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Chest pain

Pain

- **Pain assessment**

  - Location

  - Radiation

  - Character

  - Aggravating factors

  - Relieving factors

  - Timing

  - Circumstances in which it occurs

  - Associated symptoms

Pain

- **History is very important!**

  - previous medical history

  - medications

  - allergies

  - social (smoker, alcoholic, drugs)

  - family medical history

Overview

- Chest pain accounts for 6 million annual visits to the EDs in Europe
- Chest pain is the most common ED complaint
- Patients with chest pain present with a wide spectrum of signs and symptoms
- It is up to the clinician to recognize the life-threatening causes of chest pain

TABLE 1

Epidemiology of Chest Pain in Primary Care and Emergency Department Settings

	Percentage of patients presenting with chest pain		
*Diagnosis**	*Primary care: United States[4]*	*Primary care: Europe[3]*	*Emergency department[3]*
Musculoskeletal condition	36	29	7
Gastrointestinal disease	19	10	3
Serious cardiovascular disease†	16	13	54
Stable coronary artery disease	10	8	13
Unstable coronary artery disease	1.5	—	13
Psychosocial or psychiatric disease	8	17	9
Pulmonary disease‡	5	20	12
Nonspecific chest pain	16	11	15

**—Diagnoses are listed in order of prevalence in United States.*

†—Including infarction, unstable angina, pulmonary embolism, and heart failure.

‡ —Including pneumonia, pneumothorax, and lung cancer.

Adapted with permission from Klinkman MS, Stevens D, Gorenflo DW. Episodes of care for chest pain: a preliminary report from MIRNET. J Fam Pract 1994;38:349, with additional information from reference 3.

CHEST PAIN ≠ ACS

POSITIVE TROPONIN ≠ ACS

Differential diagnosis

- **Cardiac**
  - MI
  - Pericarditis
  - Myocarditis
  - Aortic Stenosis
- **Pulmonary**
  - PE
  - Pneumonia
  - Asthma/COPD
  - Acute Chest Syndrome
- **Pleura**
  - Pleuritis
  - Pneumothorax
- **Aorta**
  - Dissection
- **Chest wall**
  - Costocondiritis
  - Herpes zoster
  - Rib fracture
- **Gastrointestinal**
  - Esophageal Spasm
  - Eosinophilic Esophagitis
  - Esophageal Rupture/Perforation
  - GERD
  - Pancreatitis
  - Perforated ulcer
- **Mediastinitis**
- **Anxiety disordes**

Characteristics of chest pain

Condition	Location	Quality	Duration	Aggravation/Relieving Factors	Associated Signs and Symptoms
Angina	Retrosternal pain; radiates to neck, jaw, epigastrium, shoulder, arm	Pressure, burning, squeezing, heaviness	<2-10 min	Precipitated by exercise, cold, weather, stress; relieved by rest or nitroglicerin	Murmur of pappilary buscle dysfunction during pain
Unstable angina	Same as angina	Same as angina or more severe	Usually <20 min	Same as angina	Similar to stable angina
Myocardial Infarction	Retrosternal/Substernal and may radiate like angina	Pressure, burning, squeezing, heaviness	> 30 min but variable	Unrealived by rest or nitroglyderin	Shortness of breath, sweating, weakness, nausea, vomiting
Pericarditis	Usually begins over sternum or toward cardiac apex and may radiate to neck or left shoulder; more localized than MI pain	Sharp, knifelike, stabbing	Lasts many hours to days	Aggravated by deep breathing or supine position; relieved by sitting up and leaning forward	Pericardial friction rub
Aortic Dissection	Retrosternal; may radiate to back	Tearing, kniflike	Sudden onset	Occurs in setting of hypertension or predisposition, such as Marfan syndrome	Murmur of aortic insufficiency, pulse or blood pressure asymmetry

Characteristics of chest pain

Condition	Location	Quality	Duration	Aggravation/Relieving Factors	Associated Signs and Symptoms
Pulmonary embolism	Retrosternal/substernal	Pleuritic or angina like	Sudden onset	May be aggravated by breathing	Dyspnea, tachypnea, tachycardia, hypotension, signs of right ventricular failure, pleural rub, hemoptysis
Pulmonary hypertension	Substernal	Pressure	Similar to angina	Aggravated by effort	Dyspnea

Characteristics of chest pain

Condition	Location	Quality	Duration	Aggravation/Relieving Factors	Associated Signs and Symptoms
Pneumonia	Localized over affected area	Pleuritic	Brief or prolonged	Painful breating	Dyspnea, cough, fever, dull to percussion, rales, cracles
Pneumothorax	Unilateral	Sharp, well localized	Sudden onset	Fainful breathing	Dyspnea, decreased breath sounds
Musculoskeletal disorders	Variable	Aching	Short or long duration	Aggravated by movement	Tender to pressure or movement
Herpes zoster	Dermatomal in distribution	Burning, itching	Prolonged	None	Vesicular rash
Esophageal reflux	Substernal, epigastric	Burning, visceral discomfort	<1h	Aggravated by large meals	Water brash
Peptic ulcer	Epigastric, substernal	Visceral burning	Prolonged	Relief with food	
Gallbladder gisease	Epigastric	Visceral	Prolonged	May be unprovoked or follow meals	Right upper quadrant tenderness
Anxiety disorder	Localized over pericardium	Variable	Variable	Situational	Chest wall tenderness

Typical vs. Atypical Chest Pain

Typical

- Characterized as discomfort/pressure rather than pain
- Time duration >2 mins
- Provoked by activity/exercise
- Radiation (i.e. arms, jaw)
- Does not change with respiration/position
- Associated with diaphoresis/nausea
- Relieved by rest/nitroglycerin

Atypical

- Pain that can be localized with one finger
- Constant pain lasting for days
- Pain lasting for a few seconds
- Pain reproduced by movement/palpation

Benign Causes

- Musculoskeletal
- Esophagitis
- Bronchitis

Life-threatening causes of chest pain

- Acute coronary syndrome
- Aortic dissection
- Pulmonary embolism
- Pneumothorax
- Pericardial tamponade
- Esophageal rupture

What are the key parts of the Physical?

What should we exam in first minutes?

Emergency physical examination in case of chest pain

- General Appearance
- Vital Signs
- Heart (Muffled? Regular? Fast?)
- Lungs (Equal? Wet? Tympanitic?)
- Neck (JVD?)
- Abdomen (Distention?)
- Lowe limbs (Edema? Calf tenderness?)

Additional tests

- ECG
- Chest x-ray

Case 1

Case 1

- 62 years old female
- Medical history:
  - CAD
  - PCI to the LAD
  - COPD
  - Total hip artrhoplaty 3 weeks ago
- Reason for admission: COPD exacerbation

Evaluate the patient

- Determine if patient is stable or unstable
- Perform focused history and physical exam
- Read and interpret the ECG. Compare ECG to old ECG if available

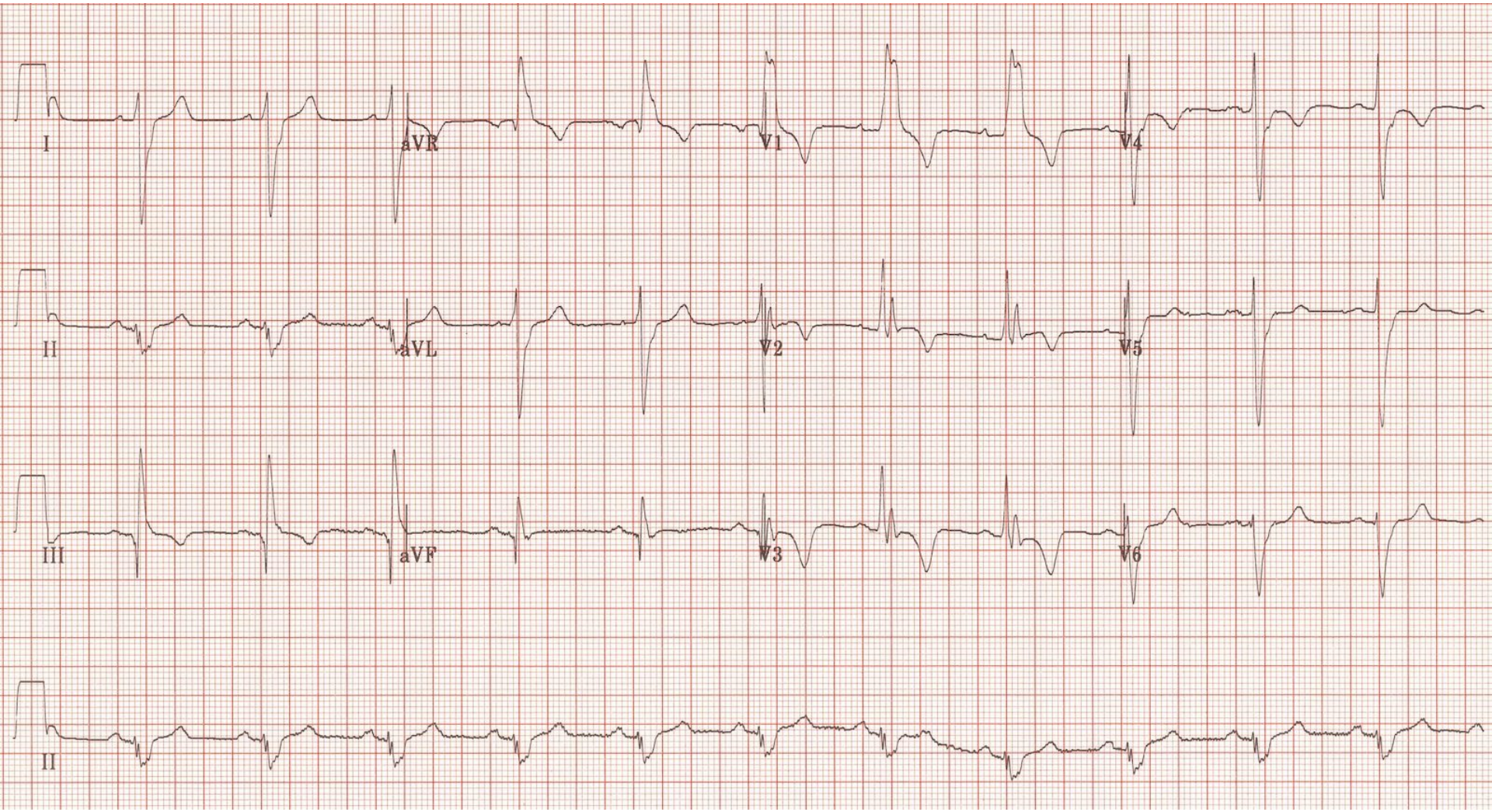
Case 1

- She had been feeling better after Ipratropium bromide
- Sudden onset of chest pain
- Worse with breathing
- The pain is not like her prior MI

Case 1

- Vital signs: HR 120, BP 110/70, RR 28, O2 sat 89% on 2L (was 95% this morning)
- Physical exam
  - Gen – in distress, using accessory muscles of respiration
  - Lungs – CTAB, no rales/wheezes
  - Heart – tachycardic, loud s2, no mumurs
  - Abd – soft, NT/ND, active BS
  - Ext – one calf warmer and swollen; tenderness

- Labs:
  CBC wnl, BNP = 520, D-dimer = positive, Troponin = 0.12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PE signs and symptoms

- Symptoms
  - SOB or dyspnea- Present in 90%
  - Chest pain (pleuritic)- 66% of patients with PE
  - Cough
  - Sudden onset
- Signs
  - Tachycardia > 100 beats per minute
  - Tachypnea > 20 breaths per minute
  - Hypoxia < 95%
  - Lower extremity swelling

PE risk factors

- Hypercoaguability
  - Malignancy, pregnancy, estrogen use, factor V Leiden, protein C/S deficiency
- Venous stasis
  - Bedrest > 48 hours, recent hospitalization, long distance travel
- Venous injury
  - Recent trauma or surgery

Wells score

Criteria	Points
Clinical signs/symptoms of DVT	3
PE is most like diagnosis	3
Tachycardia (>100 bpm)	1.5
Immobilization/surgery in previous 4 weeks	1.5
Prior DVT/PE	1.5
Hemoptysis	1
Active malignancy (trt w/in 6 months)	1

Low Risk
< 2 points

Intermediate Risk
2-6 points

High Risk
>6 points

PE unlikely
0-4 points

PE likely
>4 points

Revised Geneva score

Criteria	Points
Age > 65	1
Previous DVT/PE	3
Surgery/lower lim fracture (past monts)	2
Active malignancy	2
Unilateral limb pain	3
Hemoptysis	2
HR 75-94	3
HR >94	5

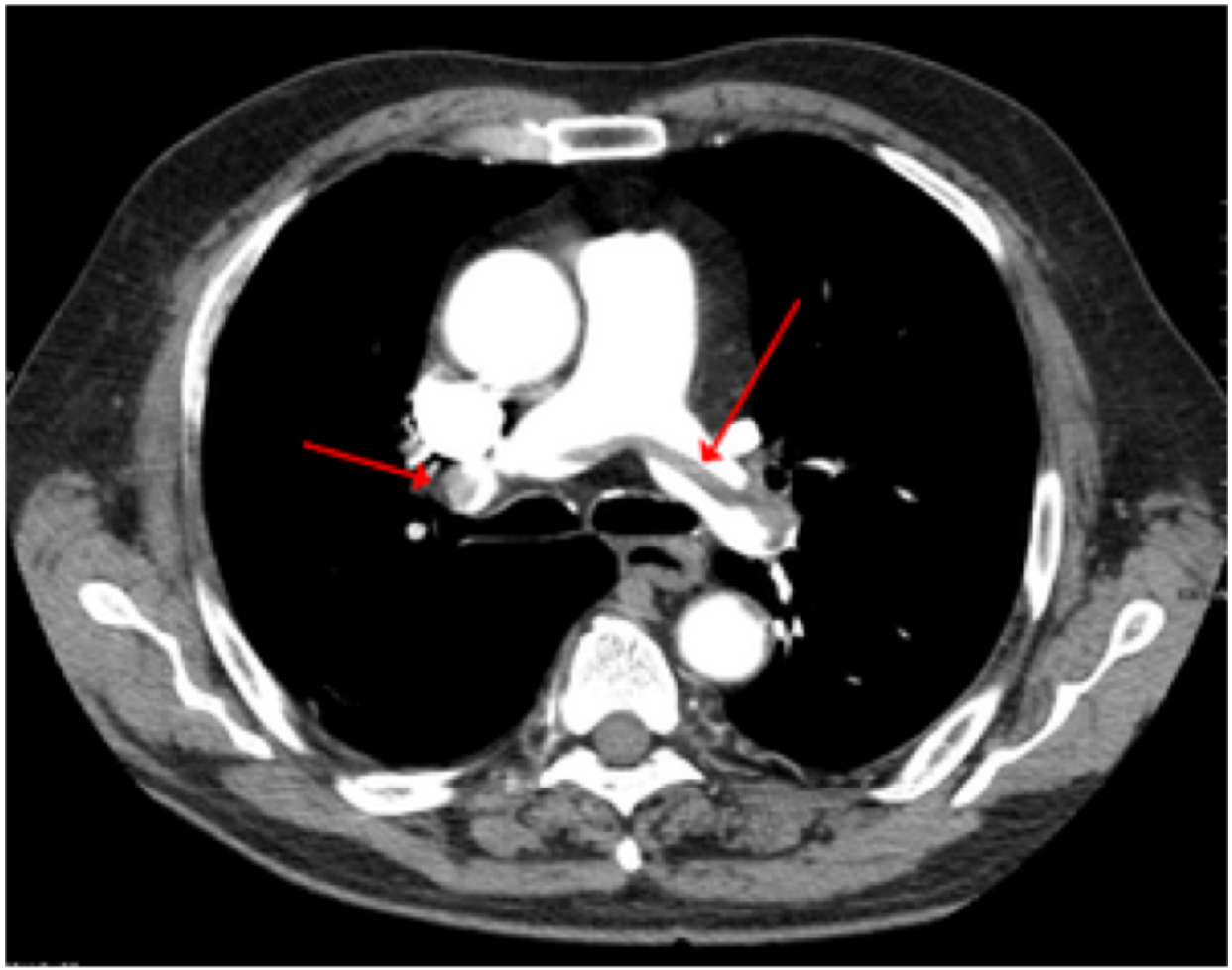
Low Risk
< 4 points

Intermediate Risk
4-10 points

High Risk
>10 points

PE diagnosis

- D-dimer
  - Very sensitive in low to moderate probability
  - Not sensitive enough for high probability
  - Not specific (Lots of false positives)
- Spiral CT
  - Current gold standard
  - Quick and available
  - Caution if impaired creatinine clearance
- Pulmonary arteries angiography



PE: Managament

- Stabliize patient
  - Oxygen
  - Fluids if hypotensive!
- Anticoagulants
  - Preferred: LMWH or Fondaparinux
    - **Enoxaparin 1.5mg/kg daily or 1mg/kg BID**
    - Fondaparinux subcutaneous once daily (weight based)
  - Alternative: UFH (IV or SC) – select high intensity protocol
    - Hemodynamically unstable patients
    - 80 u/kg bolus, 18 h/kg/hr
    - High risk of bleeding (reversible)
    - GFR < 30
  - Can initiate warfarin on same day
- IVC filter an alternative in patients with mod-high bleeding risk

PE in unstable patient

- Thrombolysis
  - Administer over short infusion time
- Catheter based thrombectomy
  - For failure of thrombolysis or likelihood of shock/death before thrombolysis can take effect (hours)
- Surgical thrombectomy
  - Failure of above therapies

Case 2

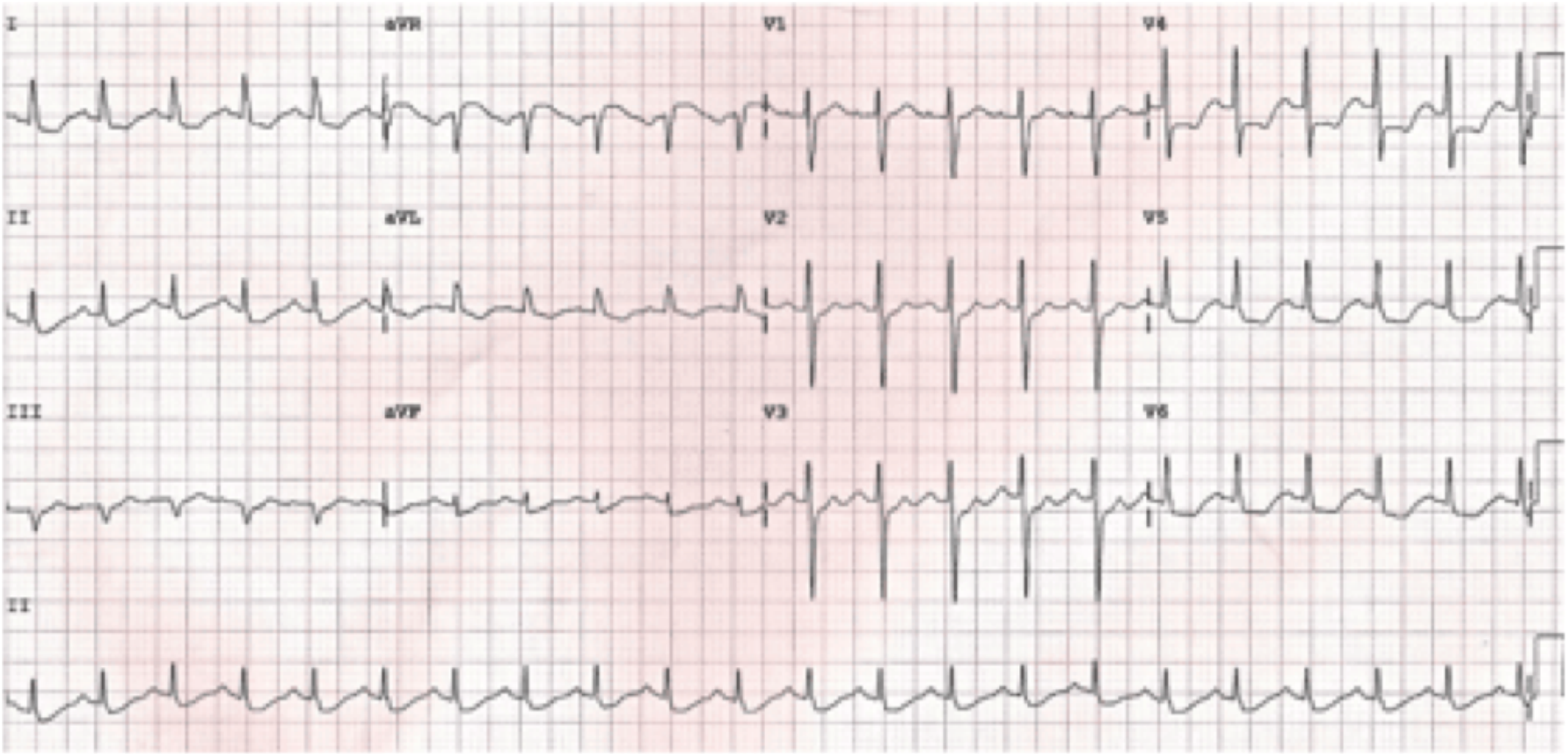
Case 2

- 67 yo man
- Medical history
  - Hypertension
  - DM t. 2
  - CAD (PCI in 2007)
- Reason for admission
  - Retrosternal chest pain that is radiating to his jaw
  - Nausea and diaphoresis

Case 2

- Vital Signs: HR 108 BP 105/60 mmHg RR 20 O2 sat 93%
- Physical exam:
  - Gen – actively having chest pain, diaphoretic
  - Lungs – crackles at bilateral bases
  - Heart – tachycardic, no mumurs
  - Rest of the exam benign
- Labs: CBC wnl, Troponin = 2.3 ng/ml (UL - 0.056 ng/ml)

Case 2



Diagnosis of ischemia

- EKG changes in Acute Coronary Syndromes:
  - ST elevations
  - ST depressions
  - T wave inversions
    - “pseudonormalization” – inversion of previously inverted T waves when compared with old EKG
  - New conduction block
  - Q waves

Risk stratification

TIMI RISK SCORE for UA/NSTEMI

HISTORICAL	POINTS
Age ≥ 65	1
≥ 3 CAD risk factors (FHx, HTN, ↑ chol, DM, active smoker)	1
Known CAD (stenosis ≥ 50%)	1
ASA use in past 7 days	1
PRESENTATION	
Recent (≤24H) severe angina	1
↑ cardiac markers	1
ST deviation ≥ 0.5 mm	1

RISK SCORE = Total Points (0 - 7)

RISK OF CARDIAC EVENTS (%) BY 14 DAYS IN TIMI 11B*

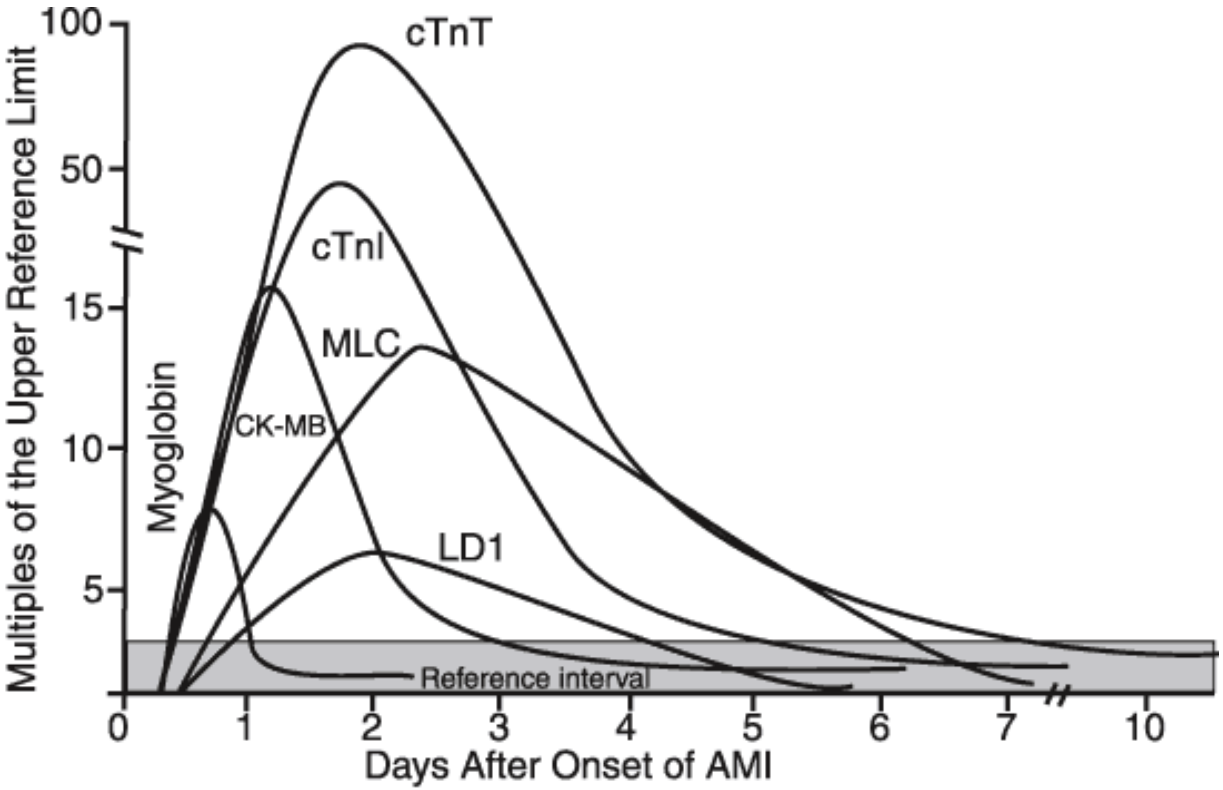
RISK SCORE	DEATH OR MI	DEATH, MI OR URGENT REVASC
0/1	3	5
2	3	8
3	5	13
4	7	20
5	12	26
6/7	19	41

*Entry criteria:UA or NSTEMII defined as ischemic pain at rest within past 24H, with evidence of CAD (ST segment deviation or +marker)

For more info go to wwwtimi.org

Antman et al *JAMA 2000*; 284: 835 - 842

Cardiac enzymes

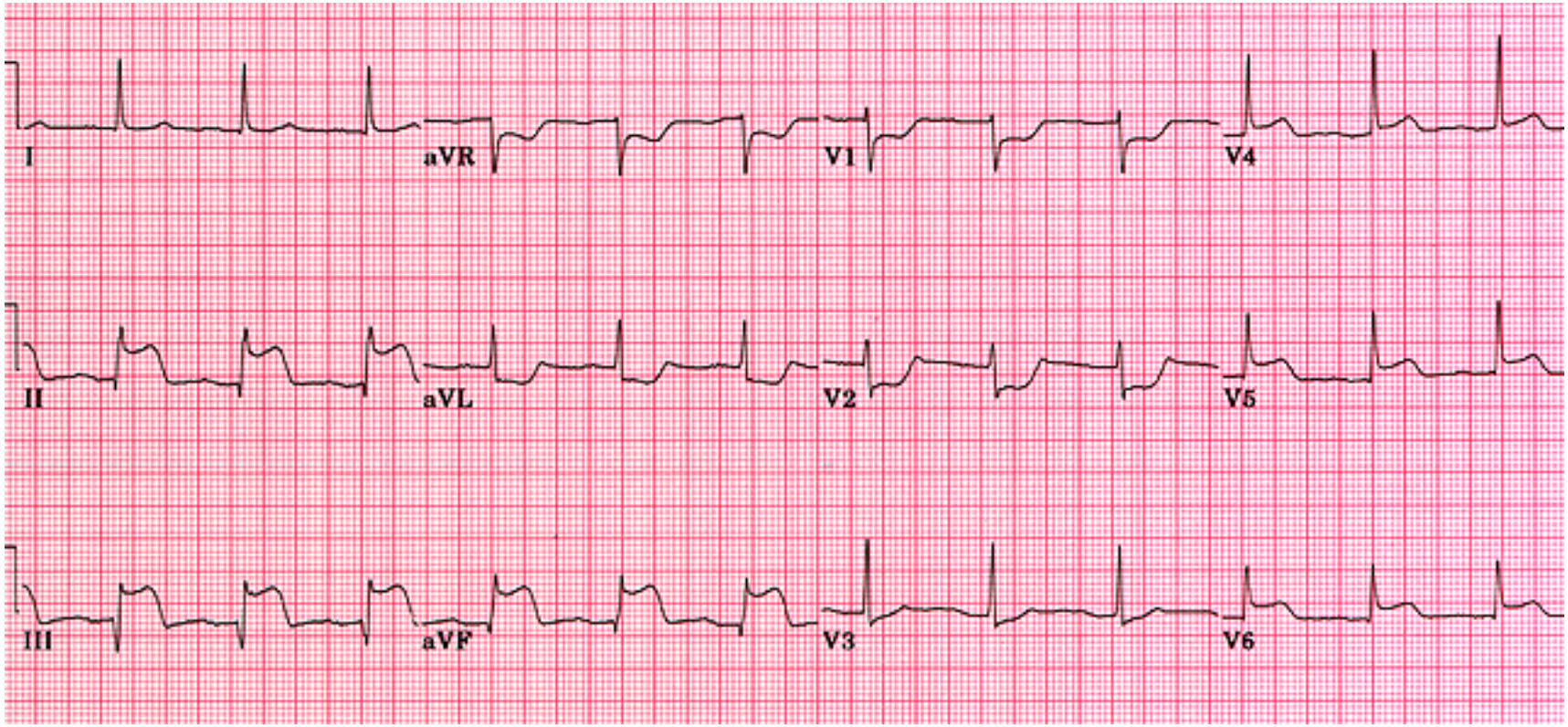


Source: Tintinalli JE, Kelen GD, Stapczynski JS: *Tintinalli's Emergency Medicine: A Comprehensive Study Guide*, 6th Edition: http://www.accessemergencymedicine.com

NSTEMI: Managament

- "Stabilize" plaque
  - Dual antiplatelet therapy
    - Plavix load 600mg followed by daily 75mg
    - ASA 300mg, then 75 daily
  - Anticoagulant
    - UF Heparin at low intensity protocol
  - Short acting beta-blocker
  - Statin
    - Atorvastatin 80mg
- Optimize Myocardial O2 supply/demand
  - Control HR -> Short acting metoprolol, can titrate quickly to HR <60 if BP allows. Give 5mg IV, can repeat at 5-15min intervals. Be wary of patients with heart failure!
  - Supplemental O2 if hypoxemic
  - SL nitroglycerin (0.4mg), repeat every 4-5 minutes
  - Morphine if still having active chest pain

What should you NOT give to this patient?



Contraindications to Nitroglycerine

- Other contraindications to NG:
  - Preload dependent states
    - Inferior MI
    - Aortic outflow obstruction (HOCM, severe AS)
  - Likelihood of hemodynamic instability
    - HR <50 or >100
    - SBP<90mmHg or more than 30mmHg below baseline
    - Use of PGE inhibitors

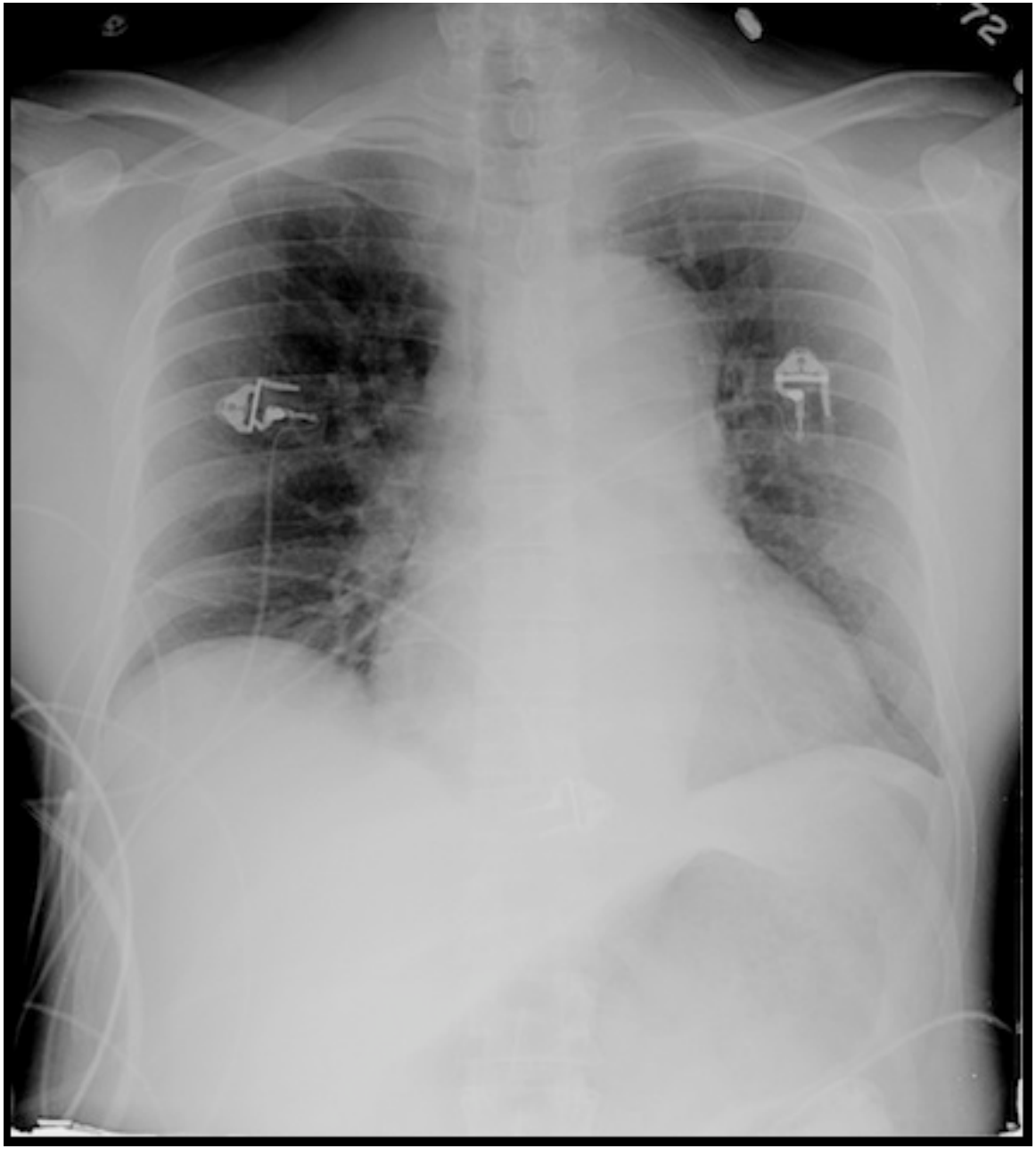
Case 3

Case 3

- 65 yo man
- Medical history
  - Unctrolled hypertension
  - DM t. 2
  - NSTEMI
- Reason for admission
  - Severe chest pain (different than prior MI)
  - Pain radiated to neck and back

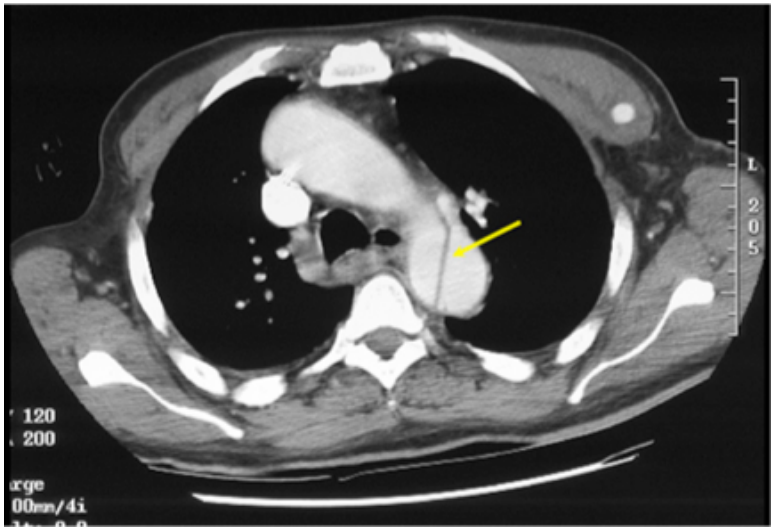
Case 3

- VS: HR110, BP145/80 in R arm, RR 16, Pox 98%
- Focused Exam:
  - GEN: in discomfort but maintating well
  - Heart: normal s1/s2, no murmurs
  - PULM ctab, no wheezes/cracles
  - EXTR: cool
  - Bilateral BP: 145/80R, 110/60L



Aortic dissection: diagnosis

- CT angiography – first line
  - 83-100% sensitive, specificity 87-100%
- TEE – second line; good for proximal, cannot visualize descending aorta well



Aortic dissection

- Risk factors
  - Male: 66% of patients
  - Hypertension: 72% of patients
  - Connective tissue disease
    - 30% of Marfan's patients get dissections
  - Cocaine Use
  - Syphilis

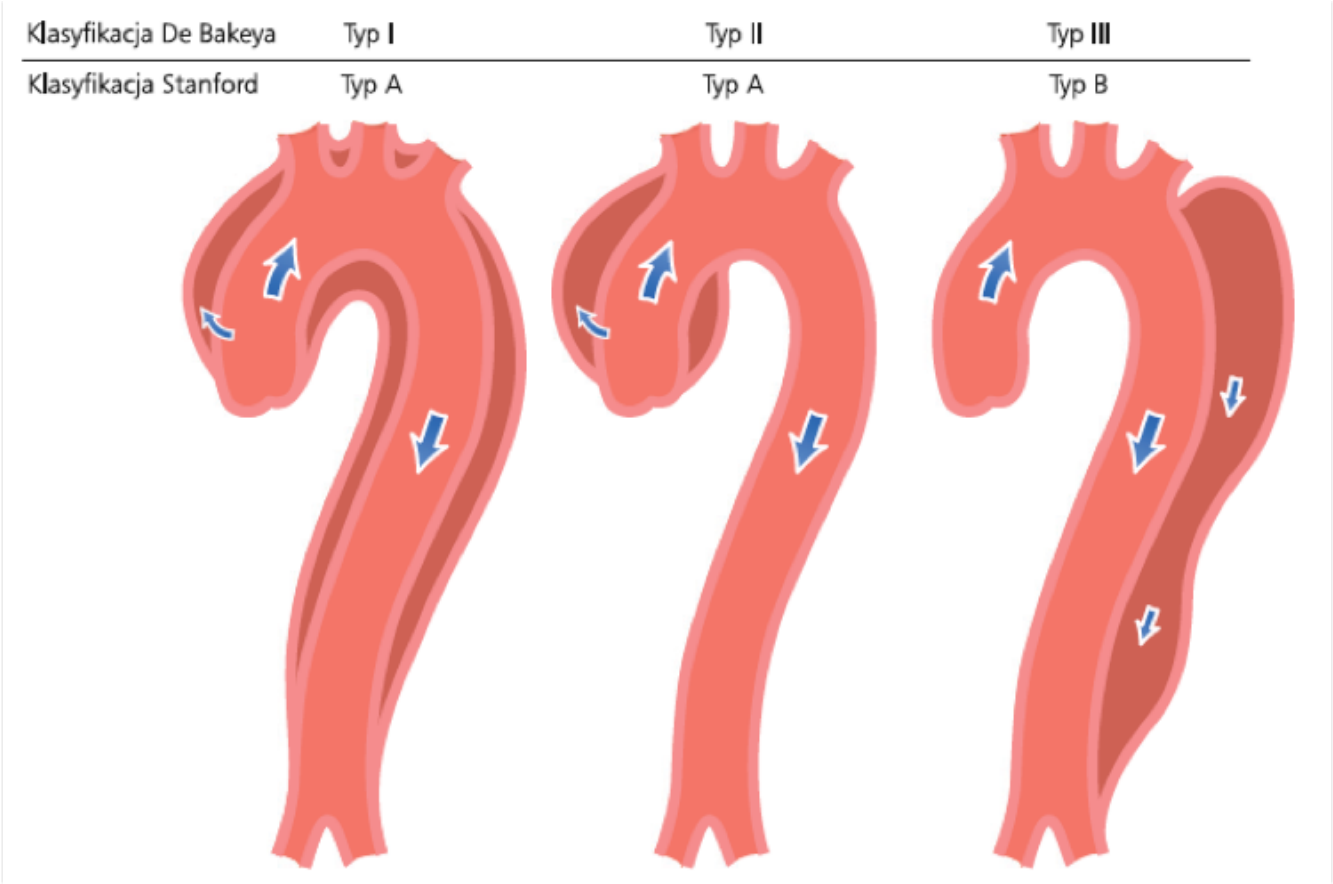
Aortic dissection

- Risk factors
  - Inflammatory conditions affecting aorta
  - Bicuspid aortic valve
  - Aortic coarctation
  - History of CABG
  - High intensity weight lifting
  - Trauma

Aortic dissectiobn: clinical presentation

- 85% have chest or back pain
- “Ripping” or “tearing” in 50%
- Neurologic symptoms in 20%
- Hematuria
- Asymmetric pulses and BP

Aortic dissection: types



Aortic dissection: Managament

- Type A

- Surgery!
- Do not delay surgery, even for LHC
- Beta blockers, titrate to HR 50-60 (labetalol, esmolol)
- BP control (nitroprusside)

- Type B

- Beta blockers, titrate to HR 50-60 (labetalol, esmolol)
- BP control – add nitroprusside or similar agent to SBP goal 100-120mmHg
- Surgery for those with end organ damage or those who do not respond to medical therapy
- Watch for hypotension – give fluids if needed, consider tamponade, MI, or rupture as complications if hypotensive

Case 4

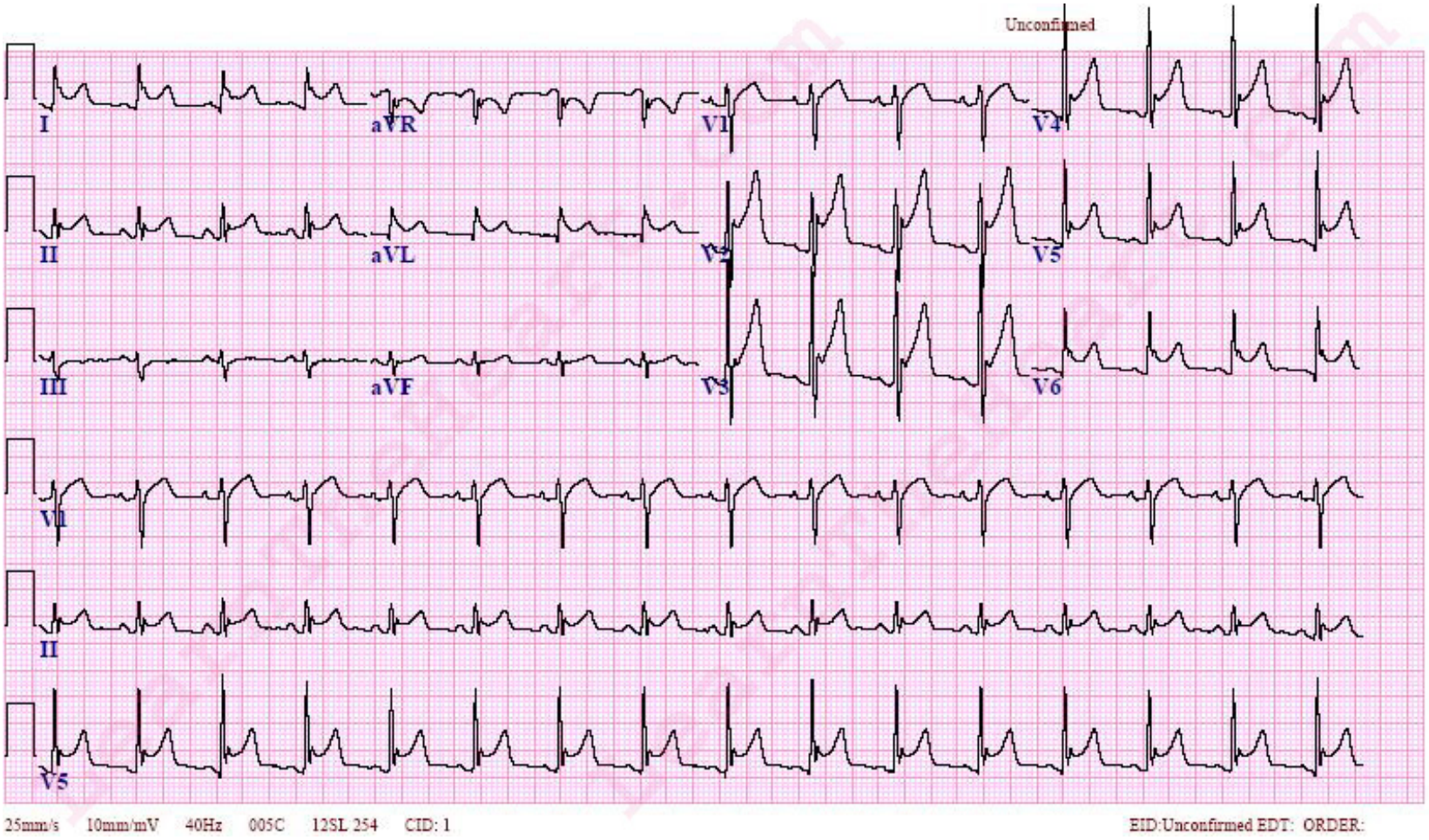
Case 4

- 24 yo female
- Medical history
  - SLE
  - Asthma
- Reason for admission
  - Chest pain for 2 days
  - Pain is worse with breathing
  - Upper respiratory tract infection

Case 4

- VS: HR 104 BP 140/76 RR 20 O2 sat 95%
- Physical exam:
  - Gen – in mild distress due to chest pain, leaning forward while in bed
  - Lungs – Clear to ascultation bilaterally
  - Chest wall – no visible rash, chest wall NT to palpation
  - Heart – tachycardic, nl s1/s2, no rub
  - Rest of physical exam benign
- Labs:
  - WBC = 14, AMI panel x 1 = negative
- CXR = negative

Case 4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Pericarditis

- Refers to inflammation of pericardial sac
- Idiopathic pericarditis typically preceded by viral prodrome, i.e. flu-like symptoms
- Typically, patients have sharp, pleuritic chest pain relieved by sitting up or leaning forward

Table 1. Etiology of Pericarditis

Type of Pericarditis	Cause
Infectious	Viral: Coxsackieviruses A and B, echovirus, mumps, adenovirus, EBV, HIV, influenza Bacterial: *Pneumococcus, Streptococcus, Staphylococcus, Legionella* Mycobacterial: *M tuberculosis, M avium-intracellulare* Fungal: histoplasmosis, coccidioidomycosis, candidiasis, blastomycosis Other: syphilis, parasites, Q fever
Noninfectious	Idiopathic Neoplasm Metastatic disease Mesothelioma Renal failure Myocardial infarction Hypothyroidism Aortic dissection with hemopericardium Pneumonia
Autoimmune-related	Connective-tissue disease: SLE, RA, scleroderma, mixed Arteritis: polyarteritis nodosa, temporal arteritis Inflammatory bowel disease Post-MI syndrome
Drug-induced	Procainamide Hydralazine Isoniazid Cyclosporine Phenytoin
Trauma-related	Thoracic-duct injury Mediastinal irradiation

EBV: Epstein-Barr virus; M: Mycobacterium*; MI: myocardial infarction; RA: rheumatoid arthritis; SLE: systemic lupus erythematosus.*

Pericarditis

TABLE 3
Electrocardiographic Differentiation of Pericarditis

Acute pericarditis	Acute myocardial infarction	Early repolarization
ST-segment elevation in many leads, with no ST-segment depression	ST-segment elevation in anatomically contiguous leads, with possible reciprocal ST-segment depression	ST-segment elevation in middle and left precordial leads, but may be widespread
Upward concave ST-segment elevation	Upward convex ST-segment elevation	Upward convex ST-segment elevation
No T-wave inversion in leads with ST-segment elevation	T-wave inversion in leads with ST-segment elevation as myocardial infarction evolves	May have T-wave inversion in leads with ST-segment elevation
PR-segment depression	No PR-segment depression	No PR-segment depression
Q waves during evolution	May have Q waves during evolution	No Q waves

Pericarditis

- High risk features:
  - Fever >38ºC and leukocytosis
  - Evidence suggesting cardiac tamponade
  - A large pericardial effusion (ie, an echo-free space of more than 20 mm)
  - Immunosuppressed state
  - Acute trauma
  - Failure to respond within seven days to NSAID therapy
  - Elevated cardiac troponin, which suggests myopericarditis

Pericarditis: Diagnostic criteria

Acute pericarditis (at least 2 criteria of 4 should be present)*:
1. Typical chest pain
2. Pericardial friction rub
3. Suggestive ECG changes (typically widespread ST segment elevation)
4. New or worsening pericardial effusion

Pericarditis: Trteatment

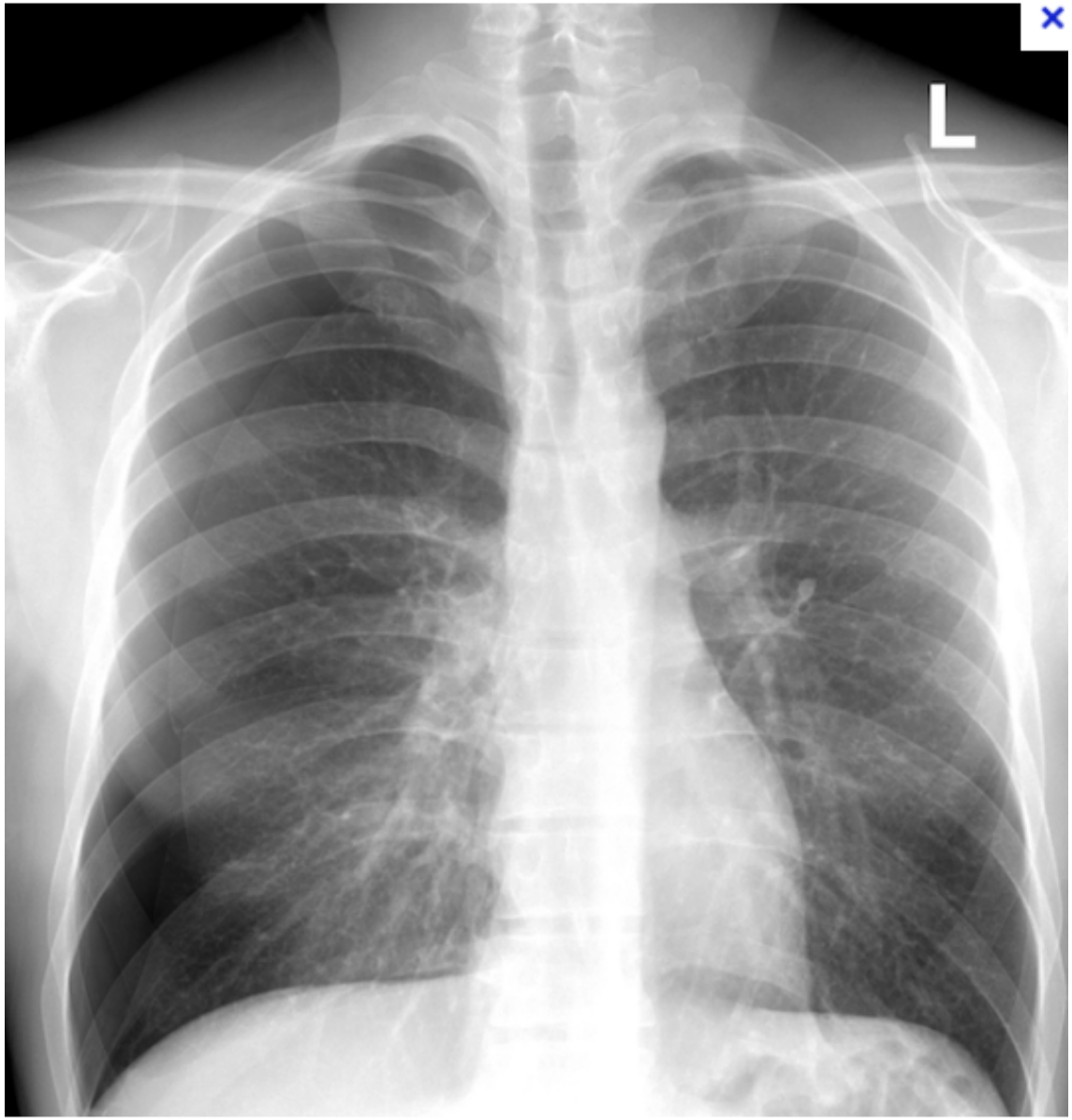
Drug therapy in acute pericarditis for adult patients

Drug	Dose*	Duration of therapy
For initial combination treatment of most patients:		
Ibuprofen•	400 to 800 mg three times daily	1 to 2 weeks
OR		
Indomethacin•	50 mg three times daily	1 to 2 weeks
PLUS		
Colchicine$^{\Delta}$	0.5 to 0.6 mg two times daily	3 months
For initial combination therapy of patients following myocardial infarction:		
Aspirin•	650 to 1000 mg three times daily	1 to 2 weeks
PLUS		
Colchicine$^{\Delta}$	0.5 to 0.6 mg two times daily	3 months
For refractory cases or patients with a contraindication to NSAID therapy:		
Prednisone	0.25 to 0.5 mg/kg/day	2 weeks
PLUS		
Colchicine$^{\Delta}$	0.5 to 0.6 mg two times daily	3 months

Case 5

Case 5

- 50 yo male
- Medical history
  - Rheumatoid arthritis
- Reason for admission
  - Chest pain
  - Progressive shortness of breath
  - 2 hours before patient underwent thoracocentesis with removal of 1.5 liters od pleular fluid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Pneumothorax: Managament

- 100% O_2 and observation in stable patients for PTX < 3 cm in size
- Needle aspiration in stable patients for PTX >3 cm
- Chest tube placement if PTX >3 cm and if needle aspiration fails
- Chest tube placement in unstable patients

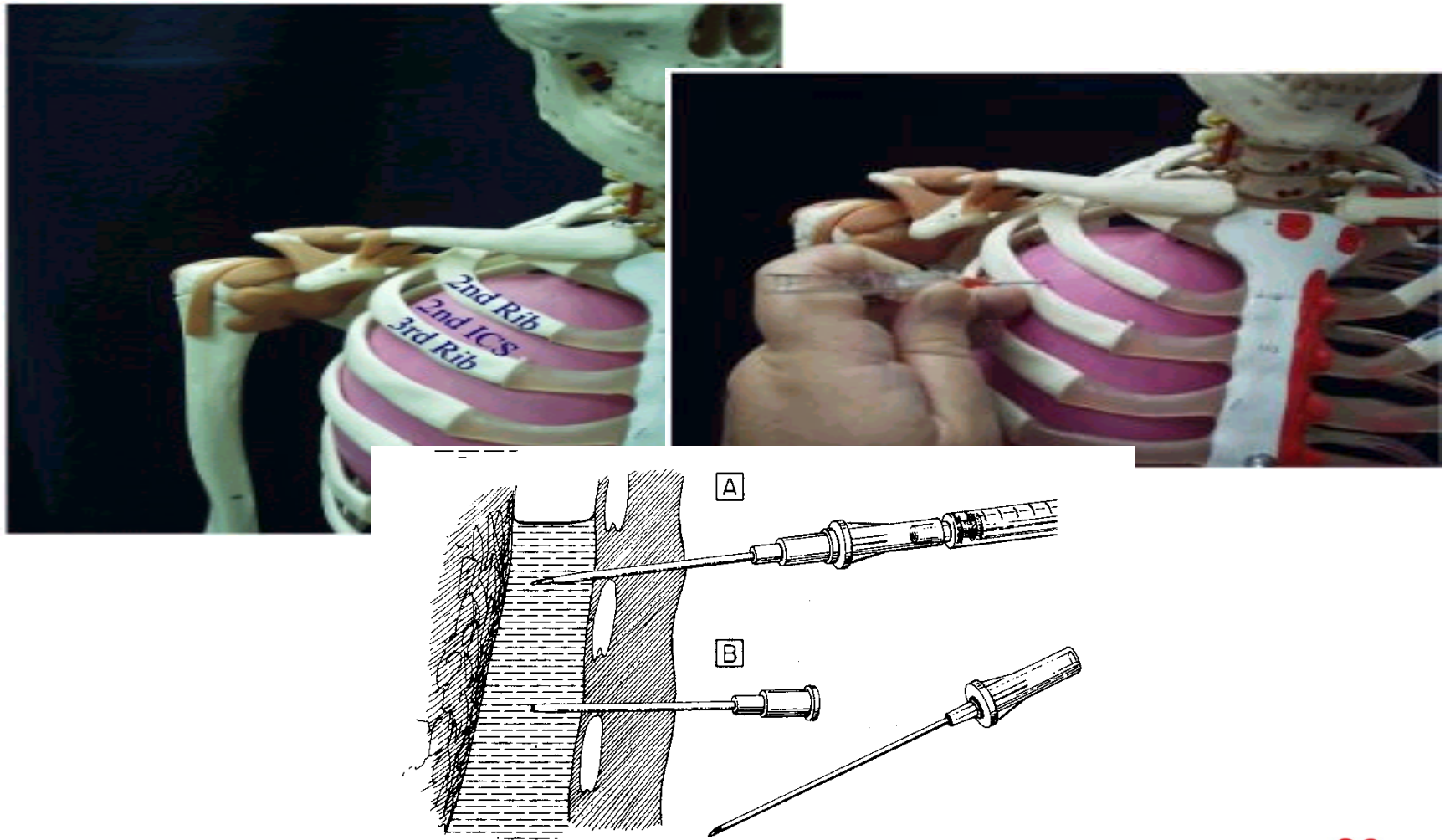
Tension Pneumothorax: Signs and Symptoms

- Difficulty breathing
- Chest pain
- Unilateral decreased/absent breath sounds
- Anxiety or agitation
- Increased pulse
- Tracheal deviation
- Jugular venous distention (JVD)
- Cyanosis

Tension Pneumothorax: Decompression

- Locate 2d intercostal space at midclavicular line
- Insert 14-gauge catheter-over-needle into chest cavity over superior edge of rib
- Listen for gush of air and observe for improvement of symptoms
- Tape catheter in place with cap or valve in place to prevent re-entry of air
- Dress open chest wound if present

Tension Pneumothorax: Decompression



Thank You.