ST ELEVATION MI

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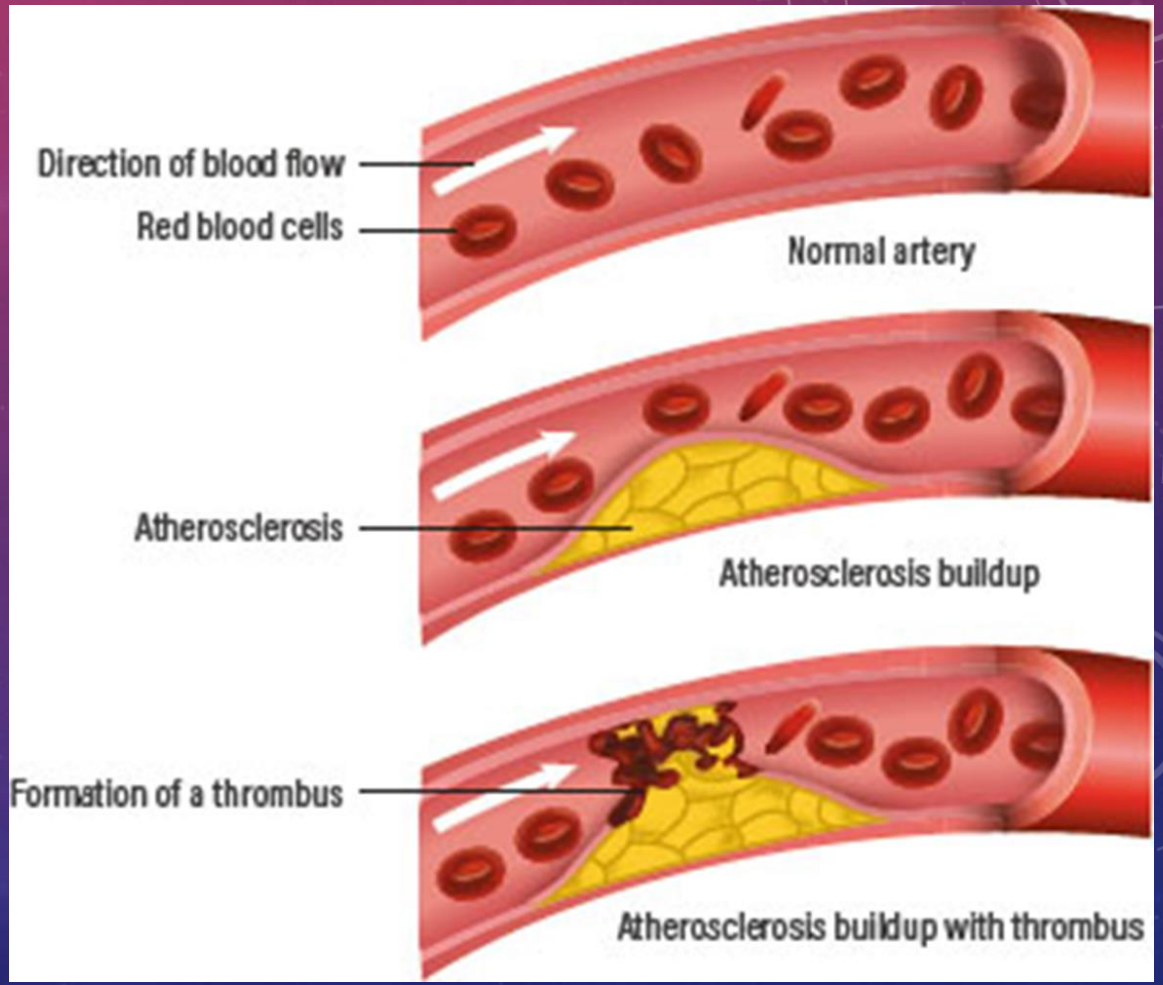
OBJECTIVES

- Definitions
- Pathophysiology of STEMI
- Treatment at PCI capable vs non-PCI capable hospital
- Medical therapy in hospital setting for STEMI patients
- Complications of STEMI

DEFINITION OF STEMI

- Clinical syndrome defined by symptoms of myocardial ischemia in associated with persistent EKG ST elevations and subsequent release of biomarkers of myocardial necrosis



HEART ATTACK SYMPTOMS: MEN VS. WOMEN

The most common symptom of a heart attack for both men and women is chest pain. But women may experience less obvious warning signs.

MEN

- Nausea or vomiting
- Jaw, neck or back pain
- Squeezing chest pressure or pain
- Shortness of breath

WOMEN

- Nausea or vomiting
- Jaw, neck or **upper** back pain
- Chest pain, **but not always**
- Pain or pressure in the **lower chest** or **upper abdomen**
- Shortness of breath
- **Fainting**
- **Indigestion**
- **Extreme fatigue**

American Heart Association.
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QUESTION 1

- What distinguishes STEMI from NSTEMI?
  - A. Plaque rupture in unstable plaque occurs in STEMI but not NSTEMI
  - B. Elevated troponins are seen in STEMI but not NSTEMI
  - C. Transmural infarction/ischemia occurs in STEMI but not NSTEMI
  - D. There is blood clot formation in STEMI but not NSTEMI

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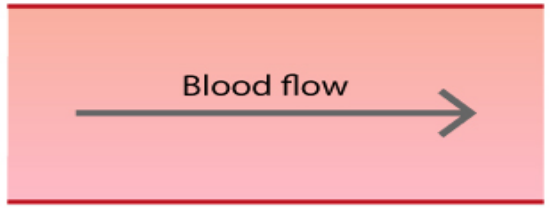
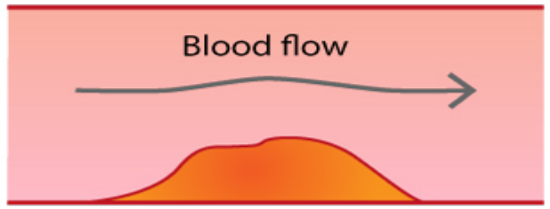
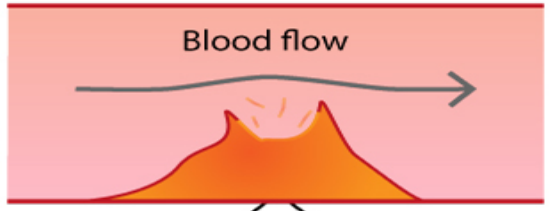


Normal coronary artery



Coronary artery with atherosclerotic lesion (plaque). These lesions are prone to disruption due to underlying inflammation in the lesion.



Disruption of lesion.
The lesion may disrupt as a result of a complete rupture or due to erosion of the cap of the lesion.

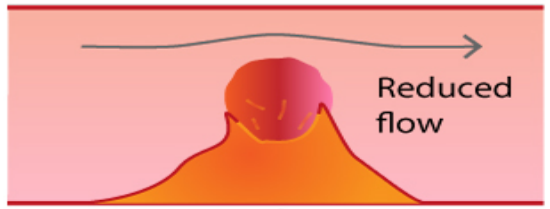
STE-ACS

Atherothrombosis causing total obstruction of blood flow

Type of ischemia: Transmural
ECG: ST elevations
Syndrome: STE-ACS (STEMI)

NSTE-ACS

Atherothrombosis causing partial obstruction of blood flow



Type of ischemia: Subendocardial
ECG: ST depressions
Syndrome: NSTEMI or unstable angina

ST ELEVATION 1mm in 2 CONTIGUOUS LEADS

except leads V2-V3 where you need 2mm ELEVATION IN MEN or 1.5 mm ELEVATION IN WOMEN

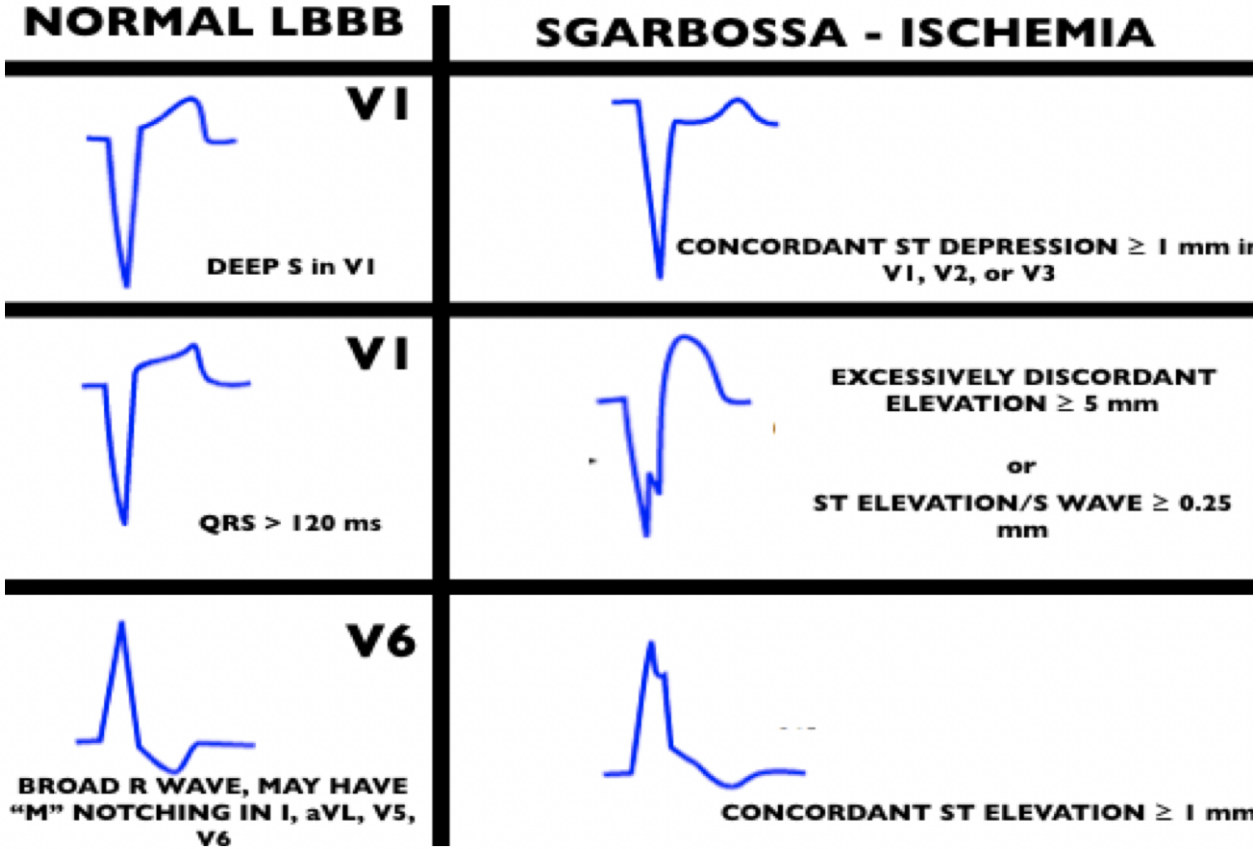
ALSO CONSIDER:
Posterior MI: ST depression in 2+ leads V1-V4

and more controversially,

Left Main or Proximal LAD occlusion (or subendocardial ischemia from demand): elevation in aVR with multilead ST

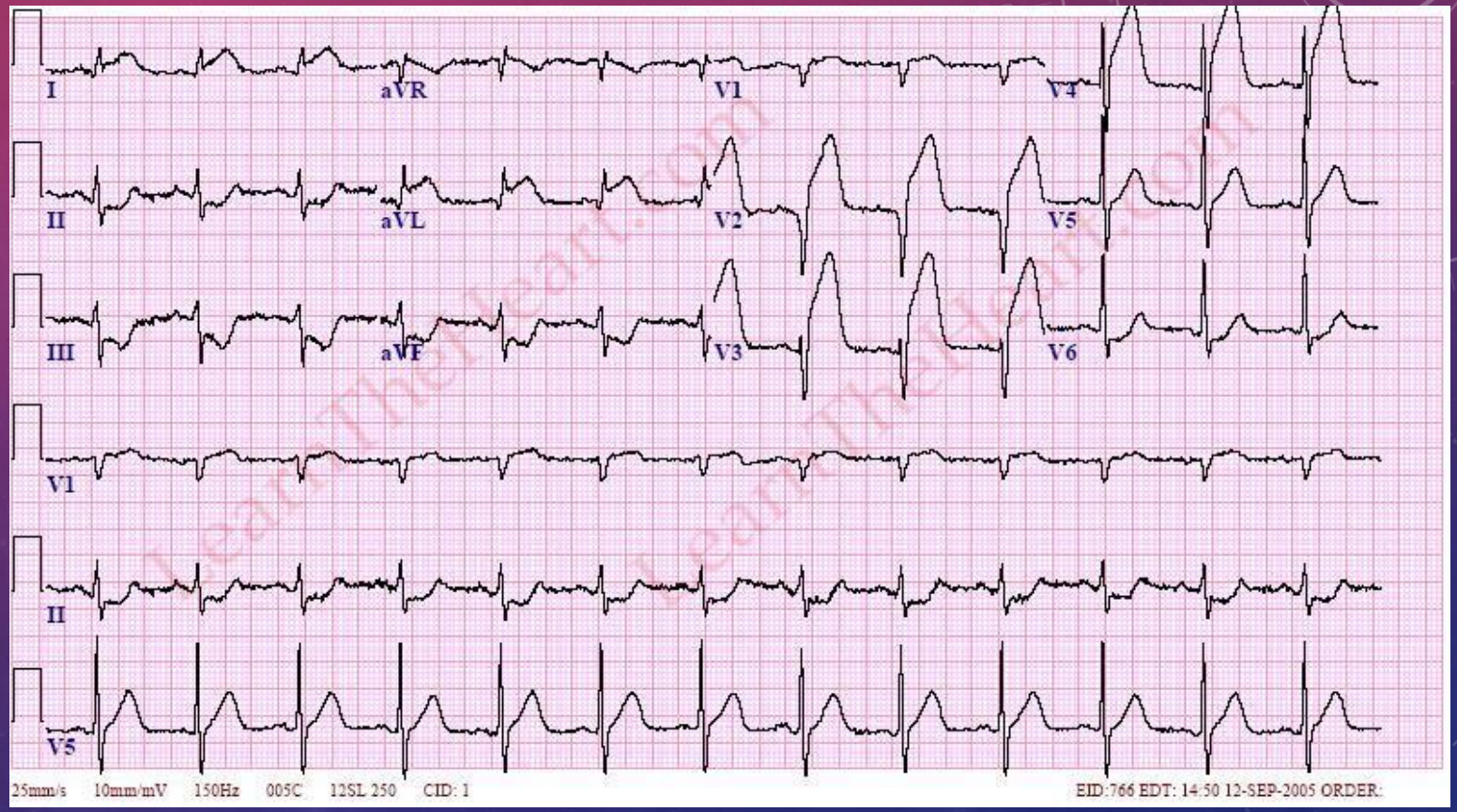
in the absence of Left Bundle Branch Block (LBBB) or Left Ventricular Hypertrophy

of note, you can read ischemia on ECGs with LBBB using Sgarbossa or modified Sgarbossa criteria:



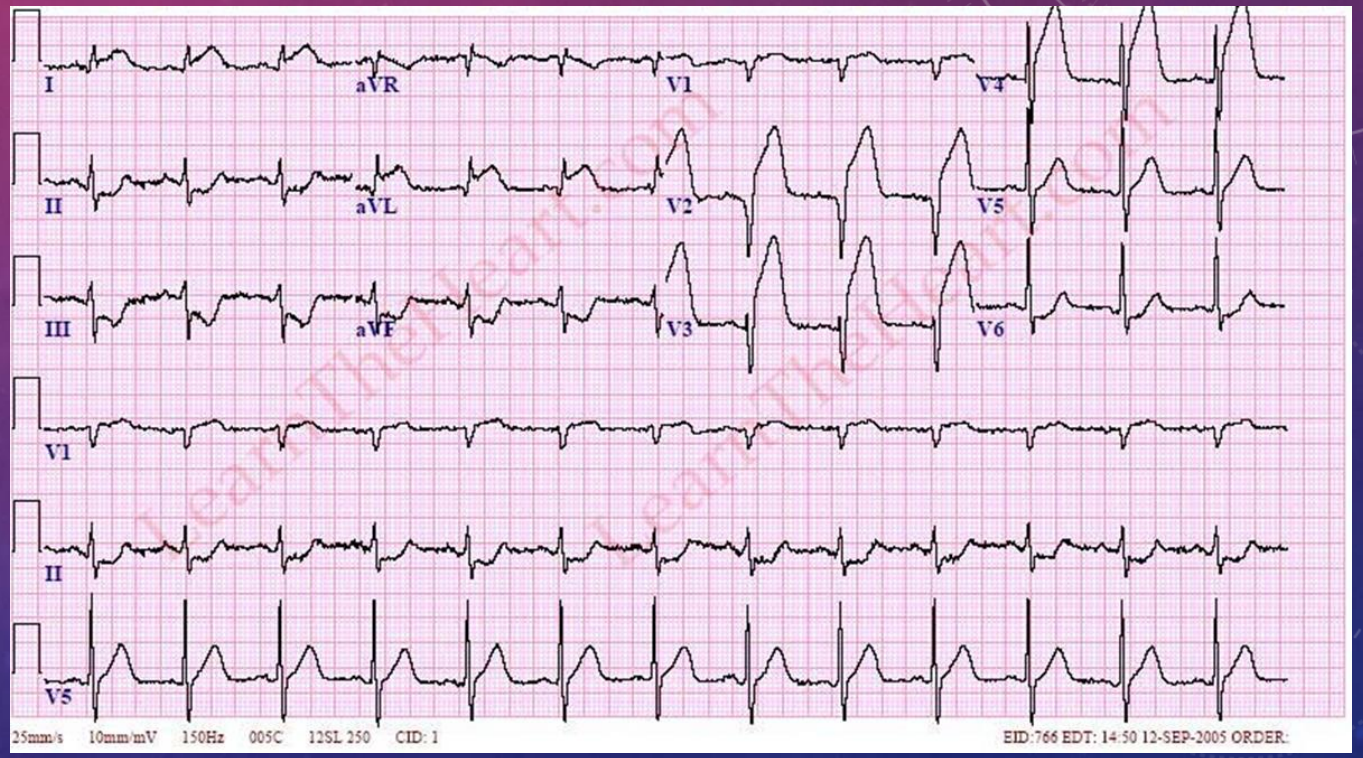
QUESTION 2

- 58 YO woman without PMH who presents with sudden onset of substernal chest pain 1 hour prior to presentation to ED.



QUESTION 2 (CONTINUED)

- What territory of the heart is affected by the STEMI?
  - A. Anterior wall
  - B. Inferior wall
  - C. Posterior wall



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QUESTION 2 (BONUS)

- What artery is expected to be occluded given this EKG?
  - A. Left anterior descending artery
  - B. Right coronary artery
  - C. Left circumflex artery
  - D. Left main artery

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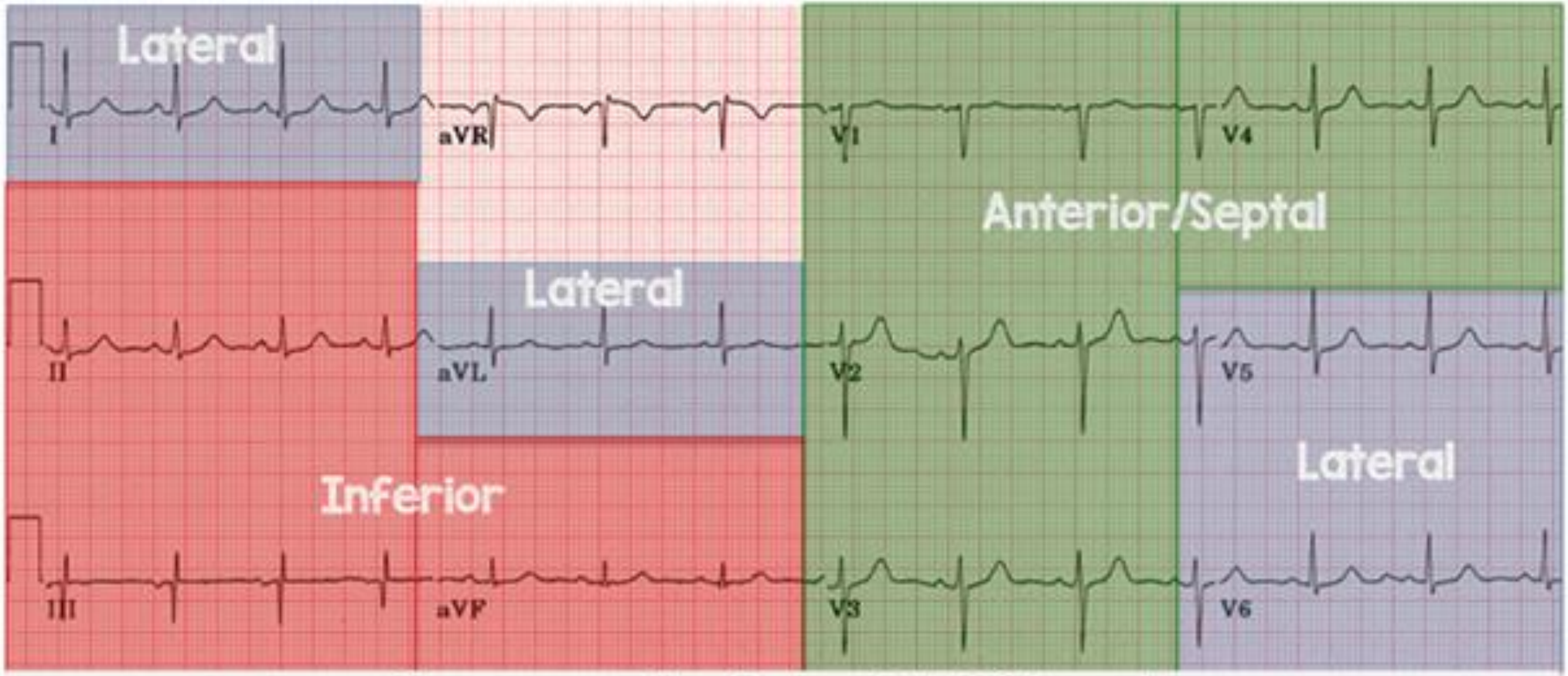


Coronary Anatomy & ECG Leads

Lateral Leads	I, aVL, V5 - V6	LCx or Diagonal of LAD
Inferior Leads	II, III, aVF	RCA and/or LCx
Anterior/Septal Leads	V1 - V4	LAD

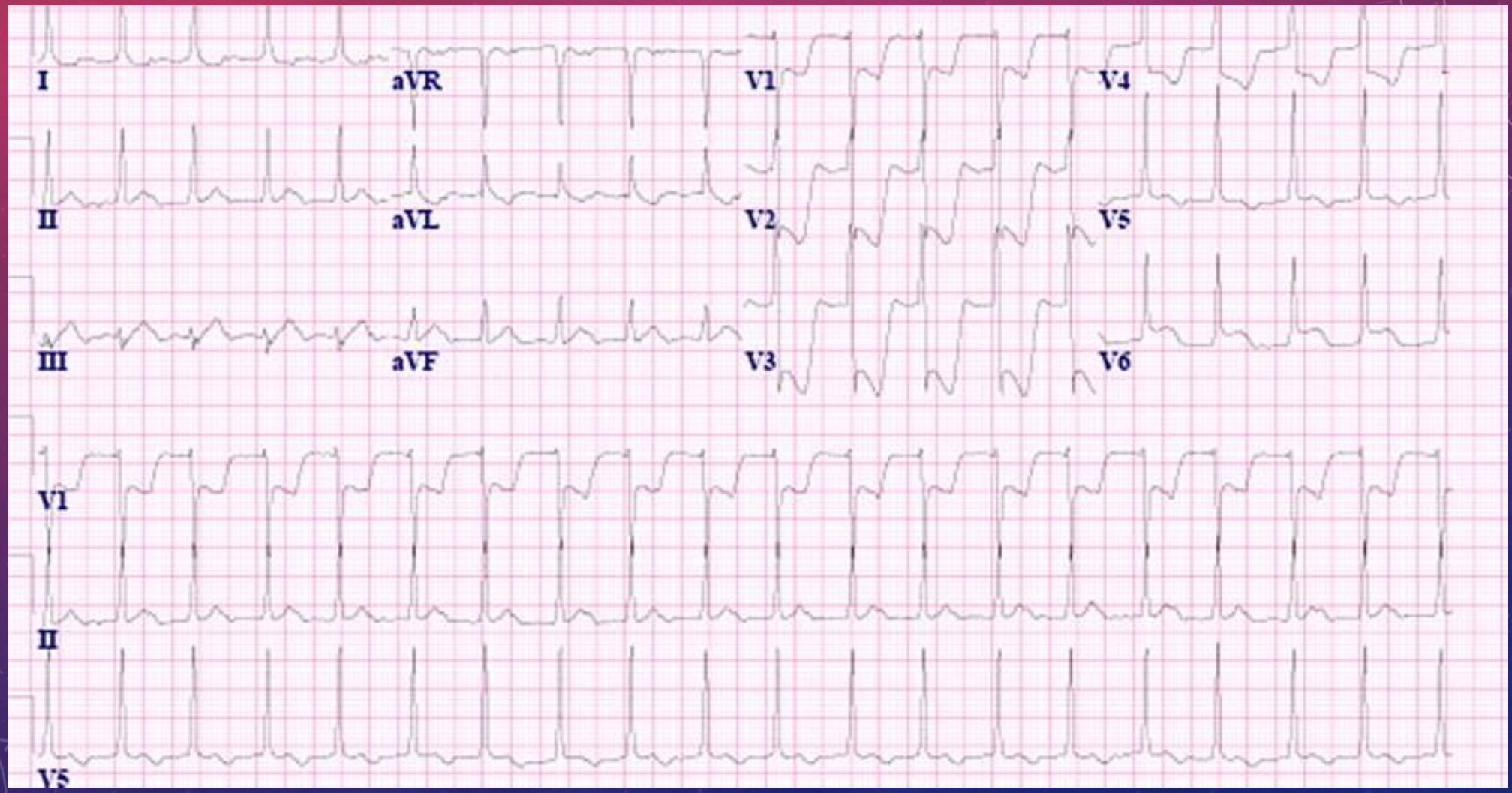
QUESTION 3

- 46 YO man with HTN, tobacco abuse, obesity who presents with dizziness and epigastric pain which waxed and waned for 3 days but has been constant for the past 30 minutes prior to presentation. After obtaining vitals, what is the first, best test to do?
  - A. CT AB/Pelvis
  - B. CXR
  - C. EKG
  - D. Head CT

QUESTION 3

- 76 YO man with HTN, tobacco abuse who presents with dizziness and epigastric pain which waxed and waned for 3 days but has been constant for the past 30 minutes prior to presentation. After obtaining vitals, what is the first, best test to do?
  - A. CT AB/Pelvis
  - B. CXR
  - C. EKG
  - D. Head CT

QUESTION 3 (CONTINUED)



QUESTION 3 (CONTINUED)

- What is the diagnosis?
  - A. Pericarditis
  - B. NSTEMI
  - C. STEMI
  - D. Aortic dissection
  - E. Acute pulmonary embolus

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- What is the diagnosis?
  - A. Pericarditis
  - B. NSTEMI
  - C. STEMI
  - D. Aortic dissection
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QUESTION 3 (CONTINUED)

- You work at a PCI capable hospital with a cardiac catheterization lab. What do you do next?
  - A. Call cardiology to activate the cath lab for primary PCI
  - B. Give thrombolytics and call cardiology
  - C. Give nitroglycerin, wait for troponin result
  - D. Rule out dissection and pulmonary embolism with CT chest

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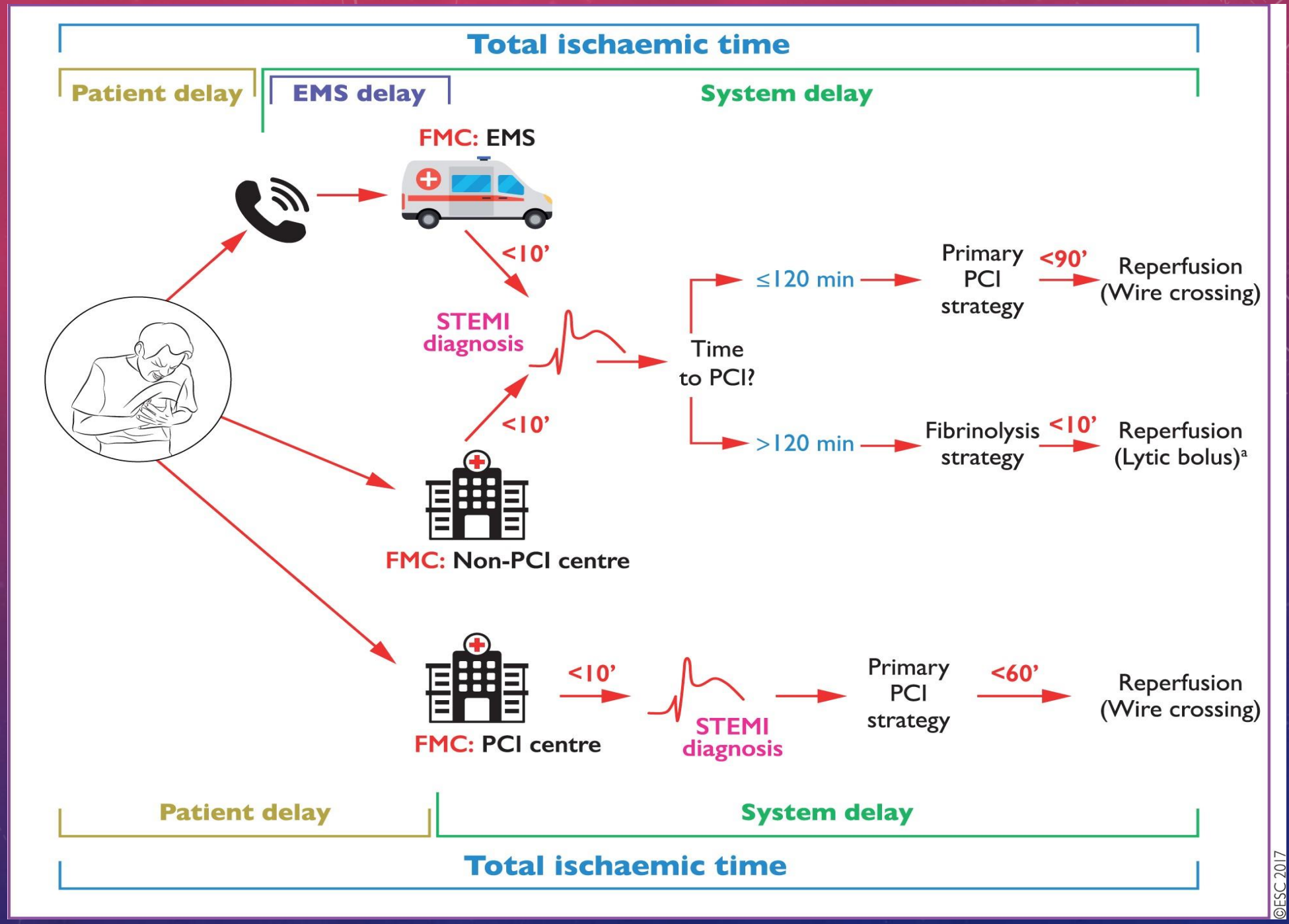
Reperfusion Goals in ST-Elevation MI (PCI = Percutaneous Coronary Intervention)

Primary PCI: Door to Balloon Time less than 90 minutes

Primary PCI: First medical contact to device time less than 90 minutes

Primary PCI: When transferred from a different hospital: First medical contact to device time less than 120 minutes

Fibrinolytic therapy: Door to needle time less than 30 minutes


Total ischaemic time
Patient delay
EMS delay
System delay
FMC: EMS
<10'
STEMI diagnosis
<10'
FMC: Non-PCI centre
Time to PCI?
≤120 min
Primary PCI strategy
<90'
Reperfusion (Wire crossing)
>120 min
Fibrinolysis strategy
<10'
Reperfusion (Lytic bolus)a
FMC: PCI centre
<10'
STEMI diagnosis
Primary PCI strategy
<60'
Reperfusion (Wire crossing)
Patient delay
System delay
Total ischaemic time
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Drug	Initial treatment	Specific contra-indications
Doses of fibrinolytic therapy		
Streptokinase	1.5 million units over 30–60 min i.v.	Previous treatment with streptokinase or anistreplase
Alteplase (tPA)	15 mg i.v. bolus 0.75 mg/kg i.v. over 30 min (up to 50 mg) then 0.5 mg/kg i.v. over 60 min (up to 35 mg)	
Reteplase (rPA)	10 units + 10 units i.v. bolus given 30 min apart	
Tenecteplase (TNK-tPA)	Single i.v. bolus: 30 mg (6000 IU) if <60 kg 35 mg (7000 IU) if 60 to <70 kg 40 mg (8000 IU) if 70 to <80 kg 45 mg (9000 IU) if 80 to <90 kg 50 mg (10000 IU) if ≥90 kg It is recommended to reduce to half-dose in patients ≥75 years of age.[121]	
Doses of antiplatelet co-therapies		
Aspirin	Starting dose of 150–300 mg orally (or 75–250 mg intravenously if oral ingestion is not possible), followed by a maintenance dose of 75–100 mg/day	
Clopidogrel	Loading dose of 300 mg orally, followed by a maintenance dose of 75 mg/day. In patients ≥75 years of age: loading dose of 75 mg, followed by a maintenance dose of 75 mg/day.	
Doses of anticoagulant co-therapies		
Enoxaparin	In patients <75 years of age: 30 mg i.v. bolus followed 15 min later by 1 mg/kg s.c. every 12 hours until revascularization or hospital discharge for a maximum of 8 days. The first two s.c. doses should not exceed 100 mg per injection. In patients ≥75 years of age: no i.v. bolus; start with first s.c. dose of 0.75 mg/kg with a maximum of 75 mg per injection for the first two s.c. doses. In patients with eGFR <30 mL/min/1.73 m^2, regardless of age, the s.c. doses are given once every 24 hours.	
UFH	60 IU/kg i.v. bolus with a maximum of 4000 IU followed by an i.v. infusion of 12 IU/kg with a maximum of 1000 IU/hour for 24–48 hours. Target aPTT: 50–70 s or 1.5 to 2.0 times that of control to be monitored at 3, 6, 12 and 24 hours.	
Fondaparinux (only with streptokinase)	2.5 mg i.v. bolus followed by a s.c. dose of 2.5 mg once daily up to 8 days or hospital discharge.	

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Table 1: Contraindications to the Use of Thrombolytics

Absolute Contraindications
Active bleeding
Disseminated intravascular coagulation
Recent (<3 months) stroke/transient ischemic attack
Recent (<3 months) neurosurgery
Recent (<3 months) intracranial trauma
Relative Contraindications
Recent (<10 days) CPR/chest compressions
Recent (<10 days) major surgery or trauma
Recent (<10 days) delivery
Recent (<3 months) major gastrointestinal bleed
Serious allergy to tPA or contrast
Severe thrombocytopenia
Renal failure
Infected thrombus
Pregnancy/lactation

CPR = cardiopulmonary resuscitation; tPA = tissue plasminogen activator.

2017 ESC/ACC STEMI/ACS GUIDELINES

- Class IA: reperfusion is recommended in all patients with symptoms of ischemia <= 12 hours and persistent ST elevations
- Class IA: Primary PCI strategy is recommended over fibrinolysis within indicated time frames
- Class III: In asymptomatic patients, a routine PCI of occluded artery is not indicated > 48 hours after onset of symptoms

QUESTION 3 (CONTINUED)

- The patient in question is taken emergently to cardiac catheterization lab. LHC showed occluded OM1 branch. He has successful primary PCI of OM1 without complications. HR is currently 50 bpm, BP is 100/60mmHg. The patient is symptoms free and without complaints. What drugs should he be on post PCI? He reports prior history of “mini-stroke”

  - A. ASA, Prasugrel, high dose statin
  - B. ASA, Metoprolol, Prasugrel
  - C. ASA, Ticagrelor, high dose statin
  - D. Prasugrel, Plavix, high dose statin
  - E. Plavix, ASA, high dose statin

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  - E. Plavix, ASA, high dose statin

MEDICAL THERAPY FOR STEMI POST PCI

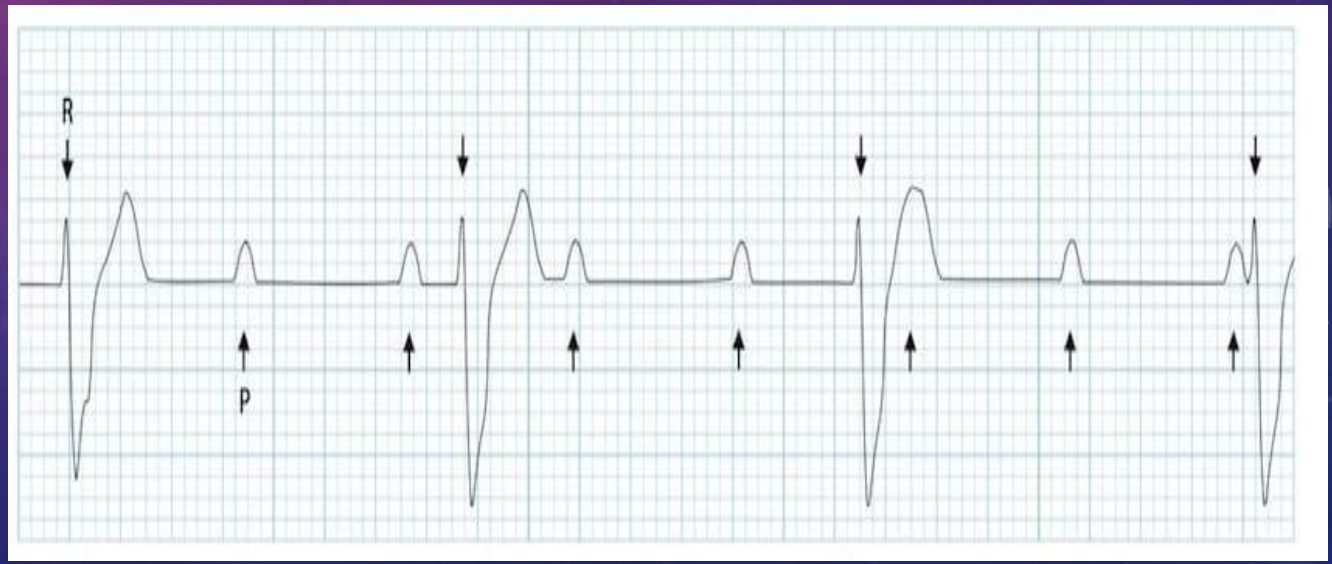
- Dual Antiplatelet Therapy (DAPT)
  - ASA load with 162-325mg with maintenance dose of 81mg daily
  - Ticagrelor load with 180mg followed by maintenance dose of 90mg BID (PLATO)
  - Prasugrel load with 60mg daily followed by maintenance dose of 10mg daily (TRITON-TIMI)
    - Contraindicated in patients with TIA/CVA, age > 75, weight < 60kg
  - Plavix may be used if Ticagrelor or Prasugrel contraindicated or not available
  - Cangrelor
    - IV antiplatelet medication used only during PCI procedure

MEDICAL THERAPY IN STEMI

- High dose statins (Atorvastatin 80mg or Rosuvastatin 40mg)
- Beta blockers
  - Avoid initially in relative bradycardia, hypotension, any high-grade AV block (Mobitz 2 or CHB)
- ACEI or ARB – LVEF <= 40%
  - Avoid in hypotension, AKI, hyperkalemia
- Mineralocorticoid receptor antagonist (eplerenone or spironolactone) – LVEF <= 40%
  - Avoid in hypotension, AKI, hyperkalemia
- ARNI – Entresto (PARADISE-MI) – not superior to ACEI

QUESTION 4

- 60 YO woman with DM, CKD who presents with anterior STEMI. She has uncomplicated primary PCI of proximal LAD within 70 minutes on medical contact. The following day in the CCU, she has this on telemetry:



QUESTION 4

- Her blood pressure is 90/50mmHg and she reports intermittent dizziness. She denies any chest pain. You start the patient on IV Dopamine drip with minimal improvement in blood pressure and no change in rhythm. What do you do next?
  - A. Change to levophed drip
  - B. Start beta blocker
  - C. Start Dobutamine
  - D. Place temporary pacer

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STEMI COMPLICATIONS

- Mechanical- early clinical recognition and ECHO
  - Free wall rupture
  - VSD
  - Papillary muscle rupture – Severe MR
- Pericarditis
  - Early, late presentations
- Arrhythmic
  - SVT and Afib
  - Vfib/VT
- Congestive heart failure

STEMI COMPLICATIONS

- Cardiogenic Shock
  - Emerging area of interest
  - Greater than 50% mortality in patients who present with STEMI and cardiogenic shock
  - Early recognition is key:
    - Clinical signs/symptoms
    - Lactic acid levels
    - Poor end organ perfusion
  - Aggressive medical management (inotropes/pressors) vs early mechanical support (Impella, ECMO, TandemHeart)

THANK YOU!

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