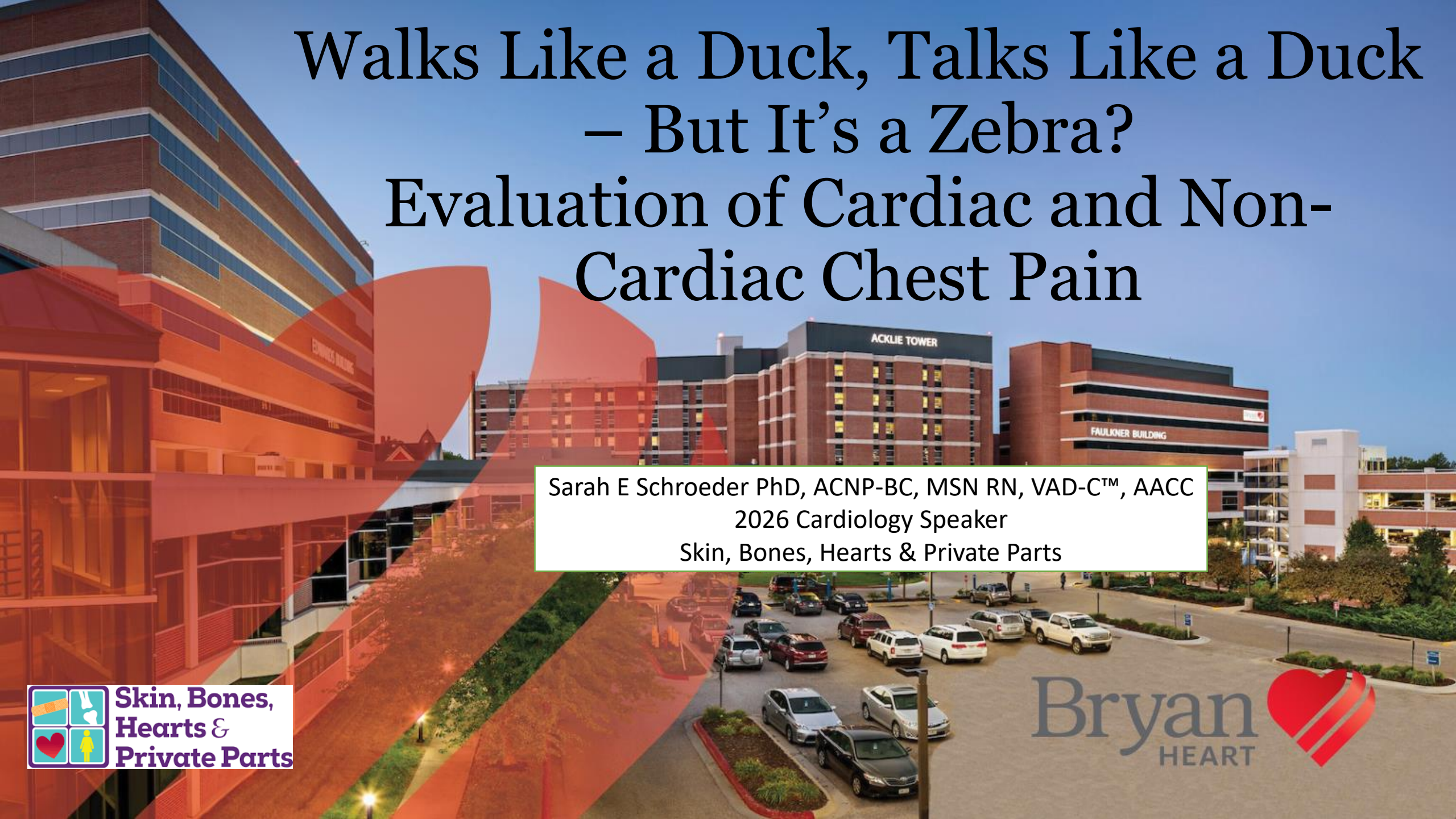
Walks Like a Duck, Talks Like a Duck – But It's a Zebra? Evaluation of Cardiac and Non-Cardiac Chest Pain



Sarah E Schroeder PhD, ACNP-BC, MSN RN, VAD-C™, AACC
2026 Cardiology Speaker
Skin, Bones, Hearts & Private Parts

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Disclosures

- Investigator-Driven Research Grant, Abbott Labs, 2023-2026
- VAD Coordinator Professional Development Grant, ICCAC, 2024-2026

I will occasionally discuss patient scenarios – any pictures directly of patients are displayed following consent and will be noted

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I have a paid subscription to Vecteezy

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Objectives

- Overarching Theme of Causes of Chest Pain
- Complex Evaluation and Treatment of Non-Ischemic Chest Pain
  - Gastroesophageal Reflux Disease (GERD)
  - Acute Pulmonary Embolus (PE)
  - Acute Aortic Dissection
  - Hypertension/Left Ventricular Hypertrophy
  - Pericarditis
  - Acute Heart Failure
- Complex Evaluation and Treatment of Ischemic Chest Pain
  - NSTEMI
  - STEMI
- Final PEARLS on Distinguishing Differences Between Types of Chest Pain

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Chest Pain

- Chest pain is **"discomfort or pain that you feel anywhere along the front of your body between your neck and upper abdomen."**

-MedlinePlus

- Poor localization of pain due to lack of sensory fibers in the spinothalamic tracts
- "REFERRED PAIN"

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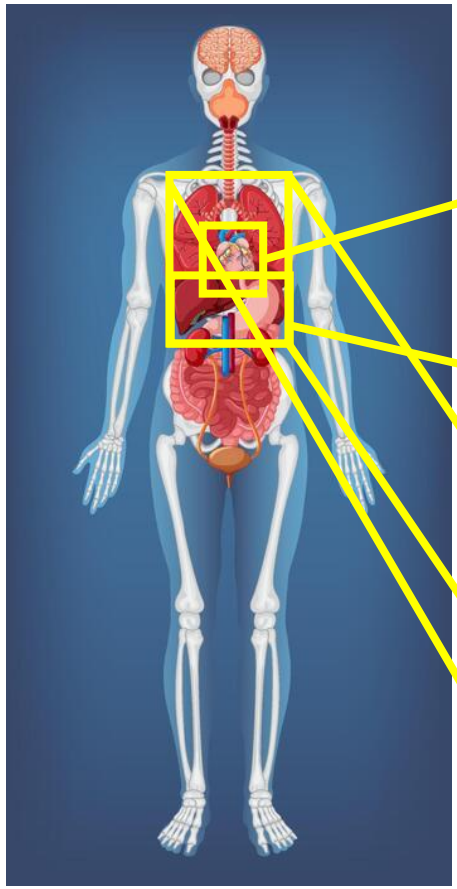
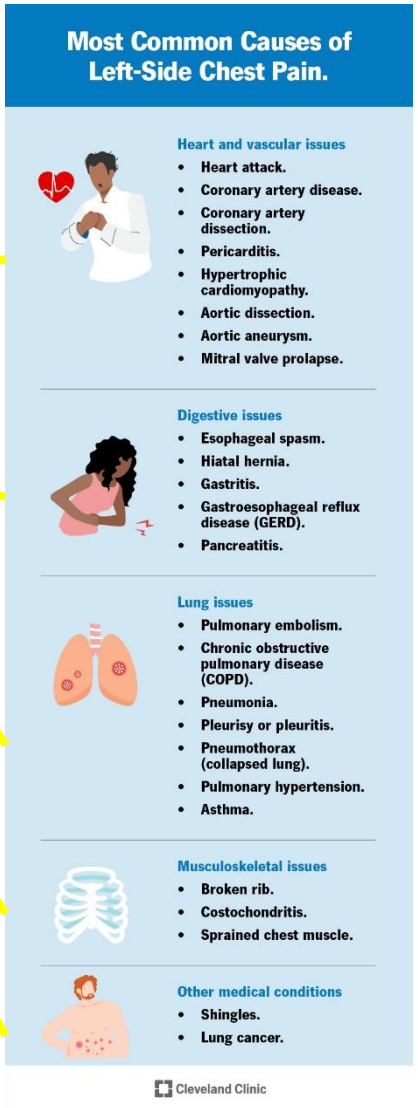
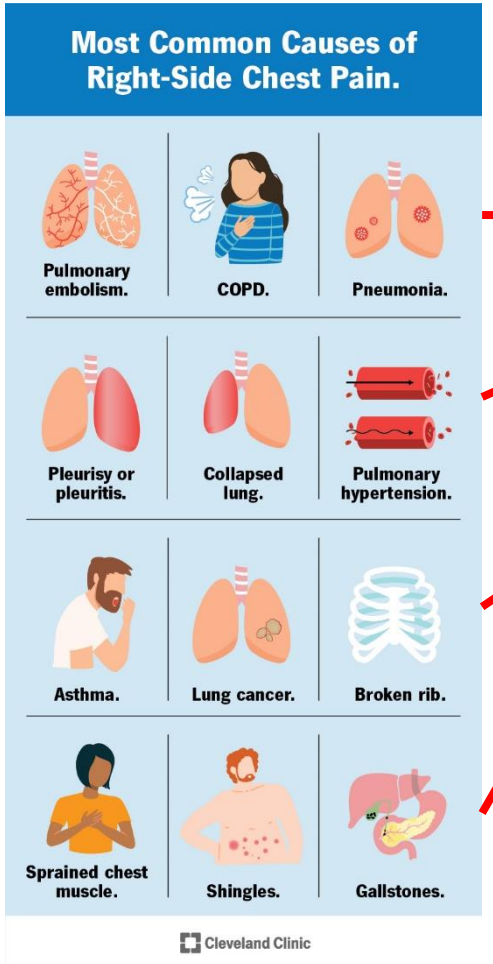
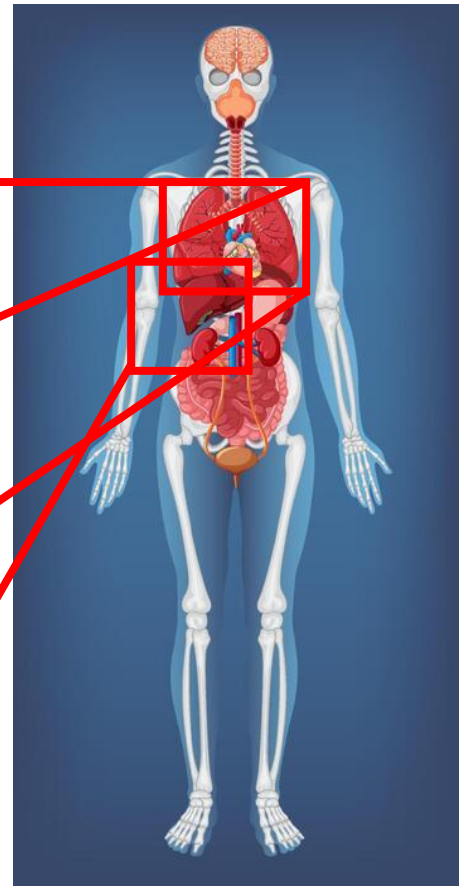
Causes of Chest Pain









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Cleveland Clinic, 2025. What Can Cause Chest Pain on the Left Side?

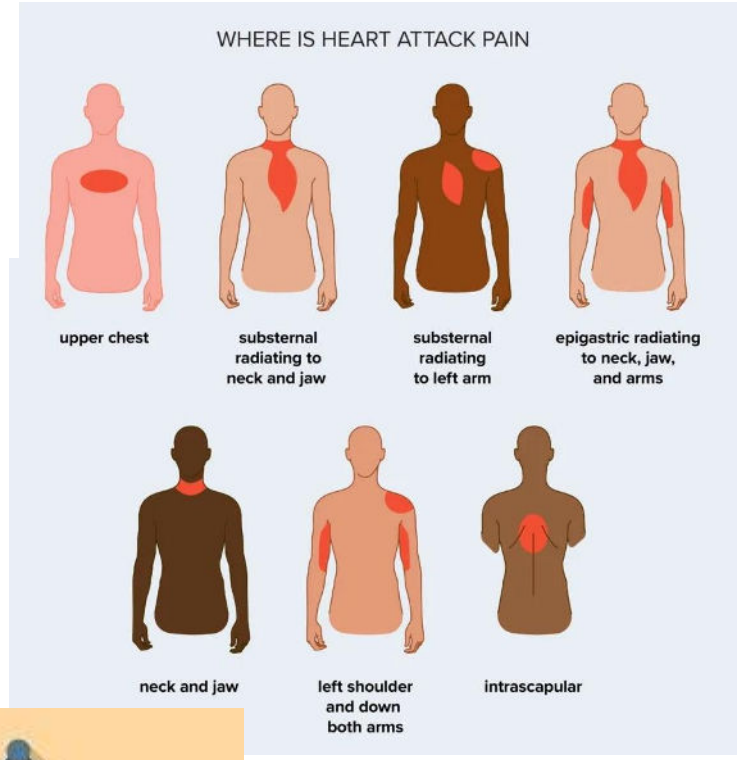
Cleveland Clinic, 2025. What Can Cause Chest Pain on the Left Side?

Complex Evaluation and Treatment: Non-Ischemic Chest Pain Scenarios

PQRST ASSESSMENT

- **P** — BETTER/WORSE
- **Q** — QUALITY OF PAIN
- **R** — REGION/LOCATION
- **S** — SEVERITY
- **T** — TIMING

PROVOKE



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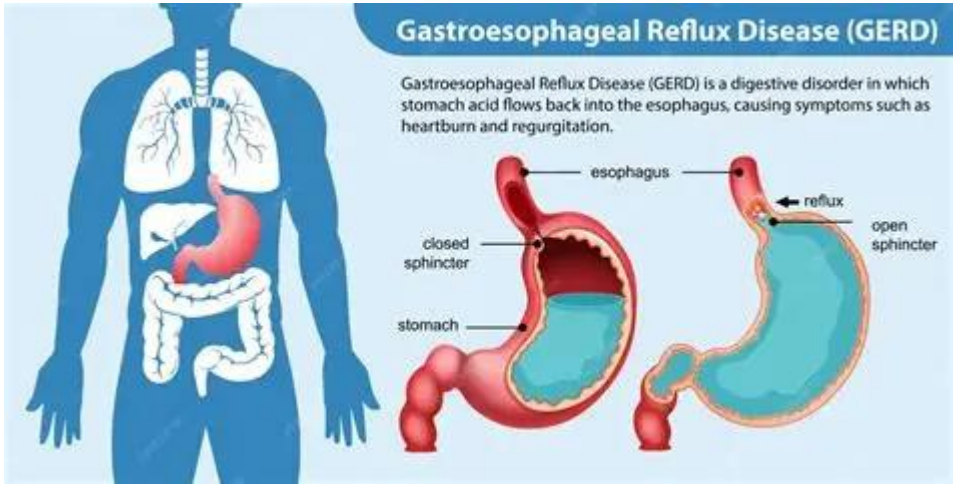
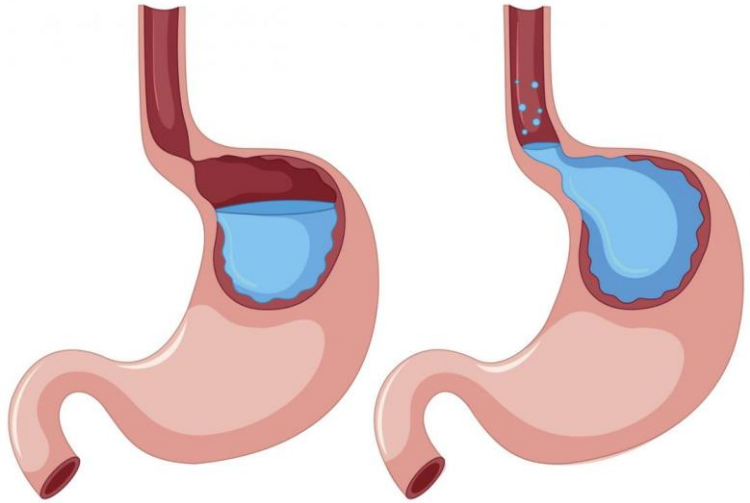
Gastroesophageal Reflux Disease (GERD)

- Stomach contents refluxes back up into the esophagus
- #1 Cause of "Non-Cardiac Chest Pain ER visit"
- Acid Reflux ≠ GERD (acute vs chronic)





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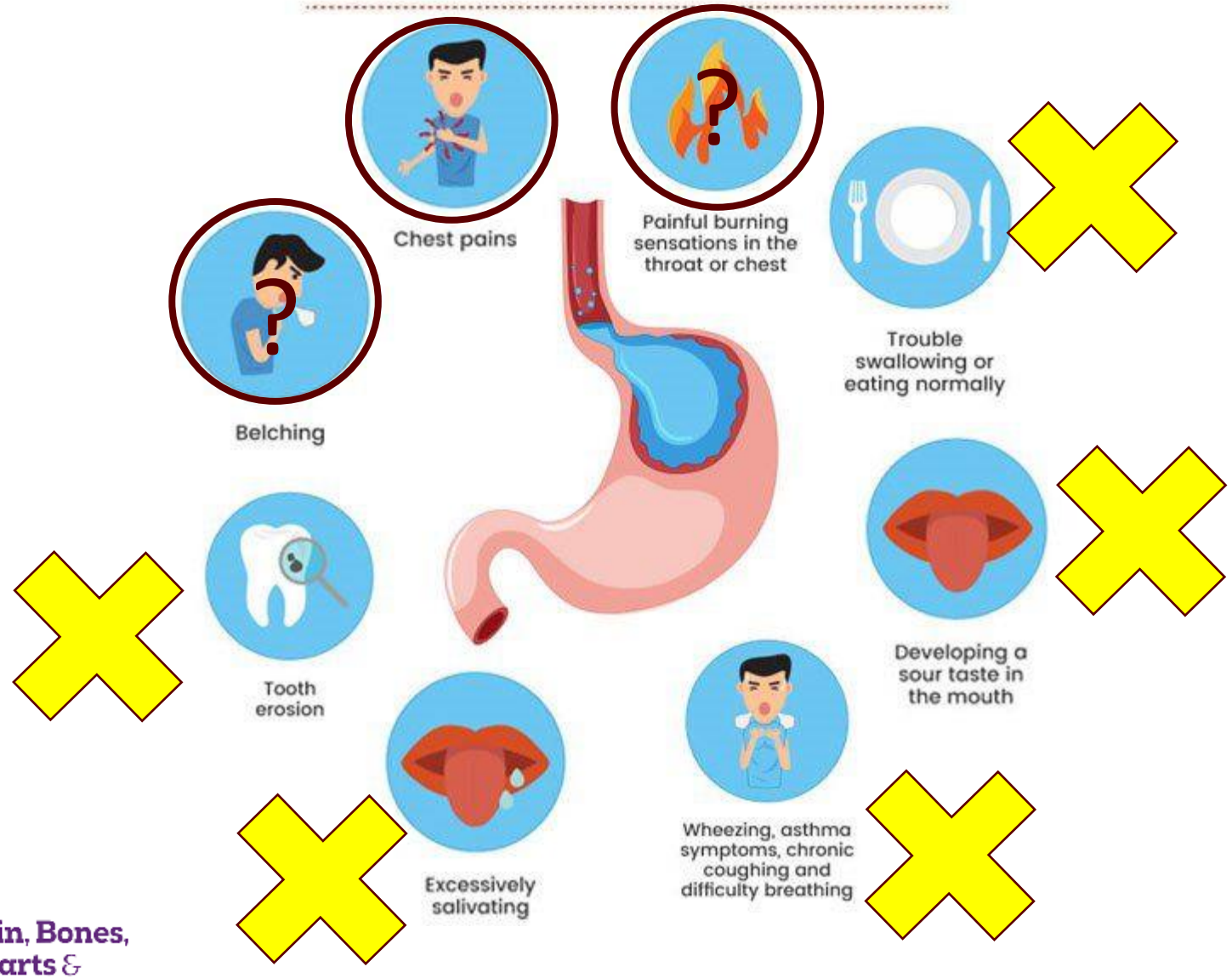
COMMON SYMPTOMS



Best Treatments:

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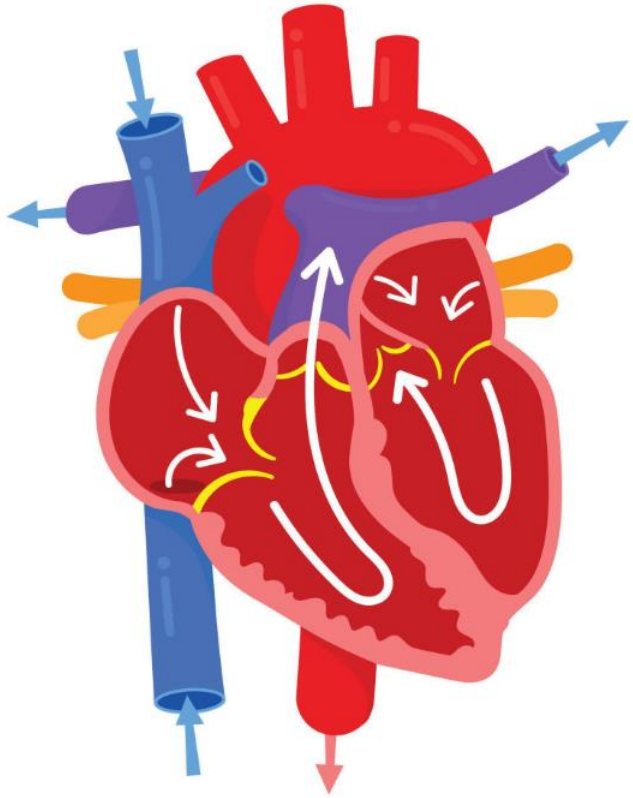
Acute Pulmonary Embolism (PE)

- Sudden blockage in a main pulmonary artery
- May or may NOT come from a DVT
- May be proximal or distal (centrally located in main PA or distally in the outward vessels
  - This is important because of the type of study that needs to be done
- Can be FATAL if symptoms dismissed



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Imaging Modalities for PE Evaluation

- **CT Angiogram of the Chest (with Contrast)**
  - 97-100% Sensitivity with 87-94% Specificity
  - Looking for LARGER vessel occlusions
  - Directly visualize the pulmonary arteries and RV dilation
- **VQ Scan**
  - 93% Sensitivity with 85 % Specificity
  - Used in Pregnancy, Renal Dysfunction, Prohibitive Weights and Iodine Allergies
  - Looks for MISMATCHED defect differences in ventilation and perfusion
  - Calculated as "Large (>75% of segment), Moderate (25-75% of segment) and Small (<25% of segment)"

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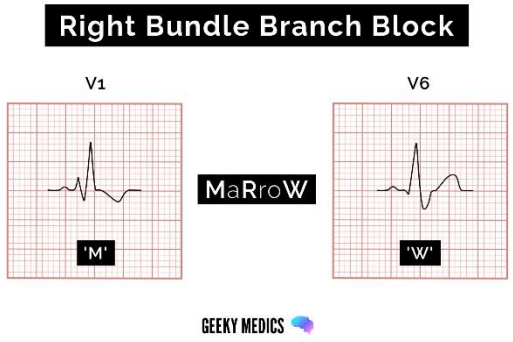
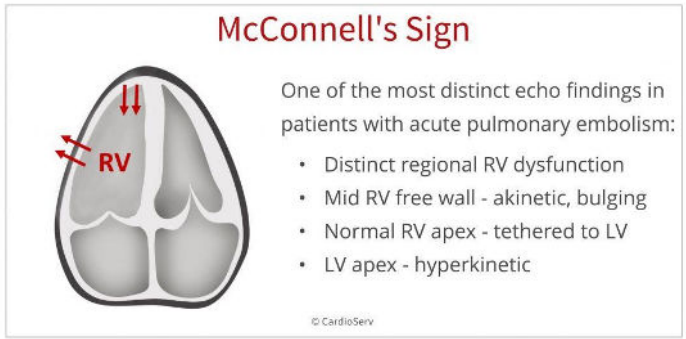
Haase et al., 2019. BMJ doi: https://doi.org/10.1136/bmj.l1945
Mirza & Hashmi, 2023. StatPearls. Lung Ventilation Perfusion Scan (VQ Scan) - StatPearls - NCBI Bookshelf

Abnormalities Seen

- **EKG Changes:**
  - Sinus Tachycardia
  - S1Q3T3=Large S wave in lead I, Q wave and inverted T wave in lead III
  - Right Axis Deviation (I negative and AVF positive)
  - Right Bundle Branch Block (QRS >/=120ms, V1-V2 rSR^1 or rsR^1 ; V6 wide S wave)
  - T- Wave inversion V1-V4 and Inferior Leads (II, III, AVF)



- **ECHO Changes:**
  - RV enlargement
  - RV dysfunction
  - McConnell's Sign:



- **CTA or VQ Scan:**
  - Clots are seen on exam, or mismatch between ventilation and perfusion

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Bundle Branch Block | LBBB | RBBB | Geeky Medics

78-Year-Old Female…

- No history of Coronary Artery Disease (CAD)
- Admitted for elevated Troponin (0.192), Limb Weakness, Paroxysmal Nocturnal Dyspnea (PND), Orthopnea and Dyspnea On Exertion(DOE)
- Had **syncopal** spell in bathroom with severe lightheadness/dizziness
- Cardiology asked to consult for possible "CHF" (weight gain, lower extremity edema, etc…)
- Echo: EF 55%, **right ventricle was severly hypokinetic and dilated**, Moderate tricuspid regurgitation, **severe pulmonary hypertension (RVSP 72mmhg)**

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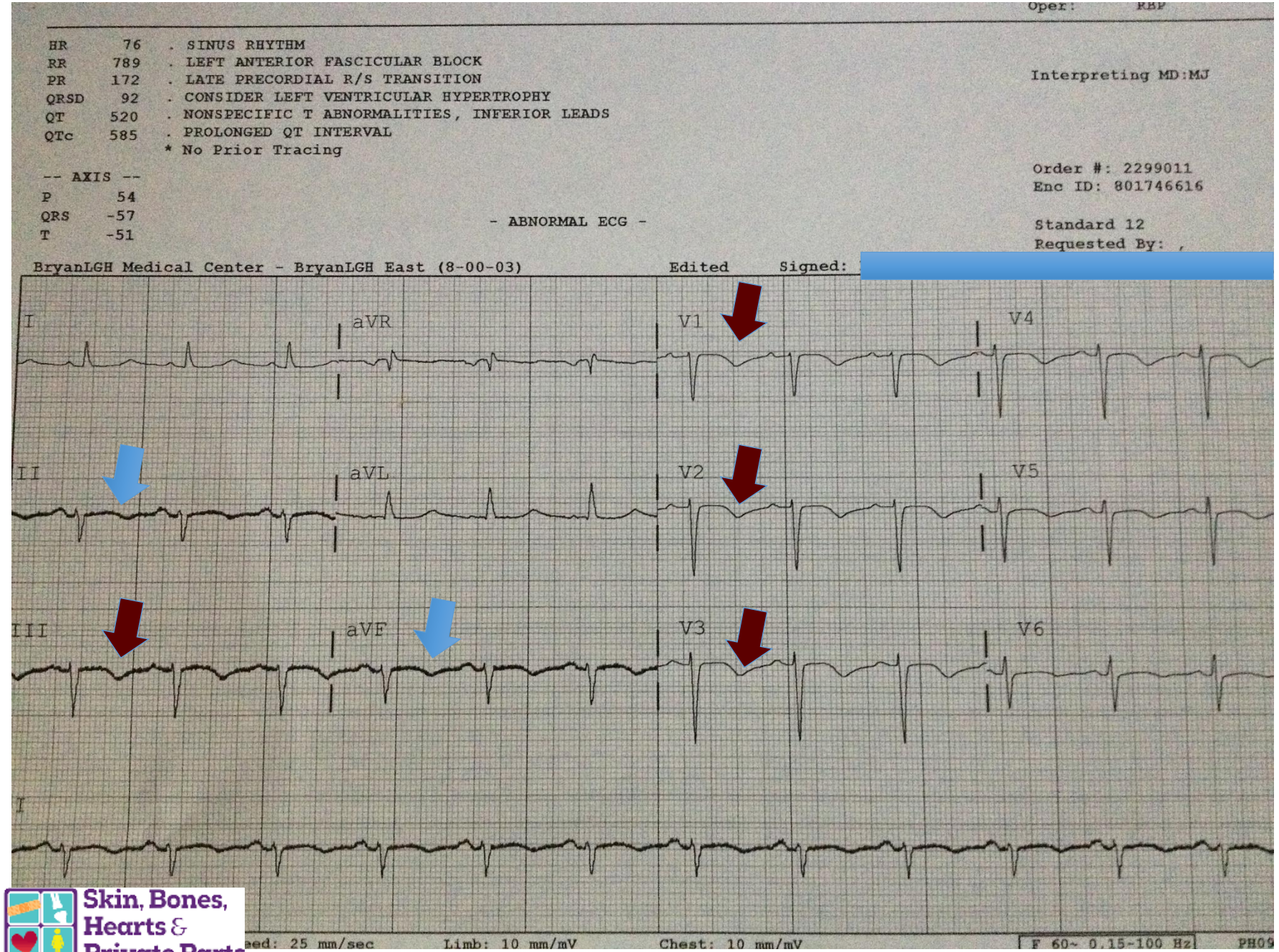

EKG changes:
Sinus Rhythm, HR 76; inverted T waves in II, **III**, AVF, and **V1-V3**-V6

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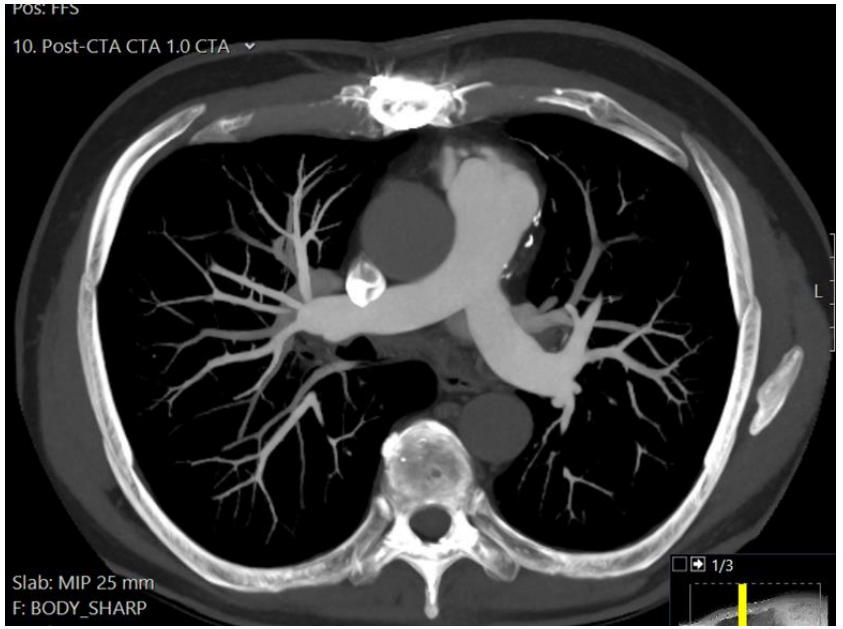
- D-dimer came back at >20 (measures degradation of fibrinolysis).
- CT angio of chest ordered to look for pulmonary embolism.
- Lots of discussion about if she could have it because her creatinine wasn't to where radiology wanted it at (although normal).
- Had to talk to the radiologist personally to tell the story and basically got told that he would do but would be VERY surprised if it would be abnormal.

Got a call 10 minutes later that her CT Angio showed:

LARGE BILATERAL PULMONARY EMBOLUS IN A SADDLE BAG FASHION-extending into both lower lobes and into the upper lobe as well. High degree of occlusion noted especially on the RIGHT.



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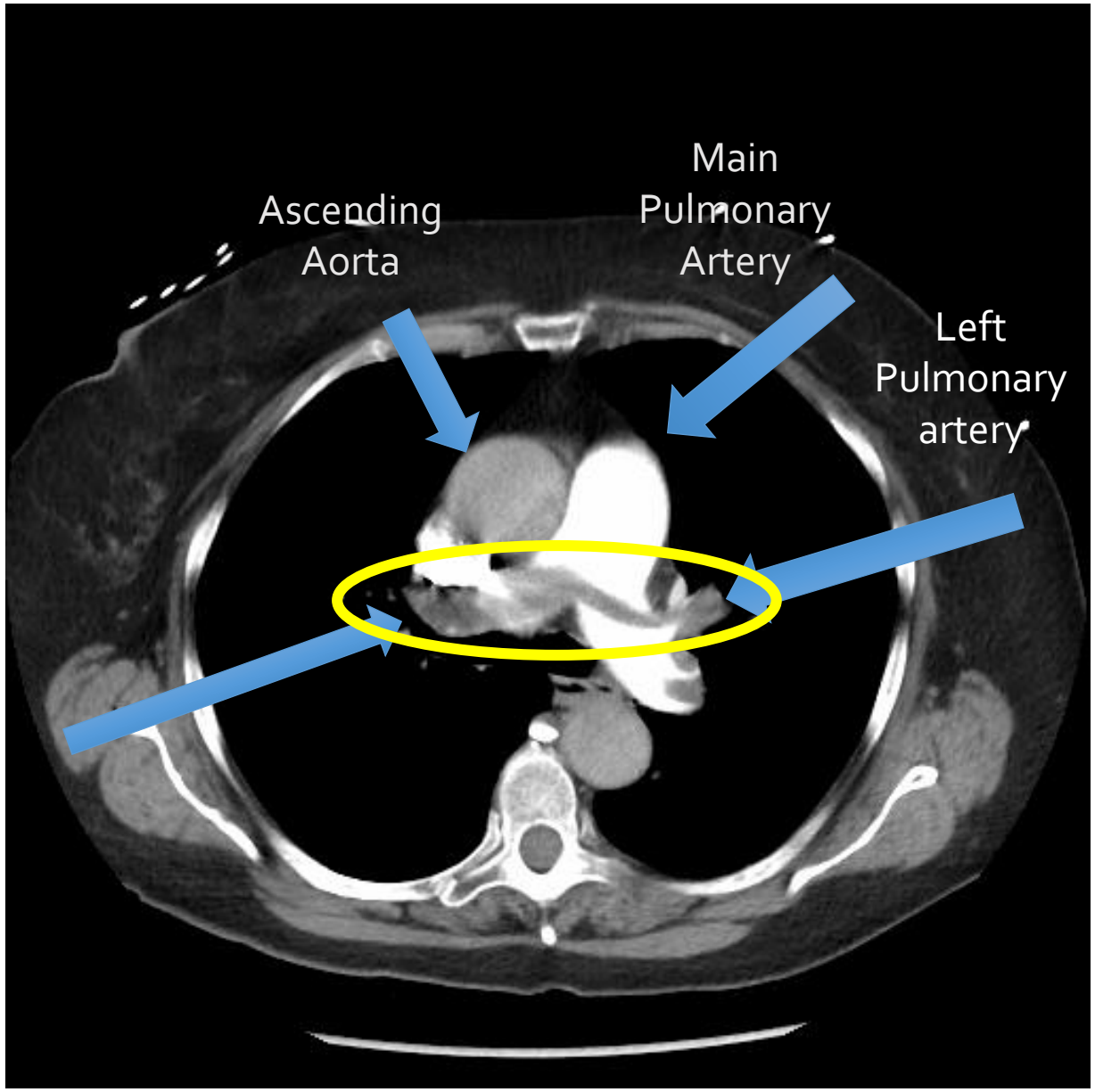

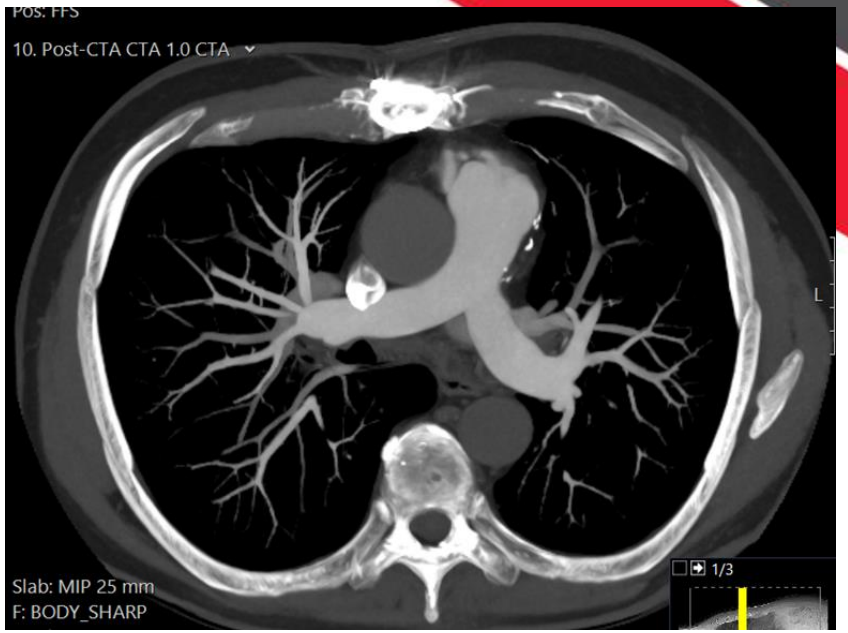

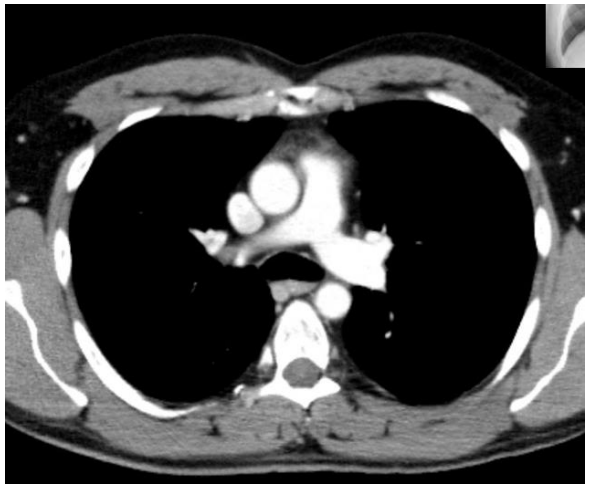

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The Story Goes On…

- After I got called about the embolus, I contacted all of the physicians.
- Talked with CT surgery, they declined to surgically fix it because she was stable and recommended tPA (clot buster)
  - She was not significantly hypoxic and hemodynamically unstable at the time
- She was given tPA in the ICU, started on dobutamine to help her right heart > stayed for another few days
- Scanned her legs (as PE's most often times comes from DVTs): **partial occlusion to the right popliteal vein (acute/subacute) and acute occlusive DVT at both channels in right peroneal veins**
- Discharge ECHO: RV normal in size, EF 45-55%, RV mild to moderate functional reduction and RVSP 37 (mild pHTN)
- Discharged without any issues on: Warfarin with goal INR 2-3 with PCP management

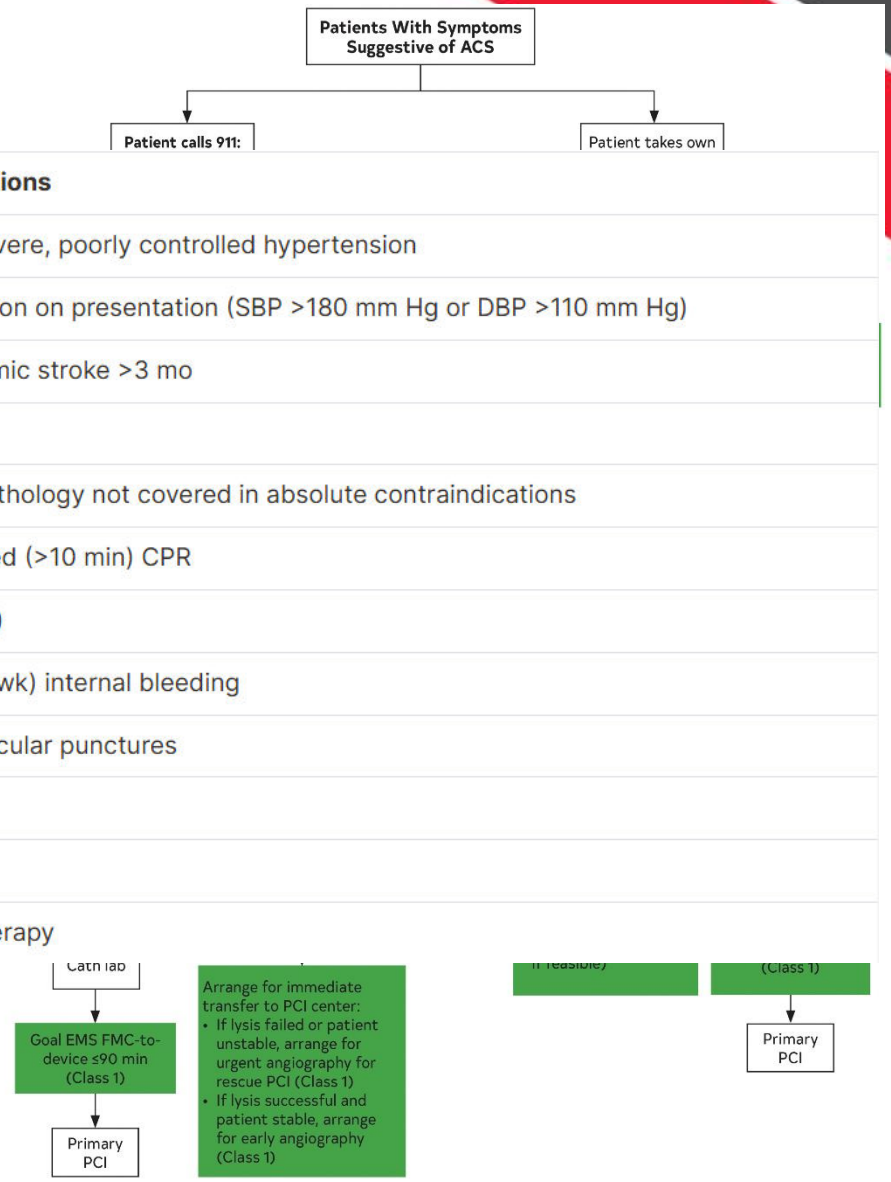
Current Guidelines for tPA Management

Table 14. Absolute and Relative Contraindications for Fibrinolytic Therapy in STEMI*

Absolute Contraindications
Any prior ICH
Known structural cerebral vascular lesion (eg, arteriovenous malformation)
Known malignant intracranial neoplasm (primary or metastatic)
Ischemic stroke within 3 mo except acute ischemic stroke†
Suspected aortic dissection
Active bleeding or bleeding diathesis (excluding menses)
Significant closed-head or facial trauma within 3 mo
Intracranial or intraspinal surgery within 2 mo
Severe uncontrolled hypertension (unresponsive to therapy) (SBP >180 mm Hg or DBP >110 mm Hg)

activator; and tPA, tissue-type plasminogen activator.

Relative Contraindications
History of chronic, severe, poorly controlled hypertension
Significant hypertension on presentation (SBP >180 mm Hg or DBP >110 mm Hg)
History of prior ischemic stroke >3 mo
Dementia
Known intracranial pathology not covered in absolute contraindications
Traumatic or prolonged (>10 min) CPR
Major surgery (<3 wk)
Recent (within 2 to 4 wk) internal bleeding
Noncompressible vascular punctures
Pregnancy
Active peptic ulcer
Oral anticoagulant therapy



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UpToDate, 2025. UpToDate

2025 ACC/AHA/ACEP/NAEMSP/SCAI Guideline for the Management of Patients With Acute Coronary Syndromes: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines | Circulation

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Acute Aortic Dissection

- "Occurs when a tear in the intimal layer of the aorta allows blood to flow between the layers of the aortic wall, creating a false lumen between the intima-media and media-adventitia layer"

-Levy et al., 2024

Mortality Risk: first 48 hours of 0.5% per hour

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Levy et al., 2024. Aortic Dissection - StatPearls - NCBI Bookshelf

Harris et al., 2022. doi:10.1001/jamacardio.2022.2718

- 33% die within the first 24 hours
- 50% die within the first 48 hours
- 2-week mortality is 75% in undiagnosed patients

30-day Survival After Repair = 90%

Sudden, Severe Onset of Pain

Tearing, Stabbing Pain

Usually NO EKG changes

More common in HTN, Turner Syndrome, Marfan's or Bicuspid AoV

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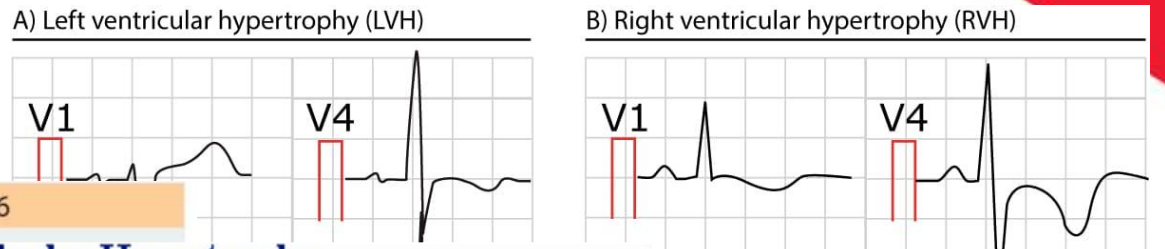
Hypertension/Left Ventricular Hypertrophy

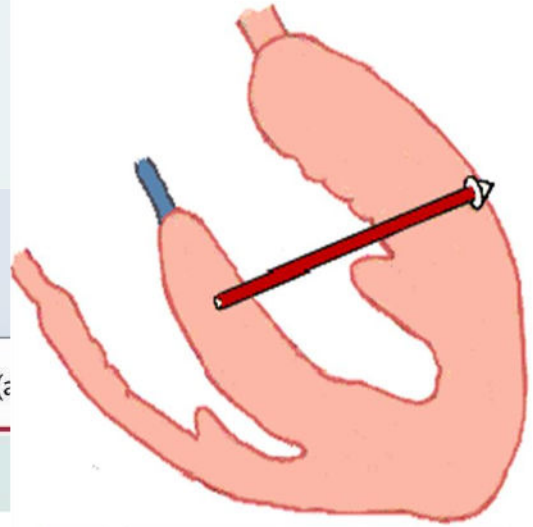


Left ventricular hypertrophy	V1/V2	V5/V6
Sv1		
R v		
Sv3 + RaVL (Cornell voltage)		
Cornell duration product[b]		

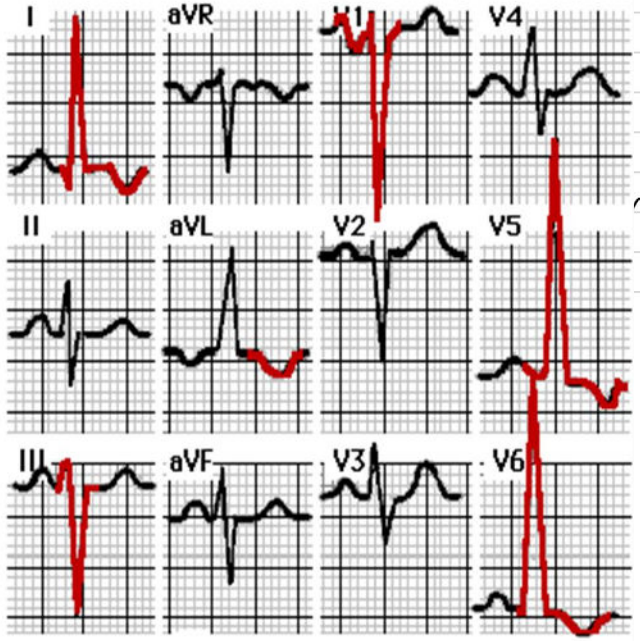
Cornell Duration Product = [S(V3) + R(a

Left Ventricular Hypertrophy

High voltage in limb leads: (R I + S III > 25 mm.)
Or precordial leads: (S V1 + R V5, or S V1 + R V6, >= 35 mm.)
Often, left atrial enlargement. ST - T abnormalities.



Arrow indicates major electrical vector of ventricular depolarization



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Simple Voltage Criteria for LVH on ECG

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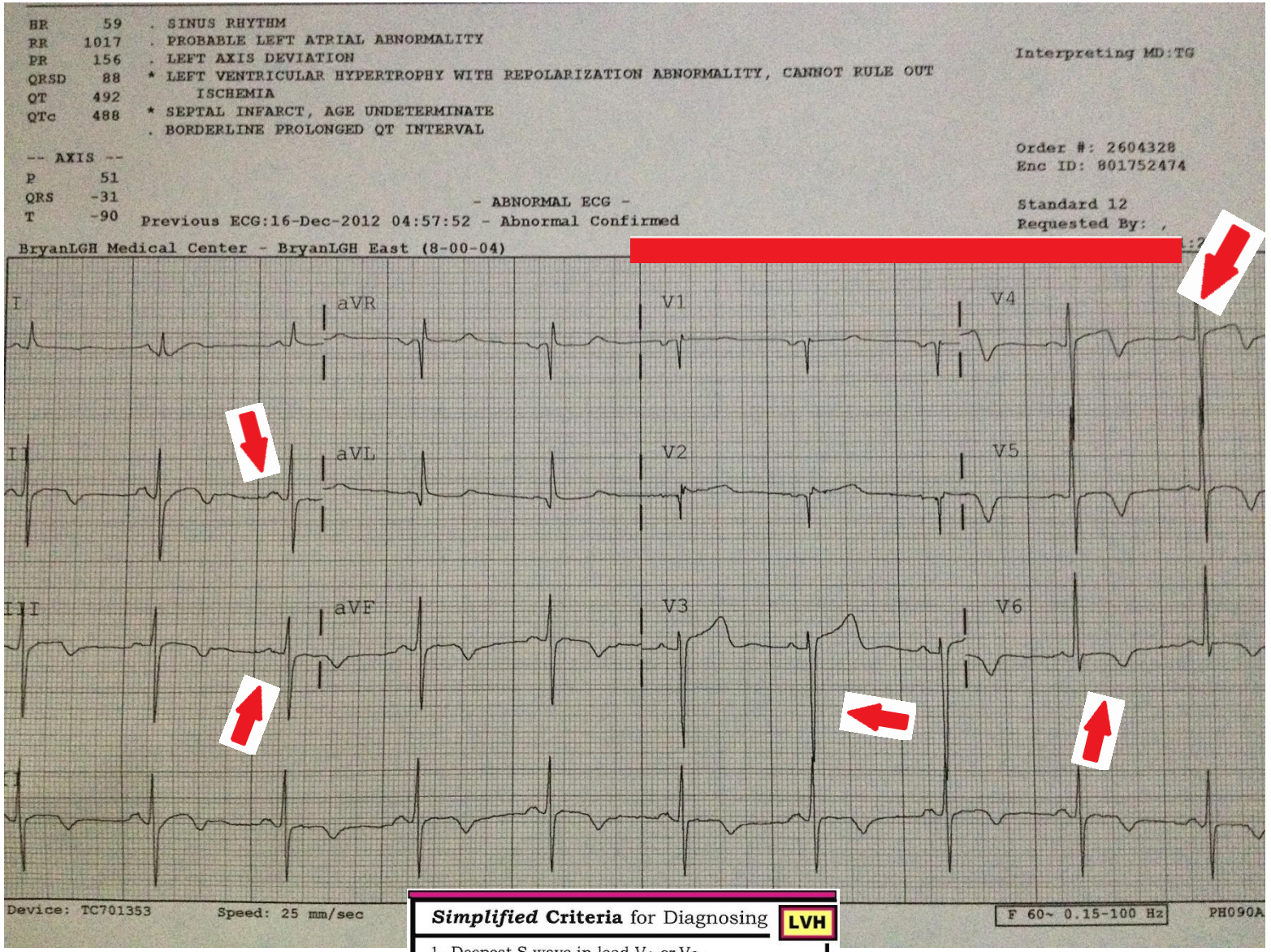
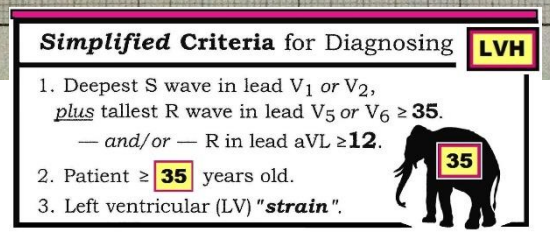
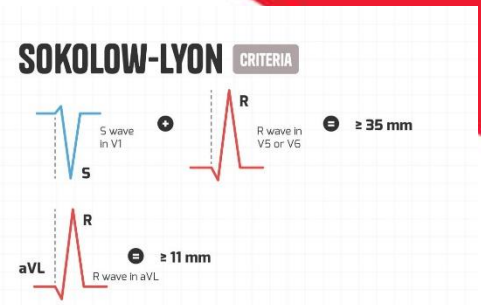
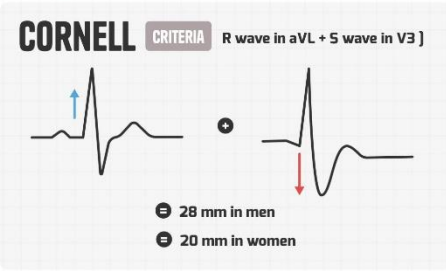
53-Year-Old Male…

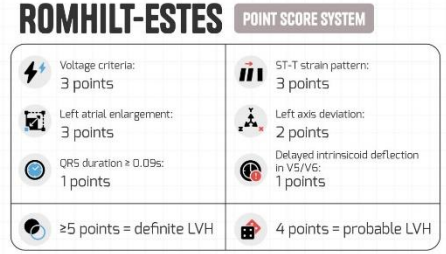
- No history of CAD but does have HTN
- Admitted 2 months before for atypical chest pain
  - Stress at that time showed diaphragmatic attenuation but no ischemia
- Came in as a cardiac alert (at table drinking coffee when he developed **sudden and severe CP**)
- EKG had inconsistent changes because of left ventricular hypertrophy (tall R waves in LV leads or **deep S waves in RV leads, widened QRS or ST-T wave abnormalities, left axis deviation, left atrial enlargement** (double peaked T wave or biphasic P wave)

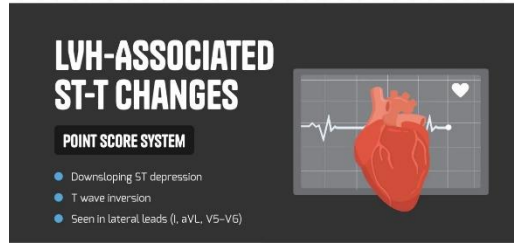












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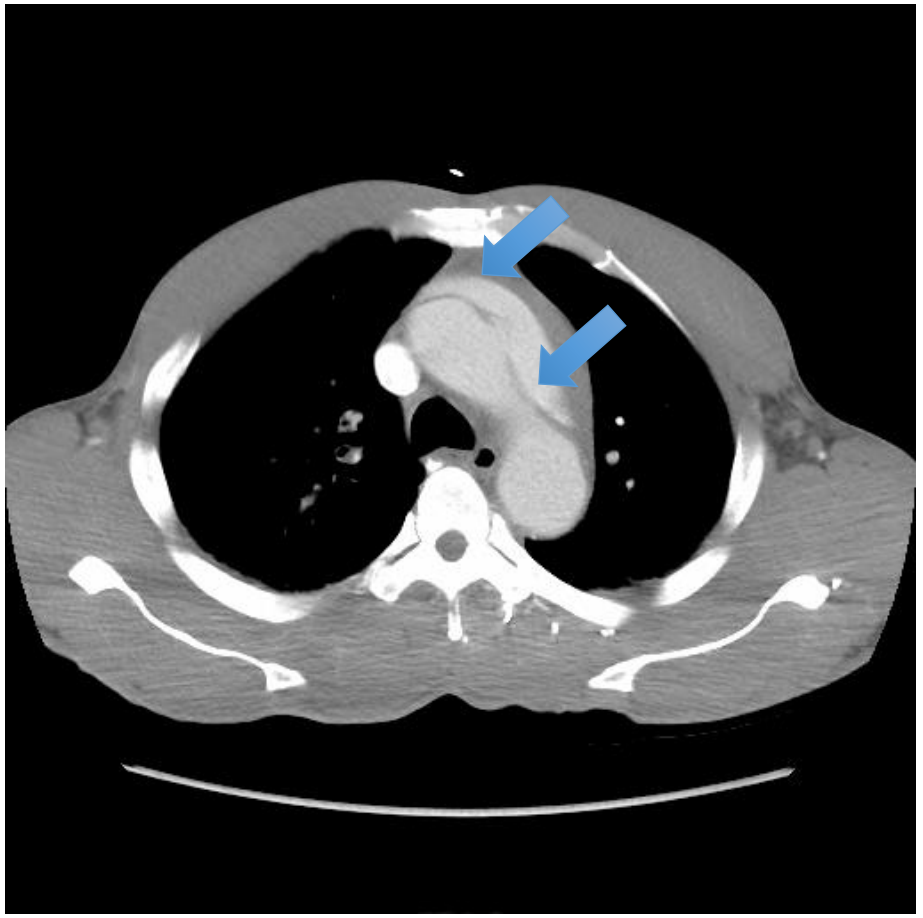
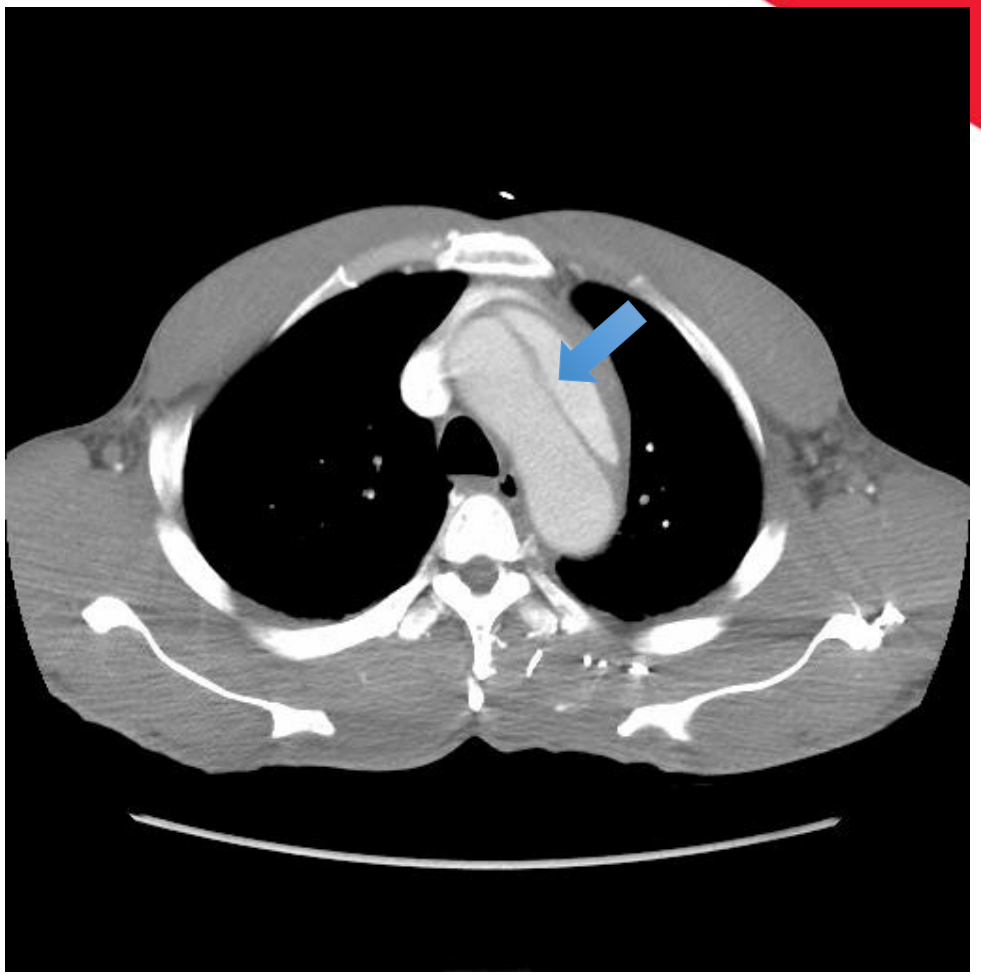
VisualMed (2025): Left Ventricular Hypertrophy ECG Criteria Infographic – Visualmed: Clinical Trials

- Went to the Cath lab because of his excruciating pain
- Had normal Coronary Arteries
- Ordered echo before going to cath as MD's typical protocol
- Echo tech called me and said something is significantly wrong with his AORTA (Aortic Root 4.5cm and Proximal Ascending aorta is 5.2 cm with pericardial effusion)
- Sent him for a CT angio dissection protocol of his chest
- Radiologist immediately called to say: Type A dissection of the ascending thoracic aorta and aortic arch; moderate sized pericardial effusion
- **PATIENT STILL HAVING CHEST PAIN BUT NOW MOVING TO HIS BACK**

When there is a dissection, one can see a FLAP… such as in these images.





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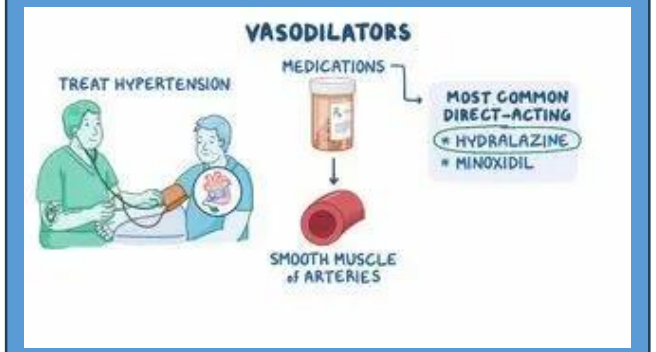
- Stat CT surgery consult and into surgery with in the hour
- Lengthy hospitalization with acute respiratory failure, acute kidney injury, neurologic changes but able enough to bite through his ET tube three different times; PEG and trach placed but ultimately discharged to rehab
- Overall was treated with beta blockers and vasodilators to keep blood pressure in control



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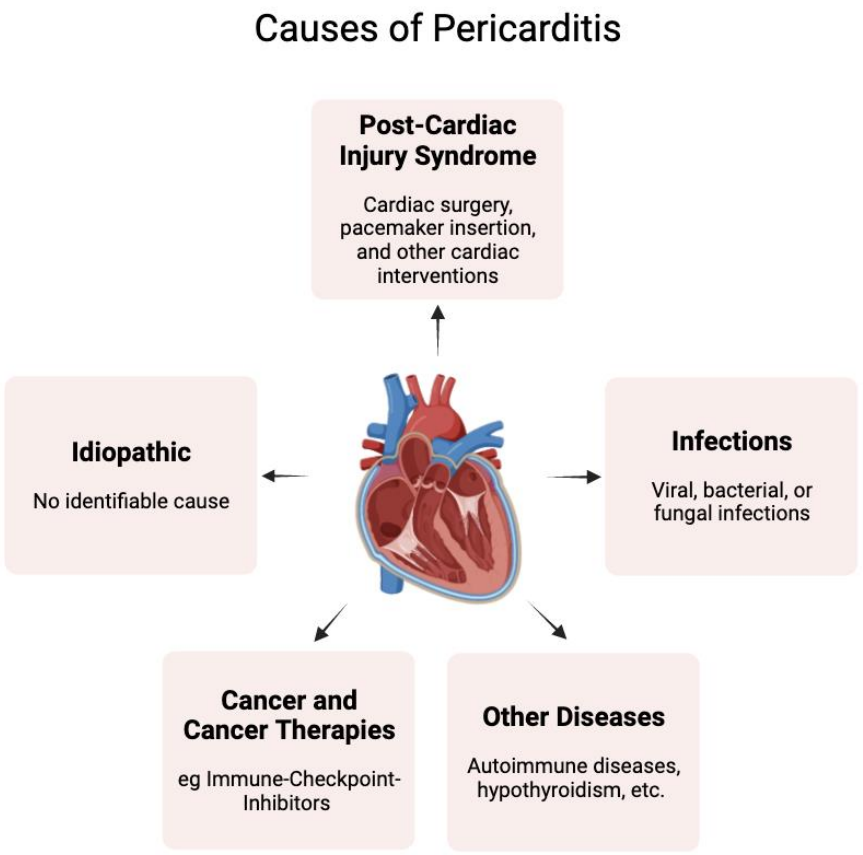
Pericarditis



Recent Cold?

Recent Surgery?

Recent Surgery?

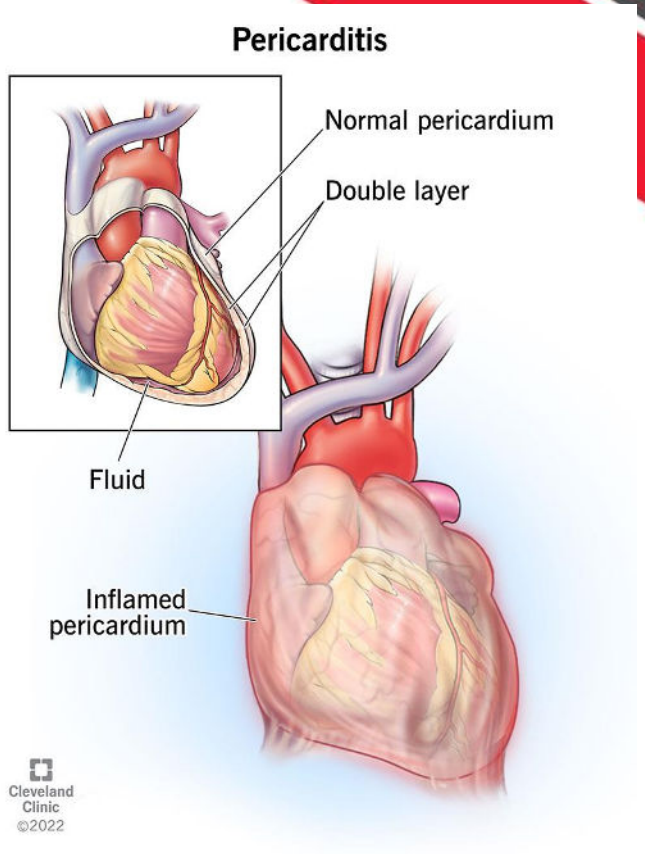


Table 3. Differential Diagnosis of Acute Pericarditis

Common	Less common
Angina pectoris	Esophageal spasm
Esophagitis	Pulmonary embolism
Gastritis (acute)	Tension pneumothorax
Gastroesophageal reflux disease	**Rare**
Myocardial infarction	Aortic dissection
Myocardial ischemia	Esophageal rupture
Peptic ulcer disease	
Pleuritis	
Pneumonia	

Information from reference 11.

Affects EKG

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[Pericardial Disease Center | UCSF Cardiology]

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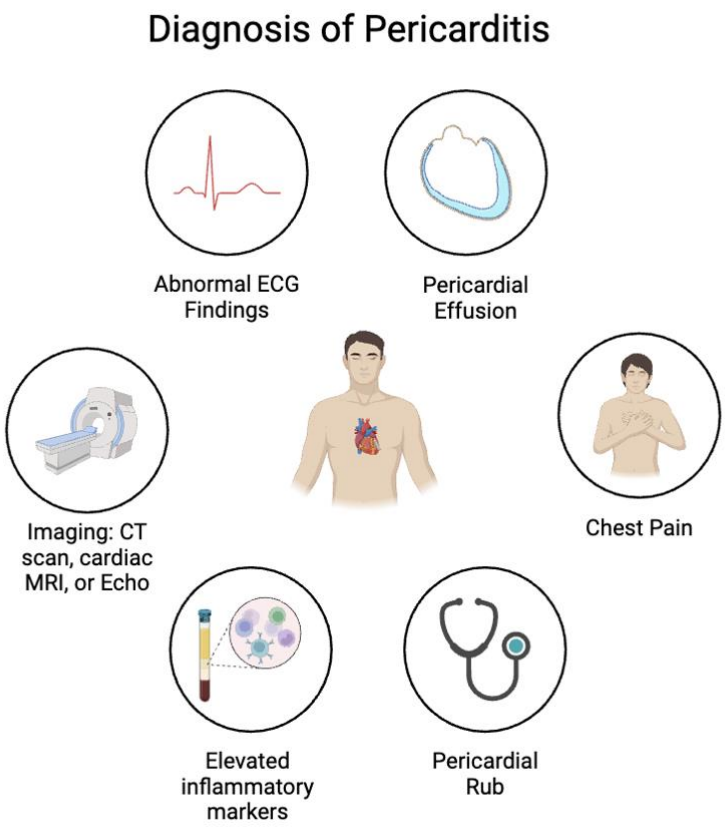
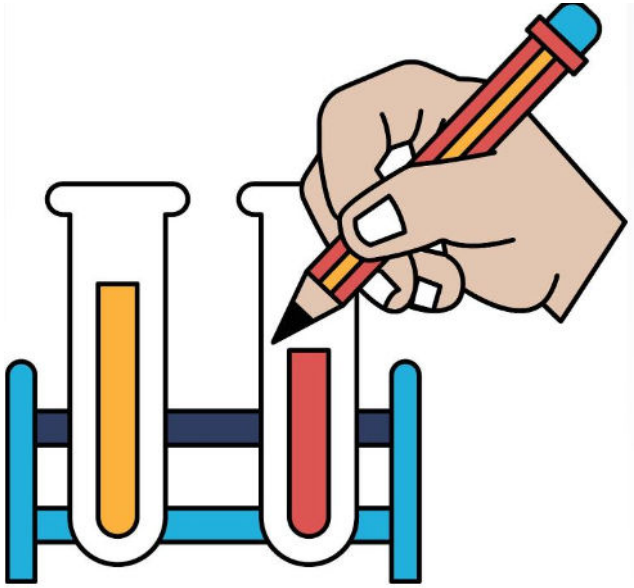
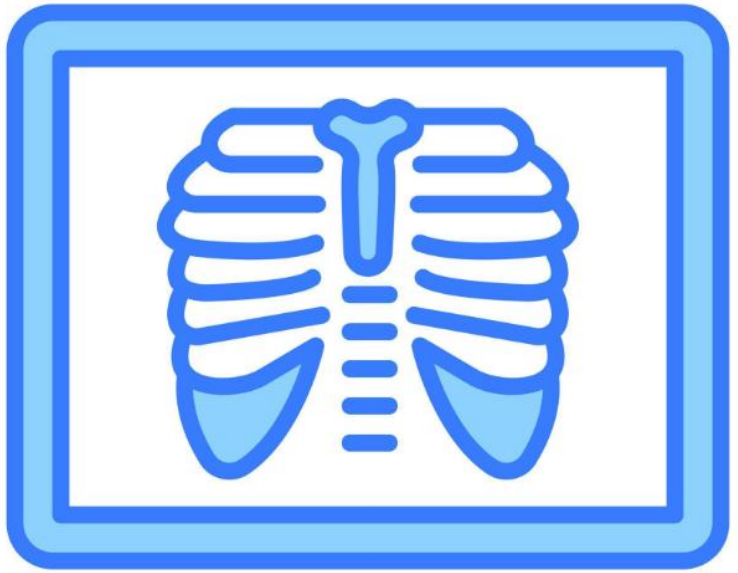
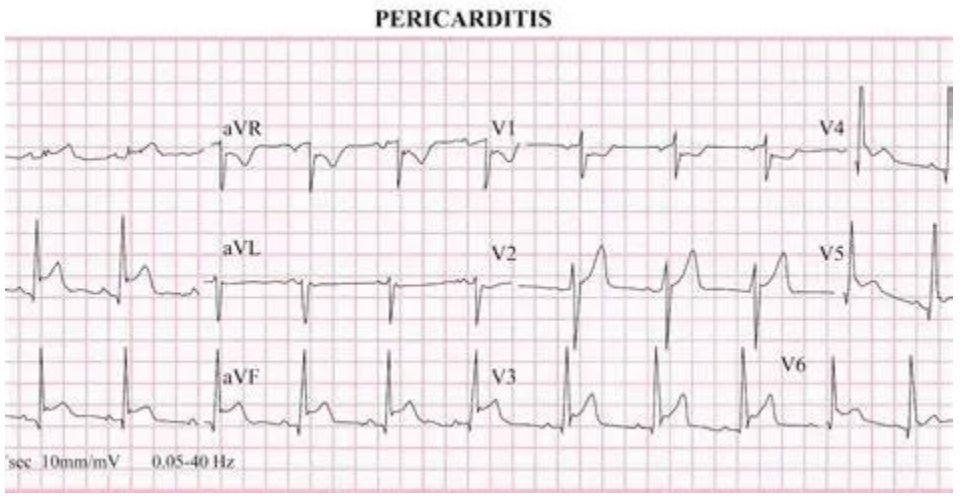
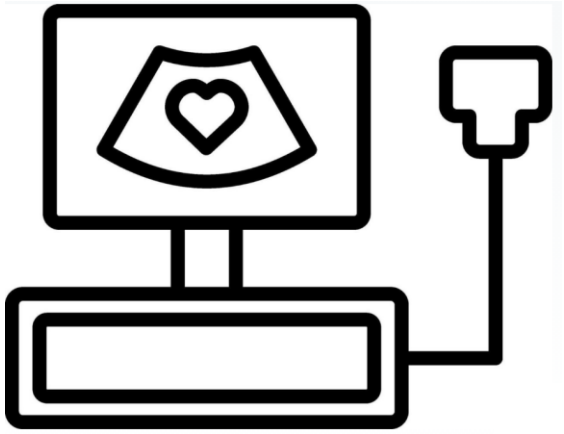
Typical ER Work Up











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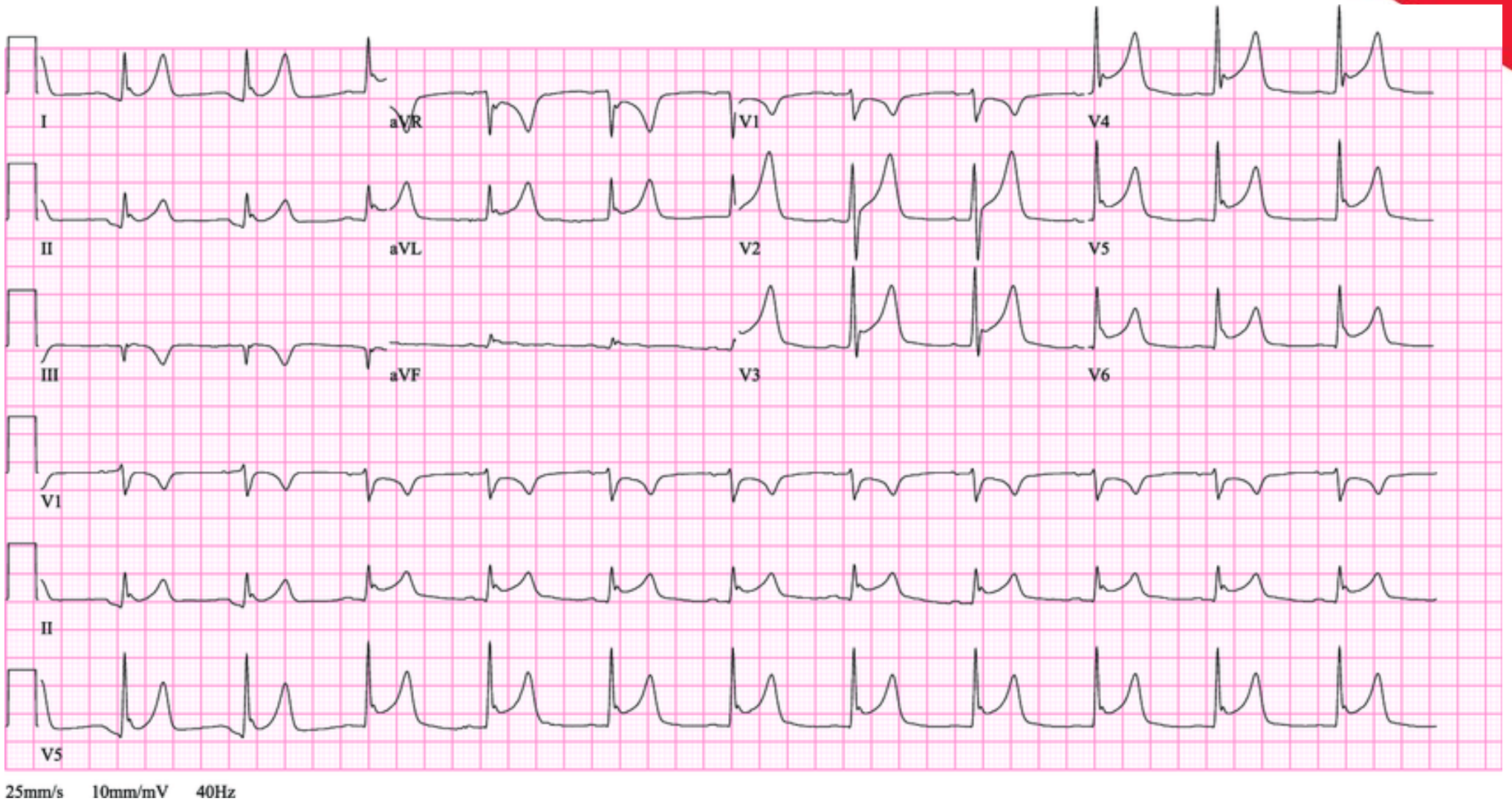

Case Scenario Discussion

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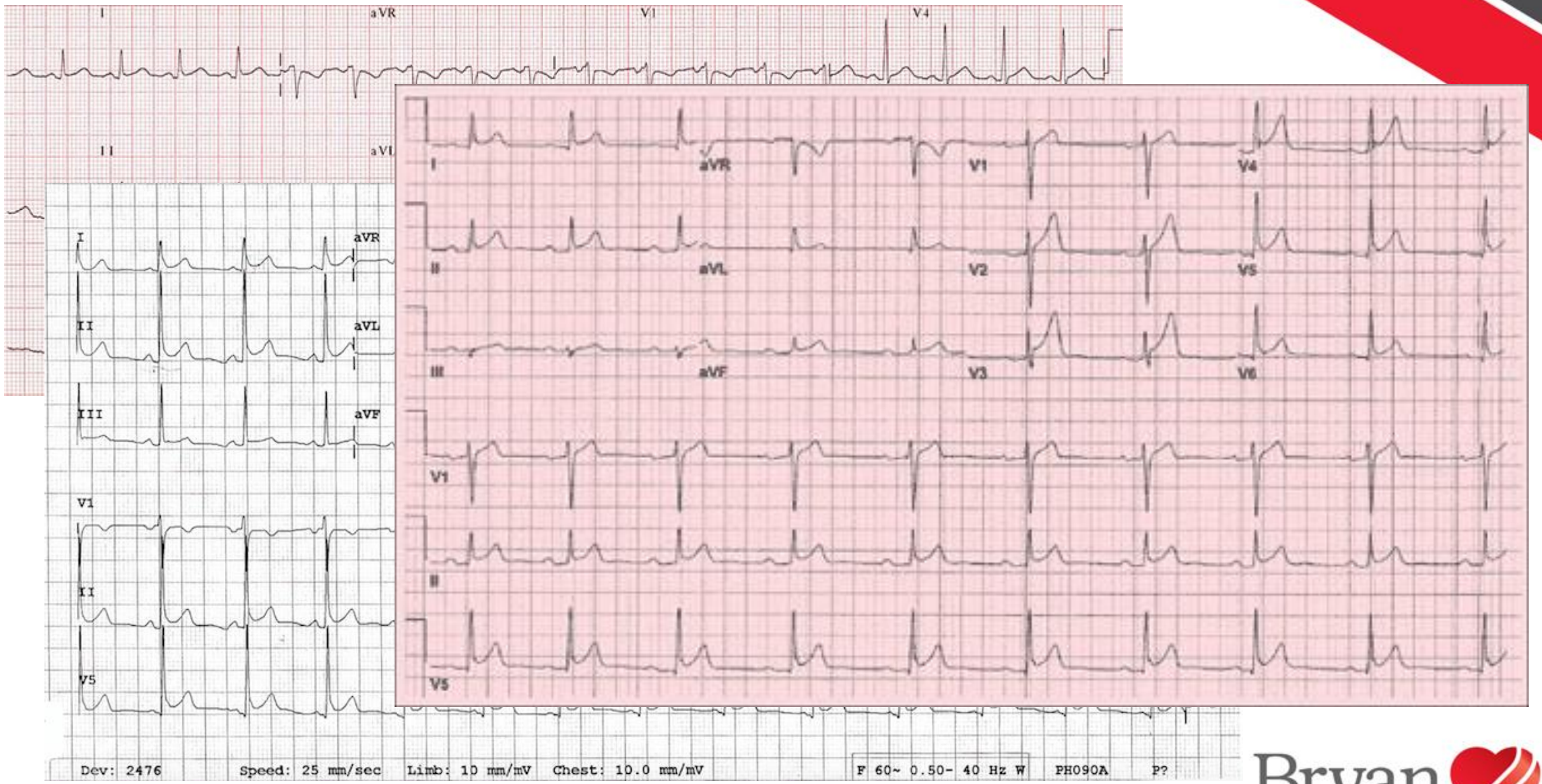

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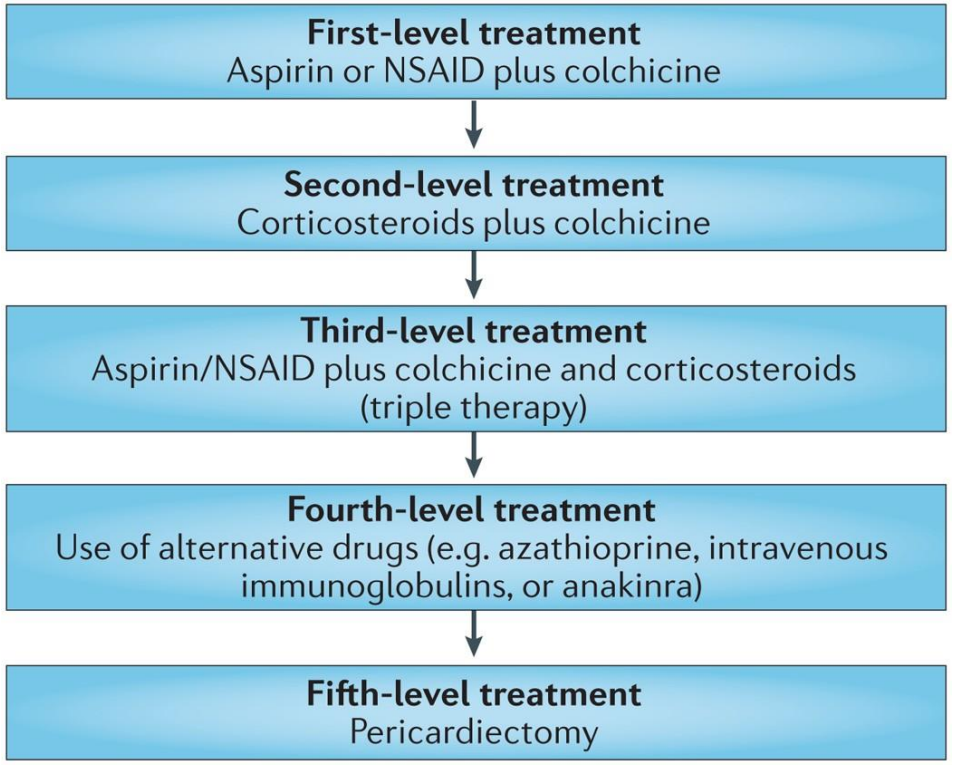
Typical Treatment of Pericarditis

Management for Pericarditis

High-dose aspirin or NSAIDs may be given for ~2 weeks as well as GI protective medication.

Colchicine, an anti-inflammatory medication, is recommended to reduce symptoms and recurrence.

Imaging tests that may be used to monitor pericardial disease such as such as chest x-ray, echocardiography, CT, cardiac MRI, and PET scans.



Nature Reviews | Cardiology

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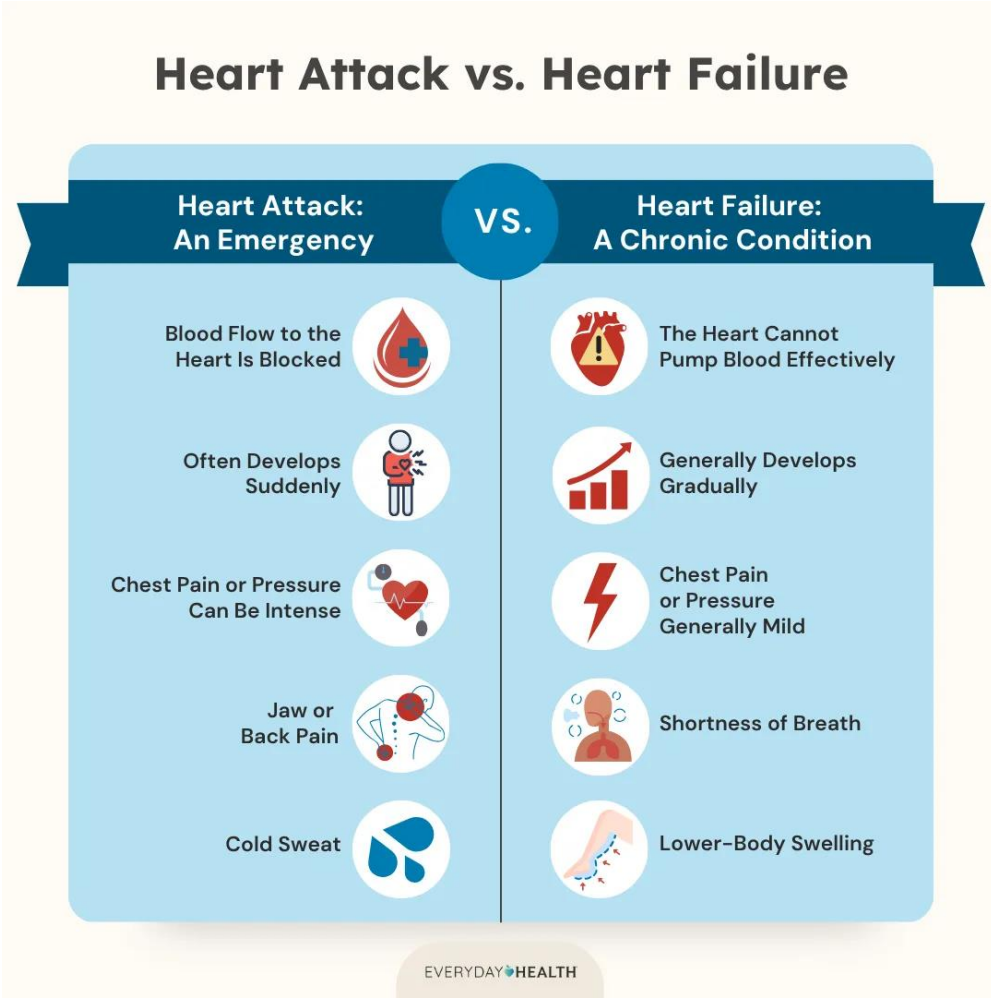
Pericardial Disease Center | UCSF Cardiology

Recurrent pericarditis: new and emerging therapeutic options | Nature Reviews Cardiology.

Acute Heart Failure



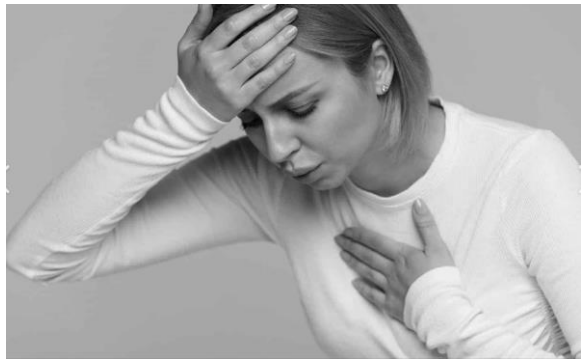
JOURNAL ARTICLE

Chest pain in patients with heart failure: why history may matter

Get access

Adam D. DeVore, Adrian F. Hernandez

European Heart Journal, Volume 35, Issue 48, 21 December 2014, Pages 3408–3409,
https://doi.org/10.1093/eurheartj/ehu408
Published: 21 October 2014



Chest pain can be a symptom of heart failure, often caused by reduced blood flow to the heart or fluid buildup in the lungs, and may present as pressure, tightness, or discomfort.

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Heart Attack vs. Heart Failure: Symptoms and Differences

Chest pain in patients with heart failure: why history may matter | European Heart Journal | Oxford Academic

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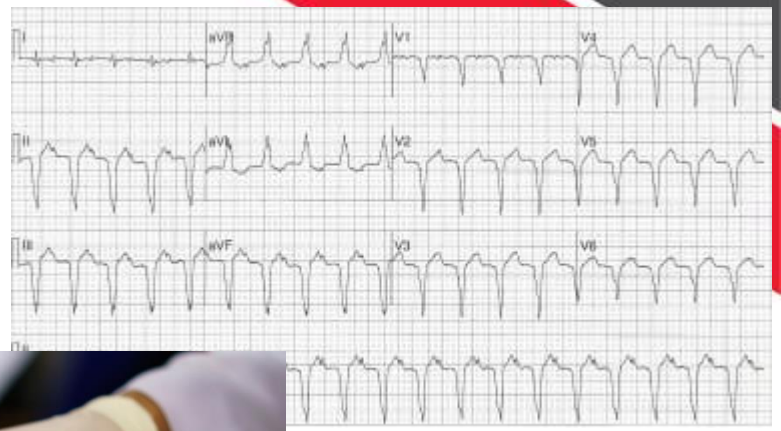
Evaluation/Diagnosis

Table 3. History and Physical Examination Findings for Heart Failure and Selected Alternative Causes

Heart failure	Alternative causes
Symptoms	Symptoms
Abdominal swelling	Abdominal swelling (liver failure)
Dyspnea on exertion	Anorexia, weight loss (sarcoidosis)
Edema	Chest pain (coronary artery disease)
Exercise intolerance	Claudication (atherosclerotic disease)
Fatigue	Cough (pulmonary disease)
Orthopnea	Diarrhea or skin lesions (amyloidosis)
Paroxysmal nocturnal dyspnea	Dyspnea on exertion (pulmonary disease, valvular disease)
Recent weight gain	Edema (liver or kidney failure)
Physical examination findings	Neurologic problems (sarcoidosis)
Abdomen: hepatojugular reflux, ascites	Palpitations (tachyarrhythmia)
Extremities: cool, dependent edema	Recent fevers, viral infection (endocarditis, myocarditis, infection)
Heart: bradycardia/tachycardia, laterally displaced point of maximal impulse, third heart sound (gallop or murmur)	Syncope (bradycardia, heart block)
Lungs: labored breathing, rales	Physical examination findings
Neck: elevated jugular venous pressure	Abdomen: distended, hepatosplenomegaly, tender, ascites (liver disease)
Skin: cyanosis, pallor	Extremities: joint inflammation/warmth (rheumatologic disease)
	Heart: irregular rate or rhythm (arrhythmia)
	Lungs: wheezing (pulmonary disease)
	Neck: thyromegaly/nodule (thyroid disease)
	Skin: cyanosis (anemia), jaundice (liver failure)



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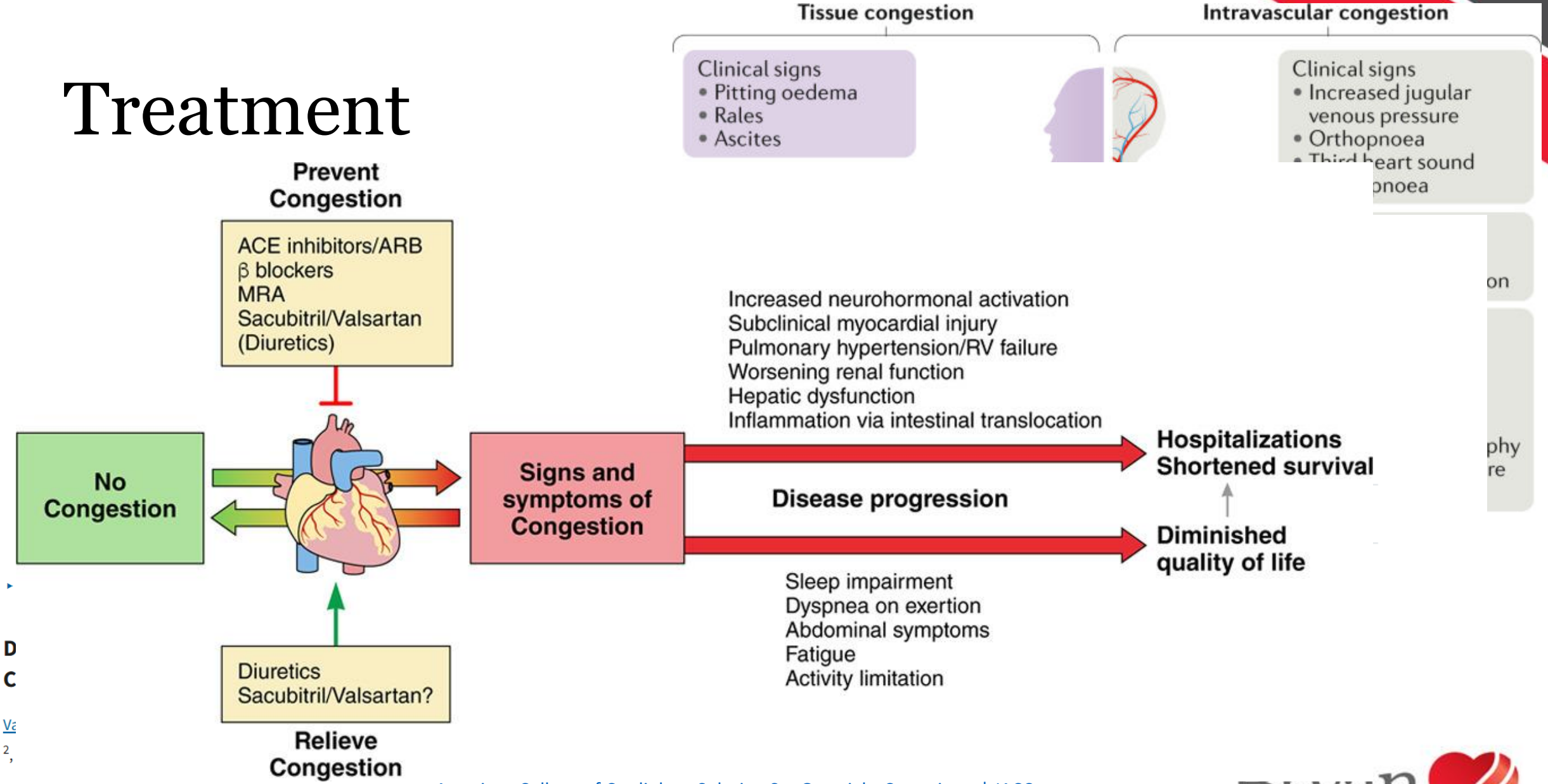
Treatment



American College of Cardiology Solution Set Oversight Committee | JACC

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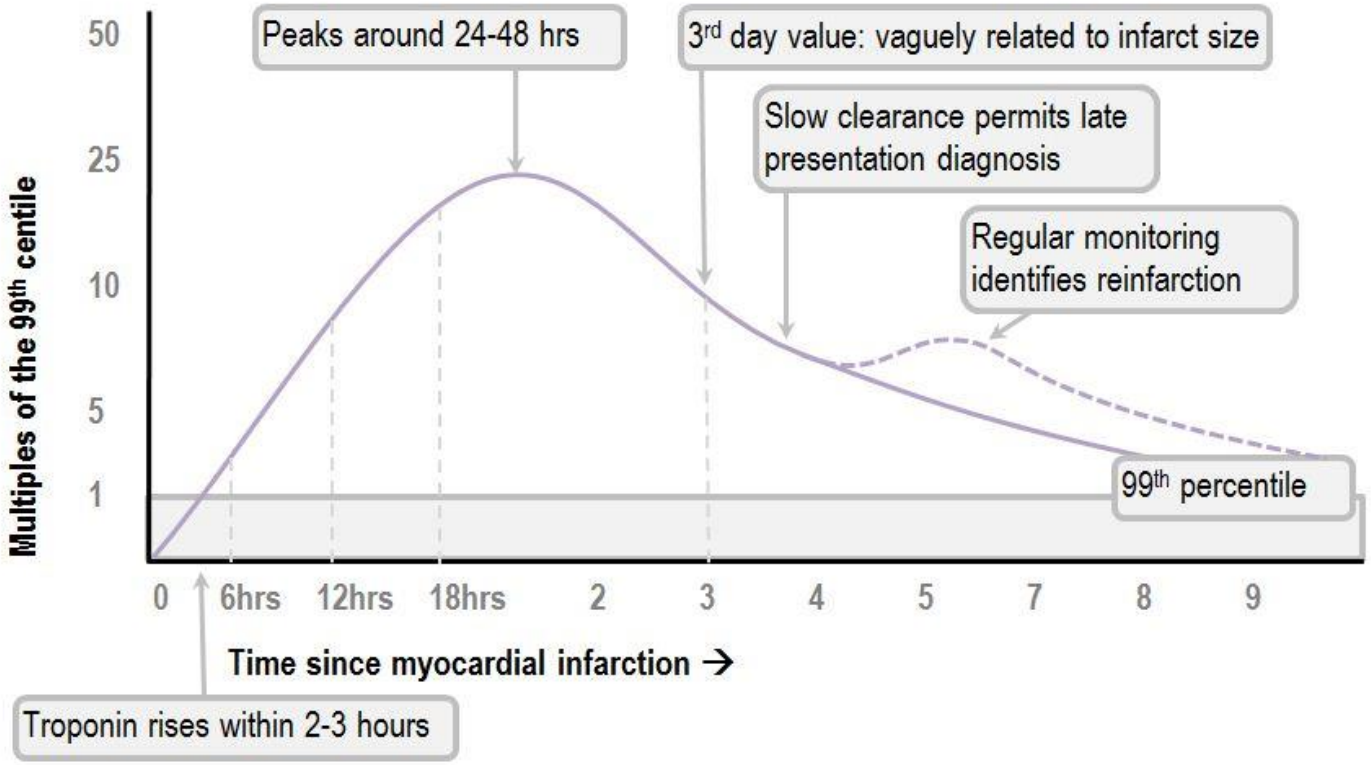
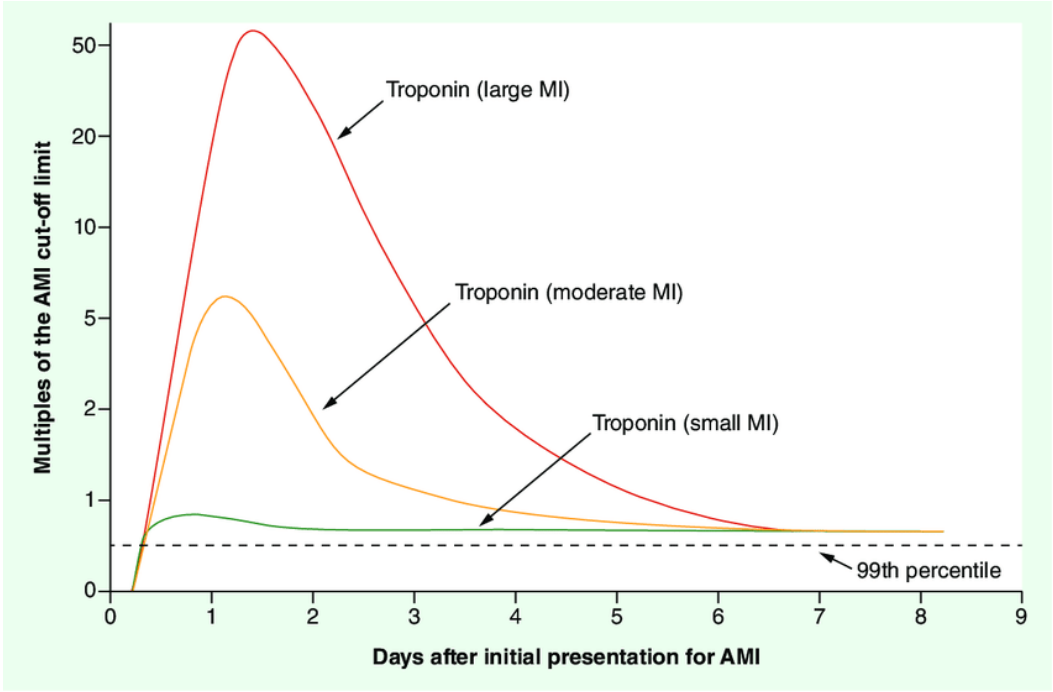
Decongestion in Acute Heart Failure—Time to Rethink and Standardize Current Clinical Practice? - PMC

Congestion in heart failure: a contemporary look at physiology, diagnosis and treatment | Nature Reviews Cardiology

Relief and Prevention of Congestion in Heart Failure Enhance Quality and Length of Life | Circulation

Non-ST Elevated Myocardial Infarction





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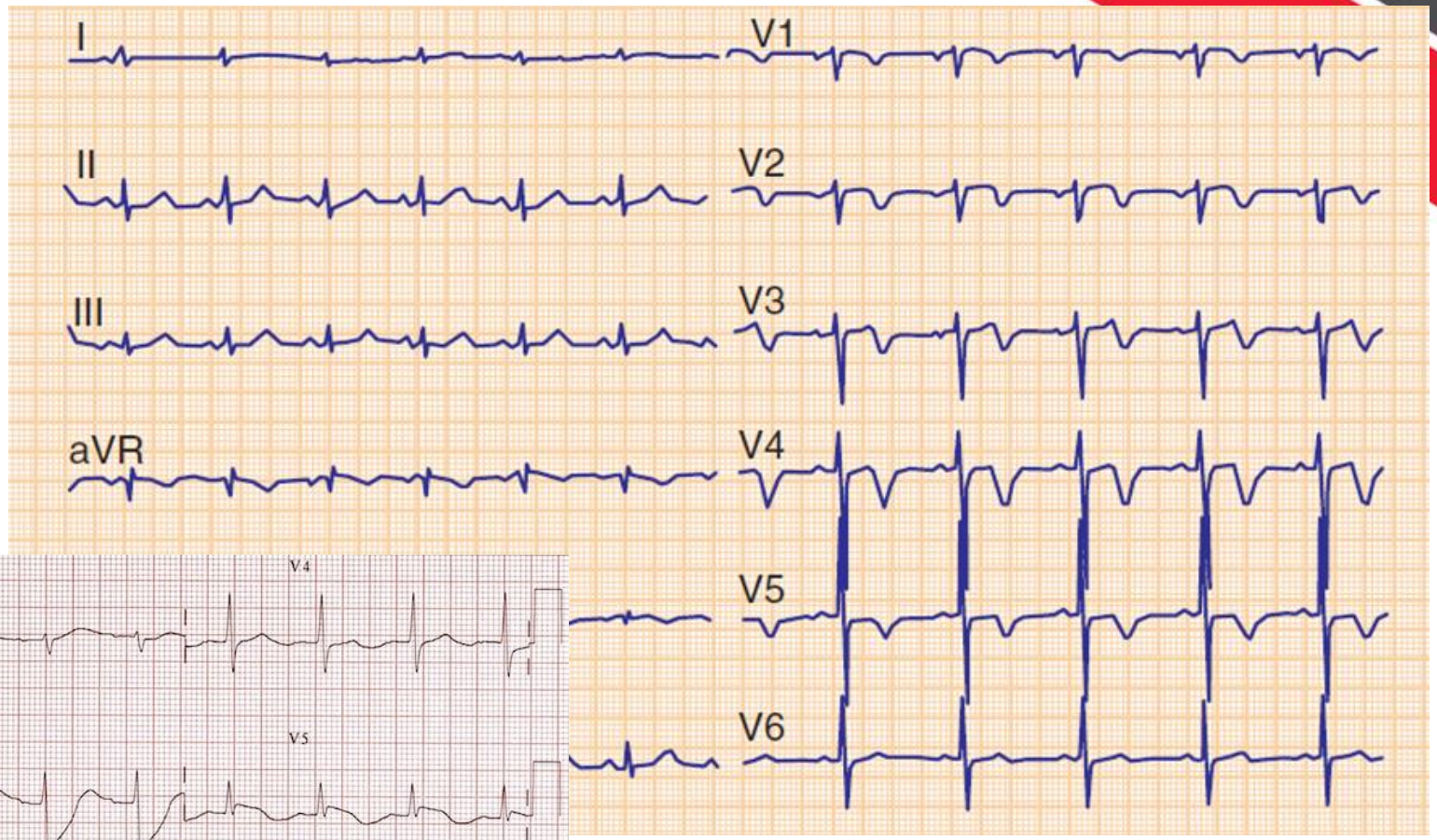
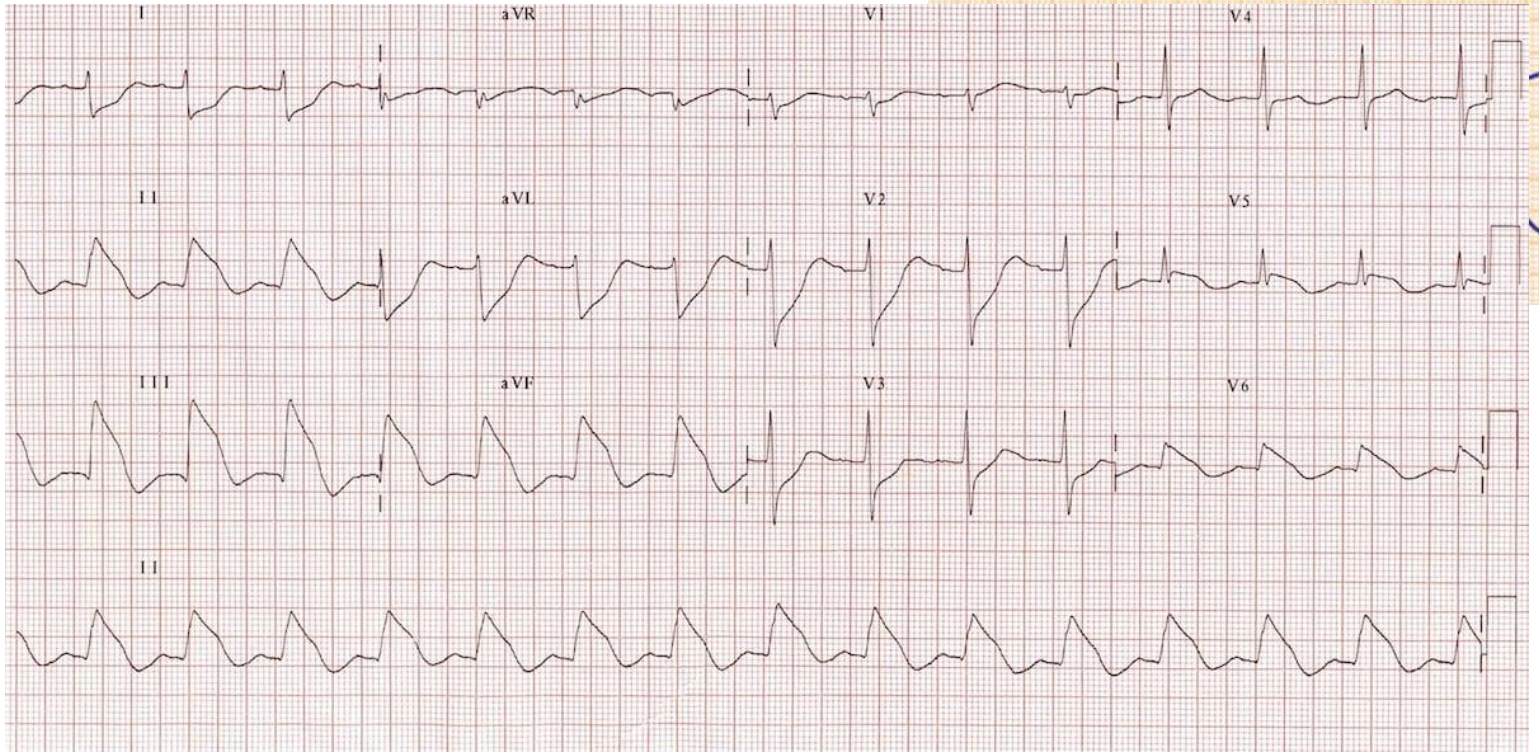
The EKG





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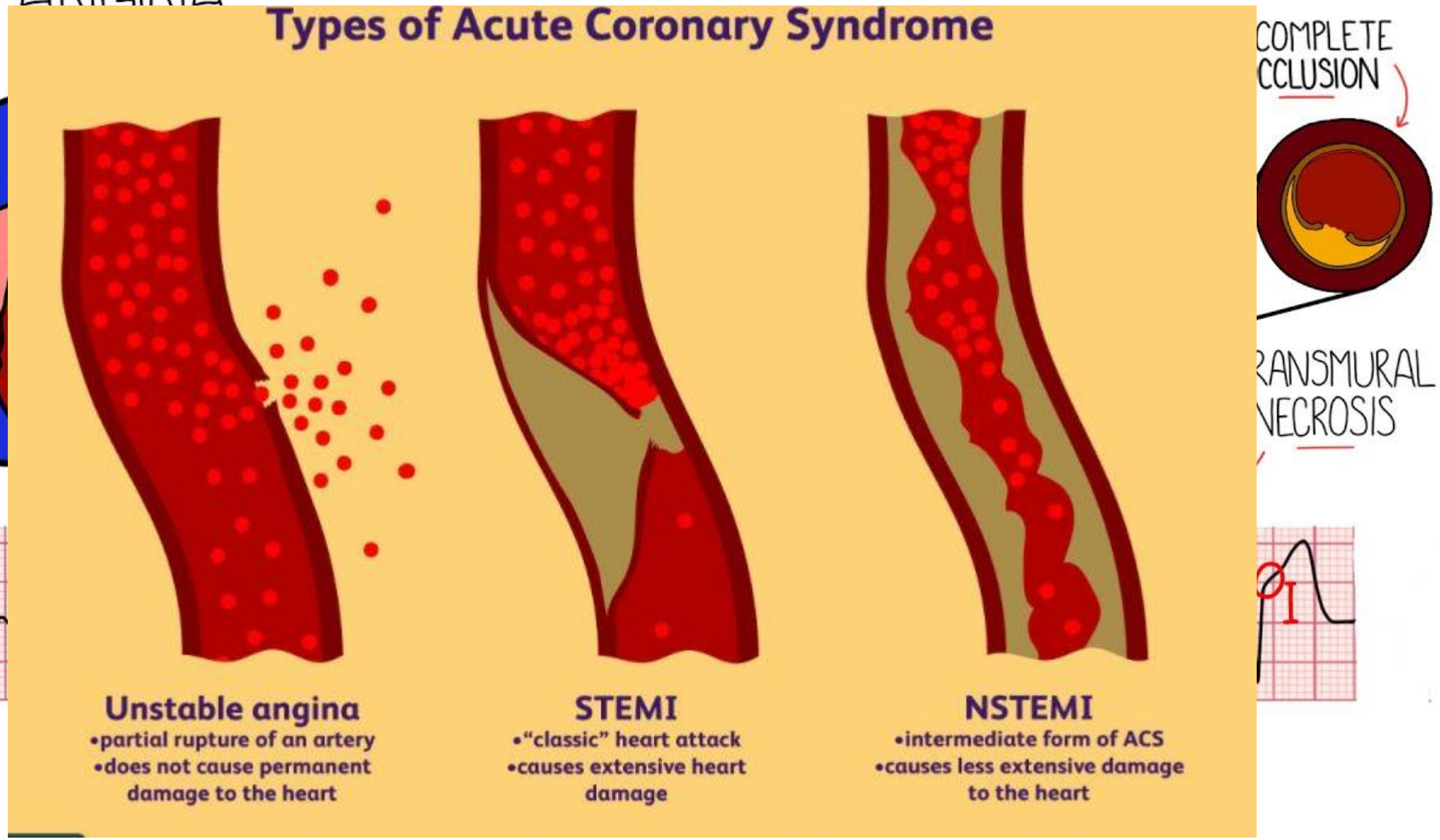
UNSTABLE ANGINA vs NSTEMI vs STEMI



COMPLETE
CCLUSION

RANSMURAL
NECROSIS

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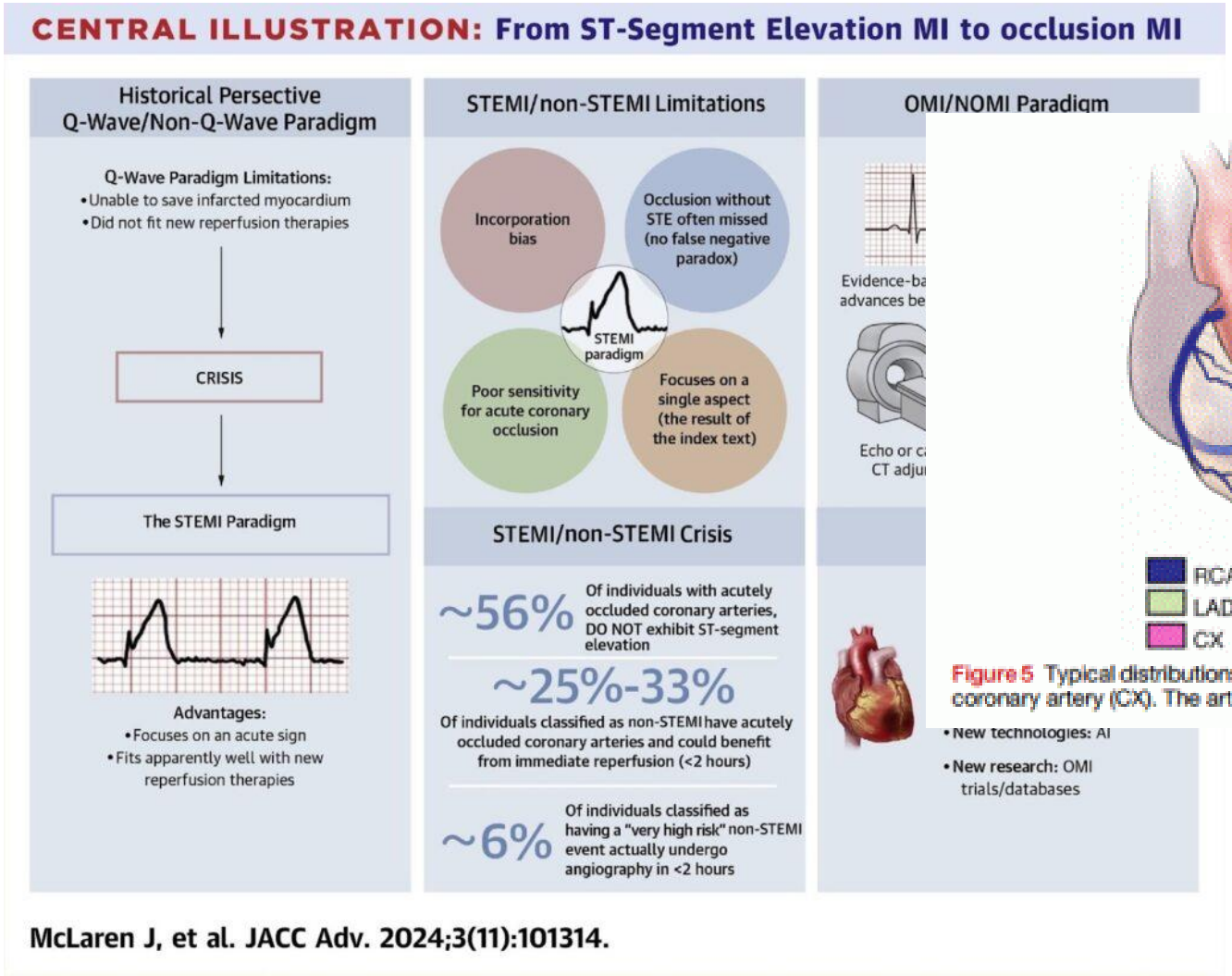
The Echo



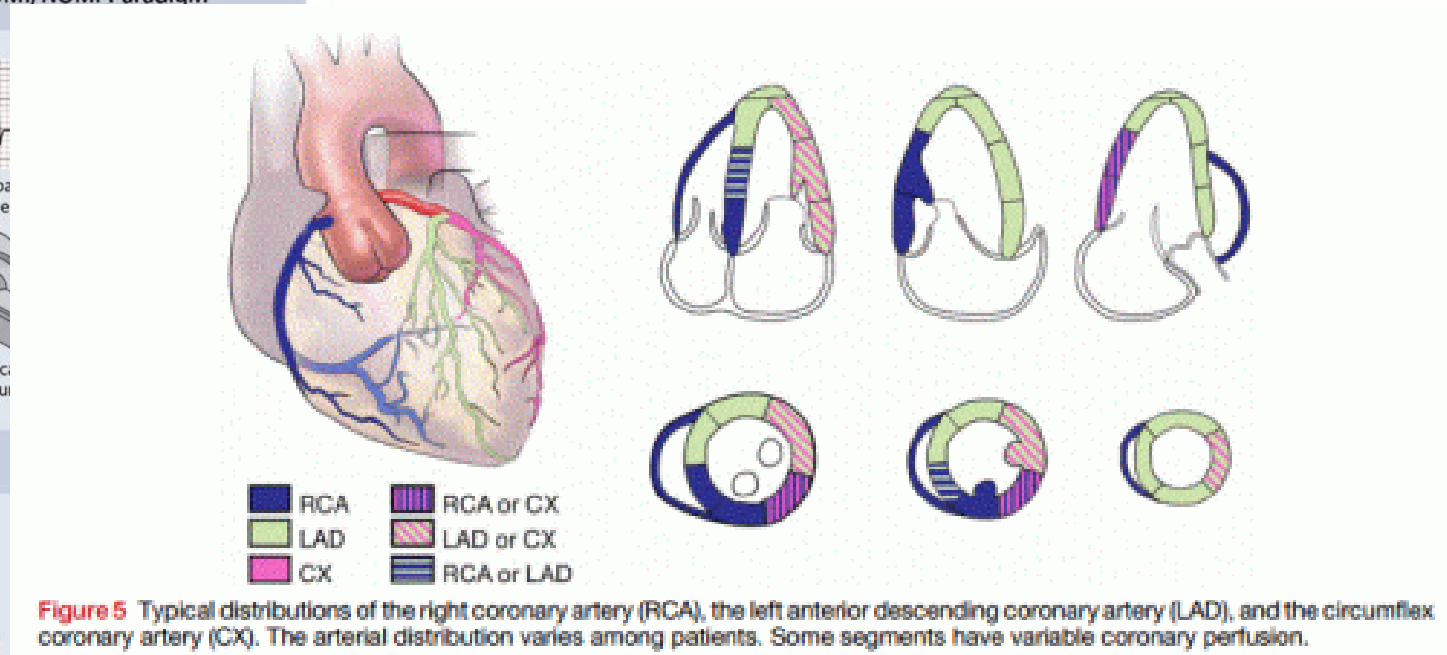


Figure 5 Typical distributions of the right coronary artery (RCA), the left anterior descending coronary artery (LAD), and the circumflex coronary artery (CX). The arterial distribution varies among patients. Some segments have variable coronary perfusion.

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[PMcardio Featured on 'This Week in Cardiology': The Shift from STEMI/NSTEMI to OMI](#)

[Inferior STEMI : Is it RCA or LCX , and why we need to bother ? | Dr.S.Venkatesan MD](#)

Aspect	STEMI Prevention	NSTEMI Prevention
Blood Pressure Control	Aggressive blood pressure control. It helps to prevent coronary artery disease and subsequent myocardial infarction.	Blood pressure management is essential to prevent myocardial ischemia. It is vital for reducing the risk of cardiovascular events, too.
Smoking Cessation	Such programs and support mitigate the risk of atherosclerosis and thrombotic events.	Smoking cessation is a crucial component of prevention strategies. They aim to prevent cardiovascular disease.
Physical Activity	Encouragement of regular physical activity to improve cardiovascular health. Also, it helps to prevent atherosclerosis.	Regular exercise aims to improve cardiac function and reduce the risk of myocardial infarction.
Healthy Diet	Promotion of a diet rich in fruits, vegetables, and whole grains. Lean proteins to maintain cardiovascular health.	Dietary modifications include reducing saturated fats and cholesterol intake. They are essential for preventing atherosclerosis and myocardial infarction.

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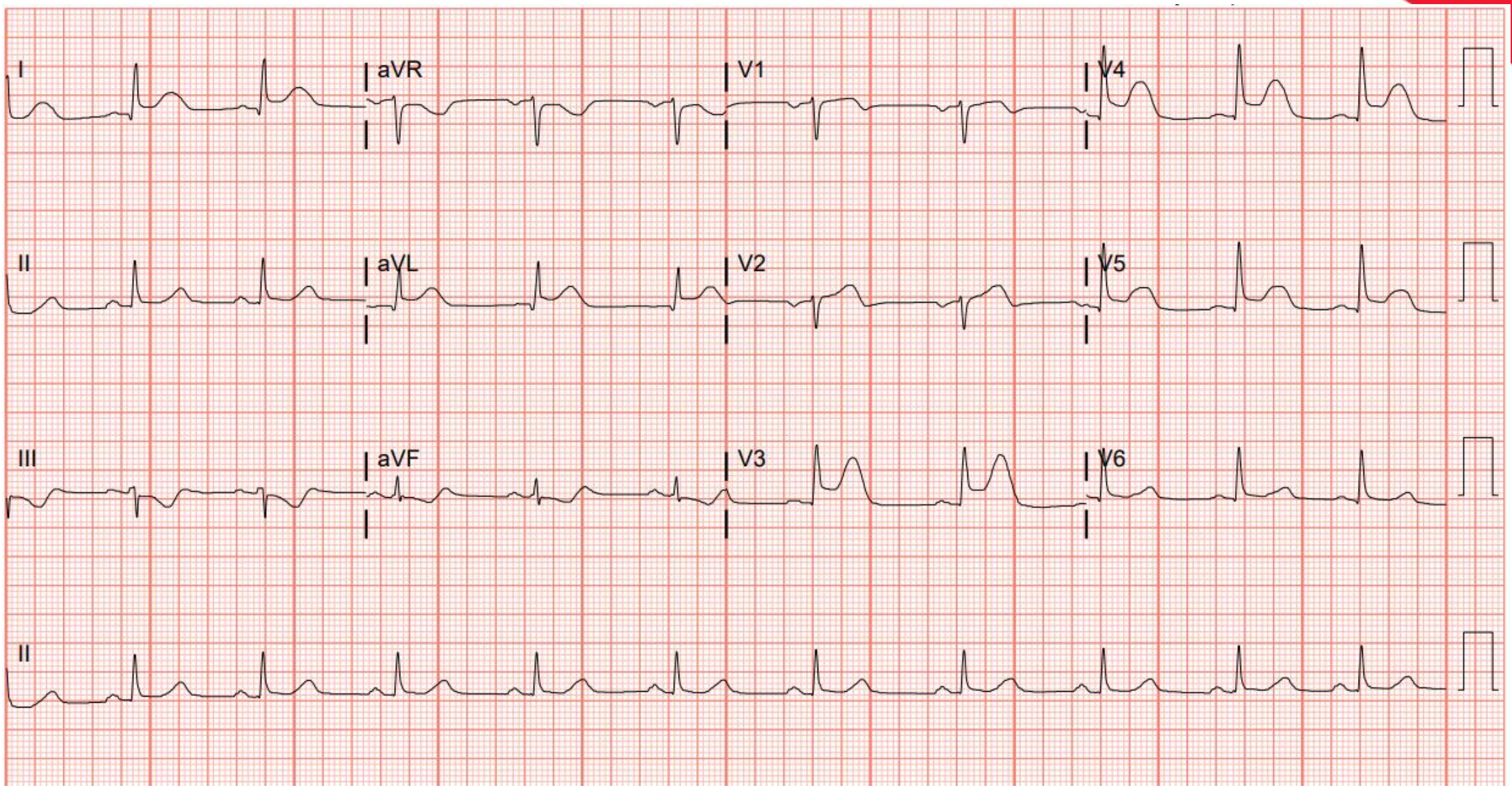
All about myocardial infarction: STEMI vs NSTEMI



Case #1: KR

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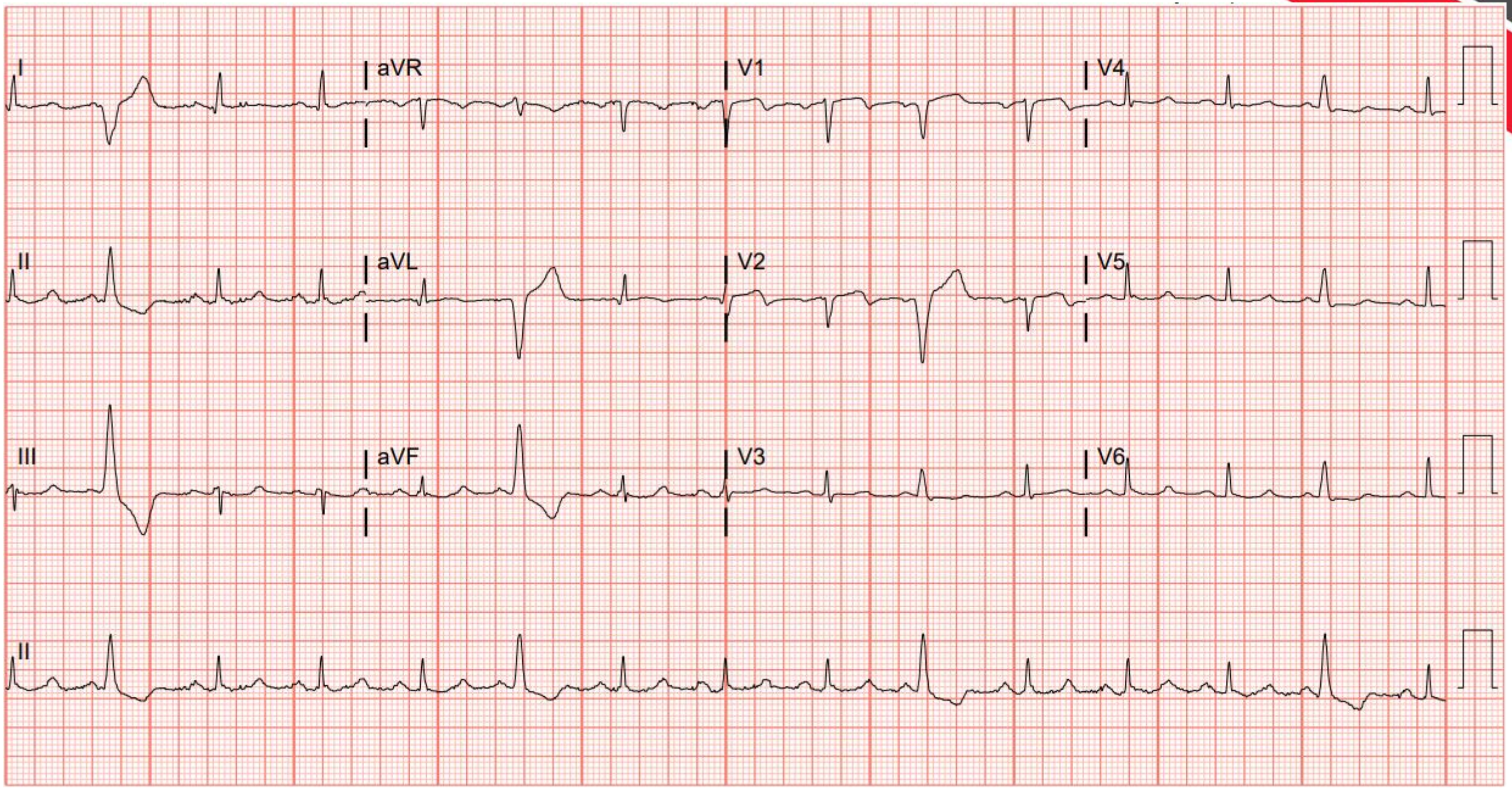
I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

Treatment Management

- CAD – treat medically
- CAD- differences between platelet inhibition
- Follow up Recomendations

ST Elevated Myocardial Infarction

- Difference between STEMI vs NSTEMI
- Labs (Troponin, CRP, Enzymes)
- Purpose of EKG
- Purpose of Echo
- Purpose of Trends
- Symptoms
- Urgency to Cath lab

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Treatment Options

- "Cardiac Alert"
- Cath lab + Stents
- Cath lab – no stents
- Cath lab > CG Shock > devices > OR
- GOAL of door to balloon window
- Talk anti-plt, tPA indications (as they are different than PEs), Risk factor modification (BP, Lipids etc…)

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Final PEARLS…

- GERD-
- PE-
- Aortic Dissection/LVH-
- Pericarditis -
- Acute Heart Failure –
- NSTEMI
- STEMI

Questions?

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