EMERGENCY MEDICINE

BOOT CAMP

INTRODUCTION TO CHEST PAIN

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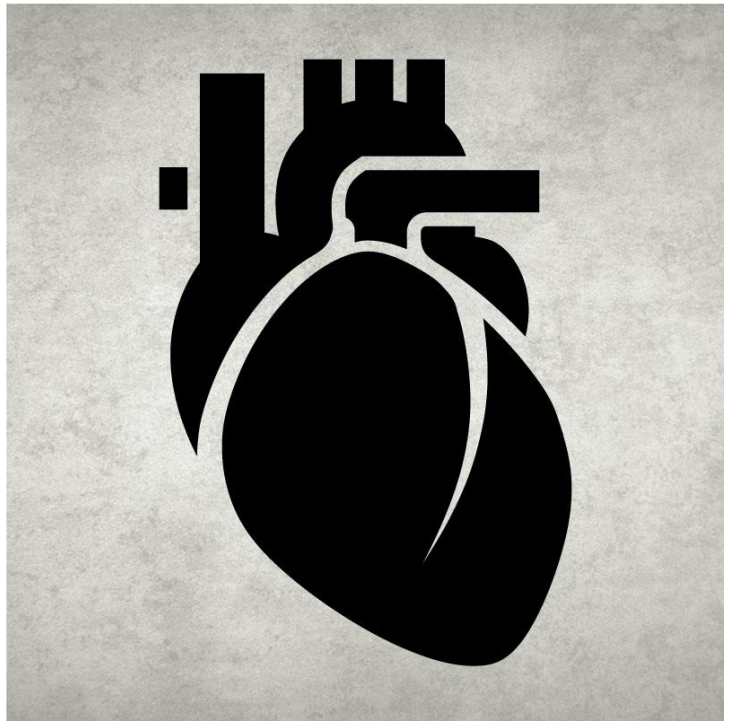
Professor in Emergency Medicine



- A 45 y/o patient arrived to the E.R. by ambulance after collapsing. Patient has been complaining of chest pain to his co-workers. What is the first thing you should do or evaluate?
- a. Do an EKG
- b. Do Chest X-ray
- c. Give an aspirin
- d. Check airway
- e. Give IV fluids

CAUSES

- Cardiovascular
  - Acute coronary syndrome
  - Pericarditis
  - Pericardial tamponade
  - Thoracic dissection of the aorta
  - SVT
  - Rapid Afib/Aflutter
  - VTaq

CAUSES

- Respiratory
  - Pulmonary embolism
  - Pneumothorax
  - Pneumonia
  - Pneumomediastinum
  - Pleural irritation

CAUSES

- Gastrointestinal
  - Cholecystitis
  - Pancreatitis
  - Hiatal hernia
  - Esophageal disease
  - Gastroesophageal reflux
  - Peptic ulcer disease
  - Dyspepsia

CAUSES

- Musculoskeletal
  - Chest wall syndrome
  - Costochondritis
  - Acromioclavicular disease
  - Herpes zoster
  - Chest wall trauma
  - Chest wall tumors

- Chest pain
- Irradiates to the left side
- SOB
- DOE
- PMHx: none
- Meds: none
- SocHx: smoker
- PCP: Dr. None

- VS
  - HR 62; BP 148/90; RR 18; T 99; O2sat 98%
- PE
  - HEENT: WNL
  - Chest: CTA; RRR
  - Abd: WNL
  - Ext: no edema
  - Neuro: WNL

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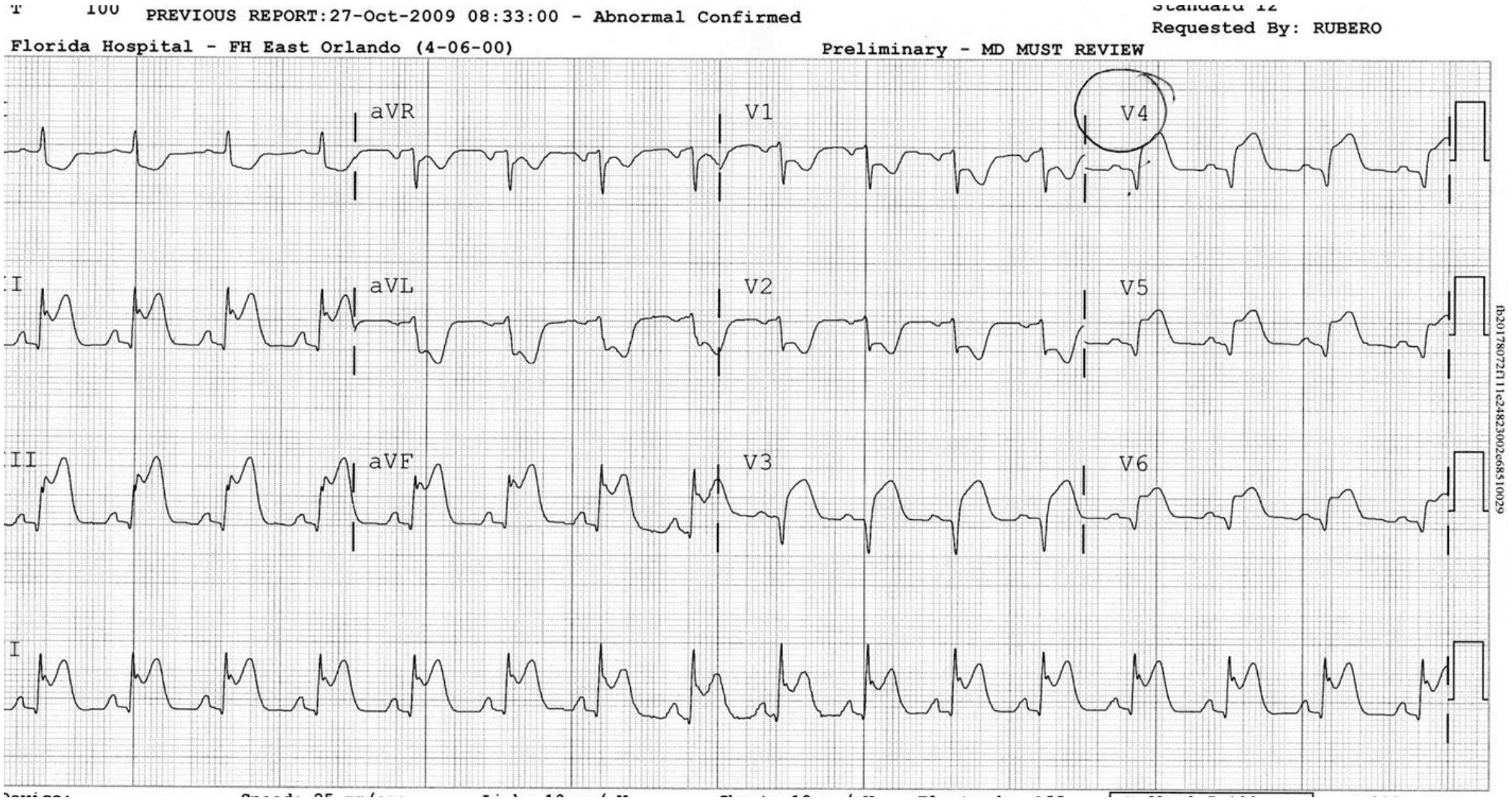

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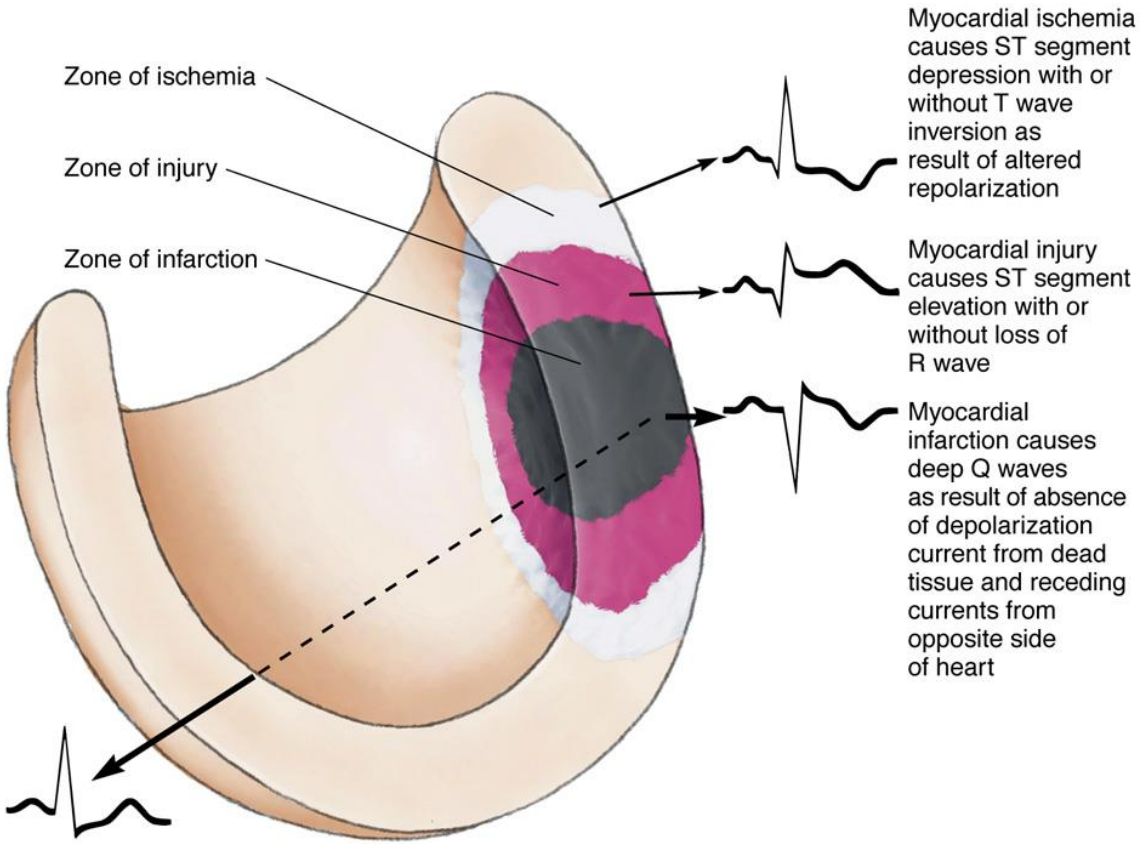
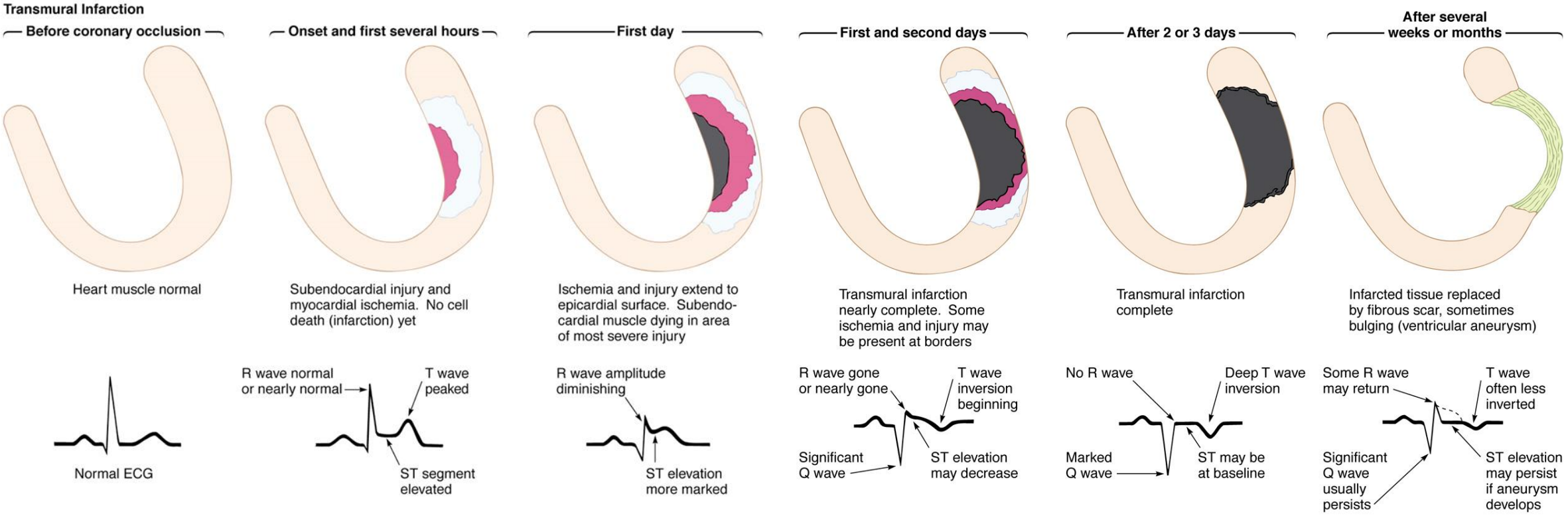
DISEASE FINDINGS

- Ischemia
- Injury
- Infarction
  - Subendocardial
  - Transmural



DISEASE FINDINGS

- Evolution of Acute Transmural Infarction



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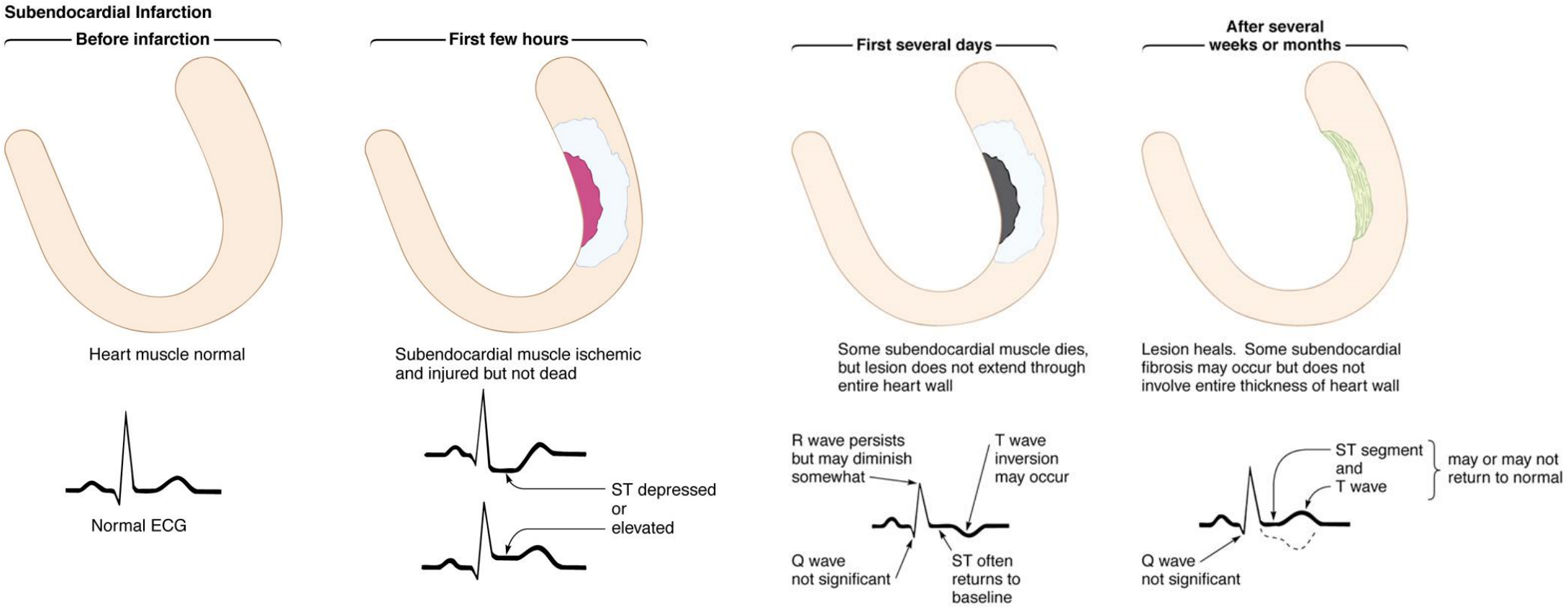
DISEASE FINDINGS

- Evolution of Acute Subendocardial Infarction



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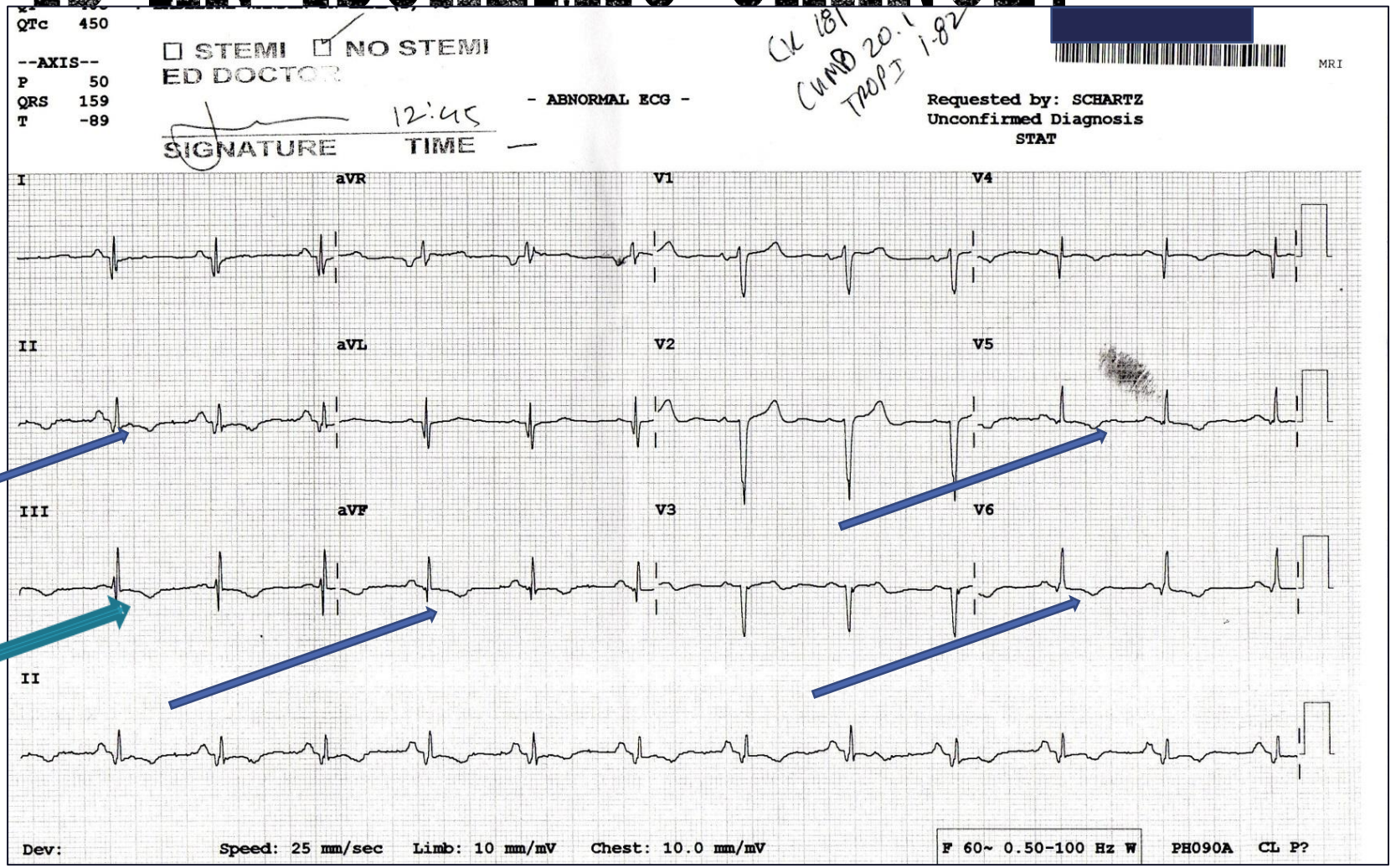
- Which coronary vessel is usually the cause of the myocardial infarction in a patient with ST elevation in V1, V2, and V3?
- a. Left anterior descending (LAD)
- b. Posterior descending branch of the right coronary artery
- c. Right coronary artery (RCA)
- d. Right ventricular branch of the right coronary artery
- e. Left circumflex artery

WHAT IS AN ISCHEMIC CHANGE?



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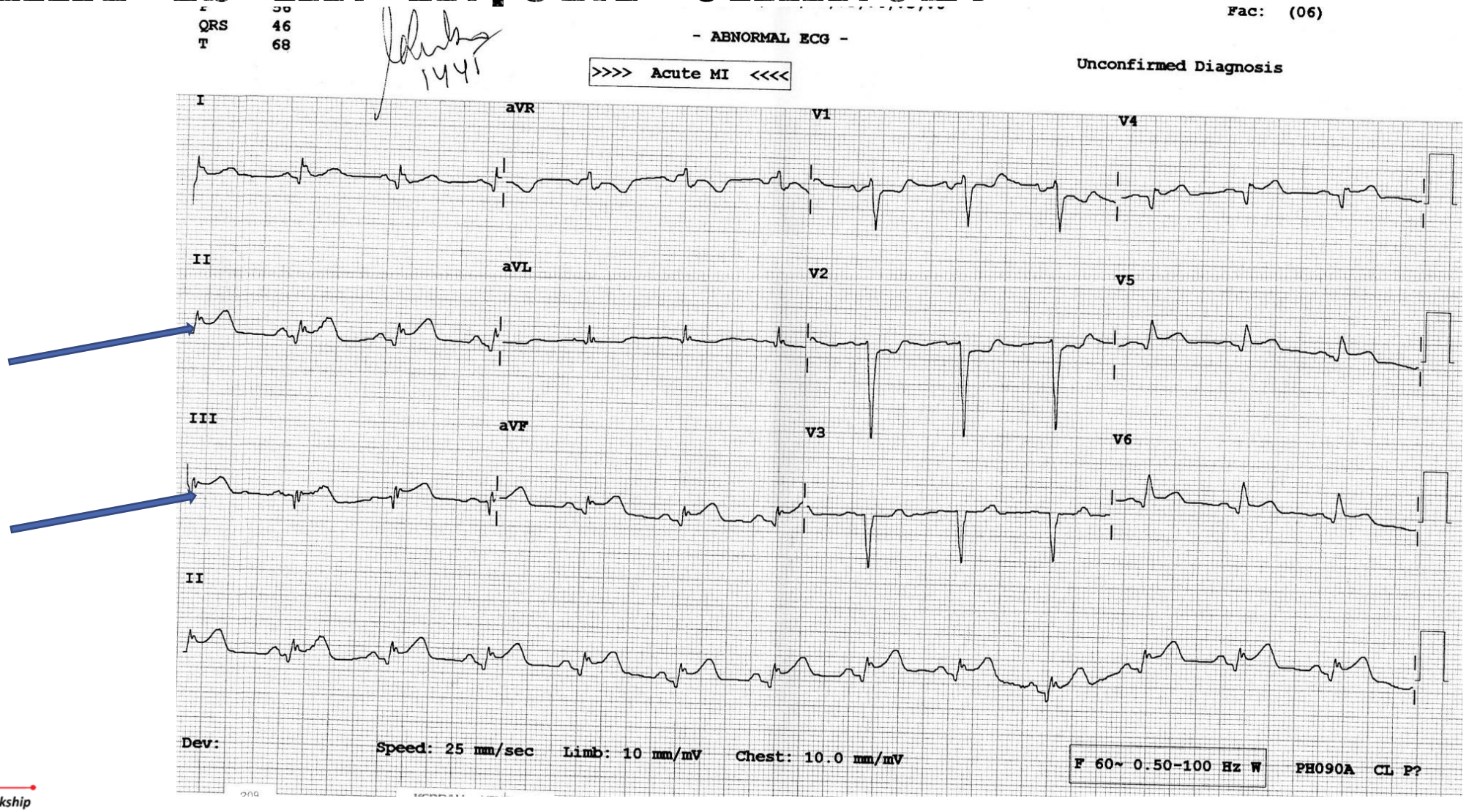
WHAT IS AN INJURY CHANGE?



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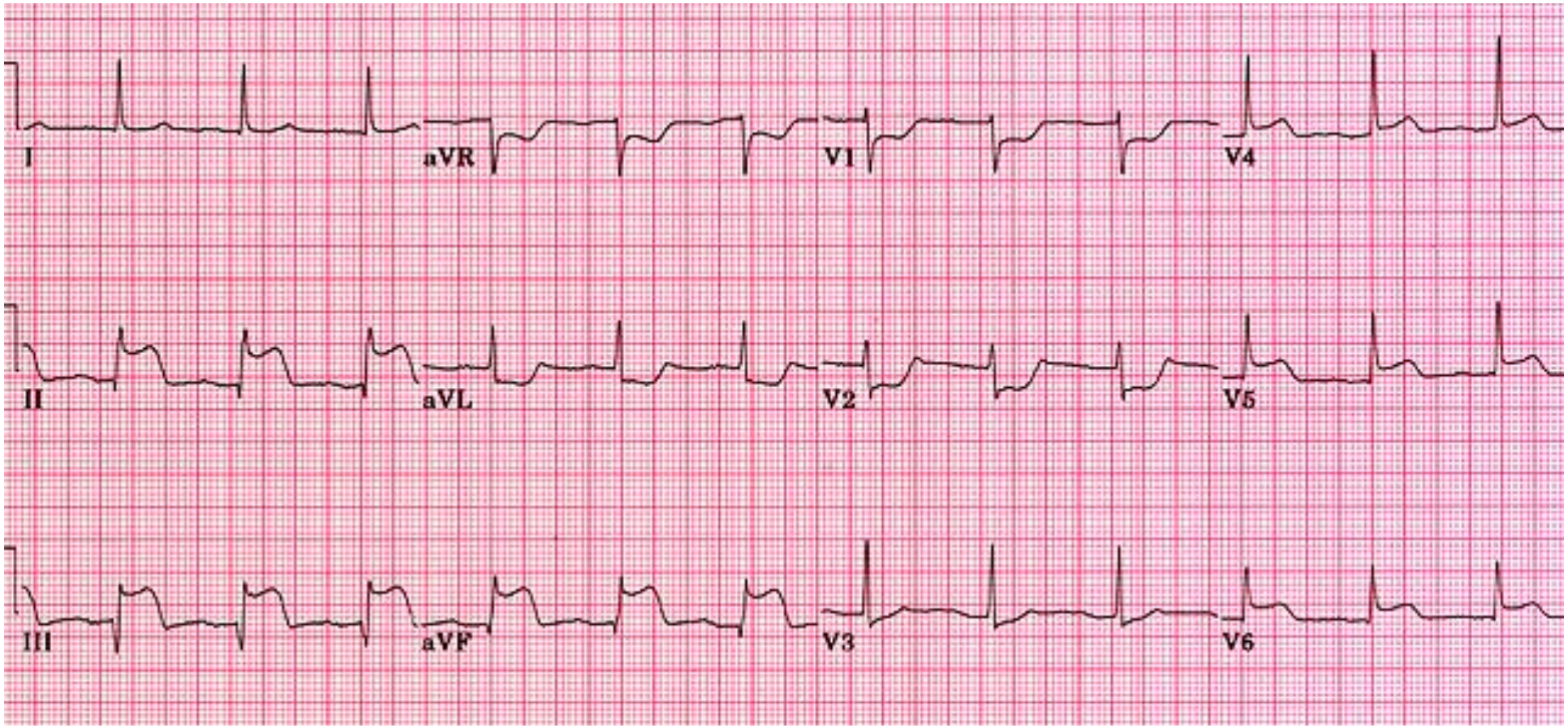
INFERIOR MI



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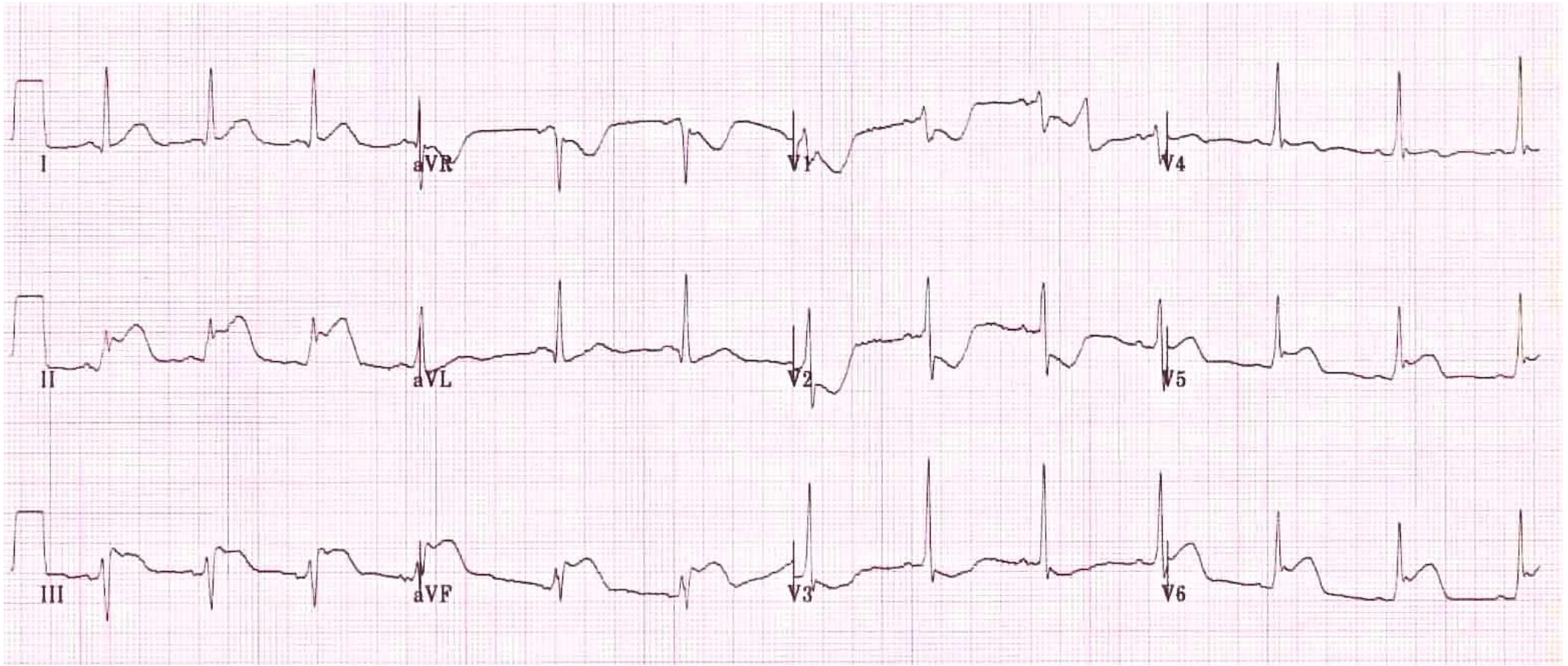
INFEROLATERAL MI



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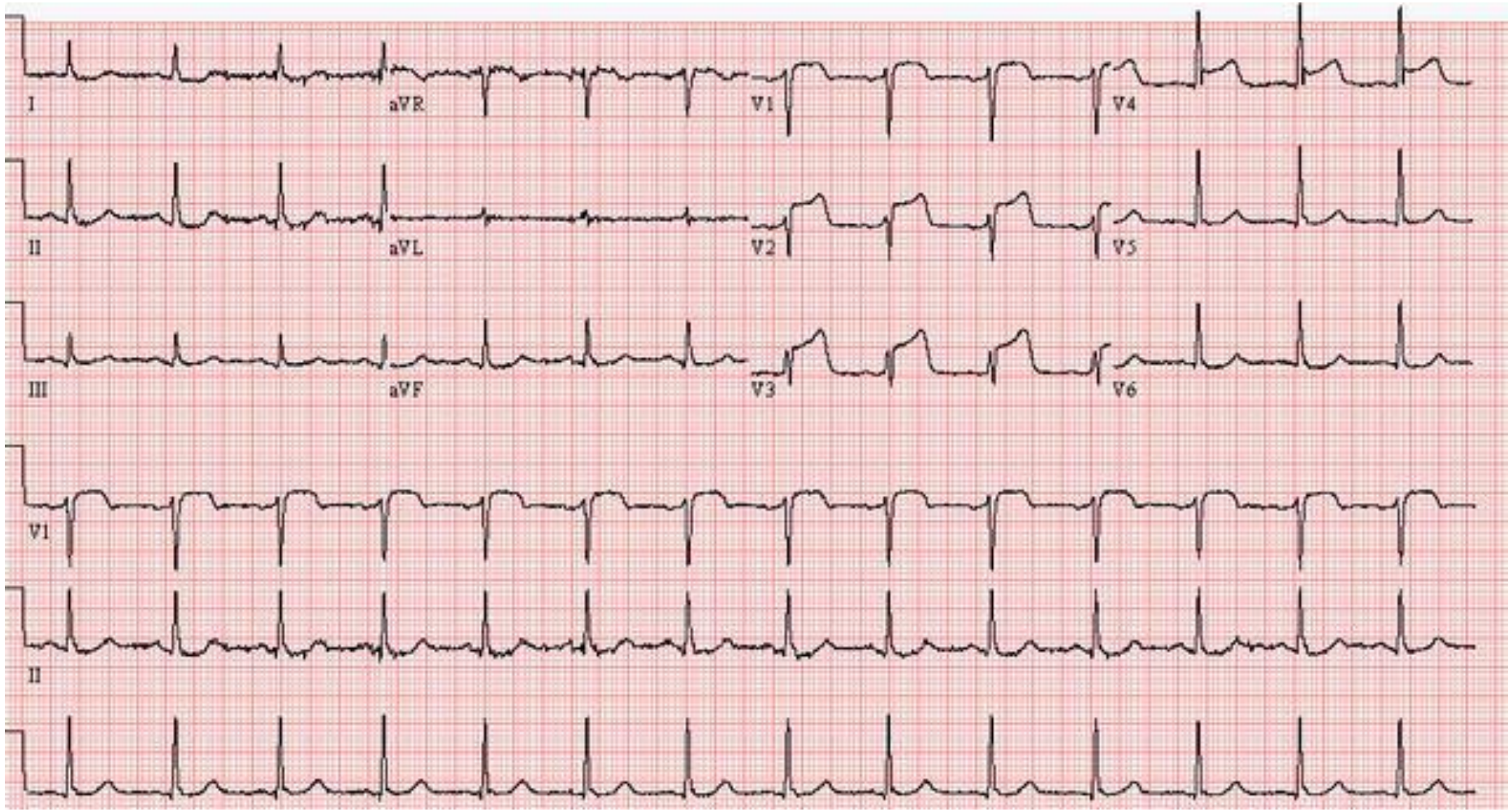
ANTERIOR MI



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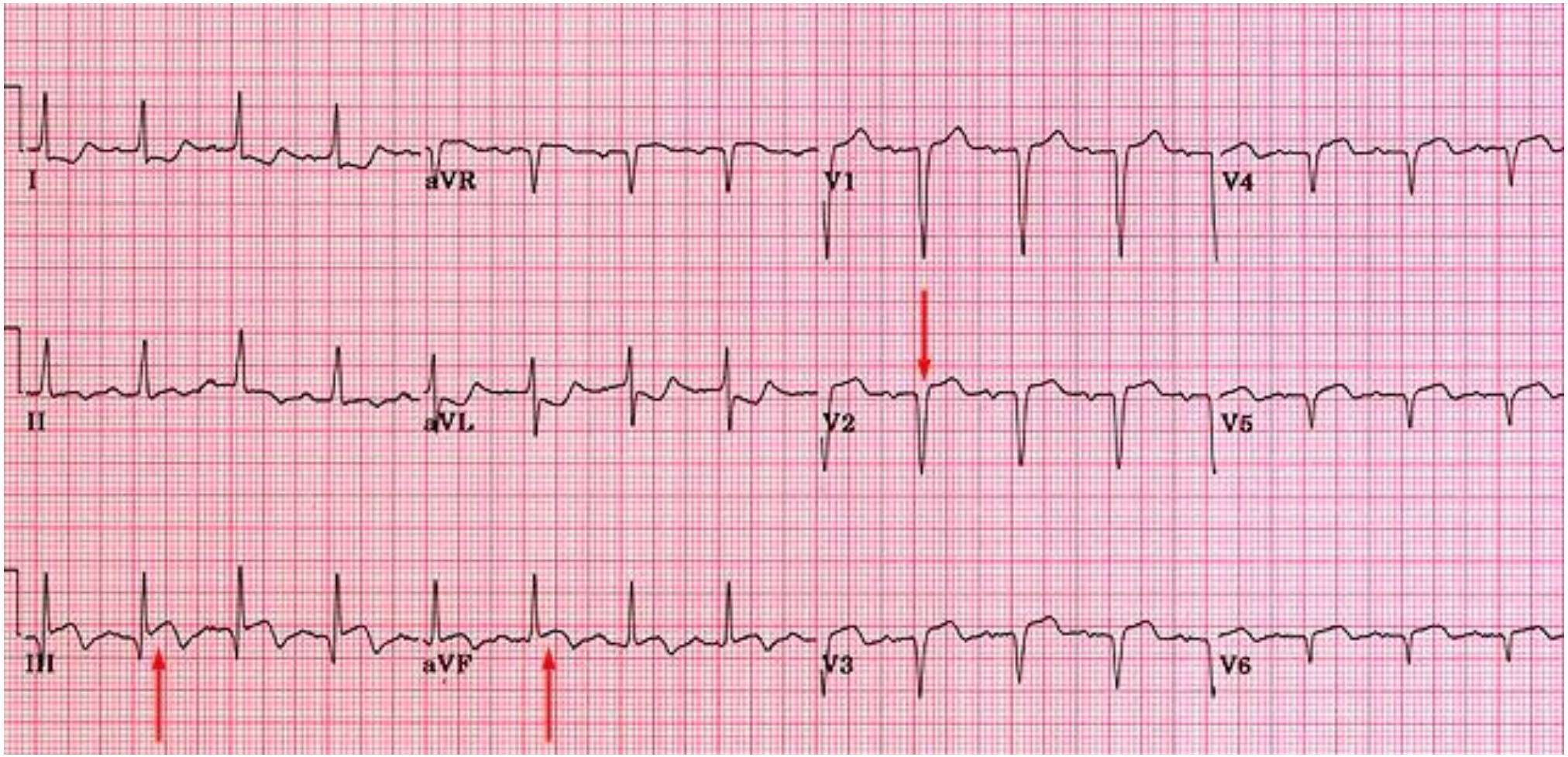
ANTERO-INFERIOR MI



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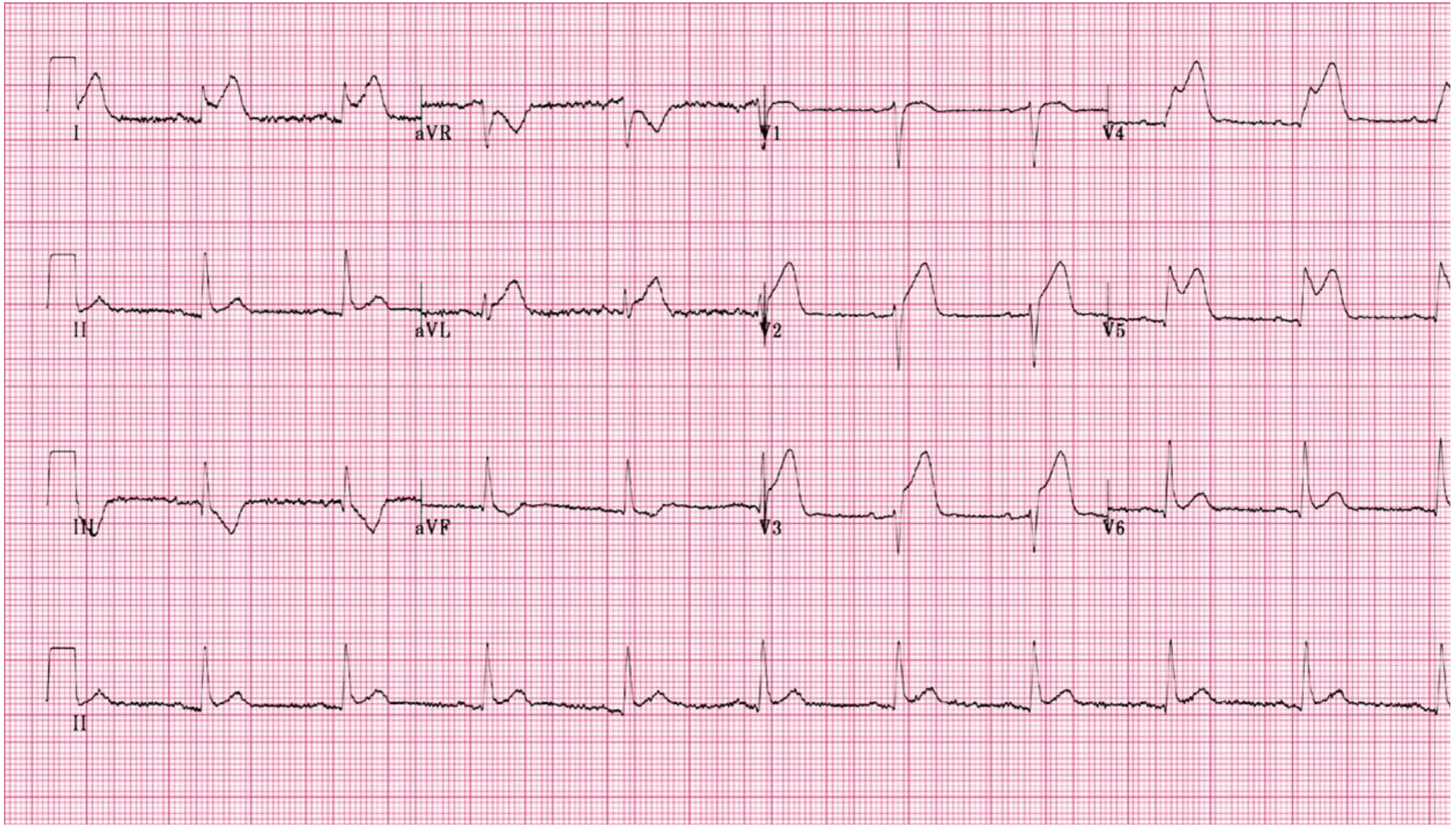
ANTEROLATERAL MI



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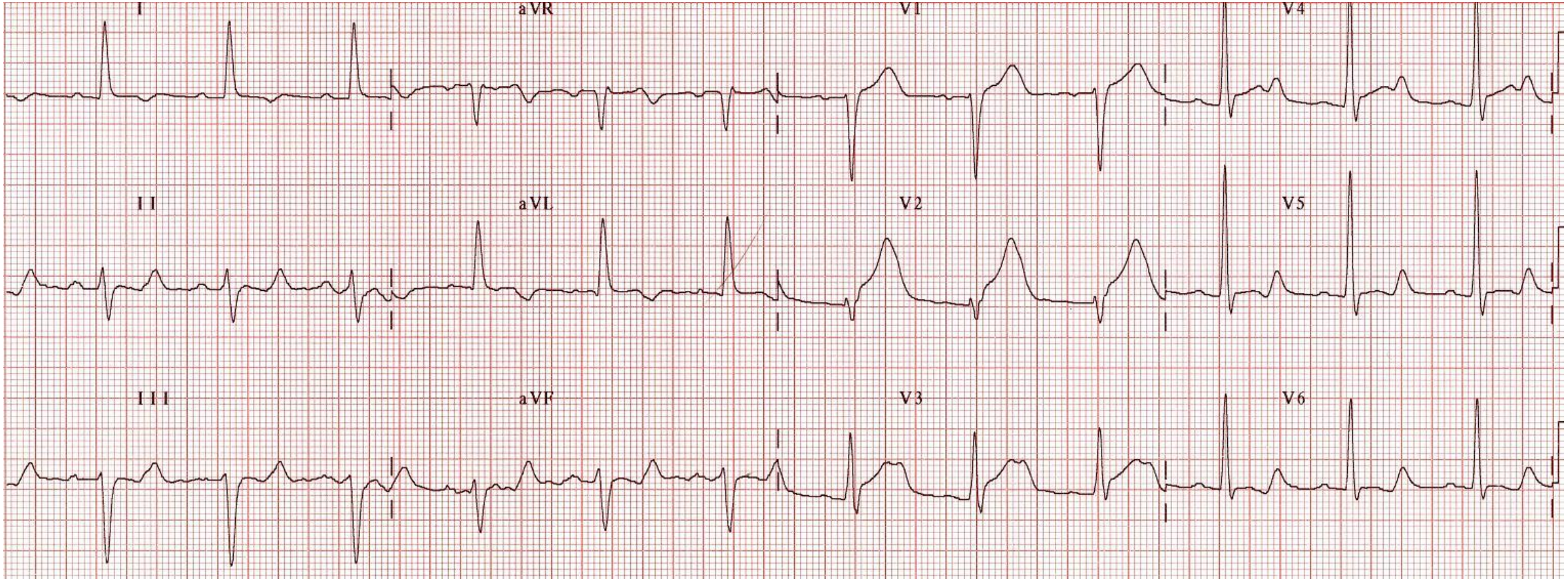
SEPTAL MI



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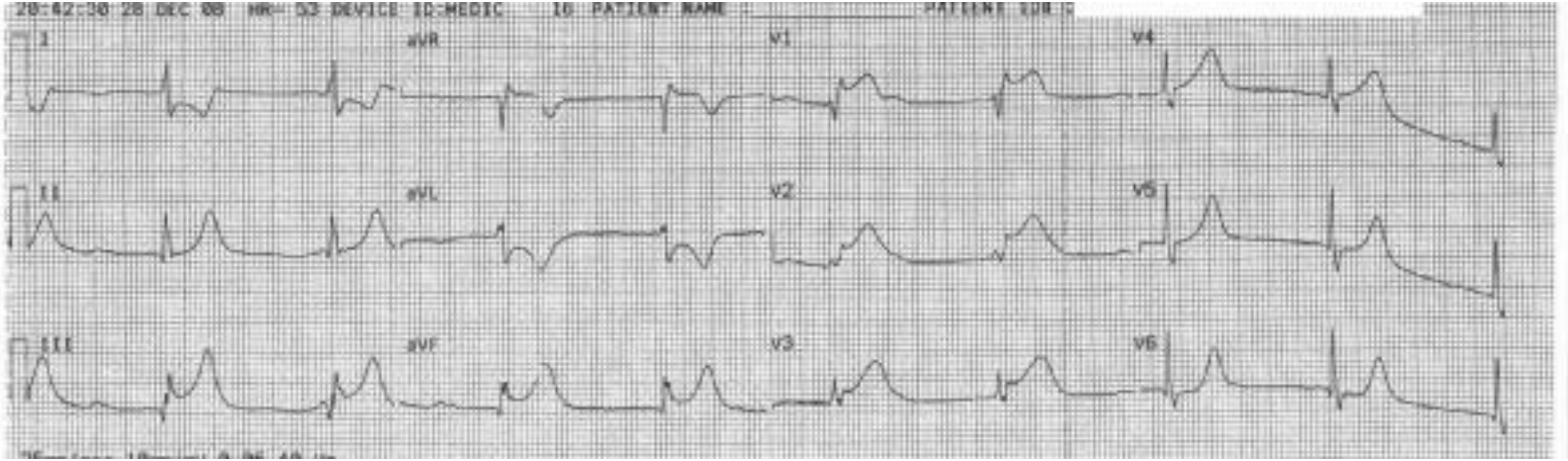
INFEROSEPTAL



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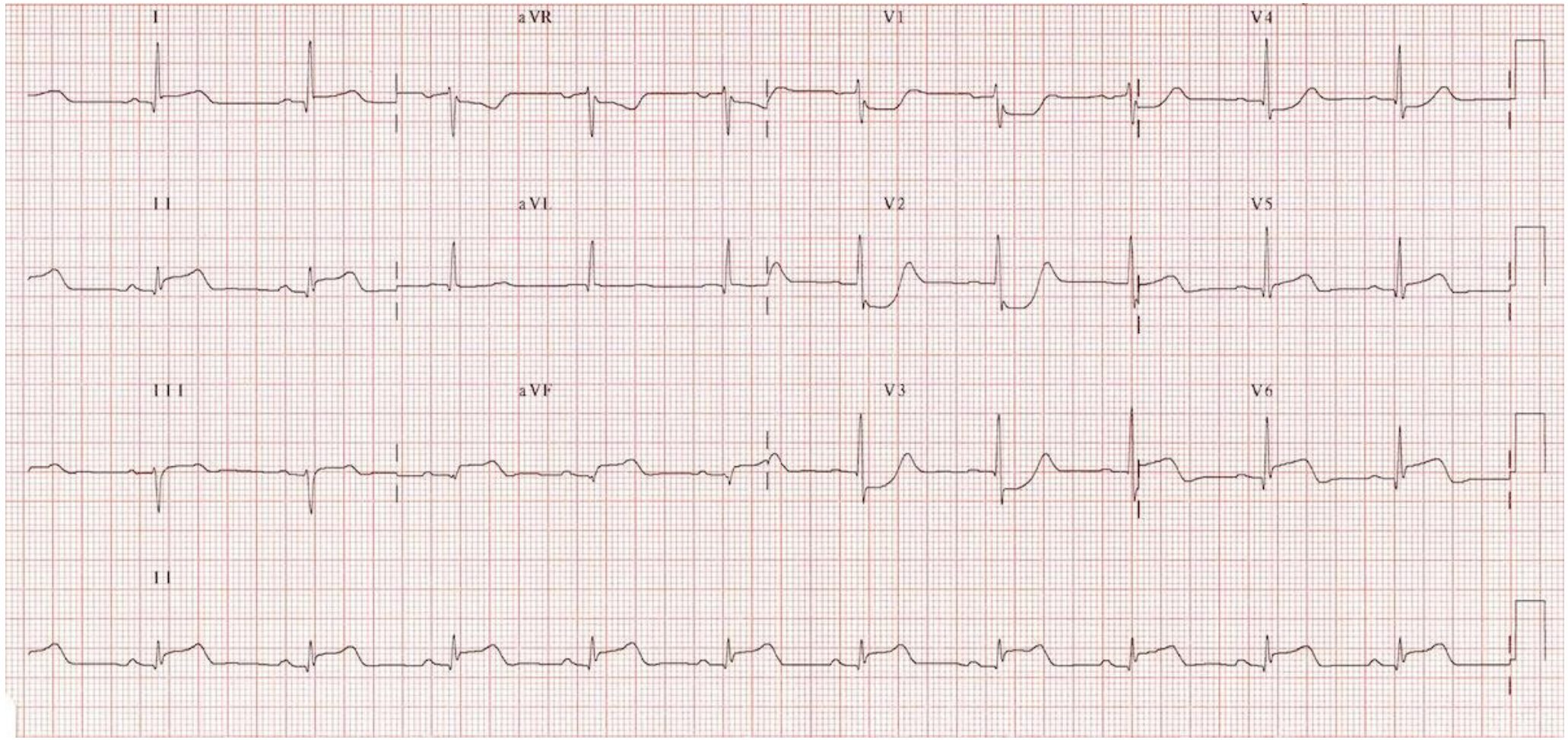
POSTERIOR MI



ST-depression ≥0.5 mm in V_1-V_3 after a tall R wave

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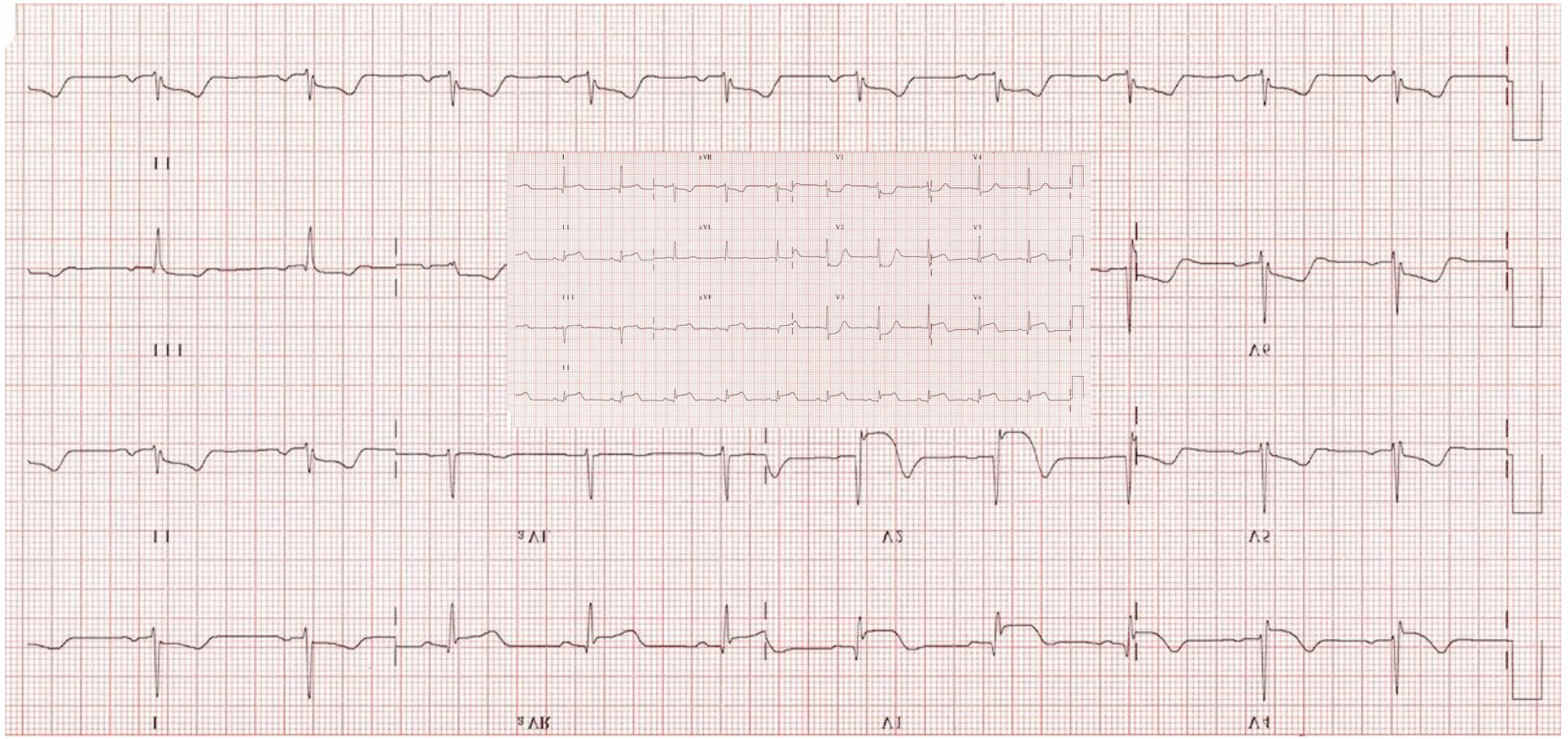

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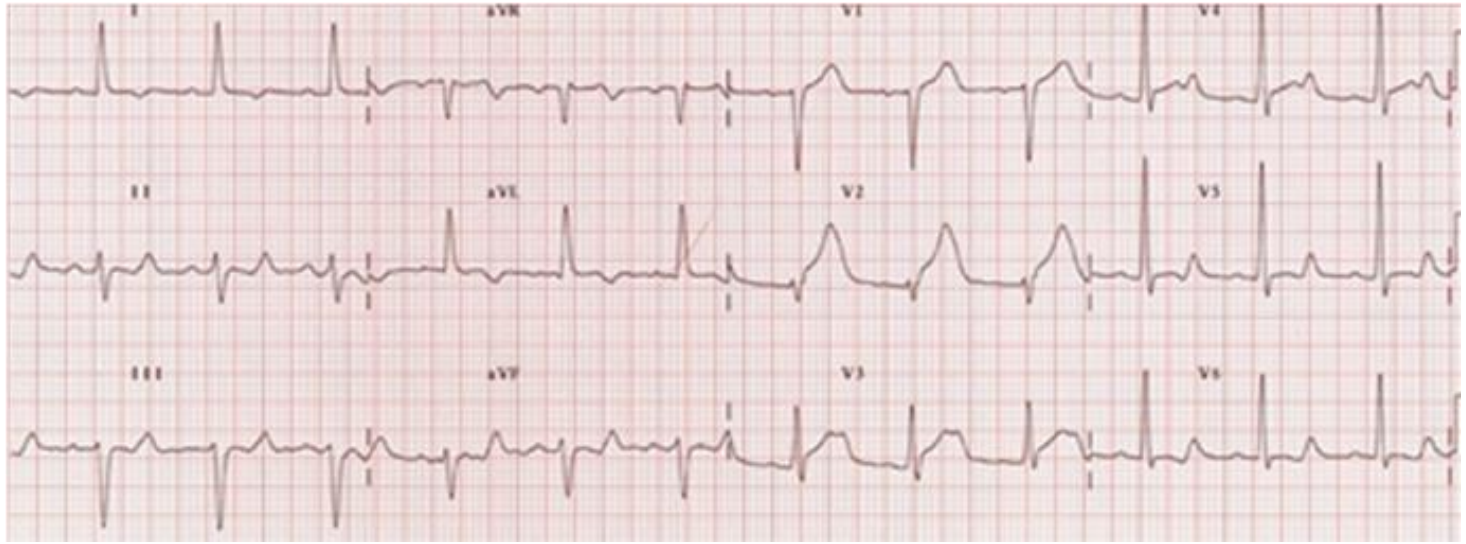
- Of the following, which diagnosis is most likely given the EKG shown in the figure?

- a. Anteroseptal MI
- b. Inferior MI
- c. Anterior MI
- d. Posterior MI



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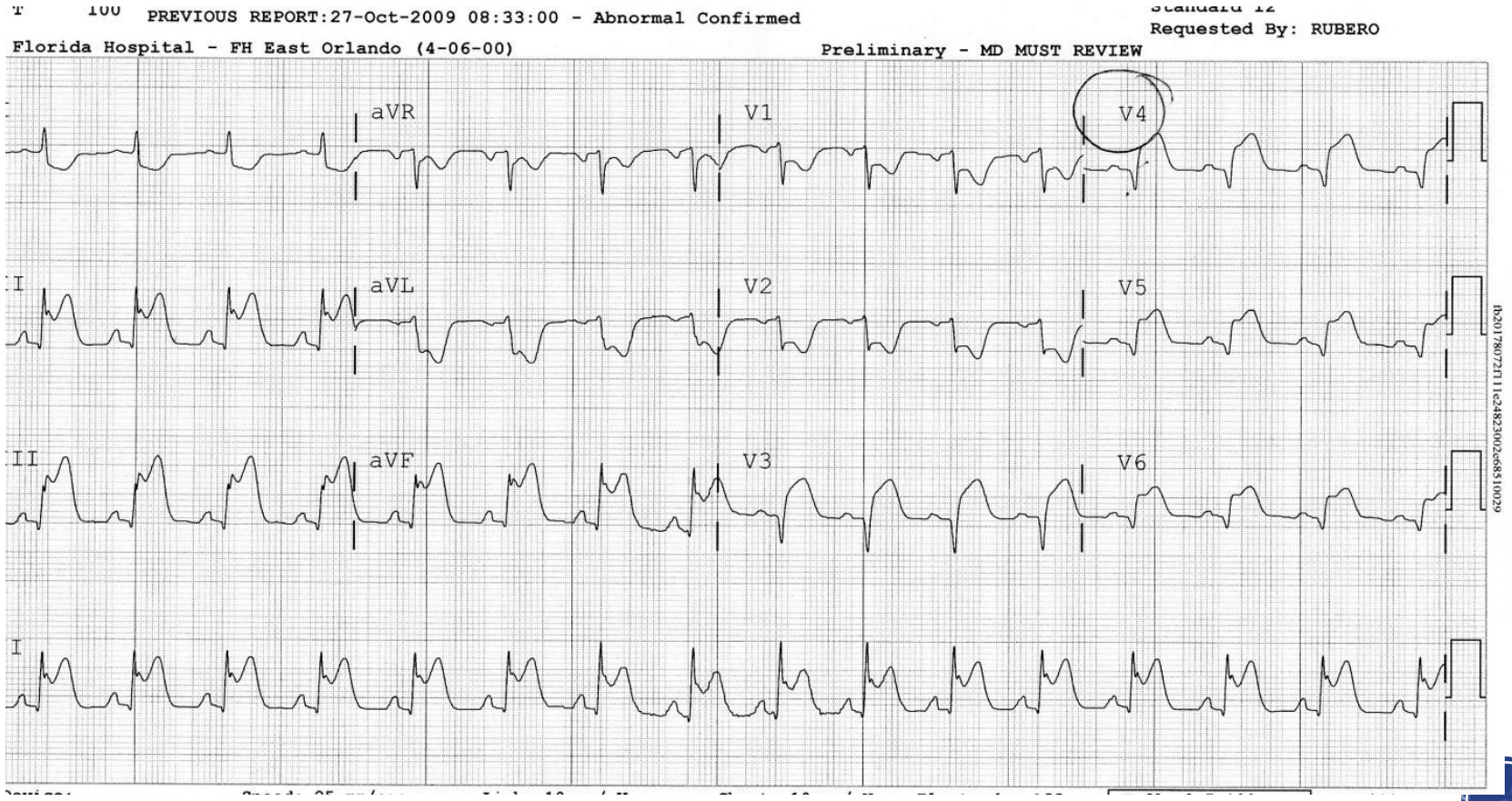
- A 58-year-old male previously in good health presents with chest pain for two hours. Vital signs are BP 126/78, HR 80 (sinus rhythm), RR 14, oxygen saturation 99%, T 36.8. His EKG shows ST segment elevation in leads II, III, aVF and V1. ST-segment elevation is greater in lead III than in lead II. What additional diagnostic test is indicated prior to giving nitroglycerin?
- a. Echocardiogram
- b. CXR
- c. d-dimer
- d. EKG with right-sided leads

- You give ASA and NTG when the BP ↓…
- What happened?
- Remember the first EKG?



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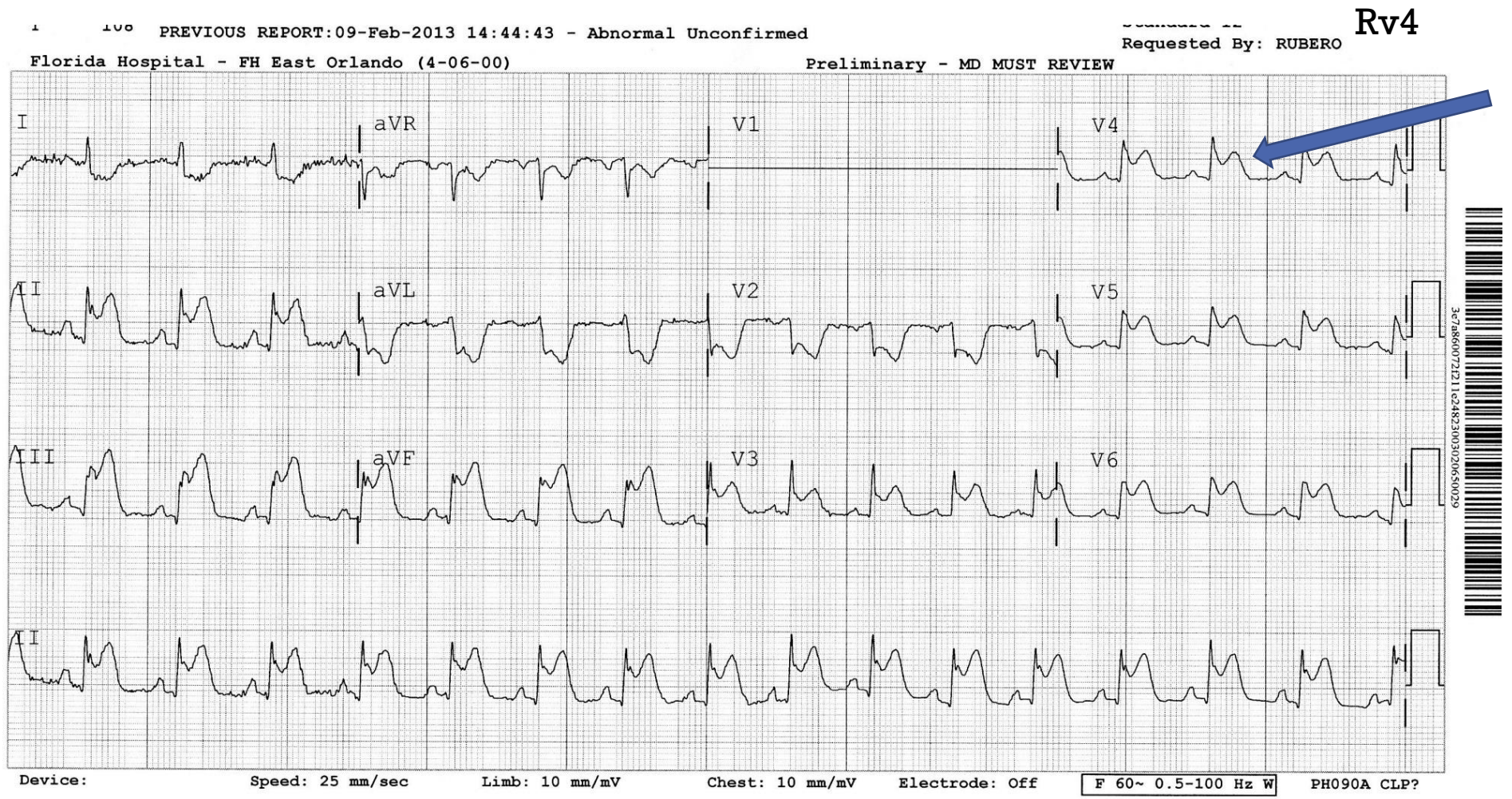
RIGHT VENTRICLE MI

- BP will drop when giving NTG
- JVD +++; Lungs: CTA
- Extensive Inferior AMI
  - RCA occlusion
- Do right side EKG
- Treat hypotension with IVF's, Dobutamine

RIGHT SIDE EKG



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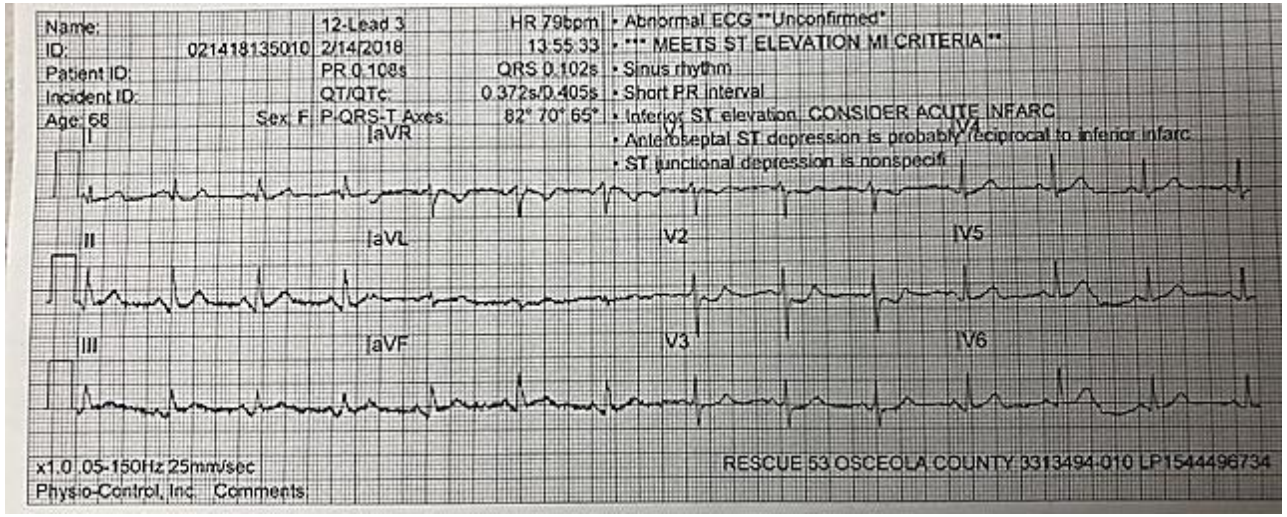

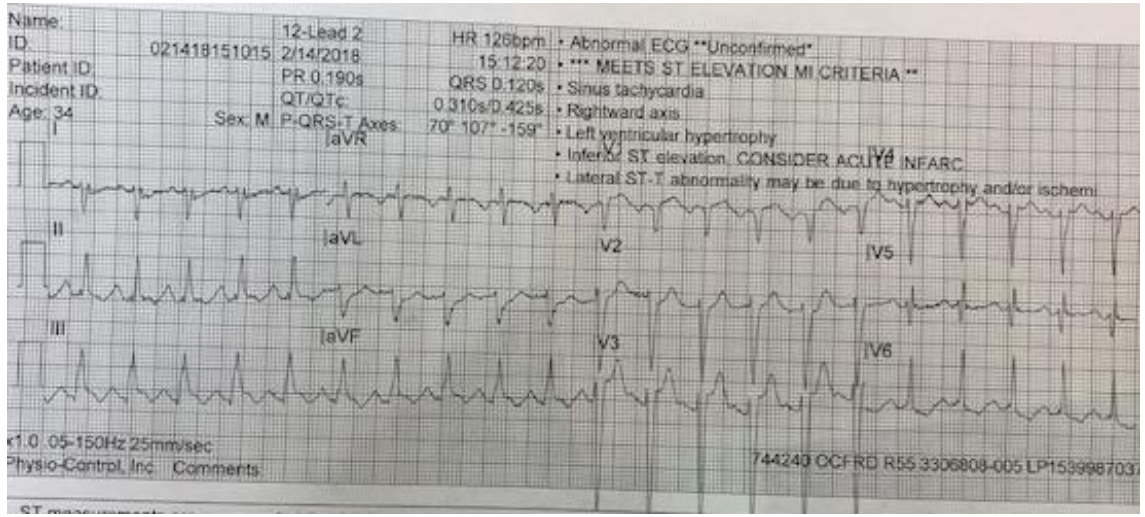

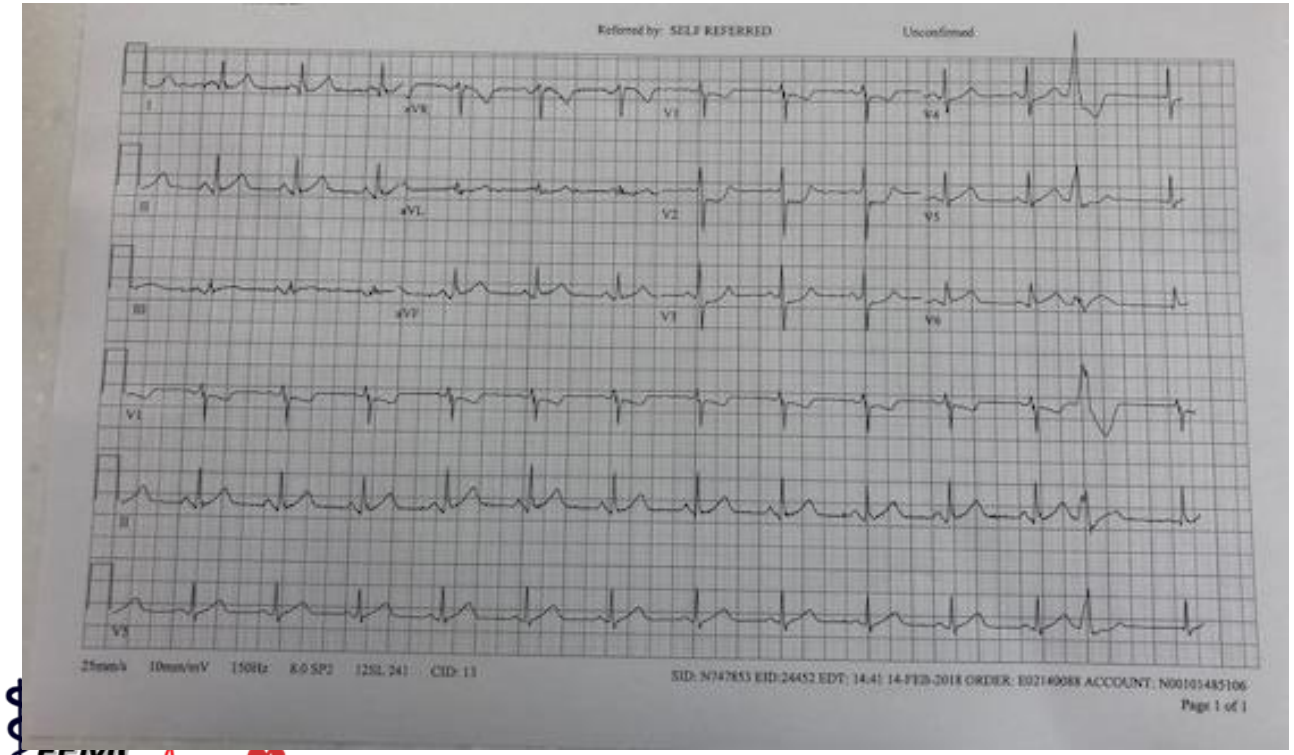

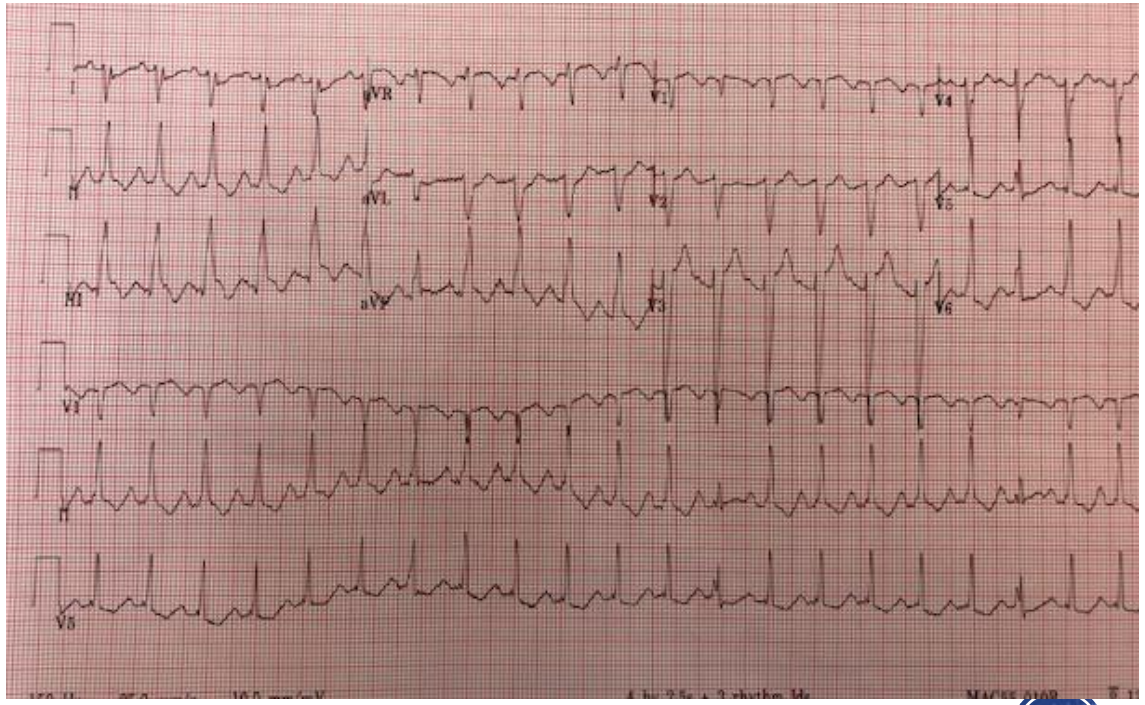

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ACUTE CORONARY SYNDROME

- AMI: NSTEMI vs STEMI
- Know the lead distributions!
- **Hypotension = think RV = FLUIDS, no NITRO**
- Hypotension with murmur = papillary muscle rupture
- Wellen's / Sgarbossa criteria
- **Aspirin only mortality benefit drug**

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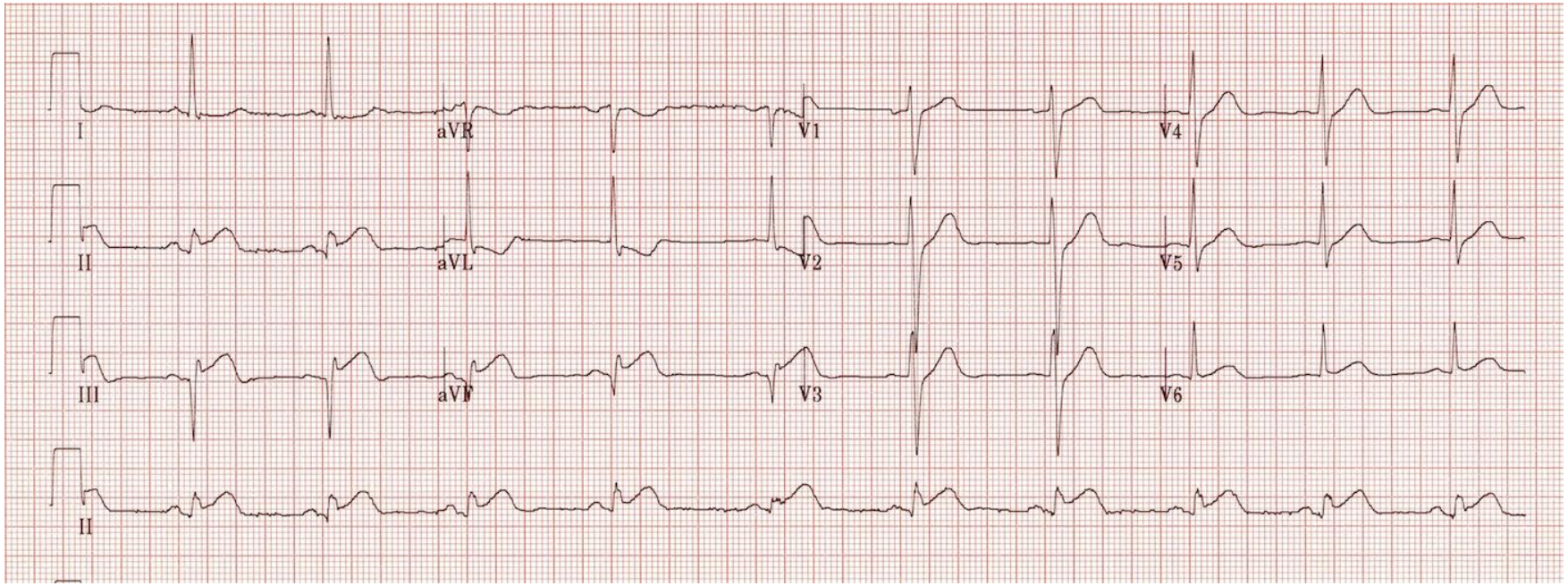
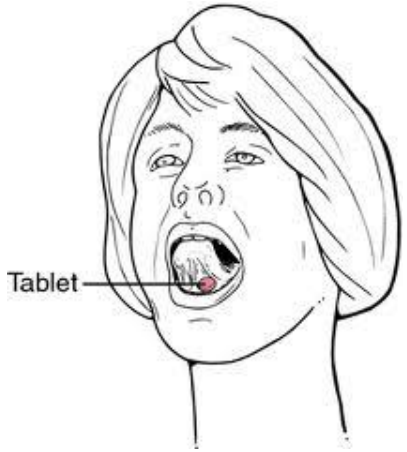
COCAINE CHEST PAIN

- Alpha-mediated vasospasm
- **Beta-blockers is always the wrong answer**
- Cocaine users predisposed to early CAD
- Treat with **BENZOS**





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NO CHEST PAIN AFTER NTG;
SENT TO HEART CATH AND CARDIOLOGY STATES…

PRINZMETAL'S ANGINA

- **Vasospasm**
- EKG will show STEMI which usually resolves with medication
- **No CAD on catherization**

Foundations Challenge
Knowledge Bomb

ED MANAGEMENT OF MI

Type	Treatment
General	IV, O2, monitor, Defibrillate arrhythmias PRN, ASA, Nitrates, Thrombolysis vs. PCI
Right Ventricular	AVOID nitrates/diuretics, give IVF
PCI	(Preferred) <90m PCI site, <120m if transferred
tPA	**Indications:** STEMI, CP >30min but <12hr, AND no PCI available <120m **Absolute CI:** prior brain bleed or mass, ischemic stroke <3mo, Head/Face injury <3mo, ?Dissection, Active bleeding or bleeding disorder
May Consider	Other platelet inhibitors, Anticoagulants, Beta Blocker, ACE-I

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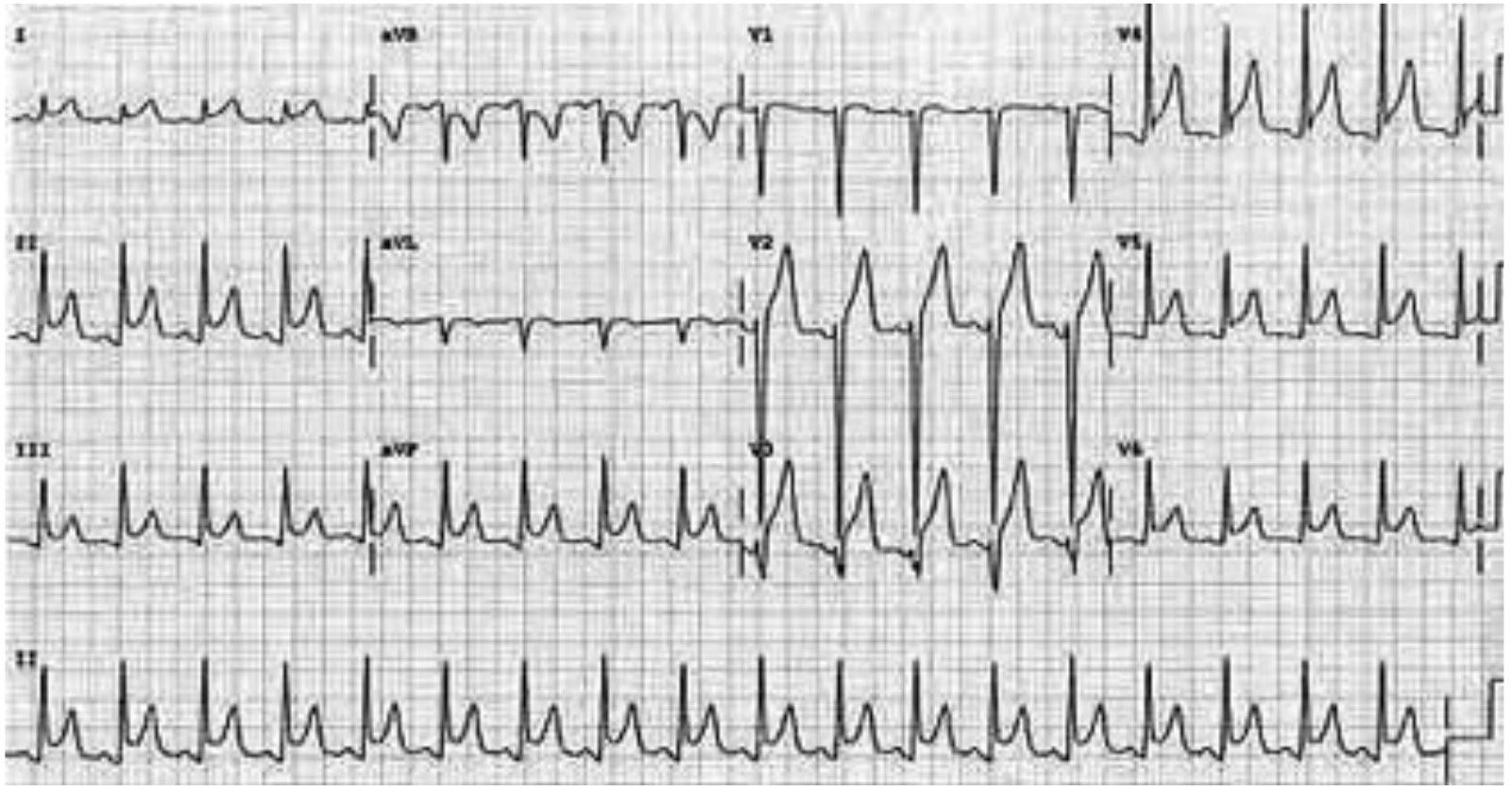

40 YO M WITH CHEST PAIN.

Dx and Tx?

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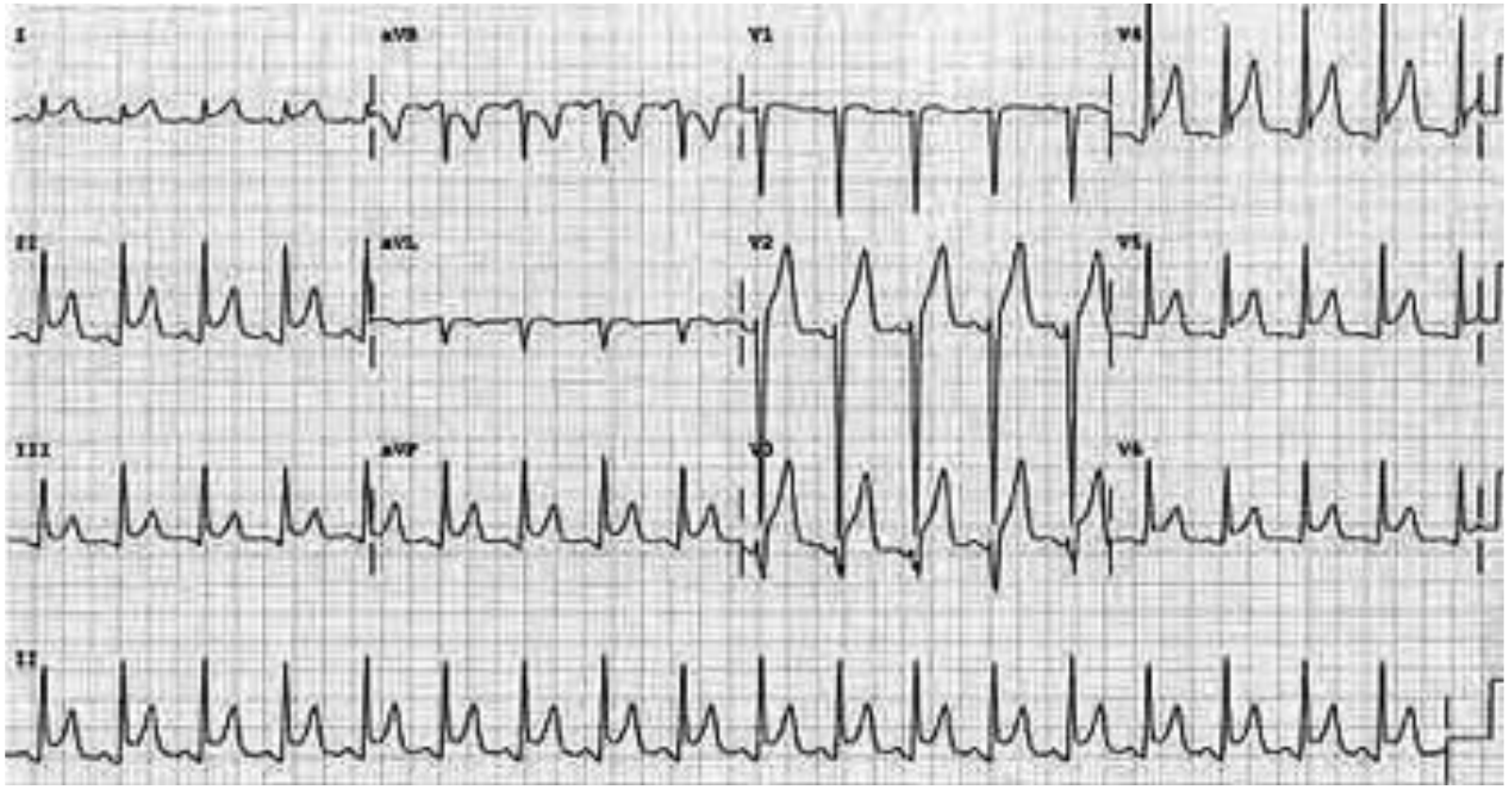

Pericarditis, NSAIDs

PR depression,
global concave STE,
no reciprocal STD

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PERICARDIAL DISEASE: PERICARDITIS AND MYOCARDITIS

- Idiopathic (most common cause)
- Infectious agents
  - Viral
    - Coxsackie viruses A and B
    - Echovirus
    - Adenovirus
    - HIV
    - EBV
    - Influenza
    - Hepatitis B
  - Fungal
    - Histoplasmosis
    - Blastomycosis
    - Coccidiomycosis
- Bacterial
  - Staphylococcus
  - Pneumococcus
  - Streptococcus
  - Meningococcus
  - Mycobacterium
  - Rickettsia
  - Borrelia burgdorferi
  - Mycoplasma

PERICARDIAL DISEASE: PERICARDITIS AND MYOCARDITIS

- Medications
  - Anticoagulants
  - Procainamide
  - Hydralazine
  - INH
- Radiation
- Metabolic
  - Hypothyroidism
  - uremia
- Cardiac injury
  - Acute MI
  - Dressler's syndrome (late post-MI pericarditis)
  - Posttraumatic (including postsurgical
- Malignancy
  - Metastatic
    - Breast, lung, melanoma, leukemia, lymphoma
  - Primary pericardial tumor
- Systemic illness
  - SLE
  - Acute rheumatic fever
  - RA
  - Scleroderma
  - Polyarteritis nodosa
  - Sarcoidosis
  - Myxedema
  - Amyloidosis

TYPES

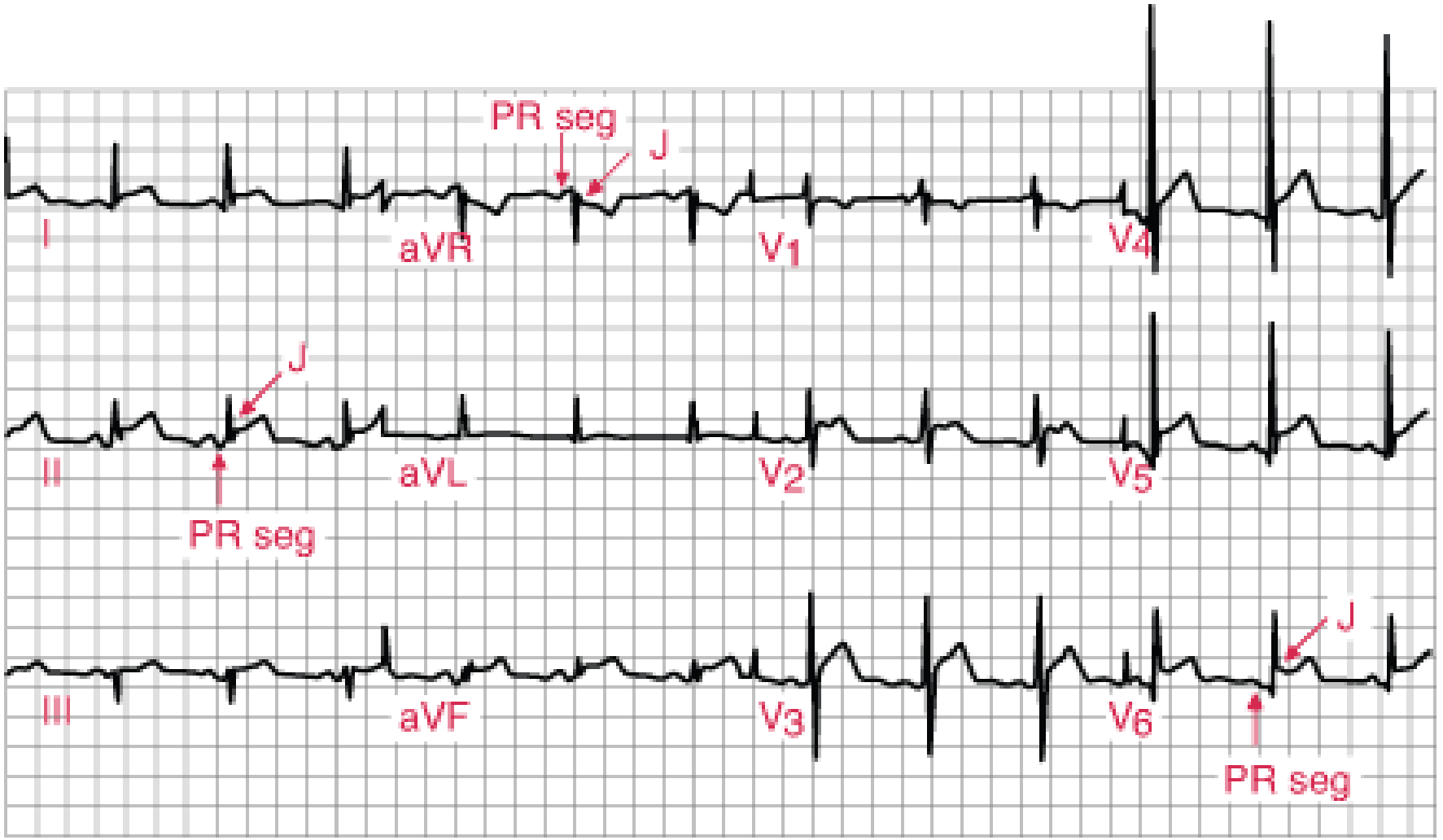
- Dry vs. wet pericarditis
- Effusion without pericardial inflammation (HIV and hypothyroidism)
- Hemorrhagic
  - Malignancy vs. TB
  - s/p PTCA
  - Postpericardiotomy syndrome
  - Complication of MI (free wall rupture, thrombolysis)
  - Idiopathic
  - Uremic
  - Aortic dissection
  - Trauma

PERICARDITIS

- Diagnosis
  - History
    - Sharp retrosternal pain exacerbated by inspiration, swallowing, or movement of the upper torso (pain is relief by sitting up and leaning forward)
    - Dyspnea
    - Low-grade, intermittent fever
  - PE
    - Pericardial friction rub is pathognomonic
    - May be positional and intermittent
    - Is scratchy in character

PERICARDITIS

- Diagnosis
  - ECG
    - NSR or sinus tach
    - Diffuse, nonantomic ST elevation with upward concavity is seen in all leads except aVR and V1
    - ST segment depression in leads aVR and V1
    - PR segment depression (very specific)
    - NEW! Findings/description: Spodick's sign
      - Slightly downward sloping TP segment
  - CXR
    - Usually is normal (sometimes with a large effusion, will see an enlarged cardiac silhouette)



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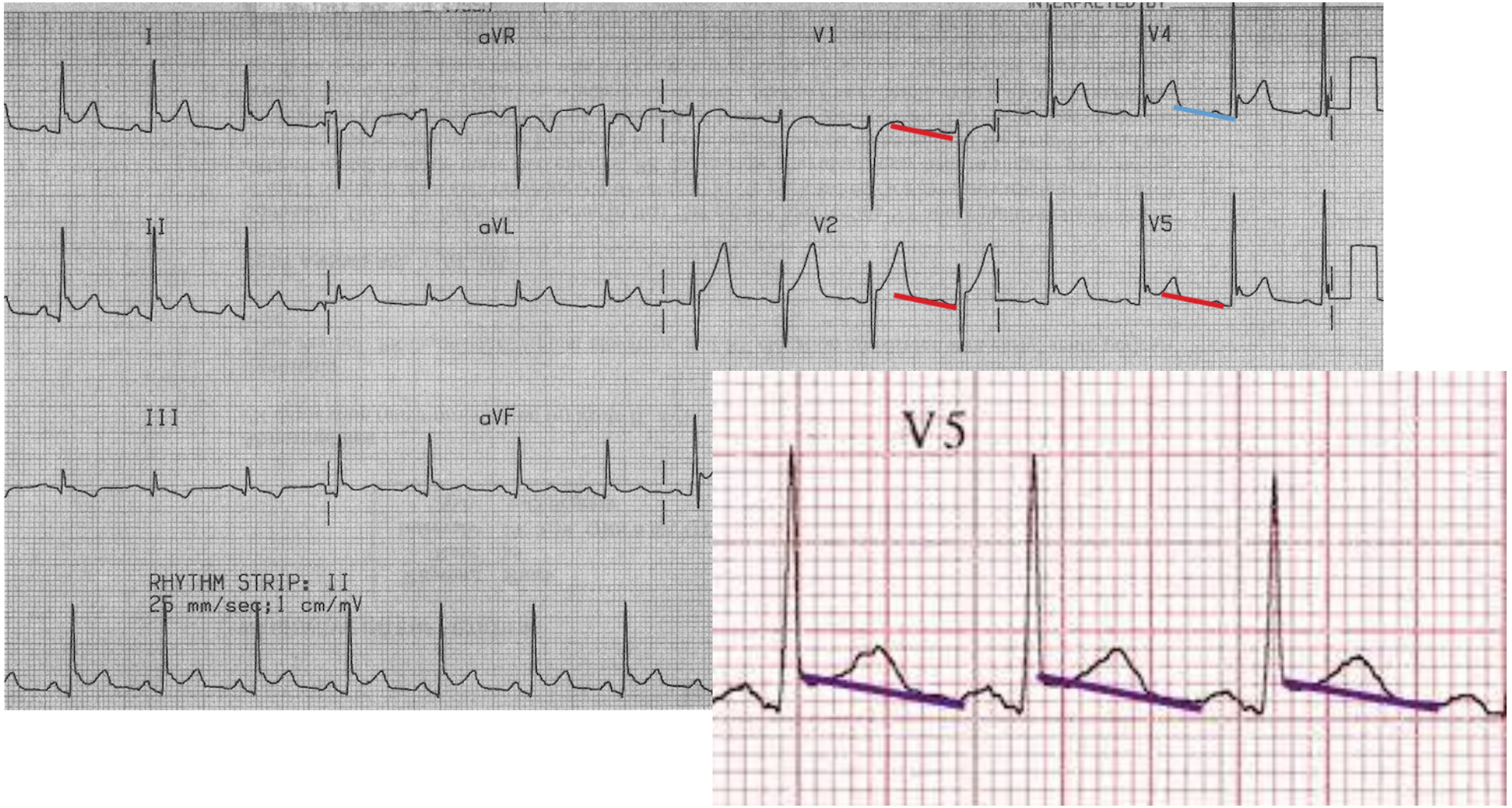

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PERICARDITIS

- Diagnosis
  - Echo-2D
    - Diagnostic study of choice
  - CT scan
    - Only useful if fluid is present
  - Lab
    - High WBC
    - High ESR
    - Cardiac enzyme can be elevated

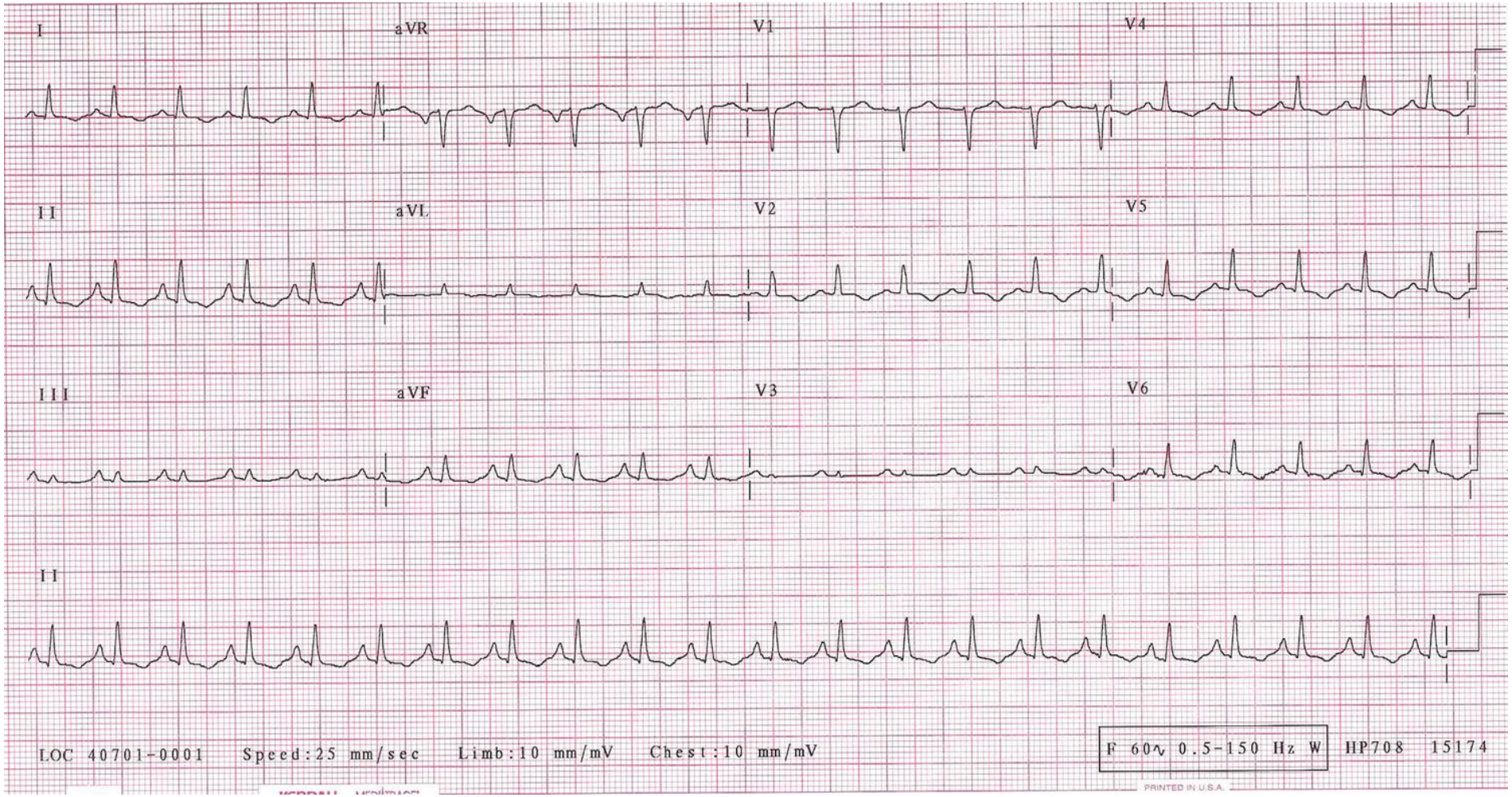
PERICARDITIS

- Treatment
  - Treat the underlying condition
    - Antibiotic
    - Supportive
    - Stop medication
    - Hemodialysis is uremia
  - Pain relief
    - NSAIDs
      - ASA, ibuprofen, Indocin, prednisone
    - Narcotics
  - Pericardiocentesis for tamponade

- Chest pain
- Irradiates to the left side
- SOB
- DOE
- PMHx: none
- Meds: none
- SocHx: smoker
- PCP: Dr. OOT

- VS
  - HR 112; BP 95/40; RR 18; T 99; O2sat 98%
- PE
  - HEENT: WNL
  - Chest: rales in bases; Taq; distant heart sounds; +JVD
  - Abd: WNL
  - Ext: no edema
  - Neuro: WNL

EKG



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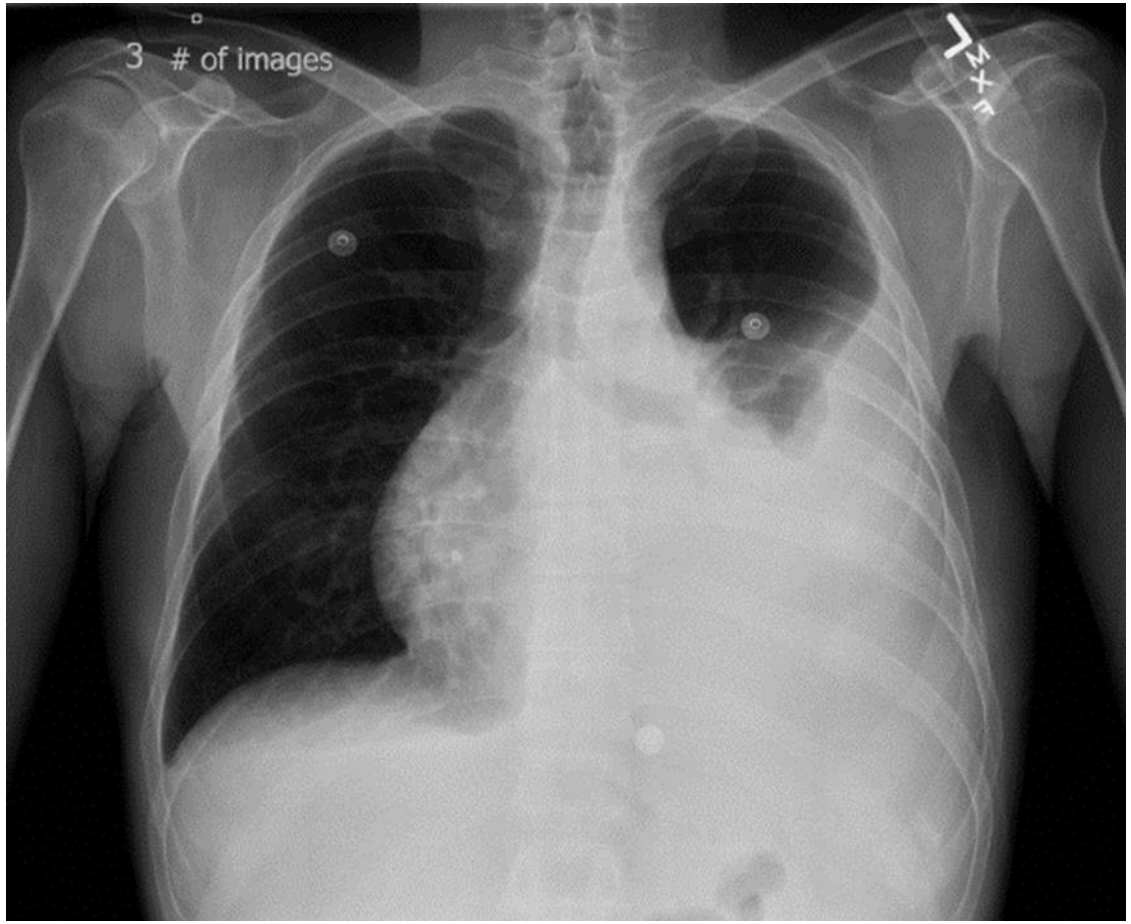
CXRAY



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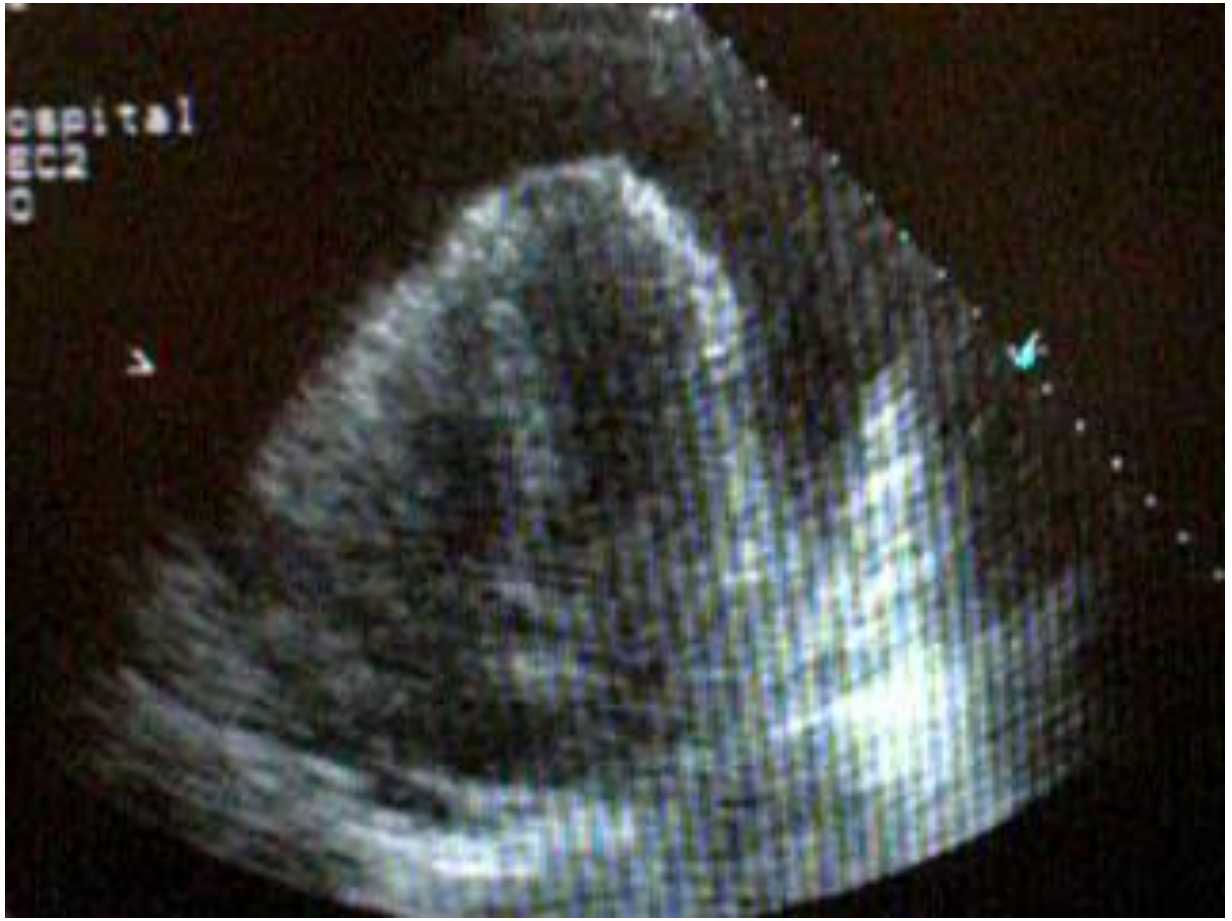

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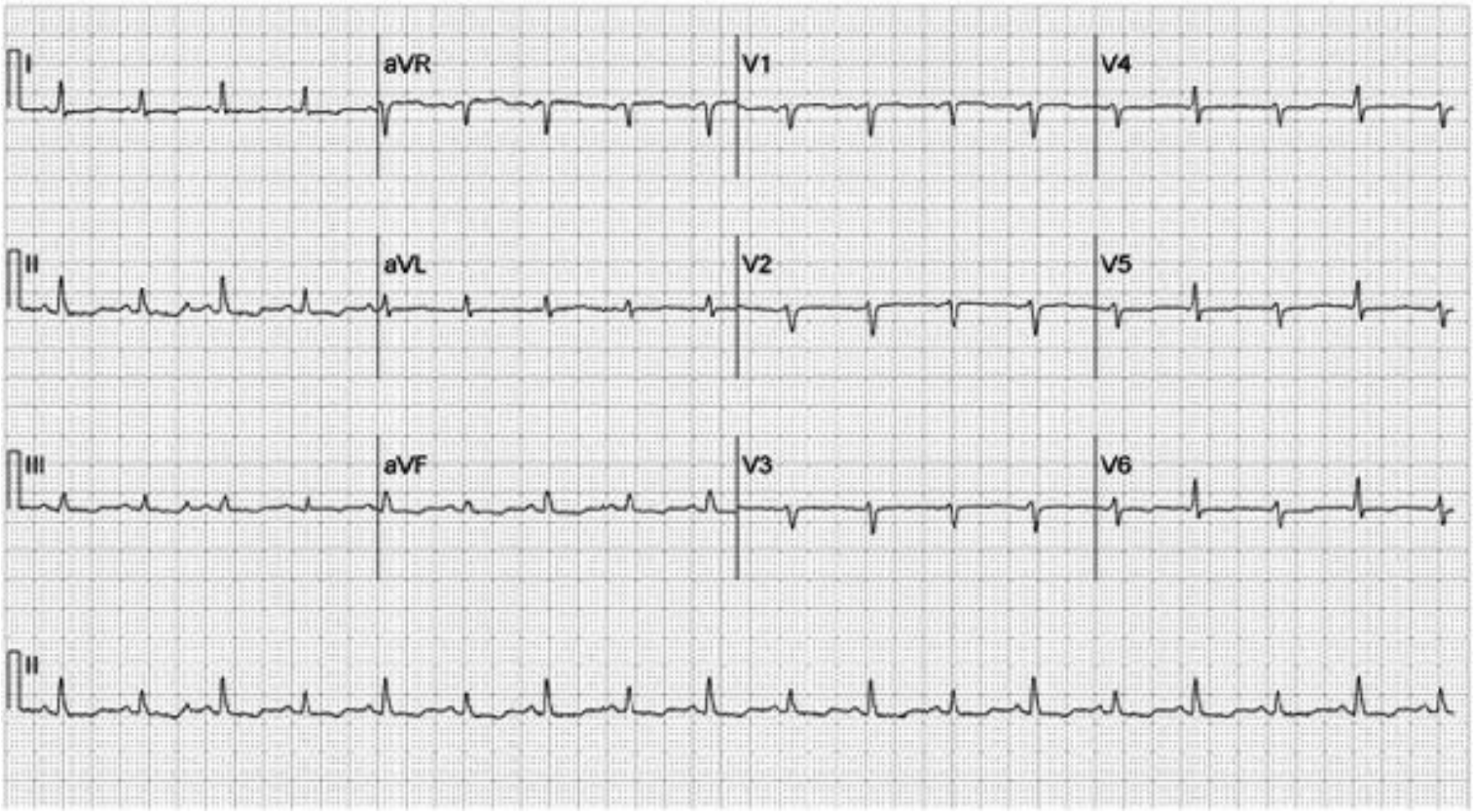
CARDIAC TAMPONADE

- Patient History
  - Determine precipitating causes.
  - Patient relates a history of dyspnea and orthopnea.
- EKG: low voltage, TAQ
- Exam
  - Rapid, weak pulse
  - Decreasing systolic pressure
  - Narrowing pulse pressures
  - *Pulsus paradoxus*
  - Faint, muffled heart sounds
  - *Electrical alternans*



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- Beck's triad
  - Hypotension
  - JVD
  - Muffled heart sounds

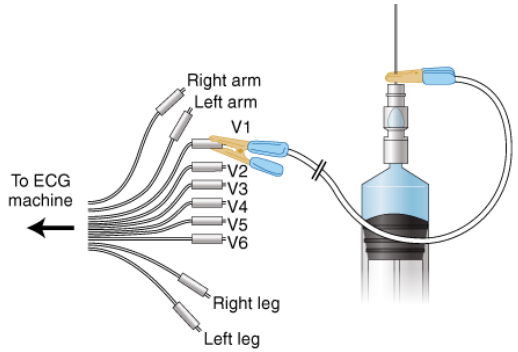
- Echocardiogram
  - Large pericardial effusion
  - Diastolic collapse of the right ventricle and the right atrium
  - Swinging motion of the heart

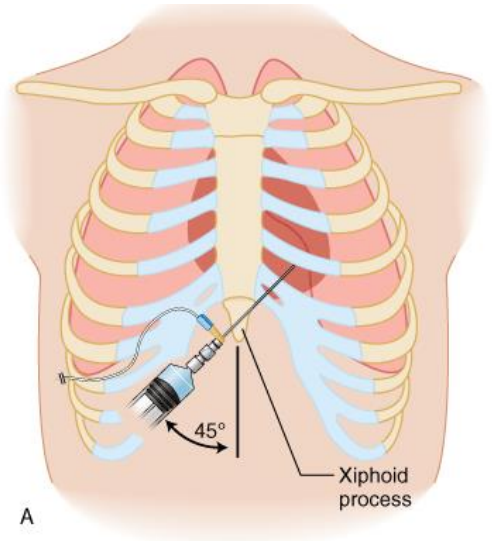
CARDIAC TAMPONADE

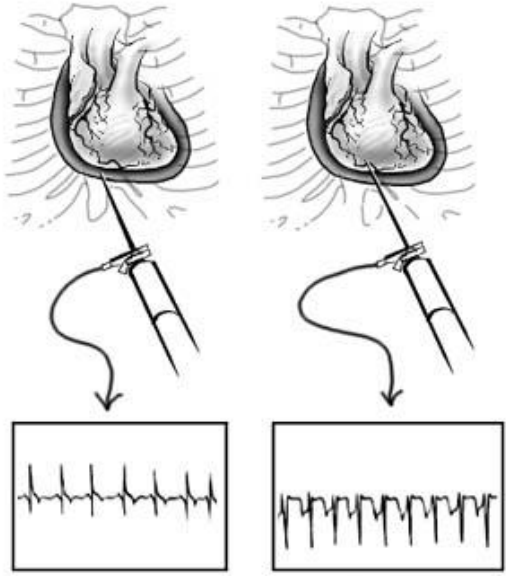
- Management
  - Maintain airway.
  - Administer oxygen.
  - Establish IV access.
  - Consider medication administration:
    - Morphine sulfate
    - Furosemide
    - Dopamine/dobutamine

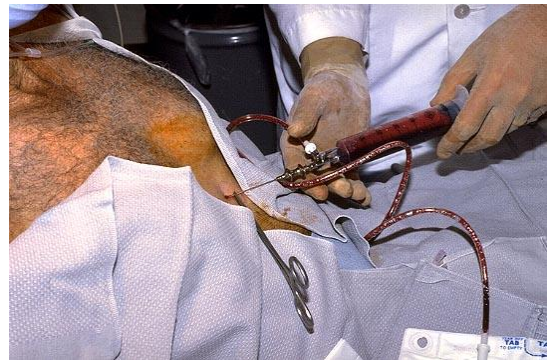
CARDIAC TAMPONADE

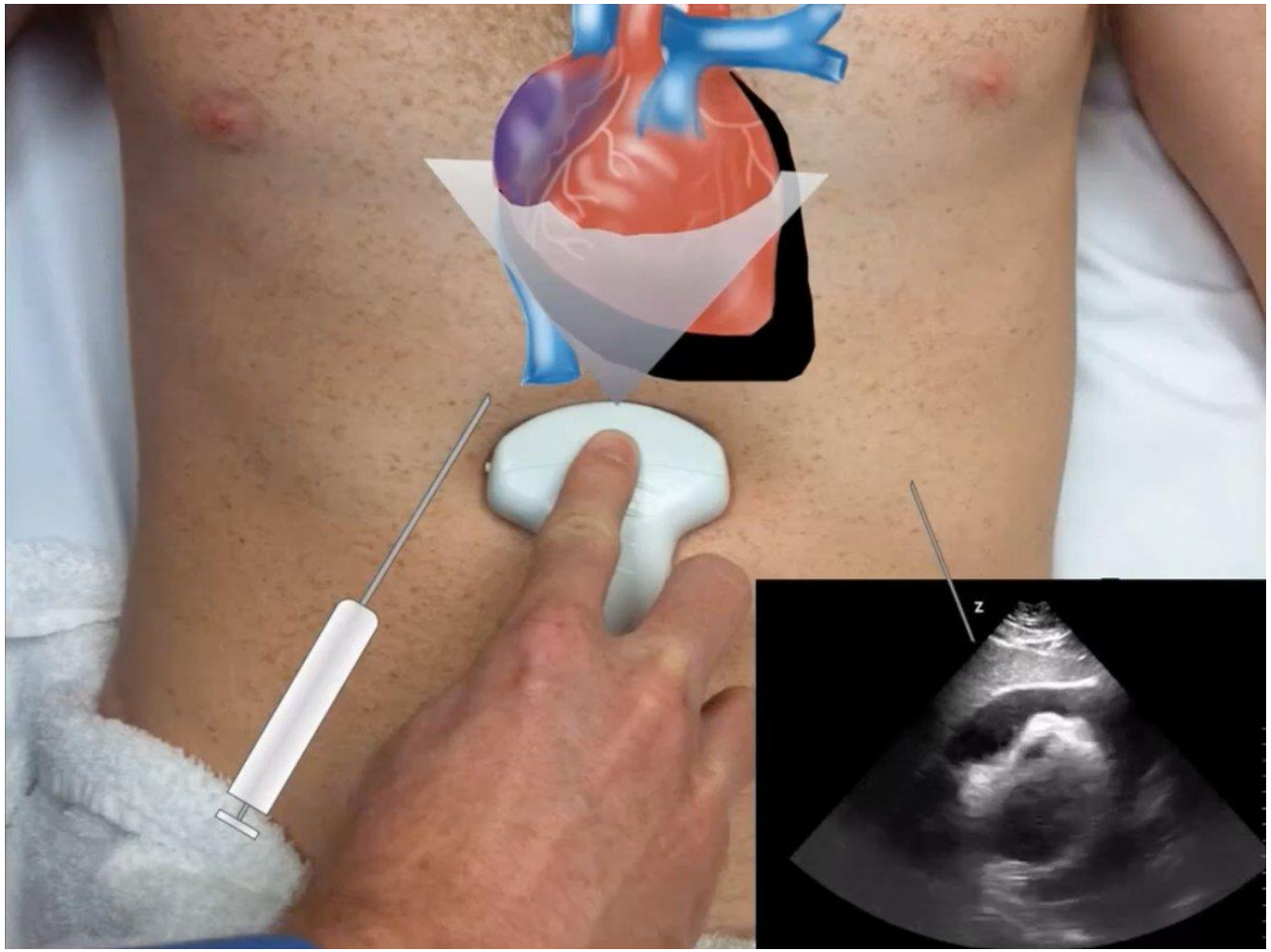
- Pericardiocentesis
  - Pericardiocentesis is the definitive treatment.
  - Insertion of a cardiac needle and aspiration of fluid from the pericardium.
  - Procedure should be performed only if allowed by local protocol.
  - Procedure should be performed only by personnel adequately trained in the procedure.


Right arm
Left arm
V1
V2
V3
V4
V5
V6
To ECG machine
Right leg
Left leg


45°
Xiphoid process
A







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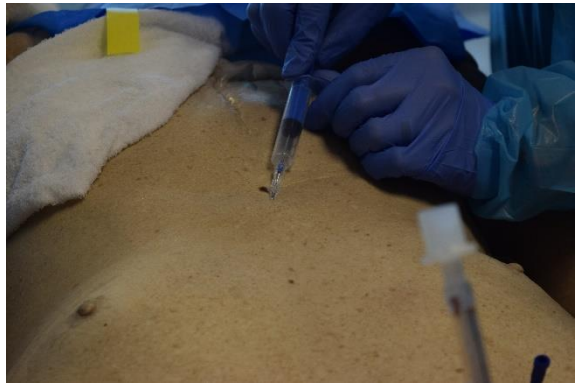

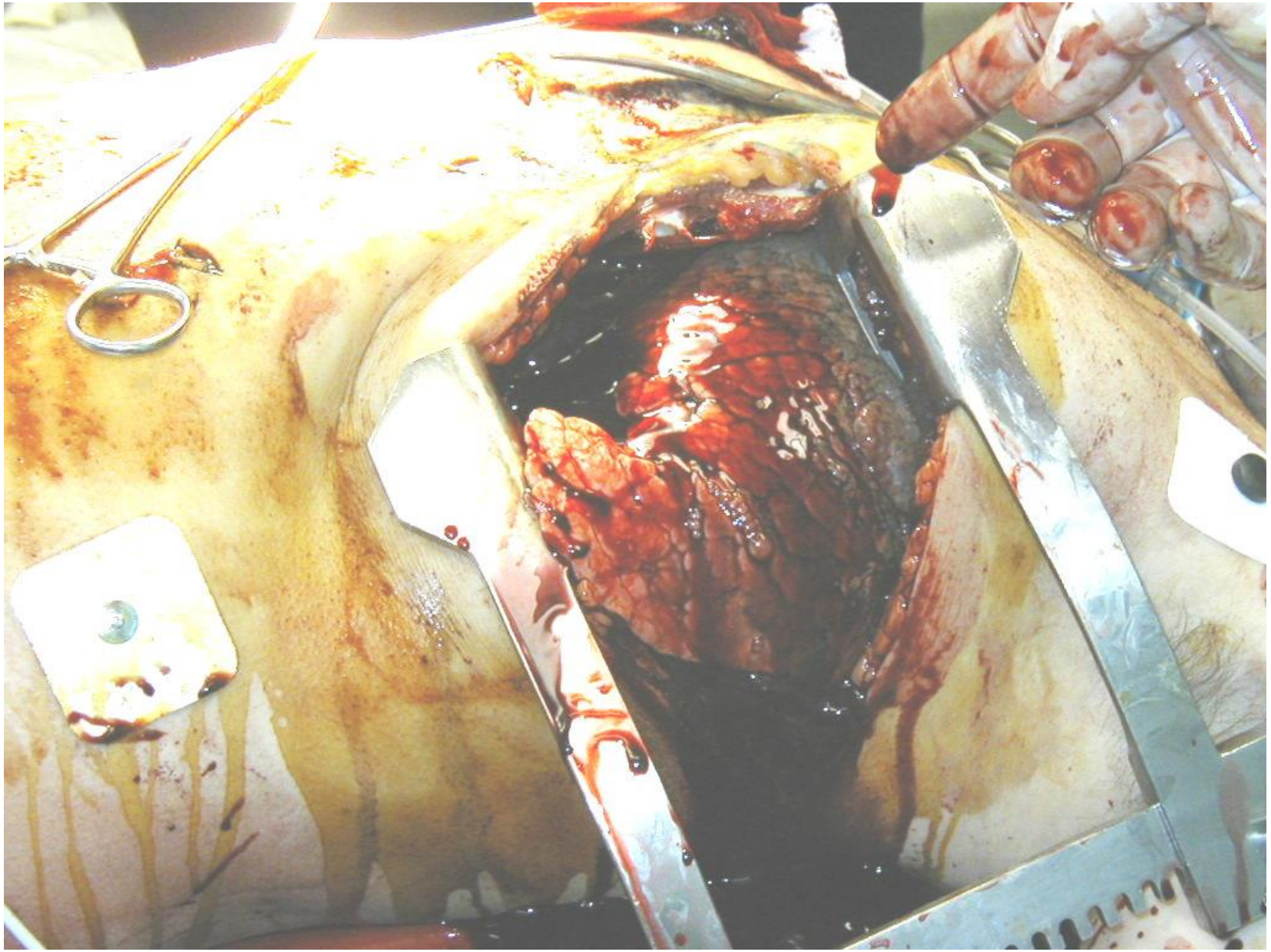

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- Which of the following is not part of the Beck's triad?
- a. Muffled heart sounds
- b. Elevated jugular venous pressure
- c. Decreased systolic blood pressure
- d. Decreased breath sound

WHAT ARE ESSENTIAL COMPONENTS OF MEDICAL MANAGEMENT FOR AORTIC DISSECTION?

Name two

WHAT TYPE OF DISSECTIONS ARE USUALLY MANAGED SURGICALLY?

???

WHAT ARE ESSENTIAL COMPONENTS OF MEDICAL MANAGEMENT FOR AORTIC DISSECTION?

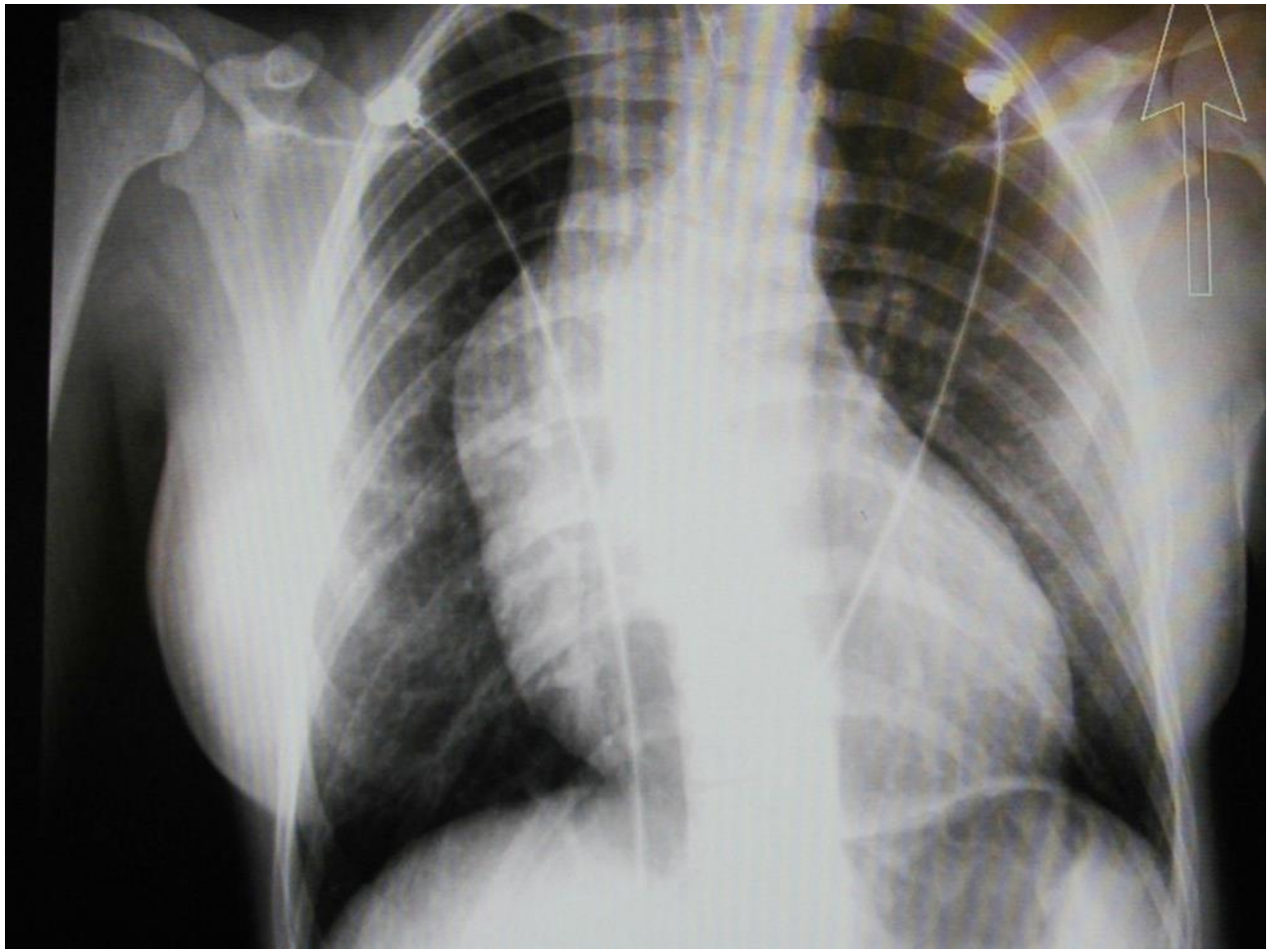
Control HR **Control BP** **T&C/Transfuse** **Control Pain**

WHAT TYPE OF DISSECTIONS ARE USUALLY MANAGED SURGICALLY?

Type A – Ascending Aorta

- VS
  - HR 92; BP 210/100; RR 18; T 99; O2sat 98%
- PE
  - HEENT: WNL
  - Chest: CTA; RRR
  - Abd: WNL
  - Ext: no edema; decreased PP
  - Neuro: WNL

CXRAY



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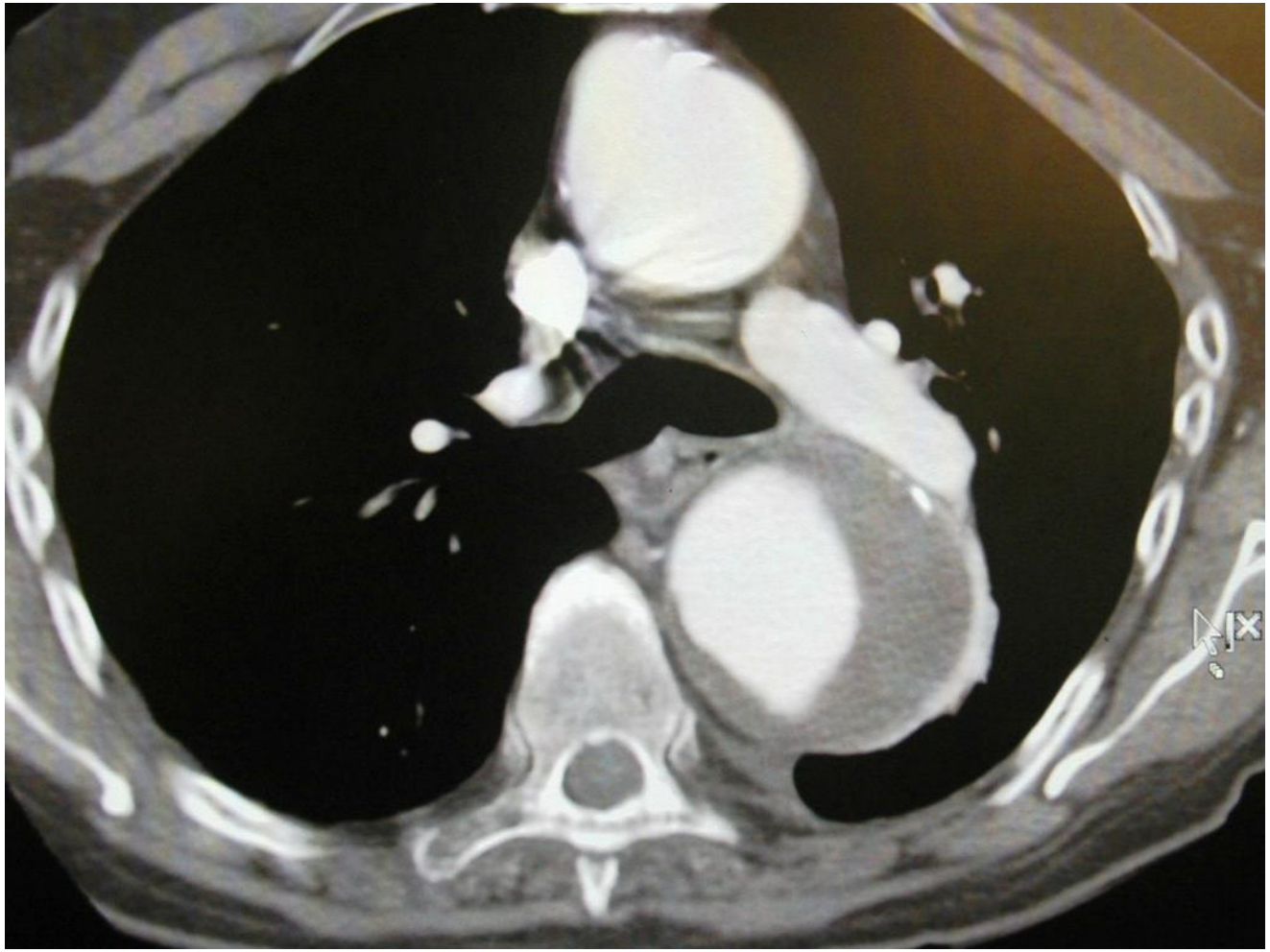
CT



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- What is going on?
- Do I need to do something now?
  - Go to the bathroom
  - Control BP
    - With what and why?
      - Labetalol
      - Nitroprusside
      - Cardene
  - Call thoracic surgeon?
  - Start praying?
  - CT?

AORTIC DISSECTION

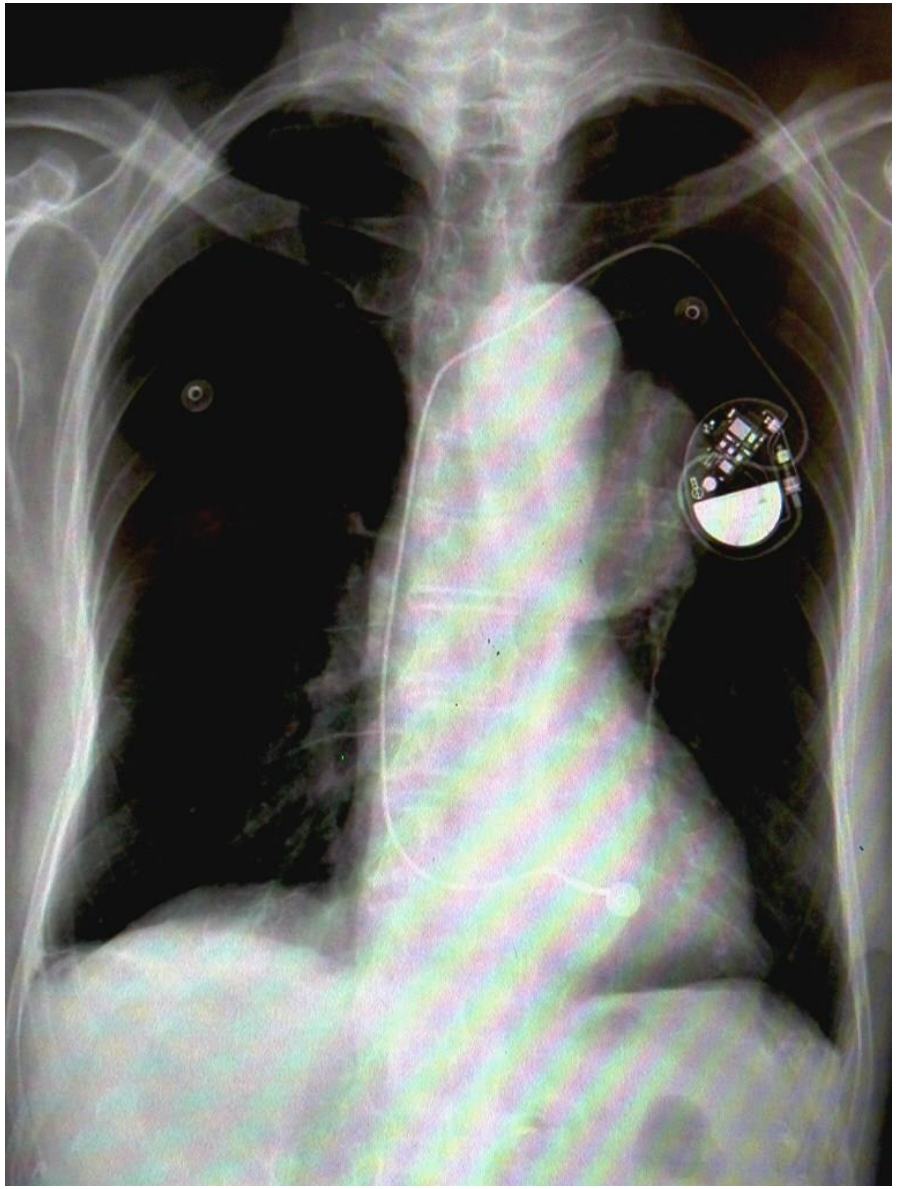
- Thoracic aneurysm
  - HTN
  - Sudden, sharp, throbbing CP
  - Back pain
  - Ischemic leg
  - Neurologic deficit
- AAA
  - Atherosclerotic
  - Hypotension
  - Anemia
  - ABD pain

- Aneurysm
  - Pathophysiology
    - Ballooning of an arterial wall, usually the aorta, that results from a weakness or defect in the wall
  - Types
    - Atherosclerotic
    - Dissecting
    - Infectious
    - Congenital
    - Traumatic

- Dissecting Aortic Aneurysm
  - Caused by degenerative changes in the smooth muscle and elastic tissue.
  - Blood gets between and separates the wall of the aorta.
  - Can extend throughout the aorta and into associated vessels.

THORACIC ANEURYSM

- Types:
  - Type A: ascending, proximal to left subclavian (DeBakey I & II)
  - Type B: descending, distal to left subclavian (DeBakey II & III)
- Findings:
  - BP differences between arms
  - Cardiac tamponade
  - Chest X-ray:
    - Change in appearance of aorta, mediastinal widening, hump in the aortic arch, pleural effusion, trachea deviation
- Treatment:
  - Nitroprusside, labetalol
  - Type A: surgery
  - Type B: medical treatment



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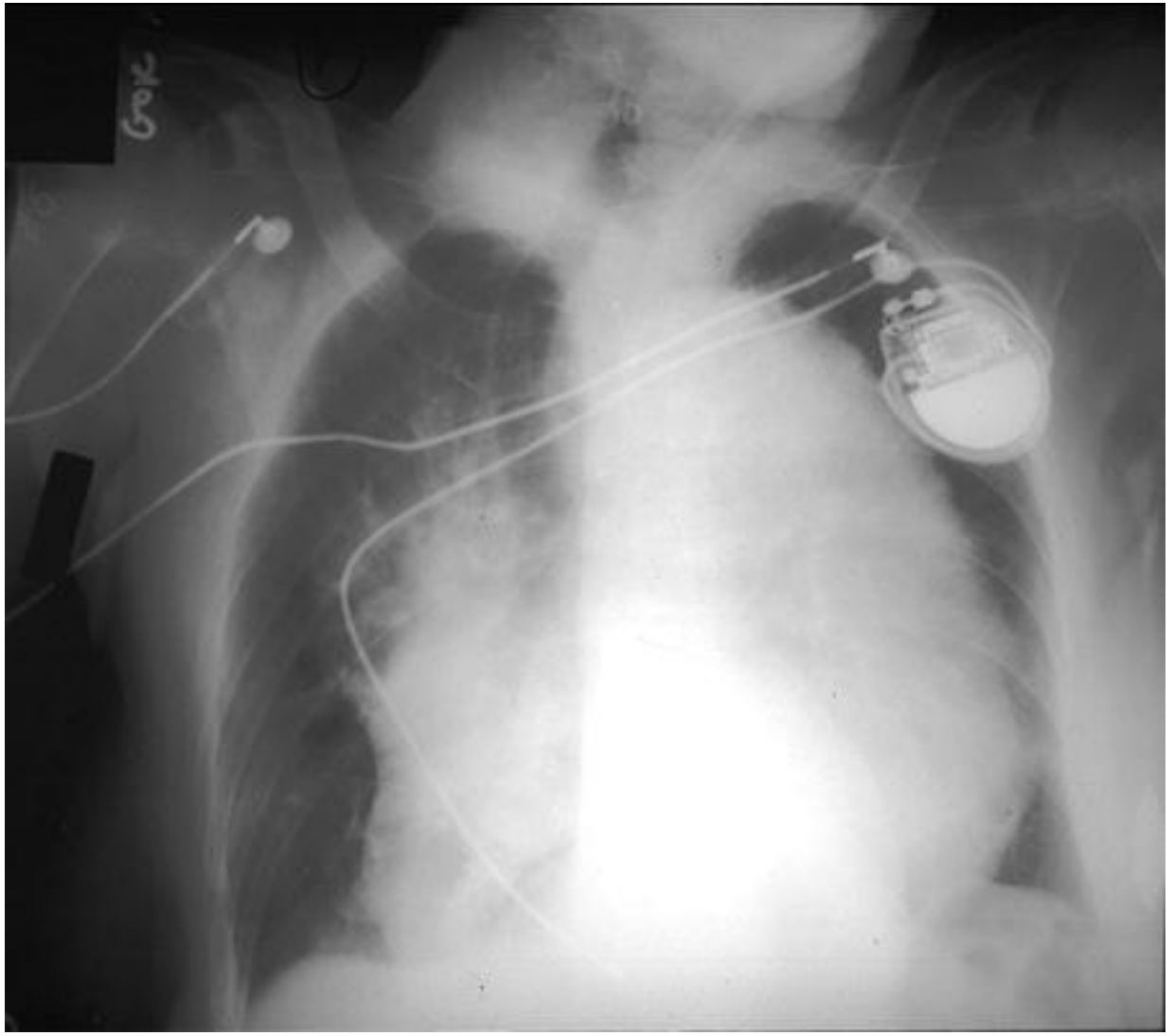

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- X-rays findings
  - Wide mediastinum
  - Loosing of aortic notch
  - Pleural effusion
  - Esophagus, trachea deviated to the right

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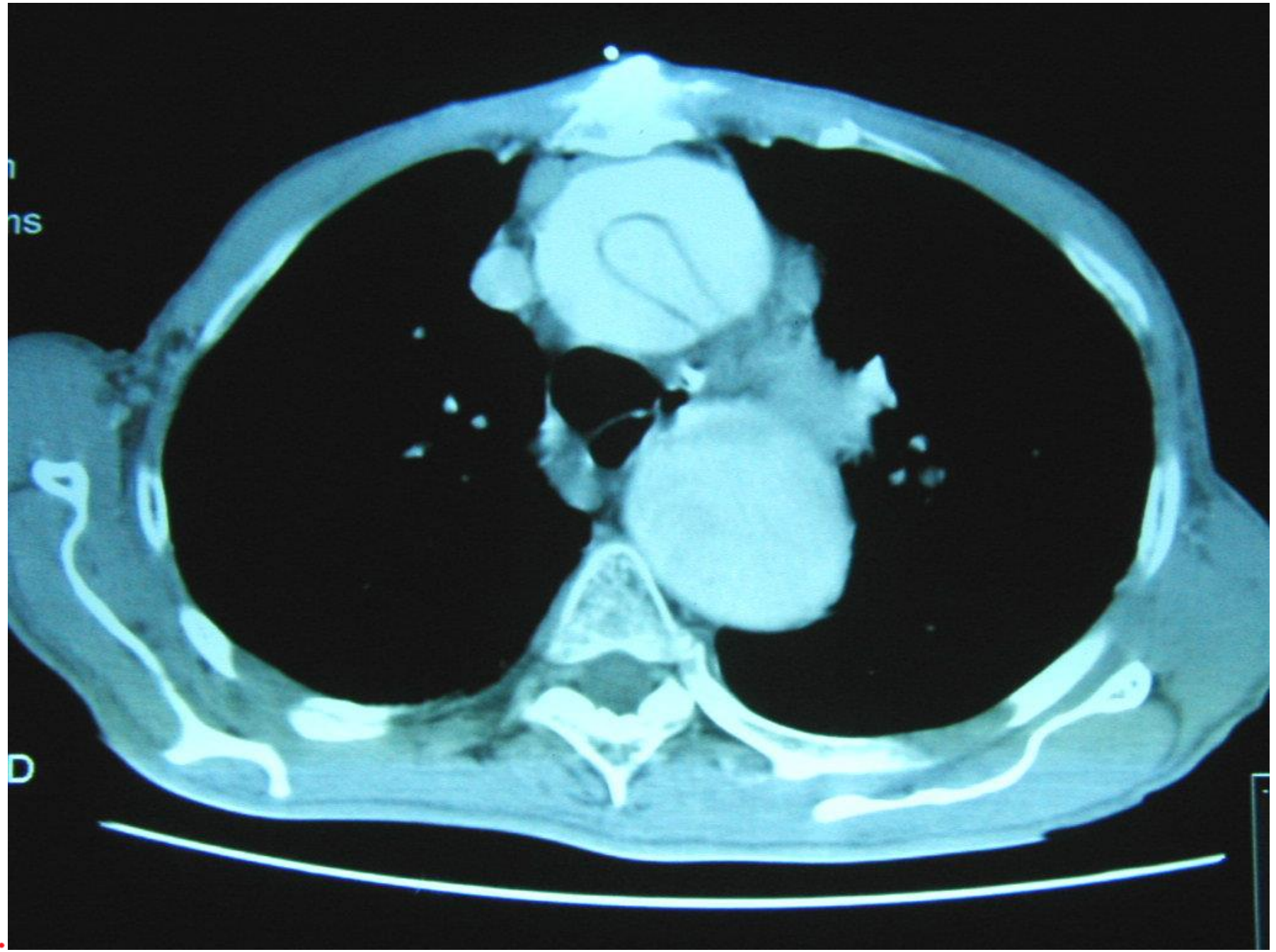

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- A type “A” thoracic aneurysm refers to dissections which involve the:
- a. Descending aorta
- b. Ascending aorta proximal to left subclavian
- c. Descending aorta from the left subclavian
- d. Ascending aorta distal to left subclavian
- e. Descending aorta from the right subclavian

FOUNDATIONS CHALLENGE
KNOWLEDGE BOMB

AORTIC DISSECTION

- **Classic Presentation**
  - Acute severe pain radiating in direction of propagation
  - BP may be high, low or normal
  - May be associated with new murmur, MI, CHF, renal failure, mesenteric ischemia, new neuro deficits

- **ED Management**
  - Control HR and BP to decrease shear stress (Esmolol (Labetalol) +/- Nitroprusside) +/- Cardene
  - Control Pain
  - T&C x10-15, Transfuse PRN
  - Unstable -> emergent cards/thoracic surgery consult and dispo to OR
  - Stable -> CT angio (NEVER send unstable pt to CT)
  - Type A (Ascending) usually managed surgically and Type B (Descending) usually managed medically

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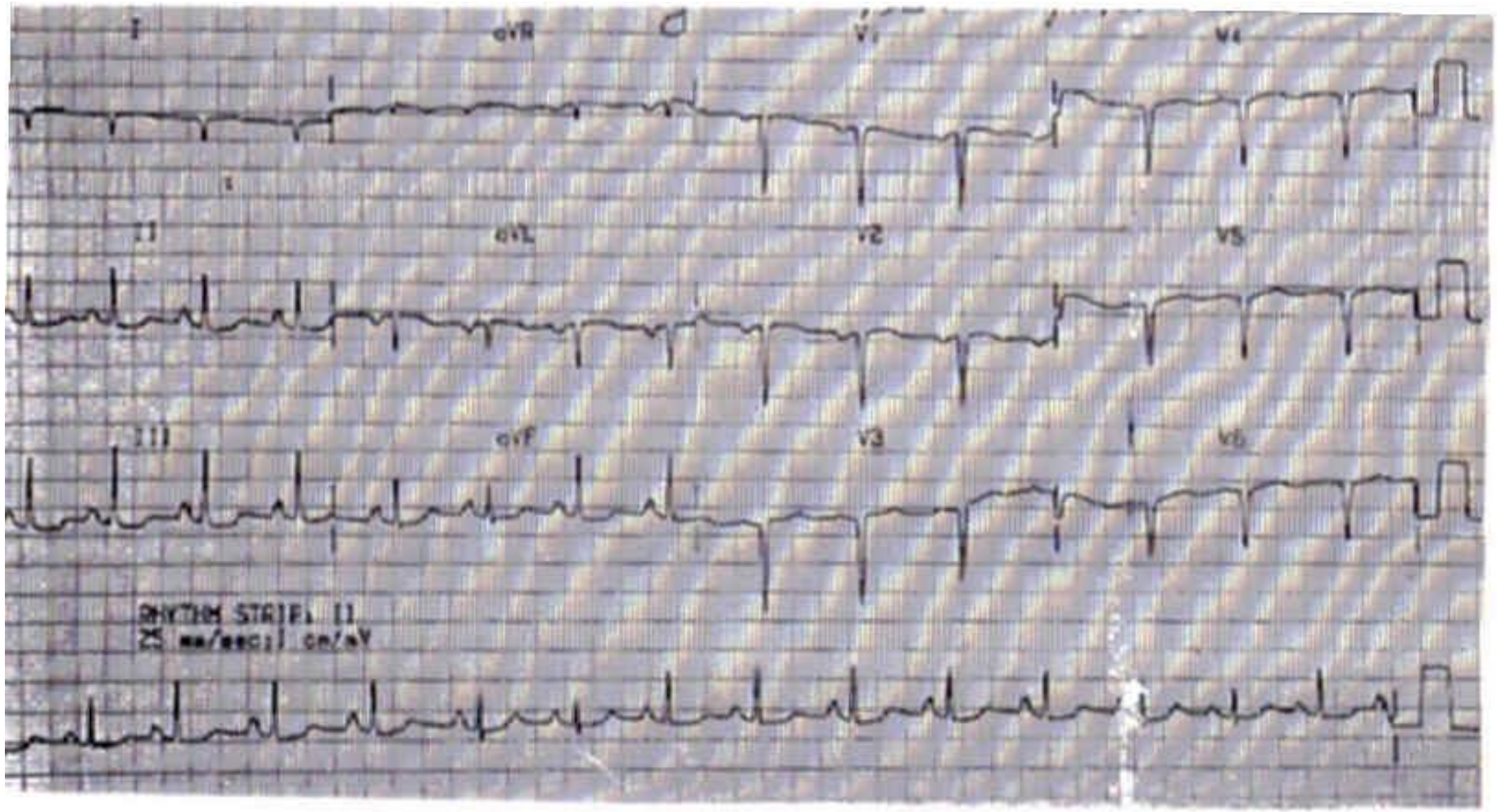
ANEURYSM

- Pathophysiology
  - Ballooning of an arterial wall, usually the aorta, that results from a weakness or defect in the wall
- Causes
  - HTN
  - Pregnancy
  - Infectious
  - Congenital
    - Coarctation
    - Marfan
    - Bicuspid aortic valve
  - Traumatic
  - Cocaine use
  - Syphillis
- Dissecting Aortic Aneurysm
  - Caused by degenerative changes in the smooth muscle and elastic tissue.
  - Blood gets between and separates the wall of the aorta.
  - Can extend throughout the aorta and into associated vessels.

FACTS

- What congenital condition predispose to aortic dissection?
- Marfan
- What type of valve disorder is common present on aortic dissection?
- AR
- What age is most common?
- 5th through 7th decade

- Chest pain
- Irradiates to the right side
- SOB
- DOE
- PMHx: none
- Meds: none
- Etc.



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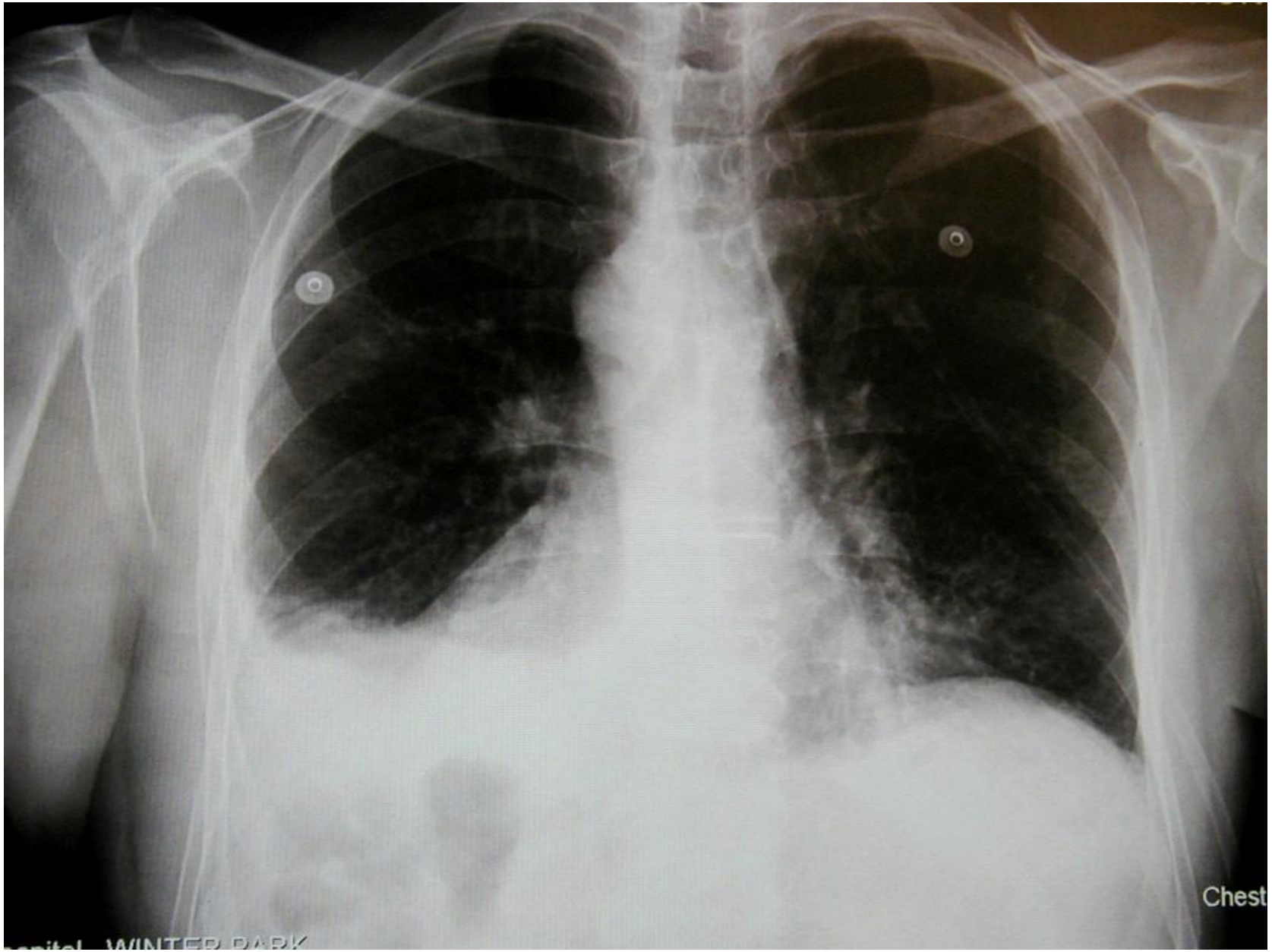

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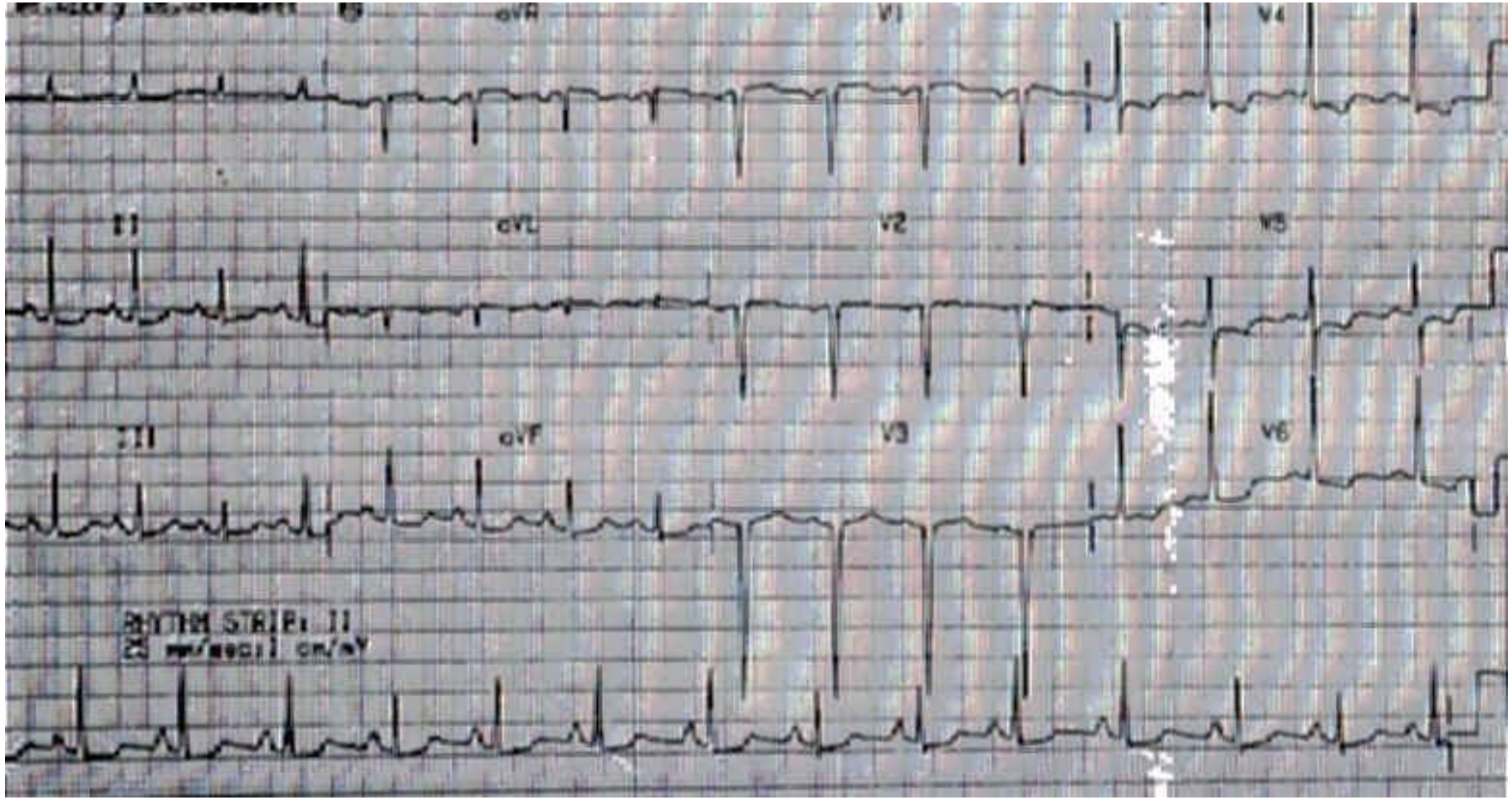
DEXTROCARDIAC



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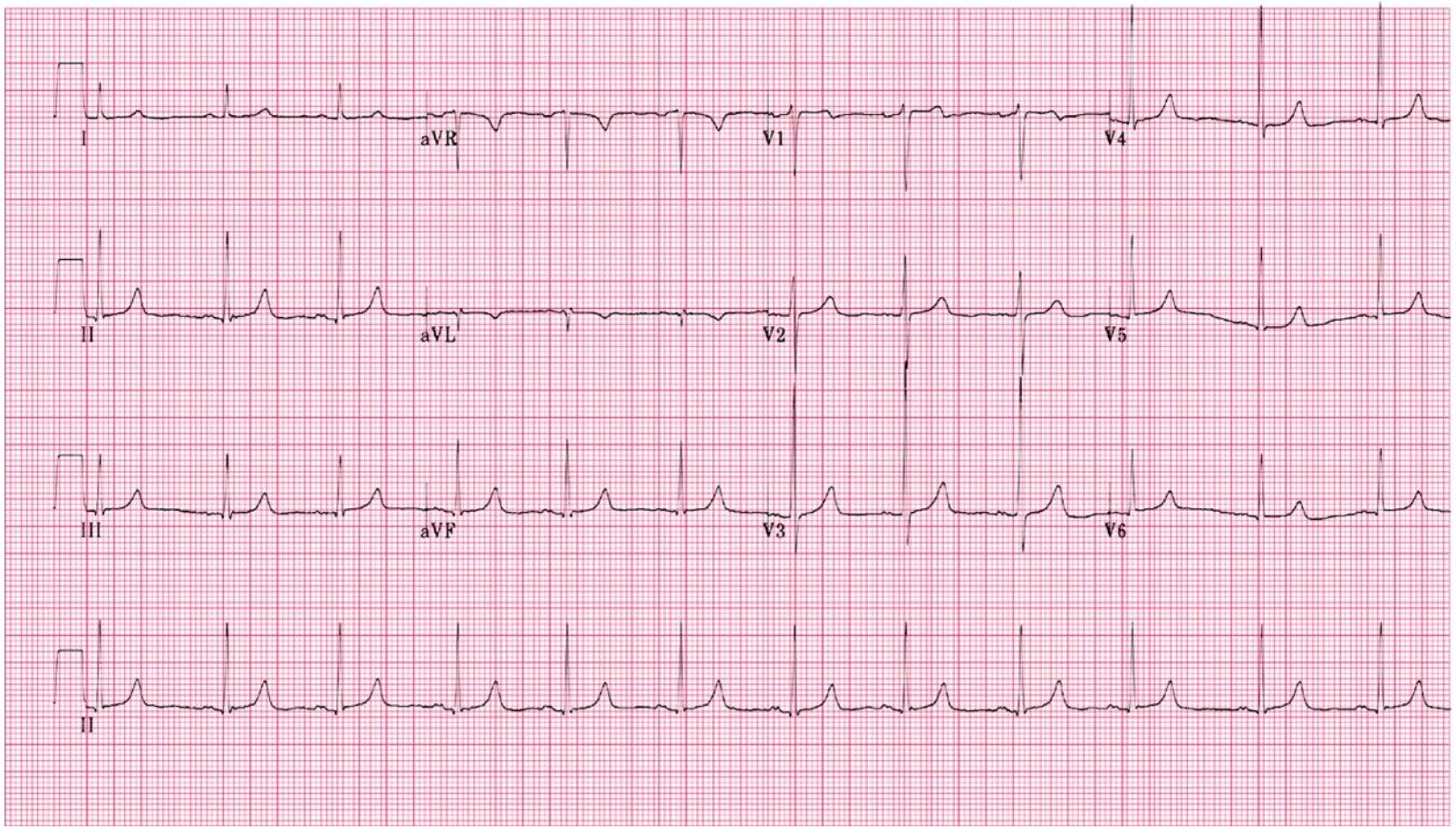
- Chest pain
- Irradiates to the left side
- SOB
- DOE
- PMHx: none
- Meds: none
- Smoker
- Etc.

- VS
  - HR 92; BP 138/80; RR 18; T 99; O2sat 98%
- PE
  - HEENT: WNL
  - Chest: CTA; RRR
  - Abd: WNL
  - Ext: no edema
  - Neuro: WNL
  - Skin: crepitus

EKG



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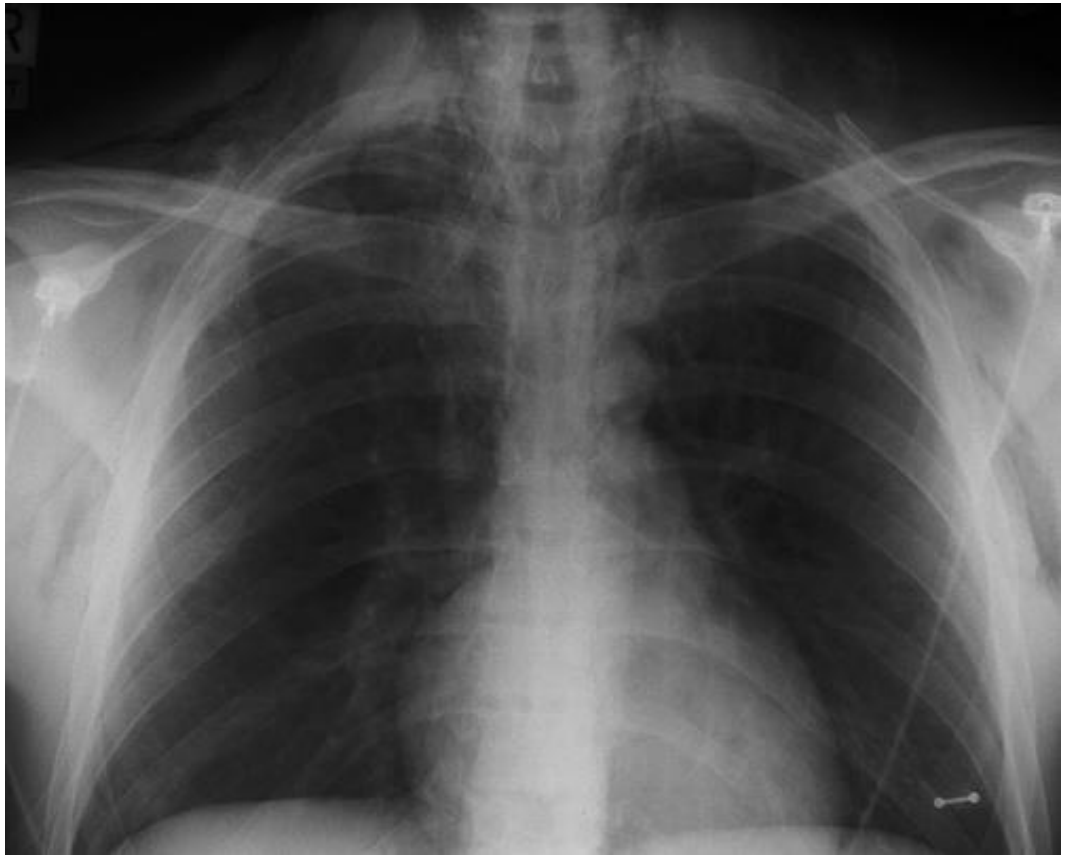
X-RAY



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PNEUMOMEDIASTINUM

- Causes
  - Idiopathic
    - Tall, skinny, young male
    - Smoker or "suctioning" action with THC, etc.
  - Esophageal rupture, for example in Boerhaave syndrome
  - Asthma or other conditions leading to alveolar rupture
  - Bowel rupture, where air in the abdominal cavity tracts up into the chest
  - Barotrauma

- Hamman's sign
  - Crunching, rasping sound, synchronous with the heartbeat, heard over the precordium in spontaneous mediastinal emphysema produced by the heart beating against air-filled tissues

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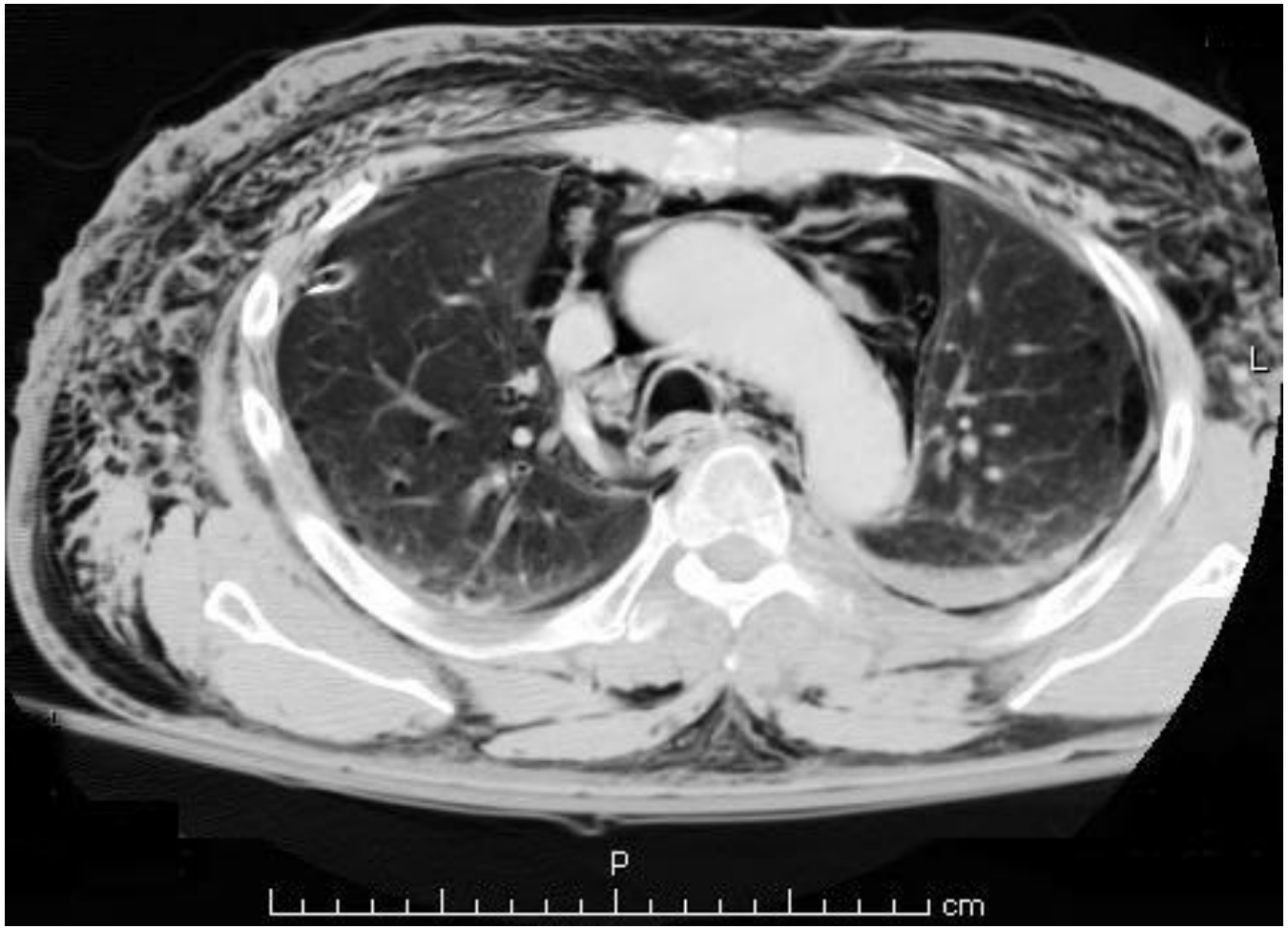

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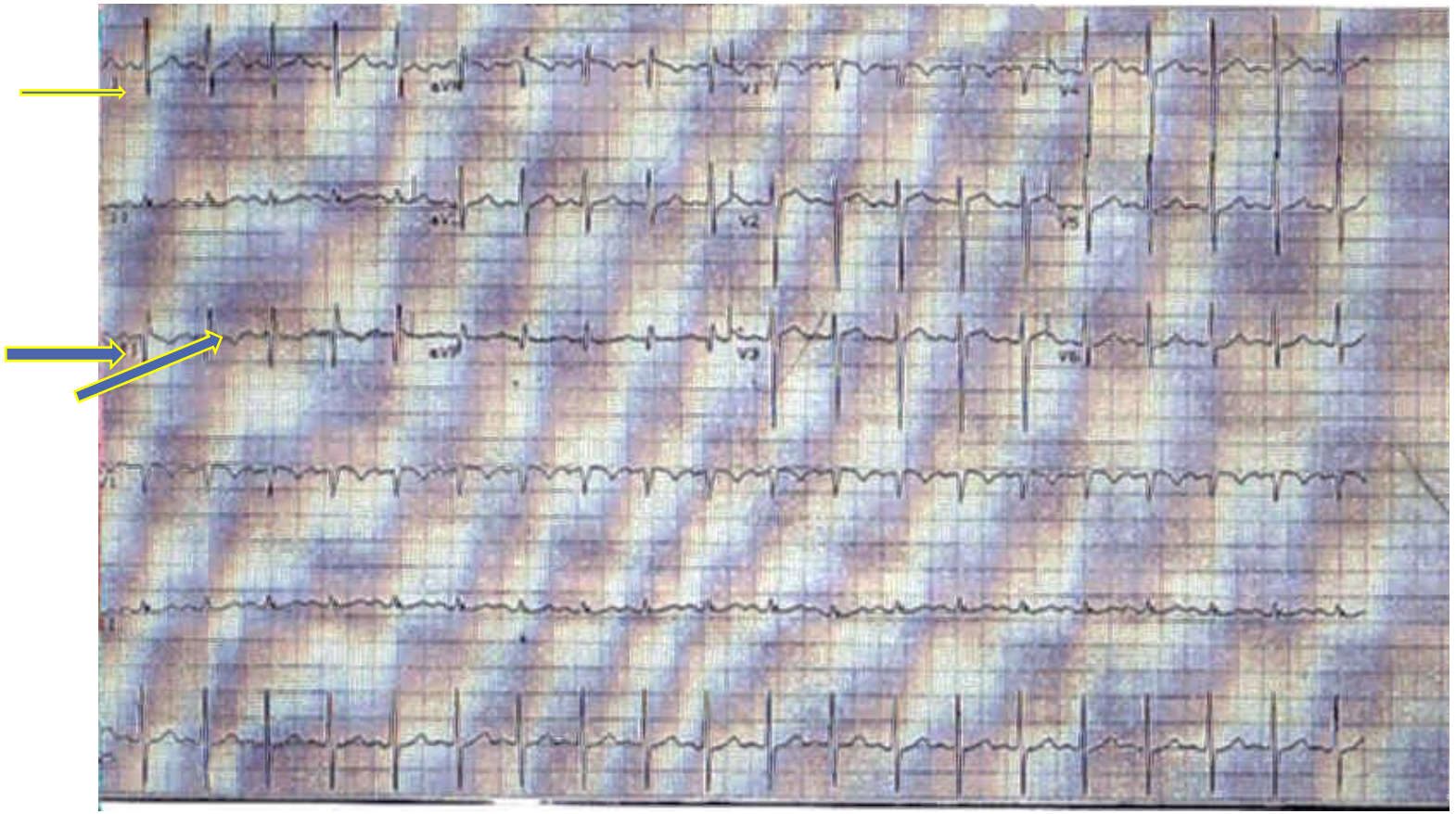
- A 32 y/o female patient came to the E.R. complaining of chest pain, palpitations, short of breath, and dyspnea on exertion. V/S: HR 110; RR 30; BP 105/40; O2Sat 88%. PE: heart, lung, abdomen examination with normal limits. Upon asking more questions, patient has family history of some type of blood disorder. Which of the following could be her diagnosis?
- a. Pulmonary emboli
- b. Pericarditis
- c. Pleurisy
- d. Lupus

- 23 y/o female
- Right CP for 2 hours
- Right CVA pain
- PMHx: none
- Meds: no remember
- All: none
- SocHx: smoker

- VS
  - HR 108; RR 18; BP 140/80; O2Sat 96%
- PE:
  - Right CVA tenderness
- Labs wnl; UA some micro hematuria
- CT Renal protocol normal except for RLL infiltrate
- Still c/o pain

- I saw CT
  - RLL atelectasis
  - No clinical for pneumonia
- Went to re-examine patient
- I have something weird in my mind
- I asked if she takes any medication, she denies
  - Asked for BCP, she said no but
  - She uses NUVA ring

EKG



What is wrong?

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CT

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PULMONARY EMBOLISM

- Pathophysiology
  - Blockage of a pulmonary artery by a blood clot or other particle.
  - The area served by the pulmonary artery fails.
- Signs and Symptoms
  - Dependent upon size and location of the blockage.
  - Onset of severe, unexplained dyspnea, CP, tachycardia, tachypnea.
  - Cough, often blood-tinged (20%)
    - Can be treated as pneumonia
  - History of recent lengthy immobilization.

PULMONARY EMBOLISM

- Pathophysiology
  - Obstruction of a pulmonary artery
    - Emboli may be of air, thrombus, fat, or amniotic fluid.
    - Foreign bodies may also cause an embolus.
    - DVT's

PULMONARY EMBOLISM

- Risk Factors
  - Recent surgery, long-bone fractures (Knee > Hip> abdominal/GU); major trauma
  - Pregnant or postpartum
  - MI
  - Age > 50
  - Prior DVT
  - Oral contraceptive use, tobacco use.
  - Sedentary, long trips
  - History of PE, Hypercoagulopathy State (Protein S, C Deficiency, Anticardiolipin Ab, Antiphospholipids Ab, lupus anticoagulant, Factor V Leiden)
  - Chronic Illness, Cancer (adenocarcinoma), nephrotic syndrome
  - Acute paralysis, immobilization

RISKS

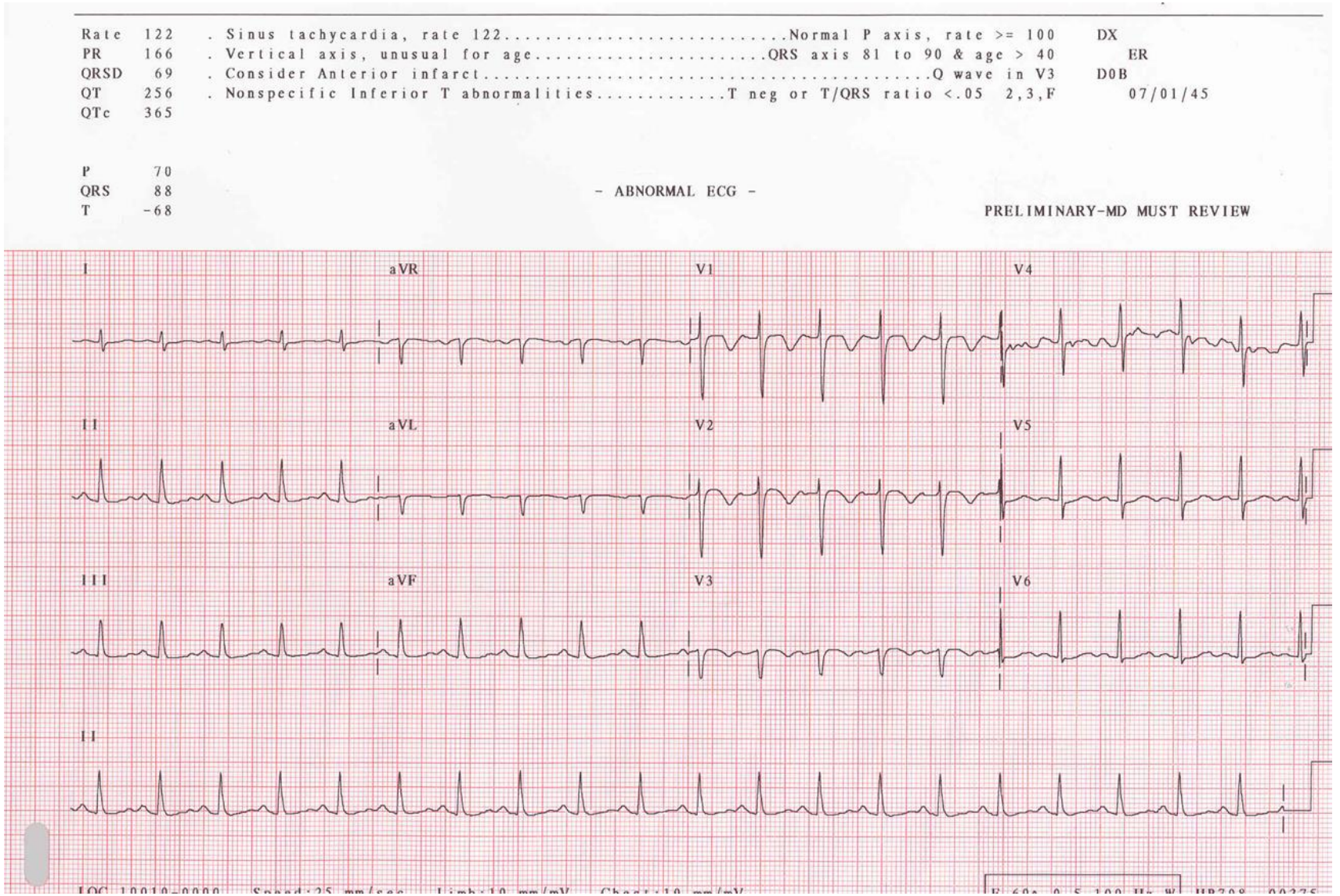
- Virchow triad
  - Venous stasis
  - Hypercoagulopathy
  - Endothelial damages

DVT

- Risks:
  - Same as PE
- Calf DVT embolized to the popliteal vein, and then to the lungs
- Test:
  - Duplex US

EKG

- Most common findings:
  - Normal
  - Sinus tachycardia and/or non-specific ST-T waves changes
- S1Q3T3
- RAD, RBBB, AFib



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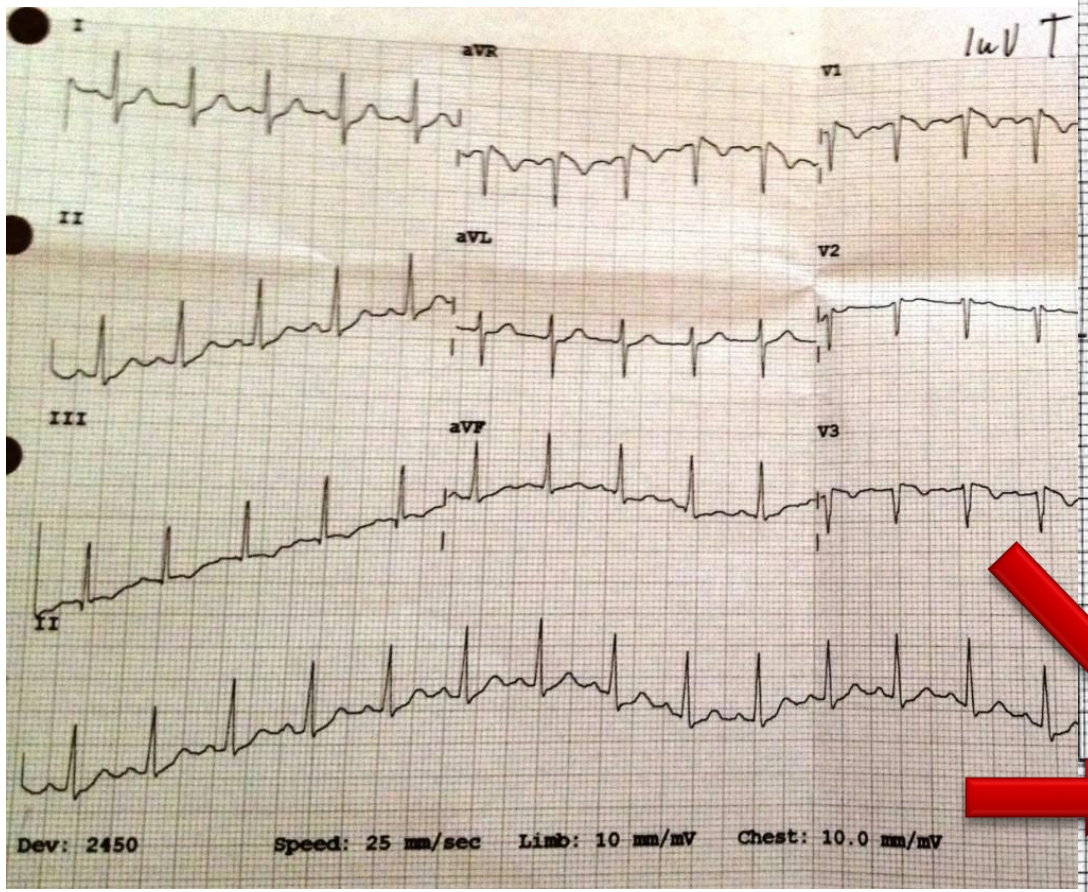

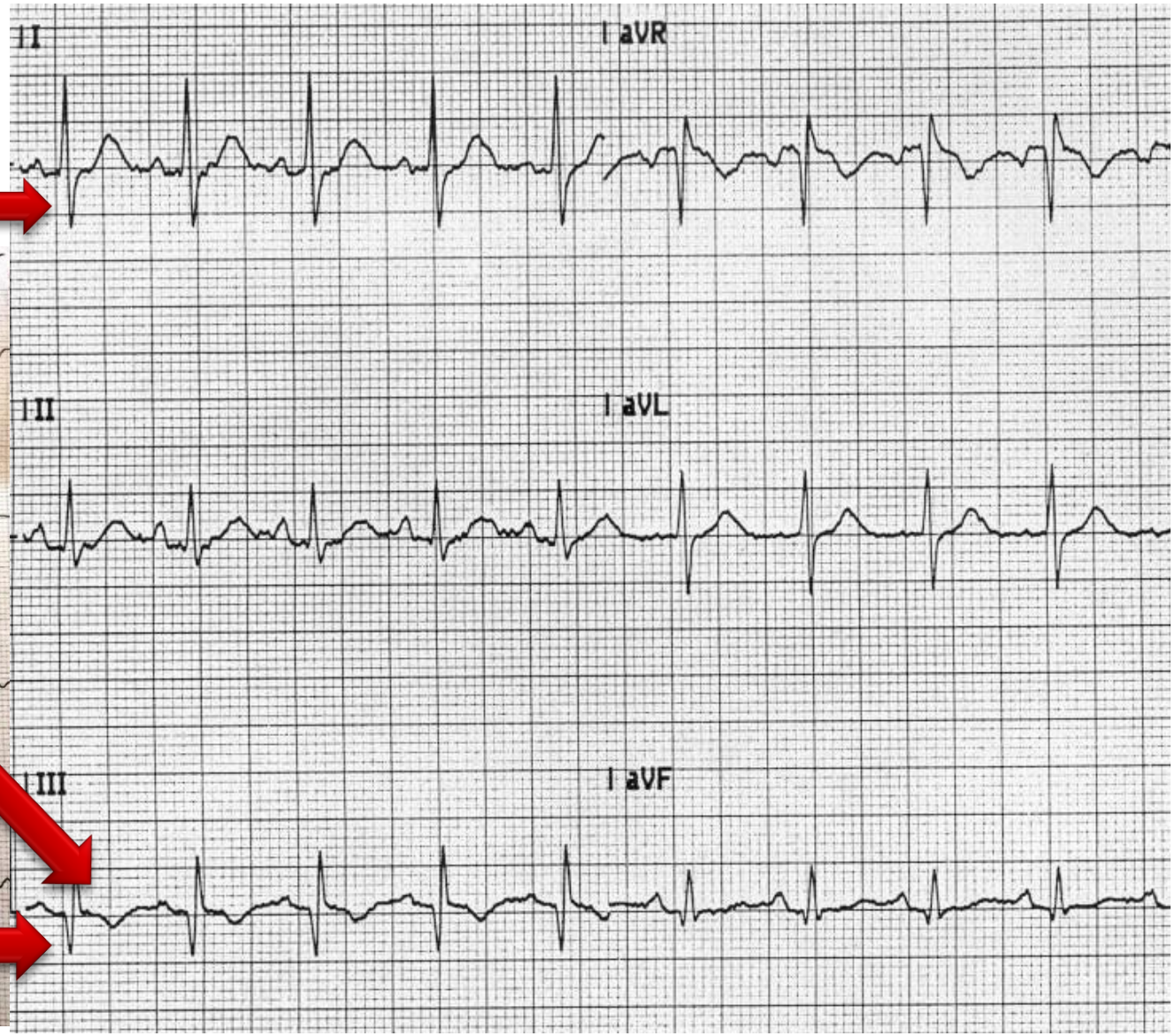

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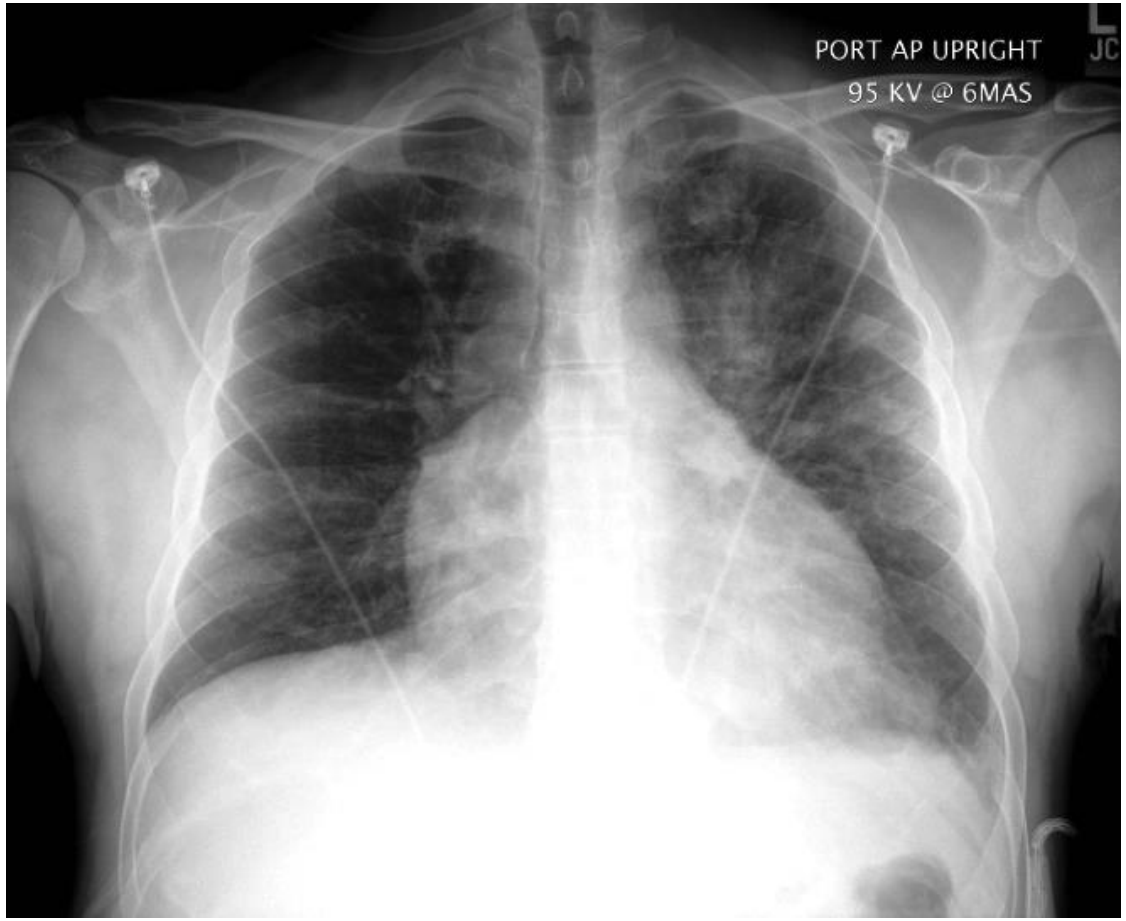
CX RAYS

- Most common finding:
  - Nothing
  - Atelectasis
  - Elevated hemidiaphragm
- Pleural effusion
- Hampton's hump:
  - Wedge shaped infiltrate abutting the pleura
- Westermark's sign:
  - Decreased lung vasculature markings ipsilateral to the PE

NORMAL



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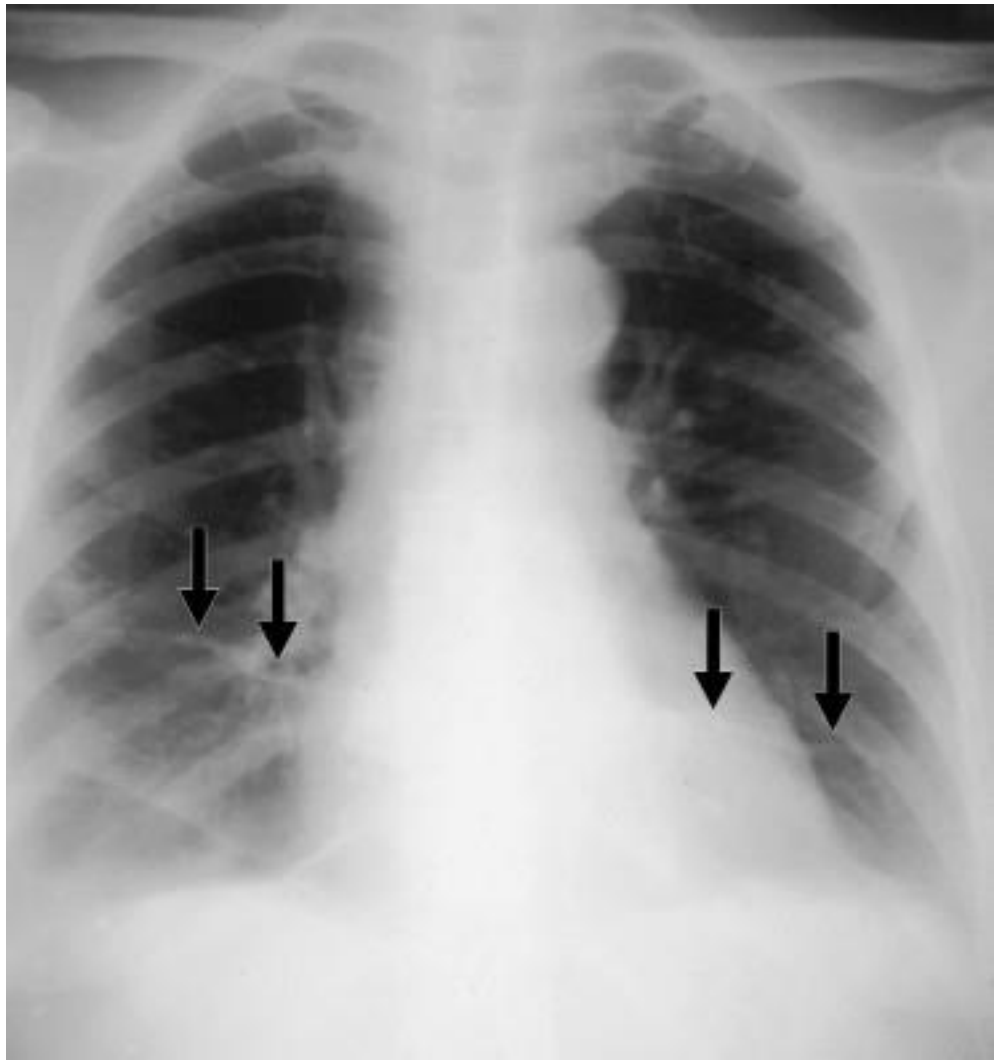
PULMONARY EMBOLI

- Tests
  - V/Q Scan
  - Spiral CT
  - Doppler US
  - ABG (hypoxia, A-a gradient)
  - D-dimer????
    - Wellen and/or Perc criteria
  - Pulmonary angiography is the gold standard
    - Indicated when Doppler, VQ scan (low/intermediate probability), CTA are non diagnostic but you have high suspicious
- Treatment
  - anticoagulant, thrombolytics

ATELECTASIS



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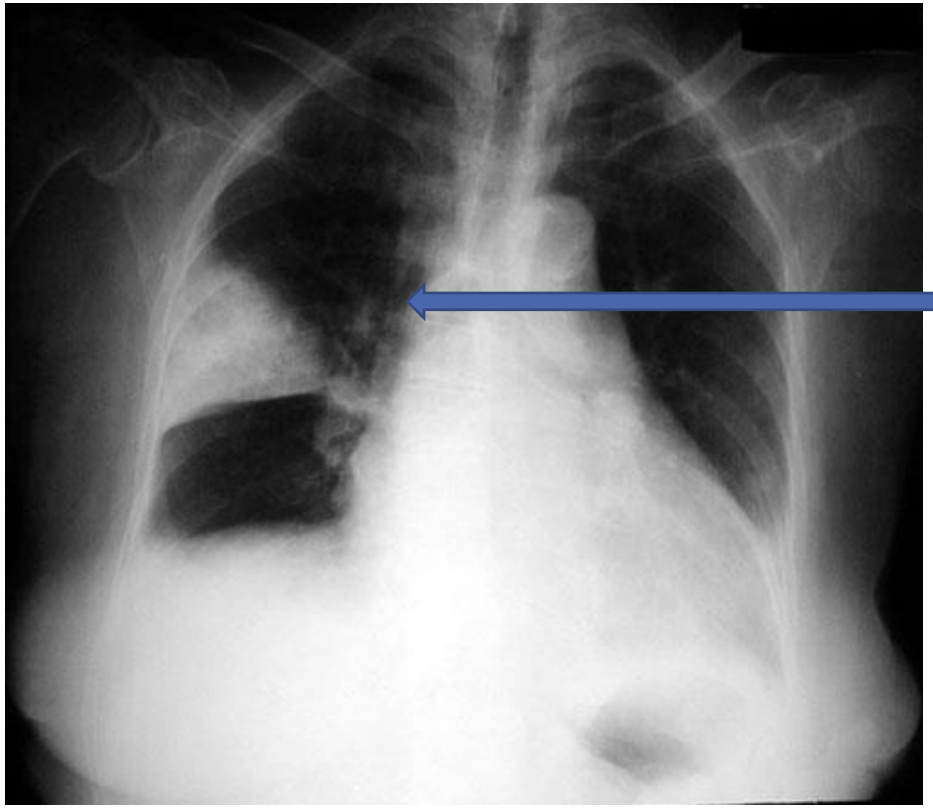
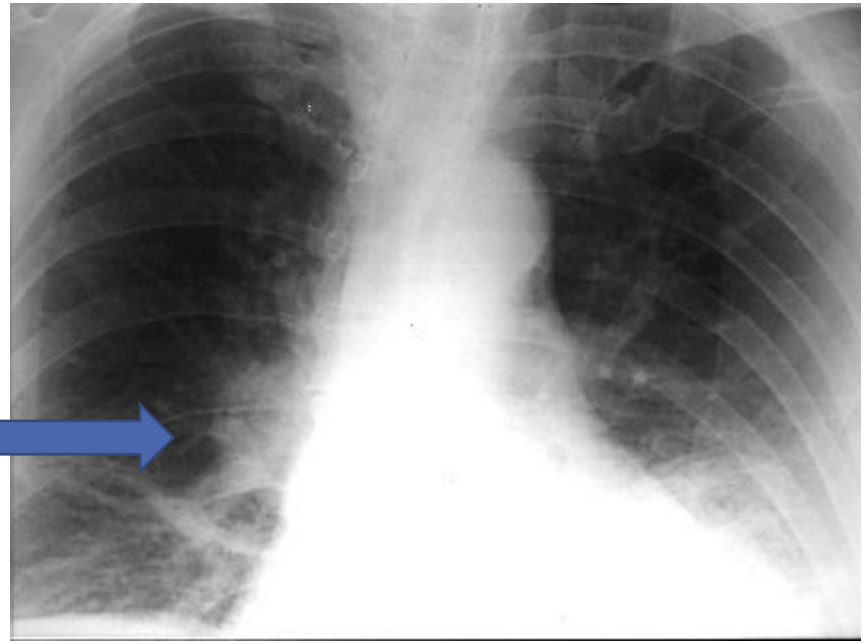
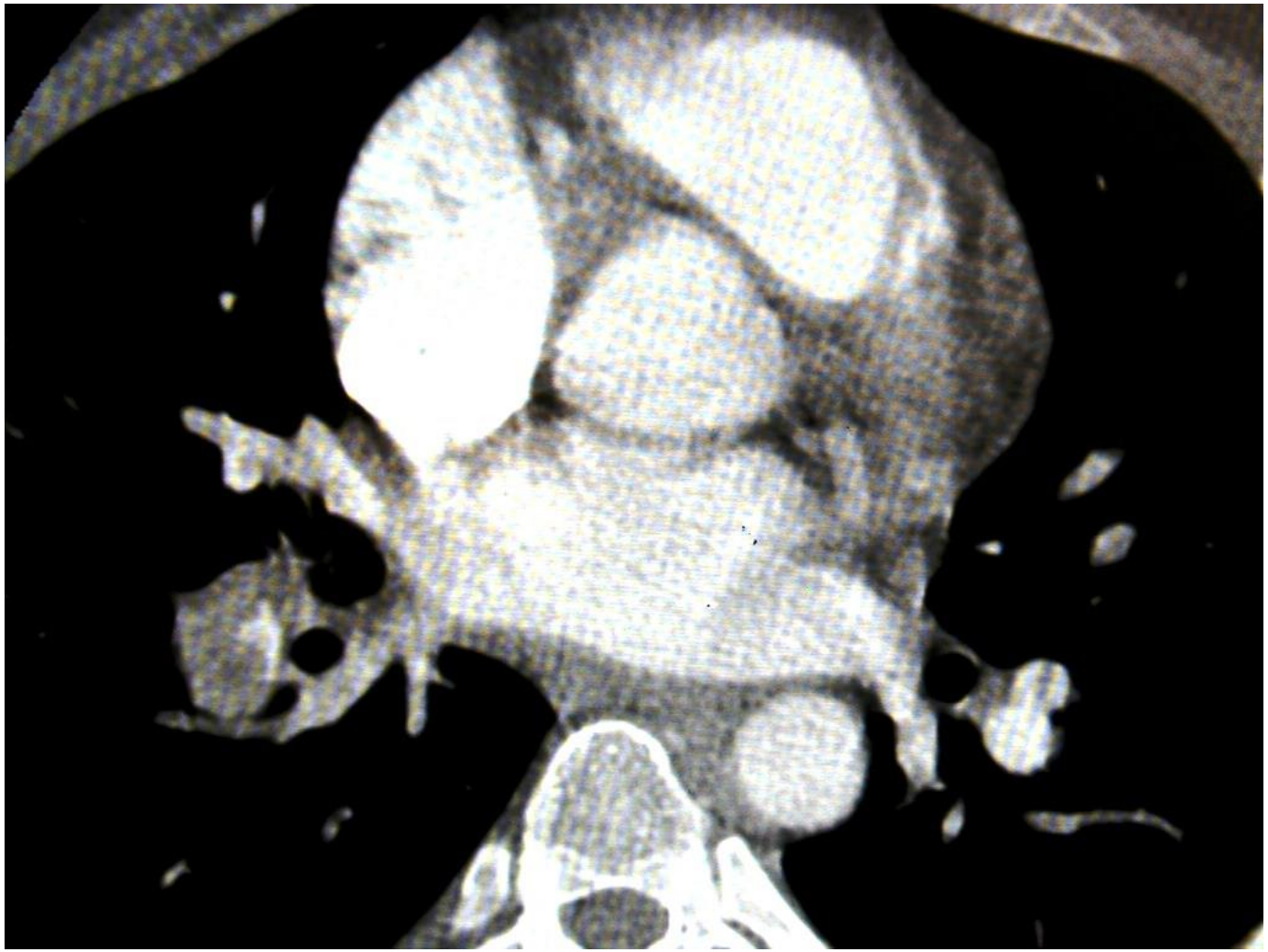


Hampton's hump

Westermark's sign



CTA SCAN



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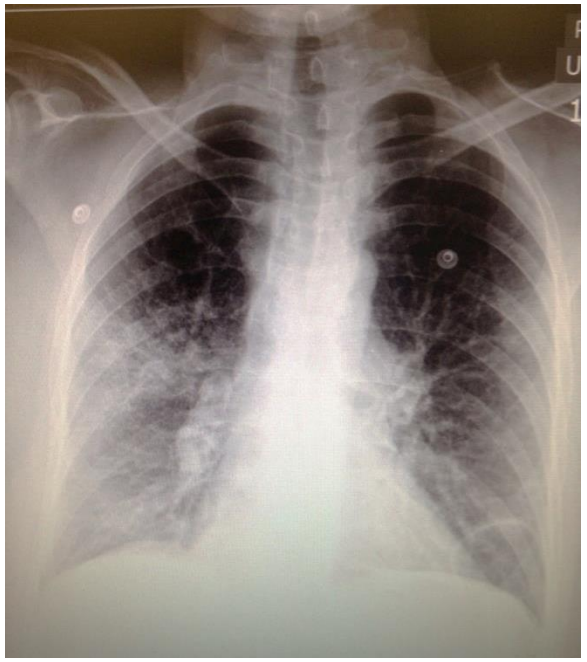
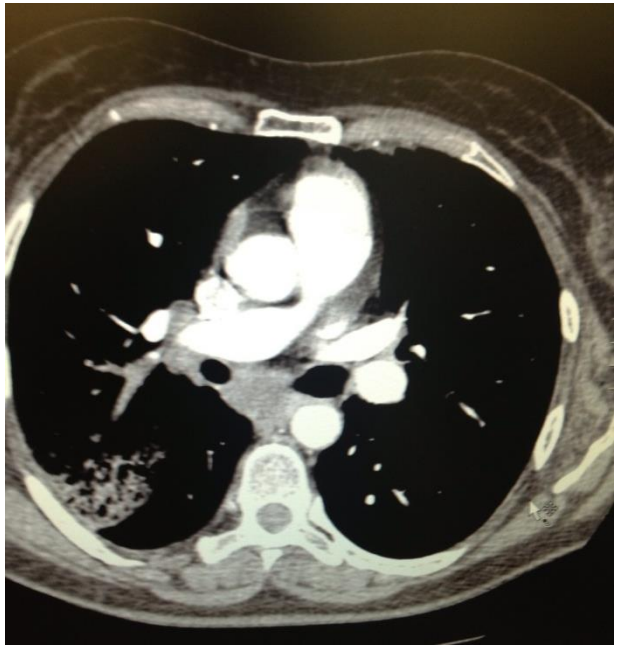
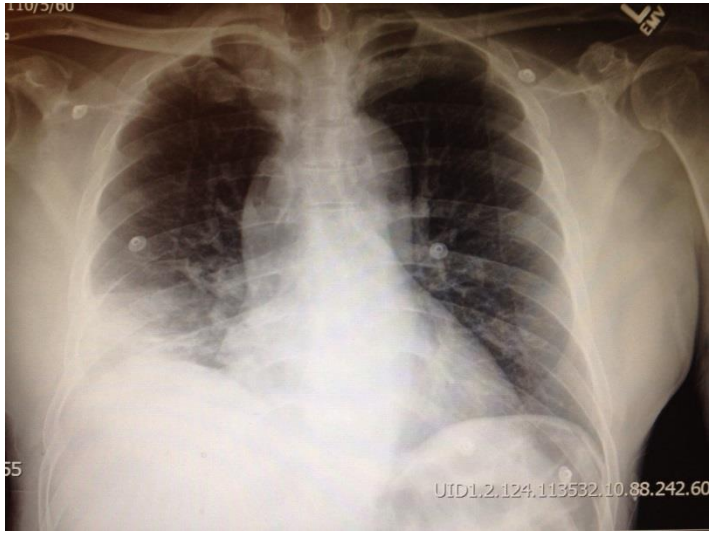
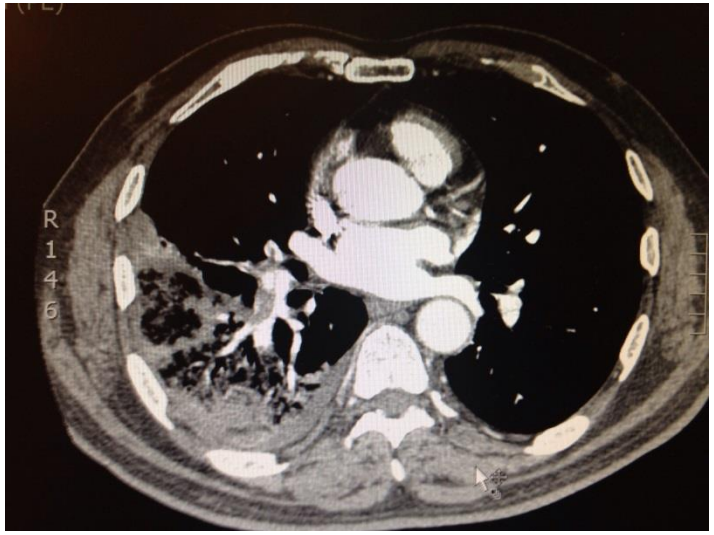
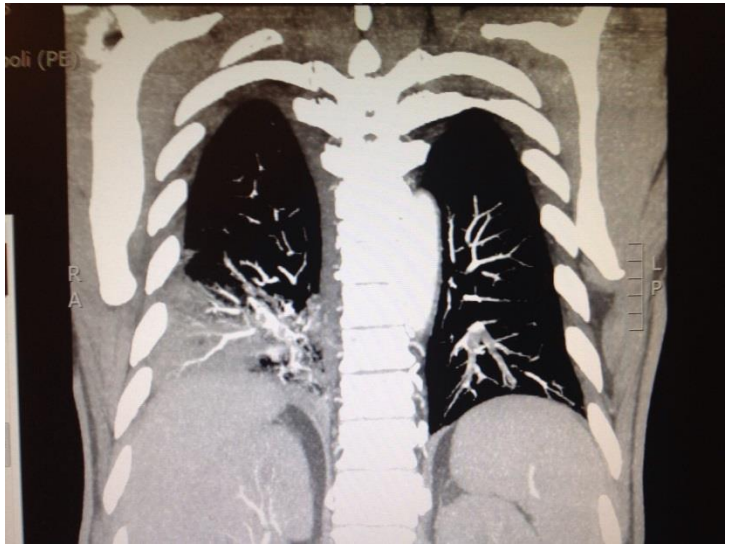


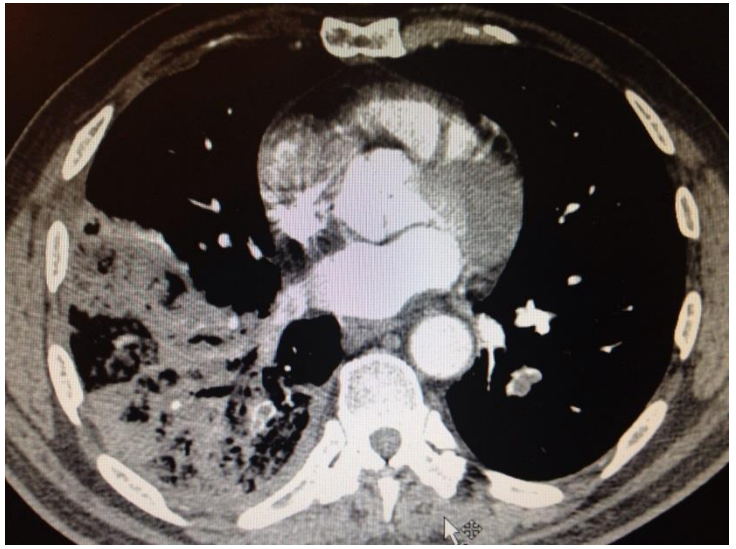
Hampton's hump











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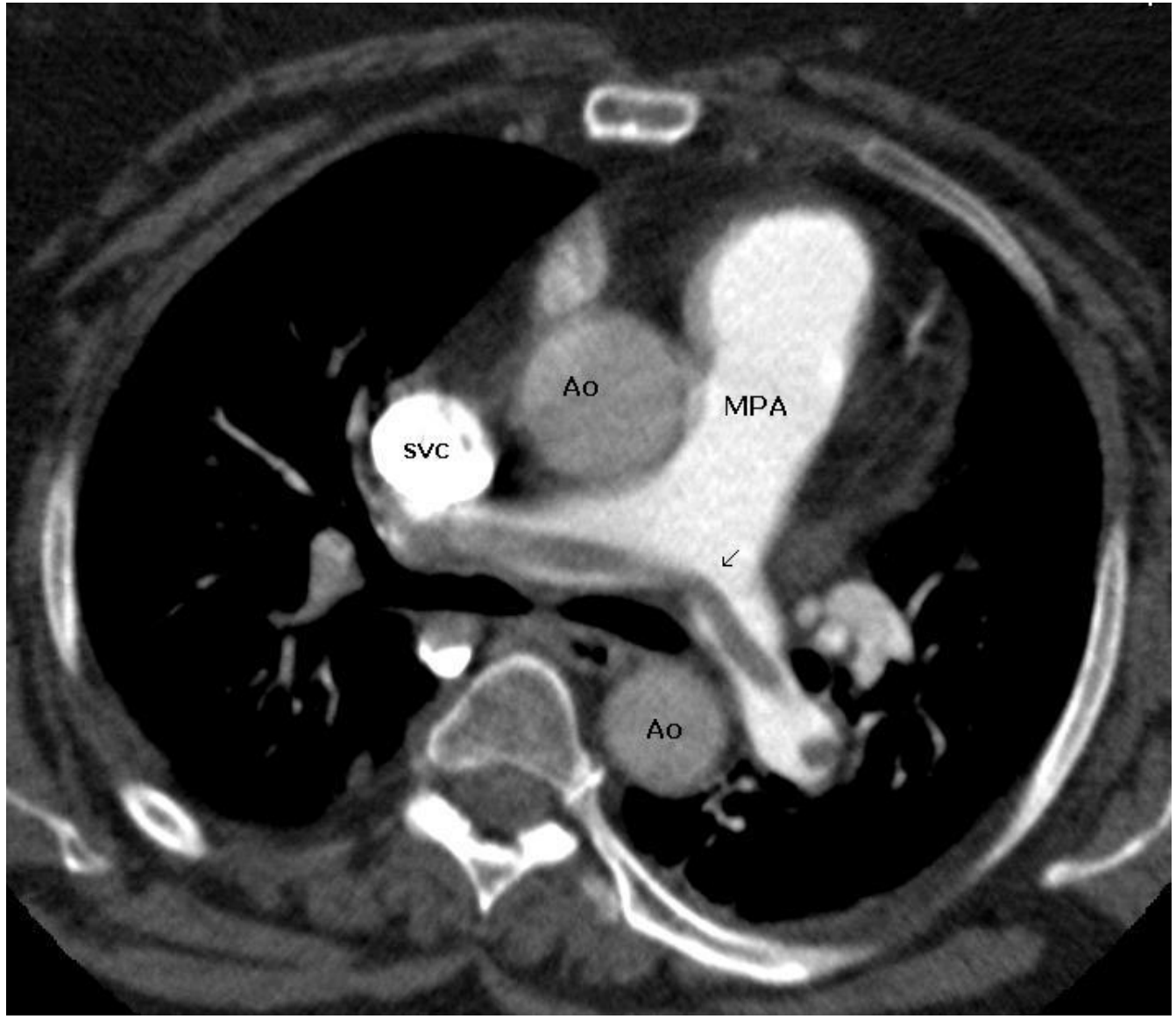
SADDLE PE



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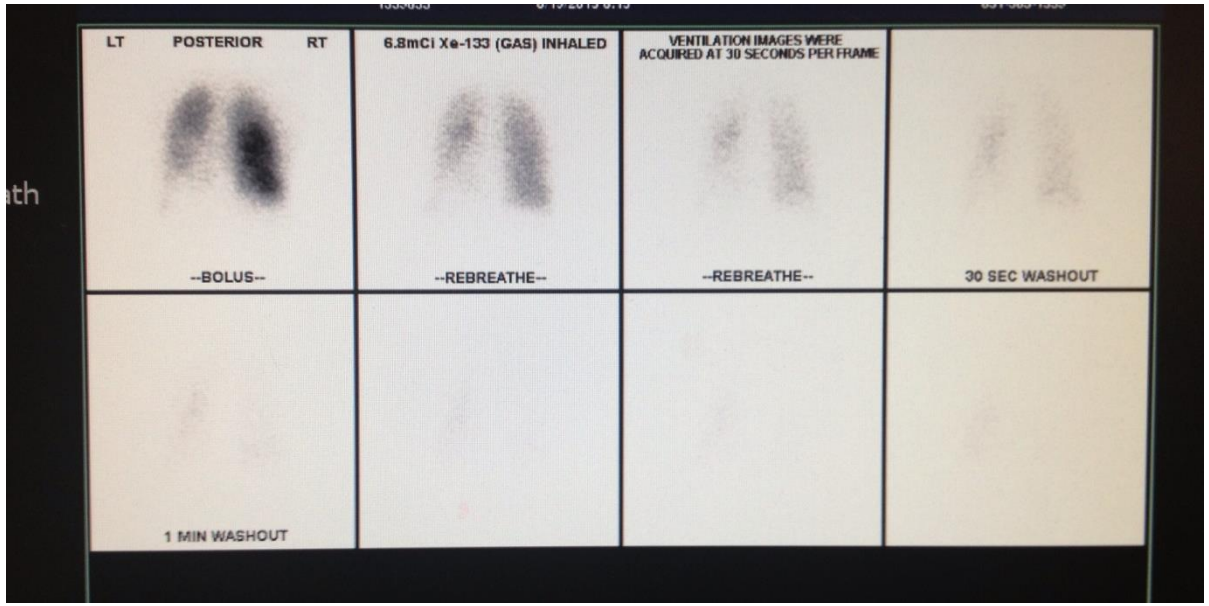
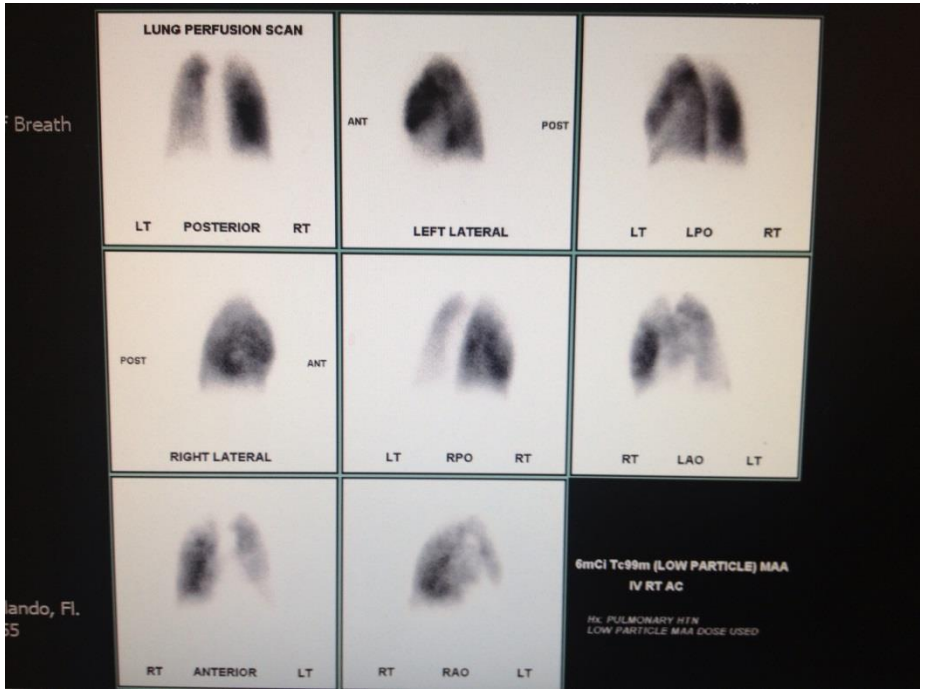
VQ SCAN

- If low probability with low clinical risks
  - Bye, bye!
- If low probability with high clinical risks
  - Needs to do further tests
  - Doppler, CTA, angiogram…
  - Between 4-40% (~14%) it can still be PE





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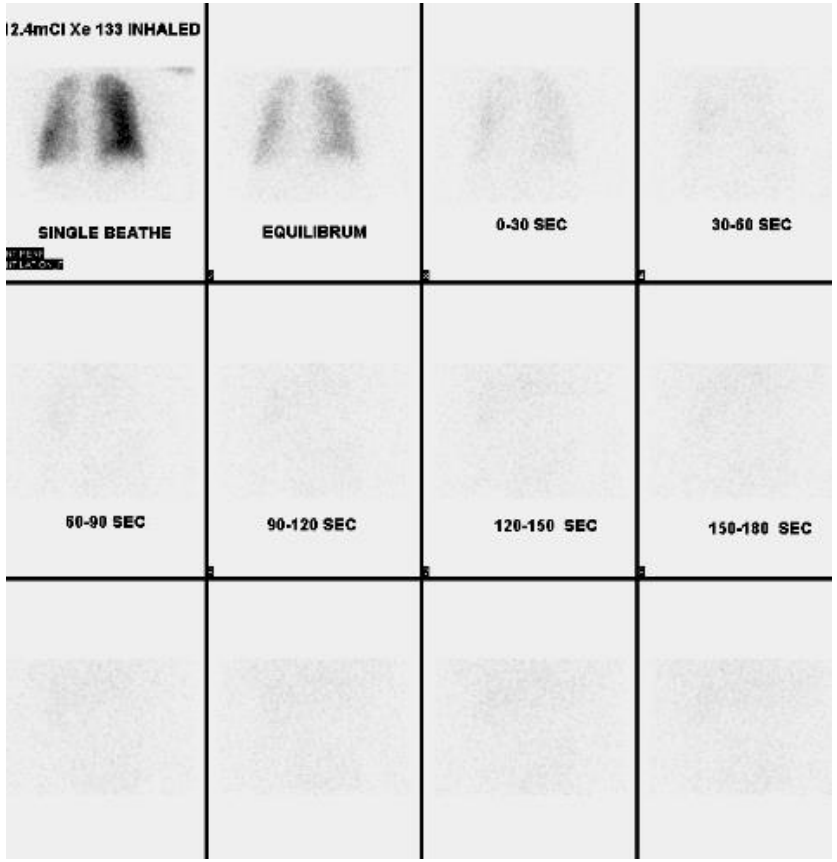

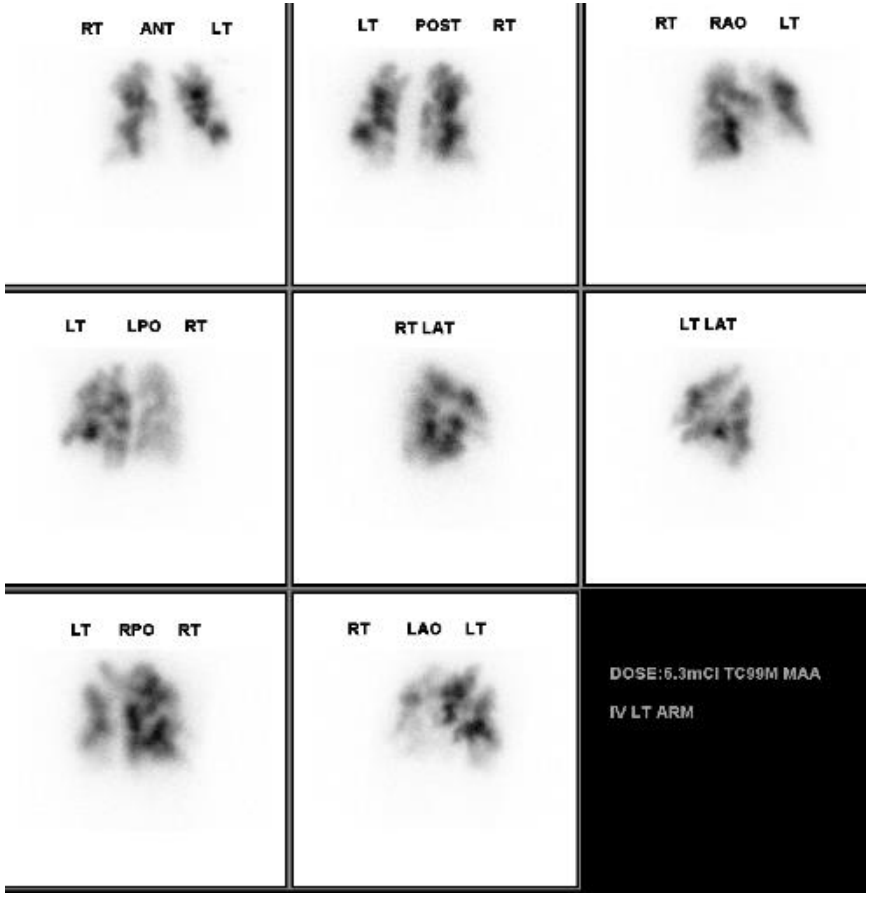

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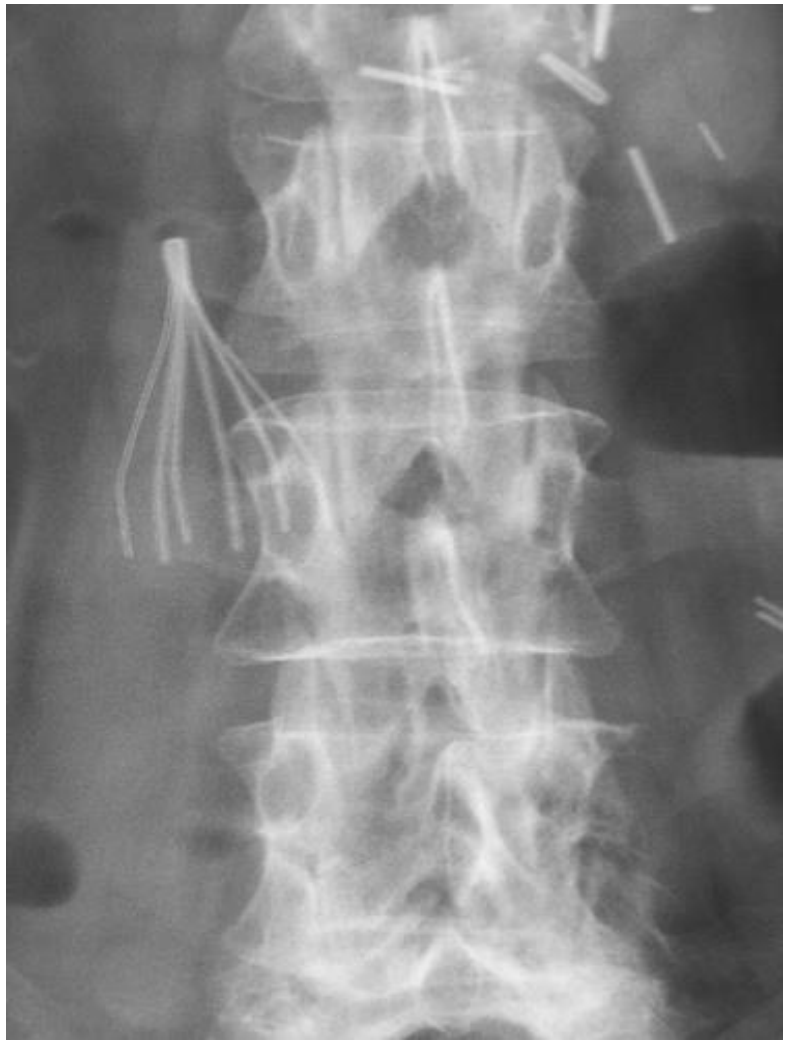
PULMONARY ANGIOGRAM

PULMONARY EMBOLISM

- Management
  - Maintain the airway.
  - Support breathing.
    - High-flow oxygen or assist ventilations as indicated.
    - Intubation may be indicated.
  - Establish IV access
  - Monitor vital signs closely.
  - Anticoagulation
    - Heparin, Lovenox, warfarin, tPA
  - Pulmonary angiogram
  - Greenfield (IVC) filter

IVC FILTER



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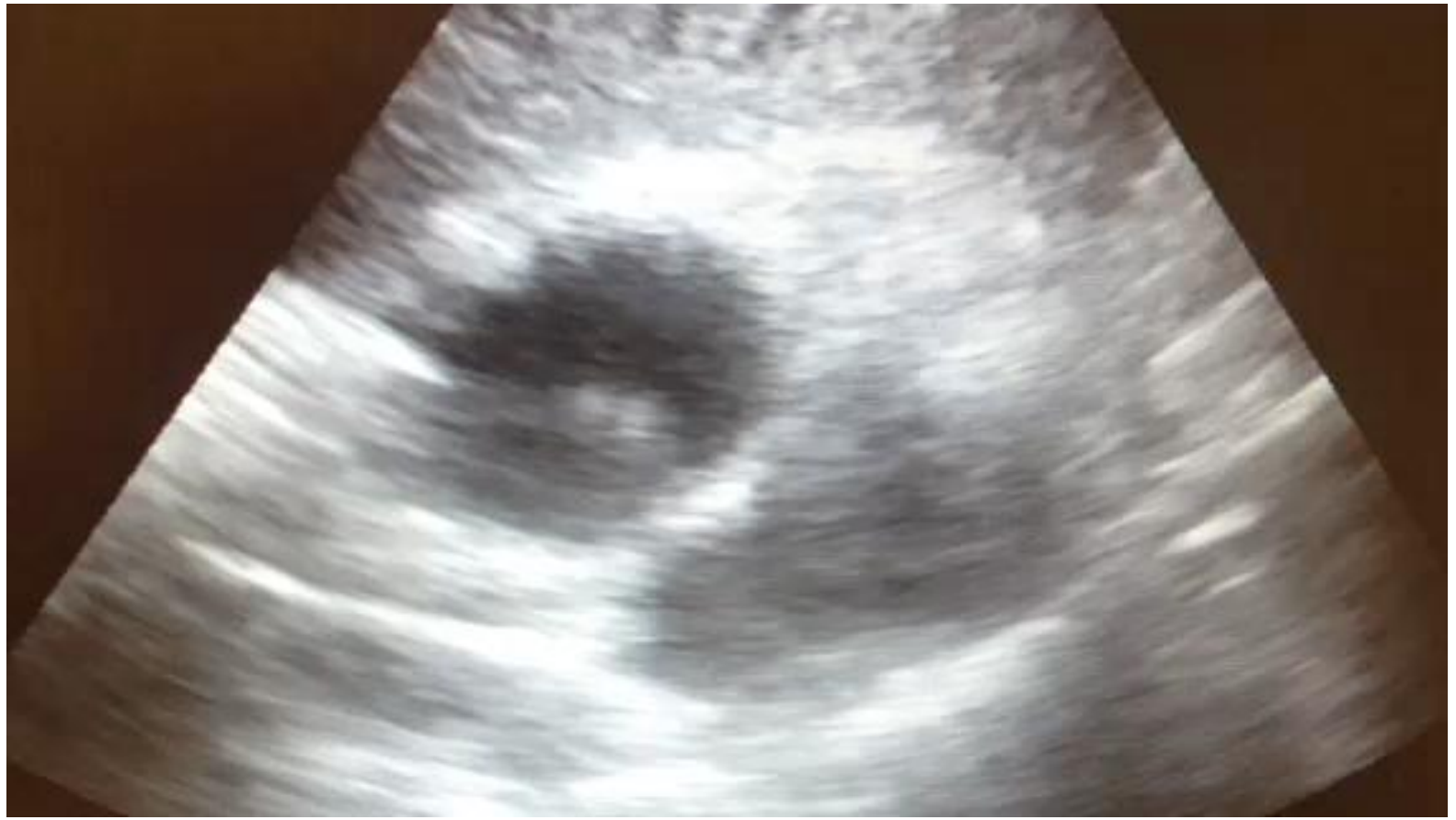
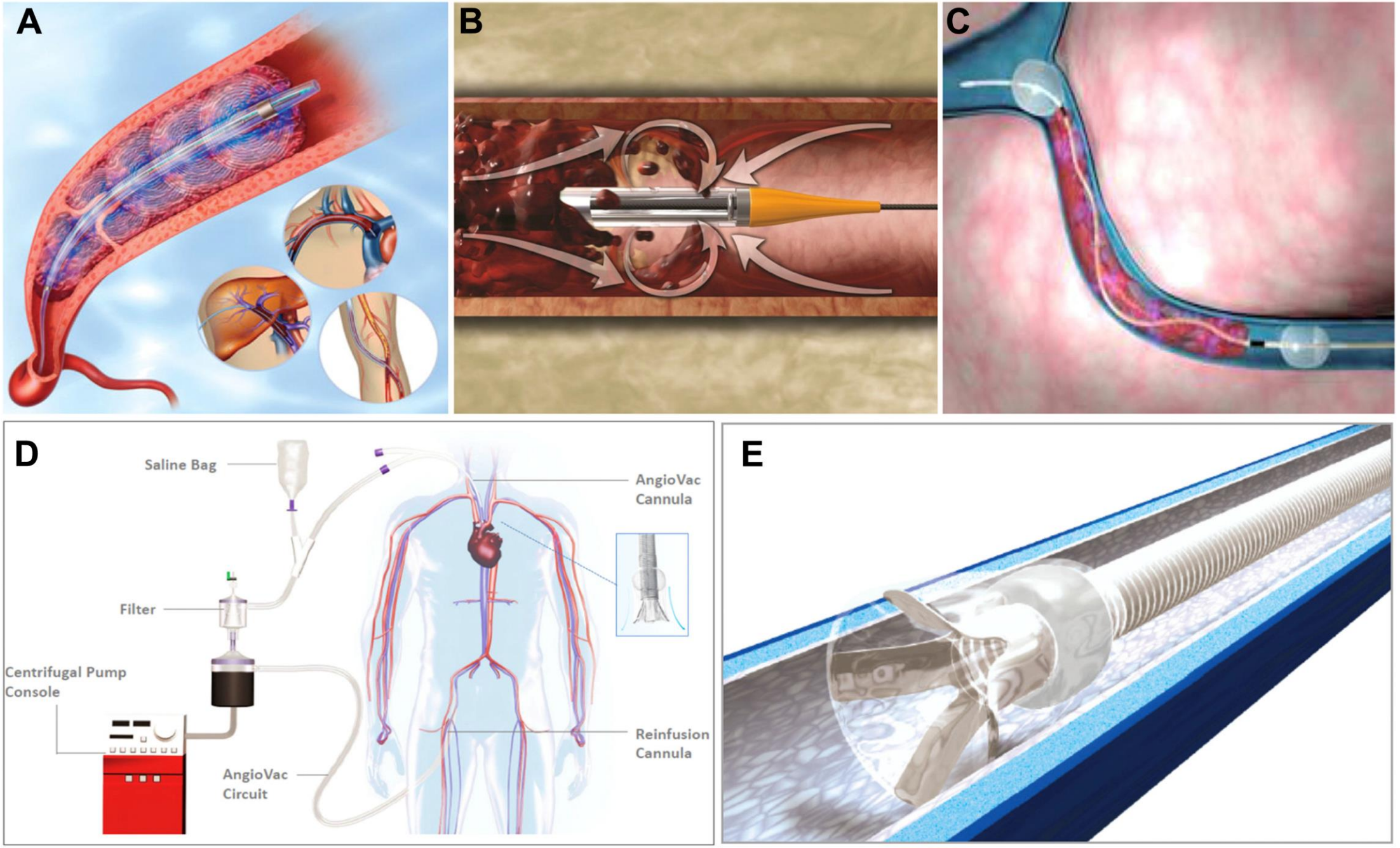
Florida Emergency Medicine Clerkship

THROMBOLYTICS / EKOS

- Definitive:
  - Hemodynamic unstable
- Controversial:
  - 40% or more of pulmonary vessels involved
  - Complete obstruction of blood flow to one or more lobes
  - Severe hypoxia
  - Right side heart failure
    - JVD, hypotension, high PCWP





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