG changes, particularly nonspecific ST and T wave abnormalities
    - *Domestic violence*
      - May complain of chest pain or have chest pain in the setting of psychiatric associated conditions (eg, panic disorder)
      - Chest pain is one of many specific physical symptoms associated with current domestic violence

Psychiatric/Psychogenic Disorders



- **Panic Attack/Anxiety Disorder**
  - Findings

Findings	LR+	LR-
In the past four weeks, have you had an anxiety attack (suddenly feeling fear or panic)?	4.2	0.09

  - Note:
    - *Panic attack may induce ischemia in a patient who has CHD*
    - *Panic disorder an independent risk factor for CHD in postmenopausal women (Women's Health Initiative Observational Study)*
    - *Screen for CHD!*

Löwe B, Gräfe K, Zipfel S, et al.
Detecting panic disorder in medical and psychosomatic outpatients.
J Psychosom Res. 2003; 55(6):515-519.

Case Review

Case 1

- **General**
  - 22yo, Man c/o L-sided chest pain x 1 day
- **Present Illness**
  - Yesterday, c/o CP after standing up to leave class.
    - *Pain was **sharp and severe** but did not affect his breathing except if he took a **deep breath**.*
    - *No sweating or dizziness. No prior episodes.*
    - *Took a cab home to Bronx and slept.*
  - Today, feels a little better but still has the L-sided chest pain.

Case 1

- **Pertinent History**
  - Medications: none
  - Past Medical/Mental Health: none
  - Surgery/Procedures/Hospitalization: none
  - Social History
    - *Denies smoking, drug-use*
    - *Alcohol use - couple/month*
    - *Exercise - Does not do much exercise. 6-8 hours/day on computer.*

Differential Diagnoses

- **22yo M c/o sharp, severe pleuritic CP**

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
Chest wall pain ***Costochondritis*** ***Contusion*** ***Rib fracture***		***Pericarditis***	***PE*** ***Pneumothorax*** ***Pneumonia/ Pleuritis***	***?***
	Less Likely - *No GI symptoms*	Less Likely *CAD* *Aortic dissection* - *Low risk*		

Case 1

- **Physical Examination**
  - Vital Signs:
    - *BP = 106/64 Right Arm; Pulse rate =73/min; RR = 16/min*
    - *Temp = 96.1 F*
    - *Pulse Oximetry/O2 Sat = 98%*
    - *Height = 5' 11.5"; Weight = 140lbs; BMI = 19.3*
  - Chest/Lung/Heart:
    - *Normal, no reproducible tenderness*
  - Heart/Vascular:
    - *Regular rate and rhythm, No murmur; full symmetric pulses*

Differential Diagnoses

- **Life-threatening Causes of Chest Pain**
  - Pulmonary embolism
  - Tension pneumothorax

  Less likely
  - Acute coronary syndrome ACS
  - Pericardial tamponade
  - Aortic dissection
  - Mediastinitis (eg, esophageal rupture)

Cardiovascular Disorders

- **Coronary Artery Disease**
  - Validated Clinical Decision Rule to Predict CAD as a Cause

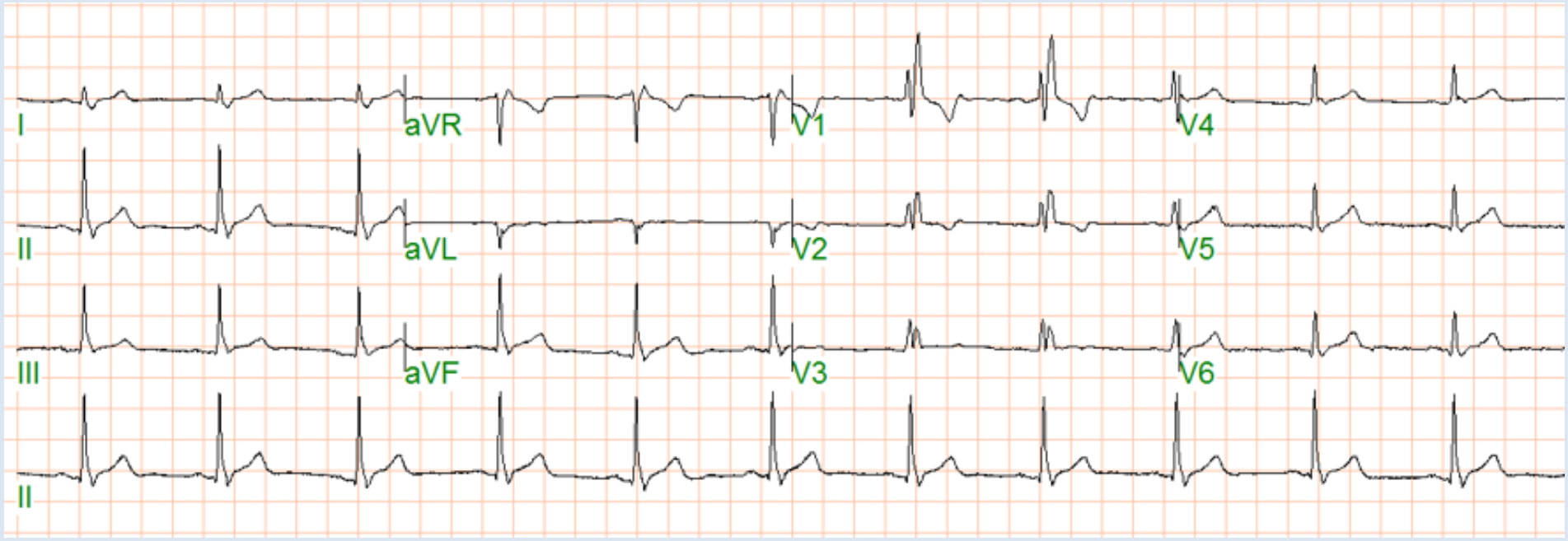
Component	Points
Men 55 years or older Women 65 years or older	1
Known vascular disease (CAD, PVD, Stroke)	1
Pain worse with exercise	1
Pain not elicited with palpation	1
Patient assumes pain is of cardiac origin	1
Total	**5**

Score	Positive Likelihood Ratio (LR+)	Positive Predictive Value (%)
0 - 1 point	1.09	0.6%
2 - 3 points	1.83	12%
4 - 5 points	4.52	63%

Adapted from Bösner S, Haasenritter J, Becker A, et al.
Ruling out coronary artery disease in primary care: development and validation of a simple prediction rule.
CMAJ. © 2010; 182(12):1298-1299

Case 1

- **ECG**
  - NSR, RBBB otherwise normal (no old ECG for comparison)
    - *Normal Axis, PR & QT intervals; No Q or ST-TW changes, HR = 75/min*



Differential Diagnoses

- **22yo M c/o sharp, severe pleuritic CP**
  - *Normal physical exam*
  - *ECG: RBBB*

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
			PE ***Pneumothorax***	**?**
Less Likely *- No reproducible pain on palpation*	Less Likely *- No GI symptoms*	Less Likely *Pericarditis* *- No ECG findings* *CAD* *- Score 0-1, No ECG findings* *Aortic dissection* *- Low risk, normal physical findings*	Less likely *Pneumonia/ Pleuritis* *- Low clinical impression (no cough, fever, abnormal lung sounds)*	

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Wells Criteria

Criteria	Points
Clinical symptoms of deep vein thrombosis (DVT)	3
Other diagnoses less likely than PE	3
Heart rate >100	1.5
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Malignancy	1
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Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - PERC (Pulmonary Embolism Rule-out Criteria)

Criteria	
Age ≥ 50	No
HR ≥ 100	No
O2 Sat on Room Air < 95%	No
Prior History of VT	No
Trauma or Surgery within 4 weeks	No
Hemoptysis	No
Exogenous Estrogen	No
Unilateral Leg Swelling	No

Finding	Management
All (8) No Low pretest probability	No need for further workup

Kline JA, Courtney DM, Kabrhel C, et al.
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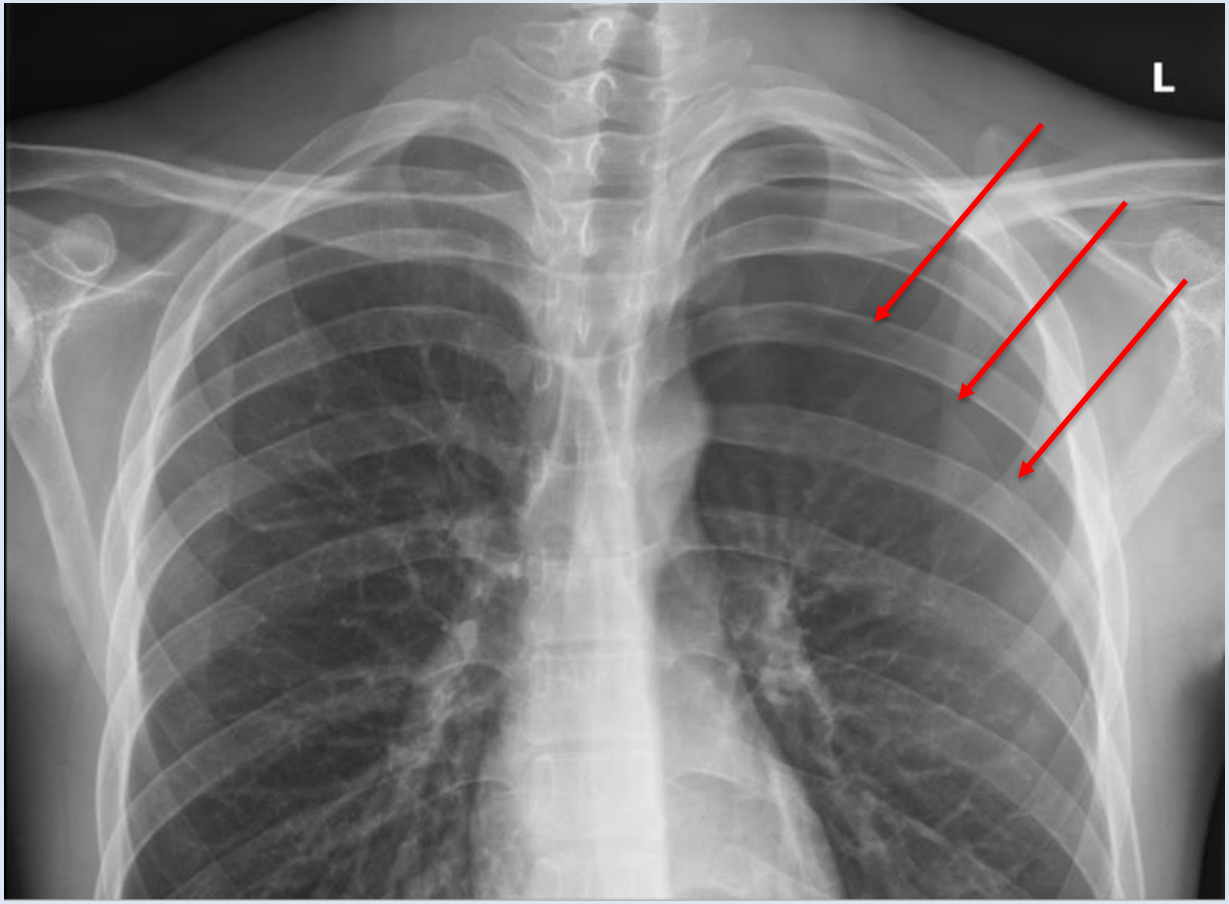
Case 1

- **Chest X-ray**

Case 1

- **Chest X-ray**
  - L-sided Pneumothorax



Case 2

- **General**
  - 24yo Woman c/o ear problem (“clogged”) x 1 month and “muscle ache in my heart” x 1 day
- **Present Illness**
  - 2 days ago, c/o L-sided chest achy sensation after biking fast.
  - Yesterday, c/o **SOB, cough** and then chest pain.
    - ***Anterior to posterior*** *over left chest, sometimes* ***left shoulder pain****.*
    - *Constant but exacerbated with deep inspiration (****pleuritic****) and when lying on either side.*
    - ***Worse with exertion****.*
    - *No palpitations.*

Case 2

- **Pertinent History:**
  - Past Medical/Mental Health: none
  - Past Surgery:
    - *R knee arthroscopic surgery (2010)*
  - Medications:
    - ***Desogestrel-EE*** *(0.15/.02, 0/0.01) for years; resumed 4 months ago*
  - Family History:
    - *Breast, ovarian and bone CA (grandparents); high cholesterol (father); MI (grandparents); hypertension (grandparents)*
    - *No h/o blood clots*

Case 2

- **Pertinent History**
  - Social History
    - *Denies smoking or drug use*
    - *Alcohol use - rare*
    - ***Travel - to/from CA over** last weekend*
    - *Exercise - rides bike to get around town daily*
  - ROS:
    - *Right ear feels "clogged" for past several days*

Differential Diagnoses

- **24yo W c/o pleuritic CP with cough and SOB**
  - On OCP, recent travel

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
Chest wall pain ***Costochondritis*** ***Contusion*** ***Rib fracture***		***Pericarditis***	***PE*** ***Pneumothorax*** ***Pneumonia/ Pleuritis***	***?***
	Less Likely *- No GI symptoms*	Less Likely *CAD* *Aortic aneyrism* *- Low risk*		

Case 2

- **Physical Examination**
  - Vital Signs:
    - *BP= 102/70 Left Arm*
    - *Pulse Rate = 74/min; RR=16/min*
    - *Temp = 97.2 F*
    - *Pulse Oximetry/O2 Sat = 98%*
    - *Height = 5' 3", Weight = 134, BMI = 24*
  - Peak Flows (L/min, expected 418):
    - ***#1. 245 (59%), #2. 230 (55%), #3. 226 (54%)***

Case 2

- **Physical Examination**
  - Chest/Lungs:
    - *No reproducible tenderness; Normal auscultation & percussion*
  - Heart/Vascular:
    - *Regular rate and rhythm without murmur; pulses full and symmetric*
  - Abdomen:
    - *No tenderness, rebound, organomegaly*
  - Extremities:
    - *No edema, swelling, cords; Negative Homan's sign*
- **ECG: Normal**

Differential Diagnoses

- **Life-threatening Causes of Chest Pain**
  - Pulmonary embolism
  - Tension pneumothorax

  Less likely
  - Acute coronary syndrome ACS
  - Pericardial tamponade
  - Aortic dissection
  - Mediastinitis (eg, esophageal rupture)

Differential Diagnoses

- **24yo W c/o pleuritic CP with cough and SOB**
  - *On OCP, recent travel*
  - *Low PF otherwise normal physical exam*
  - *Normal ECG*

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
			PE ***Pneumothorax*** ***Pneumonia/ Pleuritis***	***?***
Less Likely - *No reproducible pain on palpation*	Less Likely - *No GI symptoms*	Less Likely *Pericarditis* - *No ECG findings* *CAD* - *Score 0-1, No ECG findings*		

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Wells Criteria

Criteria	Points
Clinical symptoms of deep vein thrombosis (DVT)	3
Other diagnoses less likely than PE	3
Heart rate >100	1.5
Immobilization three or more days or Surgery in previous four weeks	1.5
Previous DVT/PE	1.5
Hemoptysis	1
Malignancy	1
Total	**12.5**

Score	Risk Stratification	LR+	% Probability
0-1	Low pretest probability	1.1	1.3%
2-6	Moderate pretest probability	1.8	16%
>6	High pretest probability	6.8	>41%

Wells PS, Anderson DR, Rodger M, et al.
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Thromb Haemost. 2000;83(3):418

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - PERC (Pulmonary Embolism Rule-out Criteria)

Criteria	
Age ≥ 50	No
HR ≥ 100	No
O2 Sat on Room Air < 95%	No
Prior History of VT	No
Trauma or Surgery within 4 weeks	No
Hemoptysis	No
Exogenous Estrogen	No
Unilateral Leg Swelling	No

Finding	Management
All (8) No Low pretest probability	No need for further workup

Kline JA, Courtney DM, Kabrhel C, et al.
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Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Management (Simplified Wells Criteria)

Score	Risk Stratification	Management
5 or more	PE likely	Work-up: CTPA or VQ scan
4 or less	PE less likely	Work-up: D-dimer

Case 2

- **Additional Work-up**
  - D-dimer
    - *Pending*
  - Chest x-ray
    - *Normal*

Differential Diagnoses

- **24yo W c/o pleuritic CP with cough and SOB**
  - *On OCP, recent travel*
  - *Low PF otherwise normal physical exam*
  - *Normal ECG and chest x-ray*

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
			PE	***?***
Less Likely *- No reproducible pain on palpation*	Less Likely *- No GI symptoms*	Less Likely *Pericarditis* *- No ECG findings* *CAD* *- Score 0-1, No ECG findings*	Less likely *Pneumothorax* *Pneumonia/ Pleuritis* *- Normal chest x-ray*	

Case 2

- **Additional Work-up**
  - D-dimer: positive
- **ER for further evaluation and management**
  - CTA: bilateral pulmonary embolism
  - Treated with anti-coagulation

Case 3

- **General**
  - 21yo Male c/o L-sided chest pain x 3 days
- **Present Illness**
  - 3 days c/o CP on and off
    - *Mild, sharp-dull,* ***worse with deep breath and body movement*** *(avoiding exertion)*
    - ***Started after lifting weights***
    - *No SOB, nausea, vomiting, diaphoresis*

Case 3

- **Pertinent History**
  - Past Medical:
    - ***Bicuspid aortic valve****, mild AR; migraines*
  - Past Mental Health:
    - ***Anxiety/Panic disorder***
  - Medications:
    - *Citalopram*
    - *Zolmitriptan as needed*

Differential Diagnoses

- **21yo M c/o pleuritic CP, 3 days**
  - History of anxiety/panic attacks, bicuspid aortic valve

Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
Chest wall pain ***Costochondritis*** ***Contusion*** ***Rib fracture***		***Pericarditis*** ***Aortic Dissection***	***PE*** ***Pneumothorax*** ***Pneumonia/ Pleuritis***	***Anxiety*** ***Panic Attack***
	Less Likely - *No GI symptoms*	Less Likely *CAD* *- Low risk*		

Case 3

- **Physical Examination**
  - Vital Signs:
    - *BP= 123/81 Left Arm*
    - *Pulse Rate = 83/min; RR=12/min*
    - *Temp = 97.2 F*
    - *Pulse Oximetry/O2 Sat = 99%*
    - *Height = 5' 11", Weight = 177, BMI = 24*
  - Chest/Lungs:
    - ***diffuse but mild L sided upper chest tenderness on palpation***
  - Heart/Vascular:
    - ***2/6 diastolic murmur**; normal bilateral pulses*

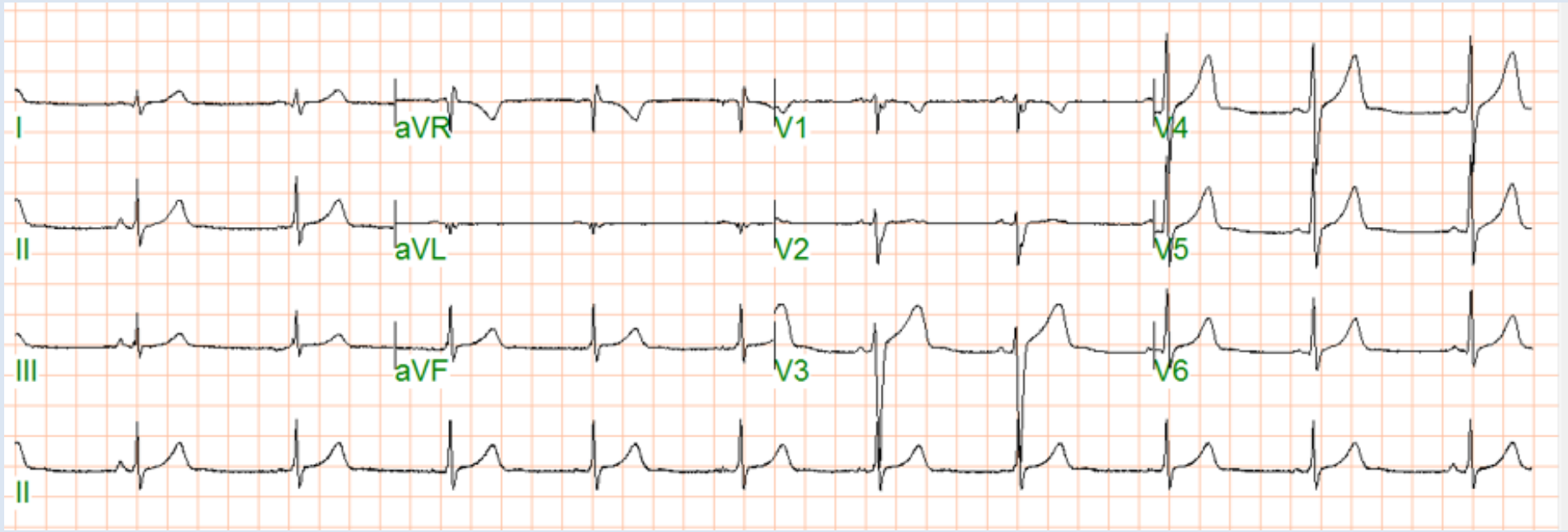
Differential Diagnoses

- **Life-threatening Causes of Chest Pain**
  - Pulmonary embolism
  - Tension pneumothorax

  Less Likely
  - Acute coronary syndrome ACS
  - Aortic dissection
  - Pericardial tamponade
  - Mediastinitis (eg, esophageal rupture)

Case 3

- **ECG (old)**
  - NSR
    - *Normal axis, Normal R progression in anterior leads*



Differential Diagnoses

- **21yo M c/o pleuritic CP**
  - *History of anxiety/panic attacks, bicuspid aorta*
  - *Heart murmur, vague chest wall tenderness on palpation*

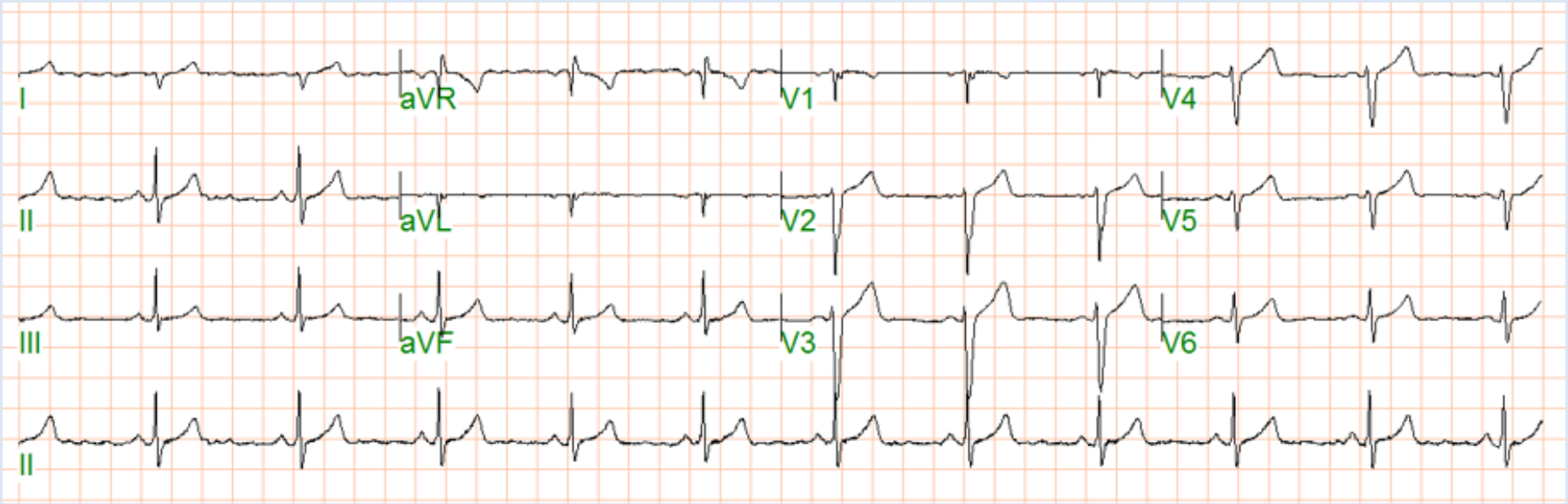
Chest wall	Gastro-intestinal	Cardiovascular	Pulmonary	Psychogenic Psychiatric
Muscle pain from weight lifting		***Pericarditis***	***PE Pneumothorax***	***Anxiety/Panic Attack***
Less Likely *Cosotchondritis* *Rib fracture* *- Lpw clinical findings*	Less Likely *- No GI symptoms*	Less likely *Aortic Dissection* *- Normal physical findings* *CAD* *- Score 0-1*	Less likely *Pneumonia/ Pleuritis* *- Low clinical impression (no cough, fever, abnormal lung sounds)*	

Case 3

- **Additional work?**
  - A. New ECG?
  - B. D-dimer?
  - C. Chest x-ray?
  - D. No further work-up?

Case 3

- **ECG (new)**
  - NSR, RAD, poor R progression anterior leads
    - *Normal PR, QT intervals; No Q, ST-TW changes; HR = 70/min*



Case 3

- **Additional work?**
  - A. D-dimer?
  - B. Chest x-ray?
  - C. No further work-up?

Pulmonary Disorders

- **Pulmonary Embolism (PE)**
  - Wells Criteria

Criteria	Points
Clinical symptoms of deep vein thrombosis (DVT)	3
Other diagnoses less likely than PE	3
Heart rate >100	1.5
Immobilization three or more days or Surgery in previous four weeks	1.5
Previous DVT/PE	1.5
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Case 3

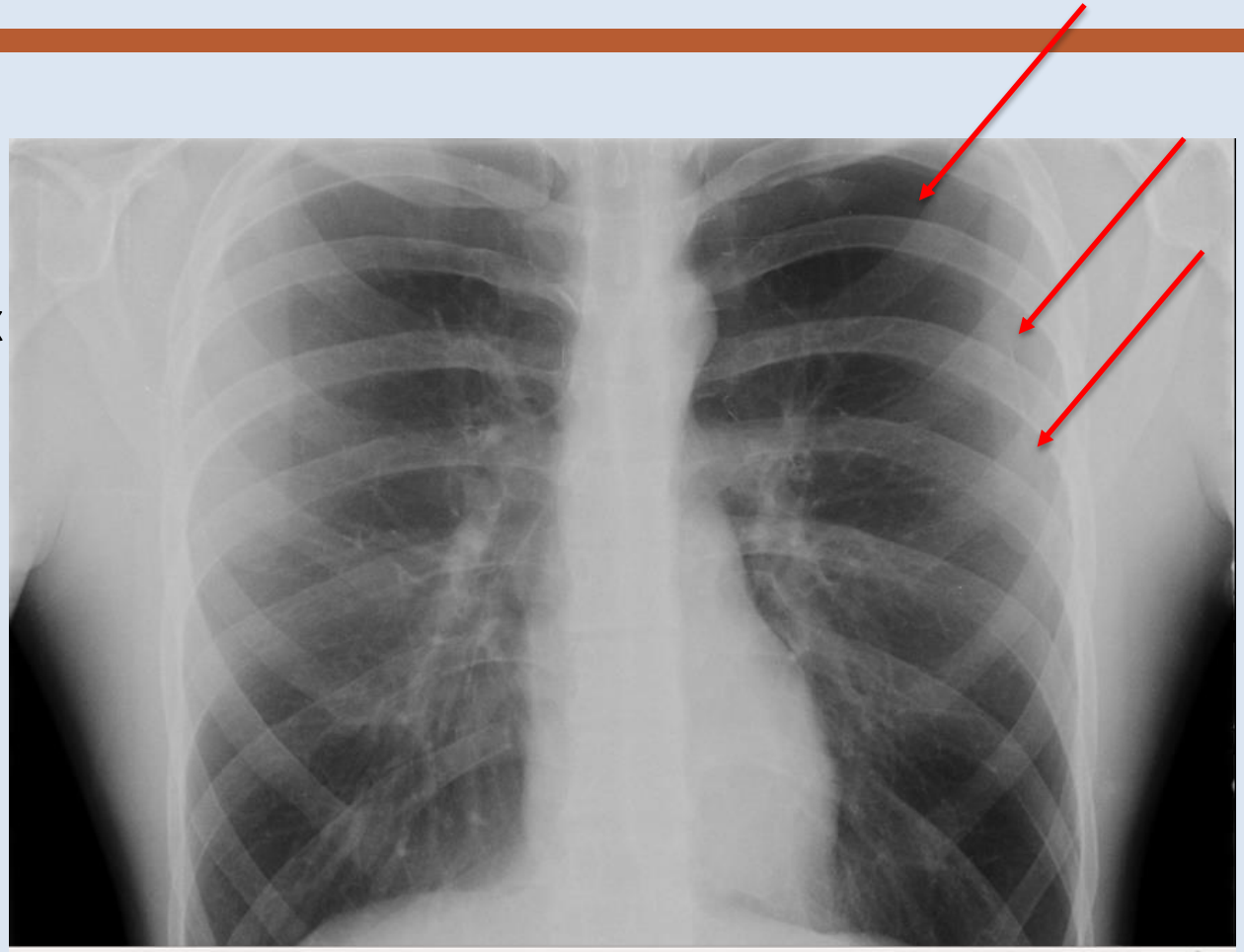
- **Additional work?**
  - A. Chest x-ray?
  - B. No further work-up?

Case 3

- **Chest X-ray**

Case 3

- **Chest X-ray**
  - L-sided Pneumothorax



Chest Pain Summary

Chest Pain Algorithm

- **Evaluation**
  - Clinical History
  - Physical Examination
  - ECG
- **Differential Diagnoses**
  - Cardiovascular
  - Pulmonary
  - Gastrointestinal
  - Chest wall
  - Psychiatric/Psychogenic
- **Algorithm**
  - Rule out Life-threatening conditions
  - Diagnose Common conditions

Evaluation of Chest Pain in the Young Adult

Thank You!

Donald F. Kreuz, MD, FACC