Myocardial Infarction

BY

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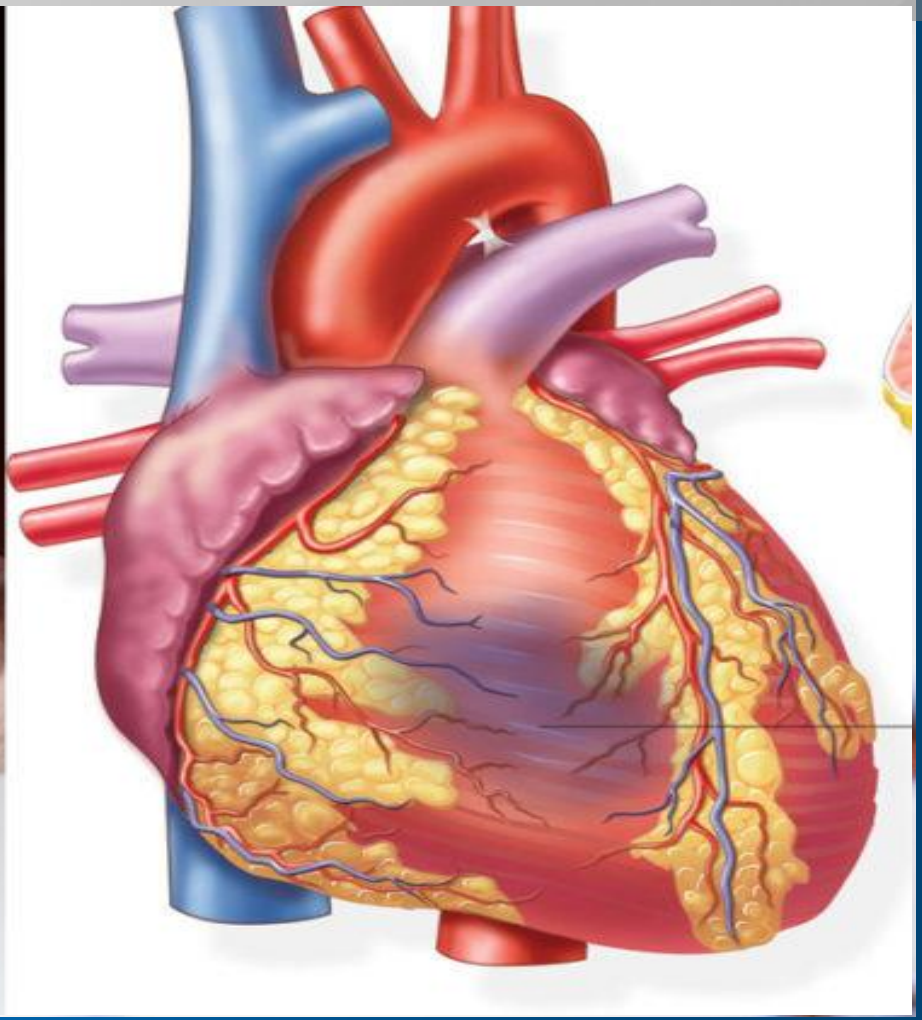


Definition

- Ischemic necrosis of part of the cardiac muscle due to sudden, persistent & complete cessation of its blood supply.

Etiology :

1.Thrombosis on top of atherosclerosis.

(The most common cause)

2. Non-atherosclerotic causes of myocardial infarction :

Coronary artery diseases : congenital anomalies ,spasm, dissection, PAN, Takayasu's disease.

Aortic stenosis, regurge.

Embolism : IE, Artificial valve, myxoma.

Risk factors for Atherosclerosis

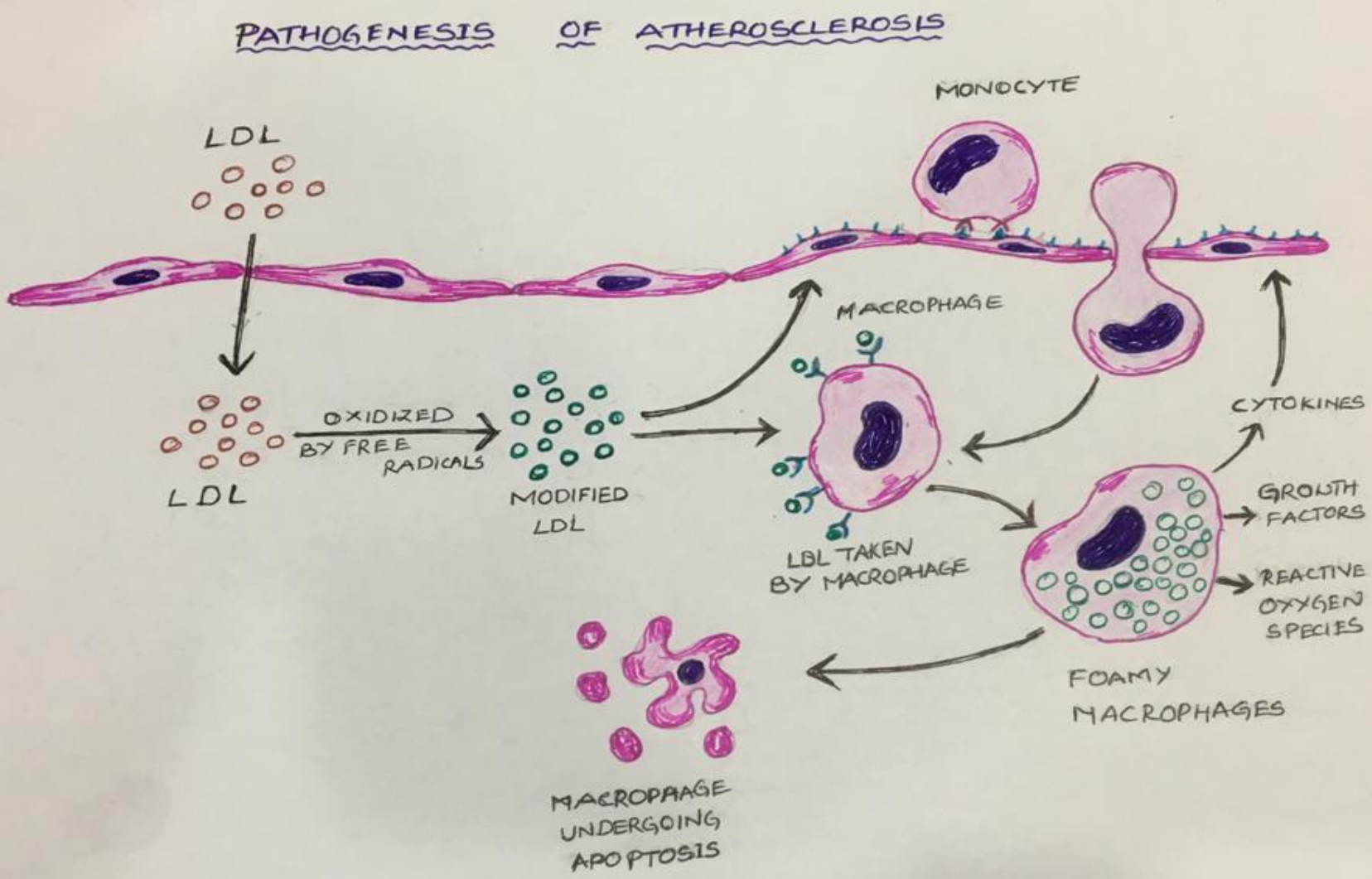
Non modifiable:

- Age.
- Sex: male> female.
- +ve family history.

Modifiable :

- Hypertension: cause endothelial damage.
- Hyperglycemia .
- Hyperlipidemia especially LDL .
- Hyperuricemia .
- Sedentary life style .
- Smoking .
- Stress.

pathogenesis



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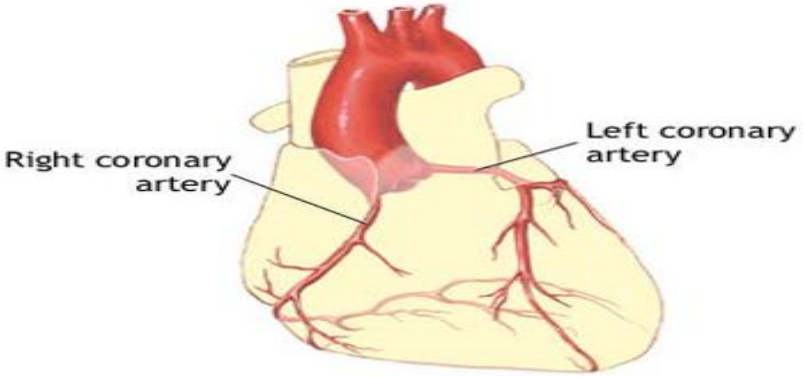
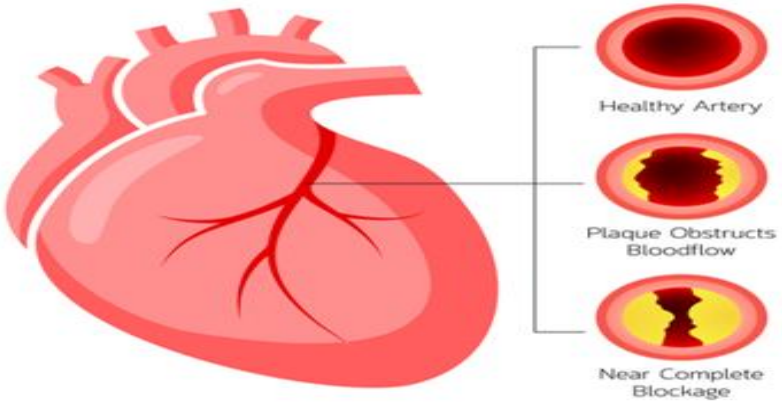
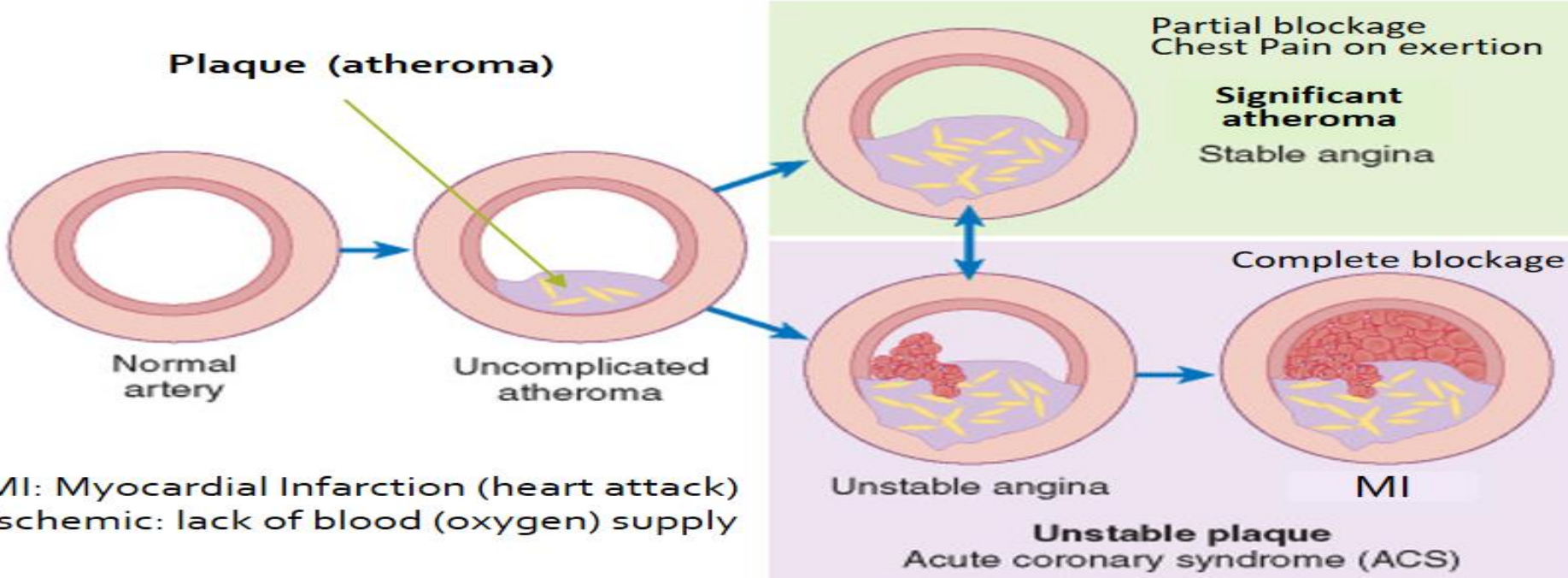




Atherosclerosis

Coronary Artery Disease



MI: Myocardial Infarction (heart attack)
Ischemic: lack of blood (oxygen) supply

Classification

- Site:

1- Occlusion of the left anterior descending artery →(anterior infarction).

2- Occlusion of the circumflex artery→ (lateral infarction).

3- Occlusion of the right coronary artery→ (inferior infarction).

- Types:
- Transmural infarction (**ST e**levation **m**yocardial **i**nfarction - **STEMI**) : infarction of full thickness of the ventricular wall.
- Subendocardial infarction(**N**on **ST e**levation **m**yocardial **i**nfarction -**NSTEMI**) :Transient or incomplete vessel occlusion.

clinical picture

Pain and/or complications

I. Chest pain: Similar to angina but :

- More severe, it may be severe enough to be described as the worst pain the patient has ever felt
- Radiates more : may below epigastric area but never below umbilicus.
- More prolonged : up to several hours.
- Unrelated to precipitating factors : may at rest.
- Not relieved by rest or sublingual nitrate.
- Associations: sweating,dizziness,dyspnea,fear of death(angor animi) & may also associated with complications.

- Painless infarction:

✓ Elderly.

✓Diabetic neuropathy.

✓ Patient under anesthesia.

✓Transplanted heart (denervated).

II. Complications

early complications:

- 1- Shock :

➢ **cardiogenic shock** :Caused by massive infarction (> 40% of the cardiac muscle) leading to severe pump failure& high jugular venous pressure.

C/P: Hypotension, tachycardia ,pulmonary edema.

Prognosis: very bad.

➢ **Neurogenic shock**

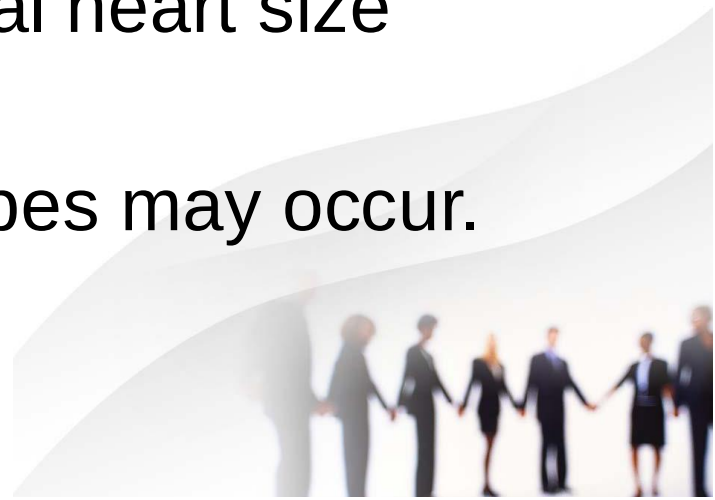
Caused by severe pain (vagal stimulation).

- C/P : Hypotension, bradycardia .
- Prognosis : good .

2- Acute heart failure : with normal heart size (within 24hs).

3. Arrhythmia(within 24hs) :All types may occur.

The most serious are: VT, CHB.



4- Myocardial rupture :

- Rupture of the septum →acquired VSD .
- Rupture of papillary muscles →acute MR → acute heart failure.
- Rupture of the ventricular free wall →blood fills the pericardium→ cardiac tamponade.

5- Dry pericarditis: (within 1-3 days)

Hemorrhagic pericardial effusion may develop especially with thrombolytic therapy.

6- Sudden death :

- Arrhythmia (VT, VF) : most deaths occur during few hours after MI.
- Acute heart failure.
- Cardiogenic shock.
- Cardiac rupture.

Late complications :

- 1- Post infarction syndrome : (Dresslers syndrome) within 4 weeks or more

Autoimmune phenomenon in response to necrotic cardiac tissue characterized by:

Pericarditis - Pleurisy - Pneumonitis -fever.

- 2- Post infarction angina :Due to affection of other diseased coronaries.
- 3- Myocardial aneurysm : (dilatation of the scar tissue of Ml)

➢ On examination: double apex .

➢ ECG : persistent ST segment elevation .

- 4- Thrombo-embolism :

Mural thrombosis :(infarction→ rough surface→thrombosis→systemic emboli)

DVT : due to prolonged recumbency →pulmonary embolism .

- 5- Complications of treatment: anticoagulant , prolonged bed rest, ...

signs

(not specific) **nothing or anything**

- The physical examination may be entirely normal.
- Pallor, sweating , nausea, vomiting & fever.
- **Pulse**:

➢ Tachycardia : sympathetic stimulation , cardiogenic shock .

➢ Bradycardia : neurogenic shock, HB, inferior Ml.

➢ Irregular : arrhythmias.

- **Blood pressure** :

➢ Hypertension : sympathetic stimulation .

➢ Hypotension : LVF, shock.

- **Cardiac auscultation :**

- S1: weak.
- S2 : reversed splitting.
- S3: due to LVF.
- S4 : due to decreased myocardial compliance.
- Murmur : of MR, VSD .
- Pericardial rub : Dry pericarditis.

Differential Diagnosis

causes of acute chest pain :

- Stable angina.
- Unstable angina.
- Ml.
- Pulmonary embolism.
- Aortic dissection.
- Pneumothorax.
- Acute dry pericarditis.

Diagnosis of MI

At least 2 of the following 3 criteria :

1. Classic chest pain.
2. ECG changes.
3. Positive biomarkers (cardiac enzymes)

Investigations

1- **ECG:**

➢ In transmural infarction (ST Elevation MI):

- 1. Convex elevation of ST segment.
- 2. Twave :Tall (hyperacute) in the first few minutes after vessel occlusion (the earliest change)

later on : Inverted T wave (representing sever ischemia)

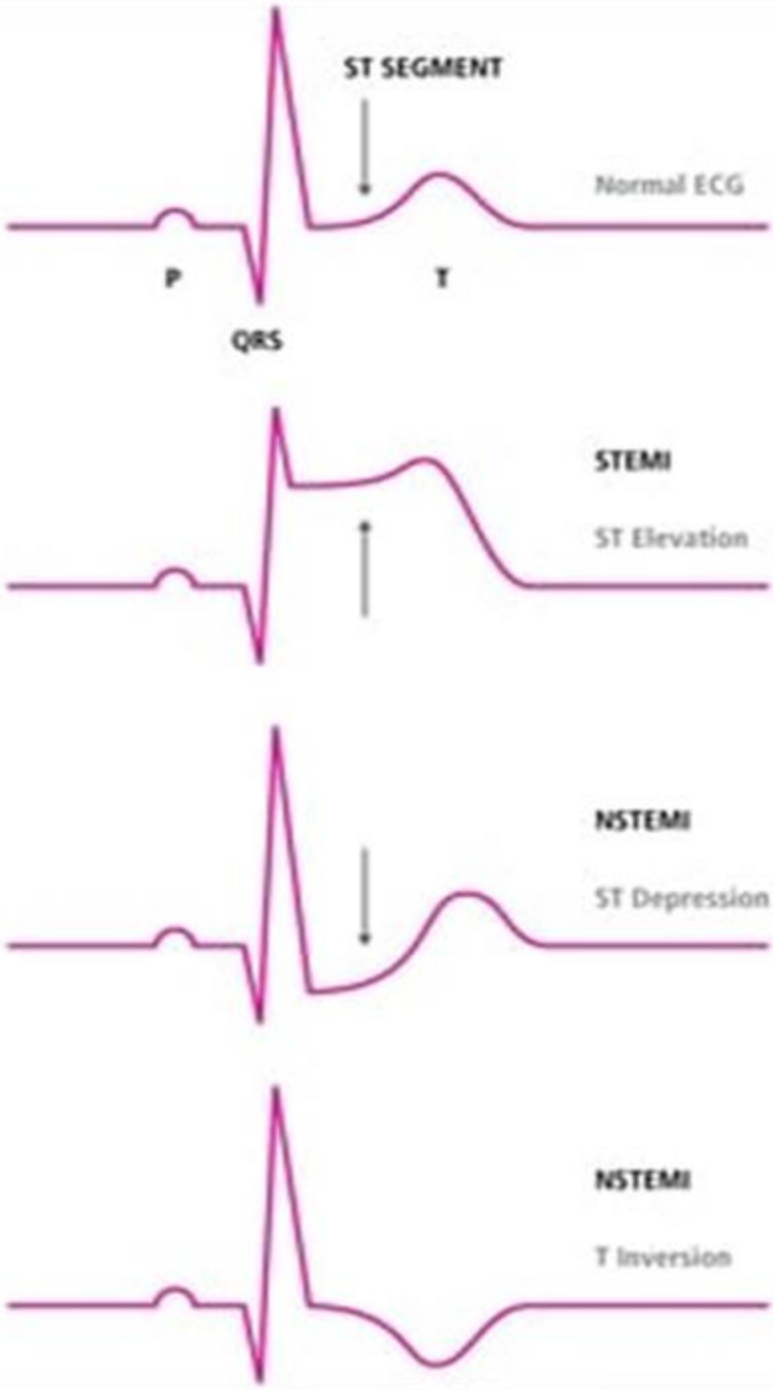
- 3. Finally, pathological Q waves occur, representing significant myocardial necrosis -& replacement by scar tissue.

(Pathologic Q waves are usually defined as duration ≥ 0.04 s or >25% of R-wave amplitude)

- In subendocardial infarction (Non ST Elevation Ml) :

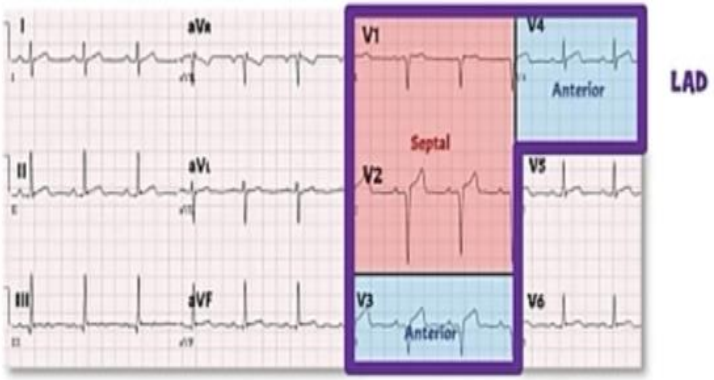
- 1. ST segment : normal or depressed.
- 2. No pathological Q waves (non Q wave Ml)
- 3. T wave : inverted.

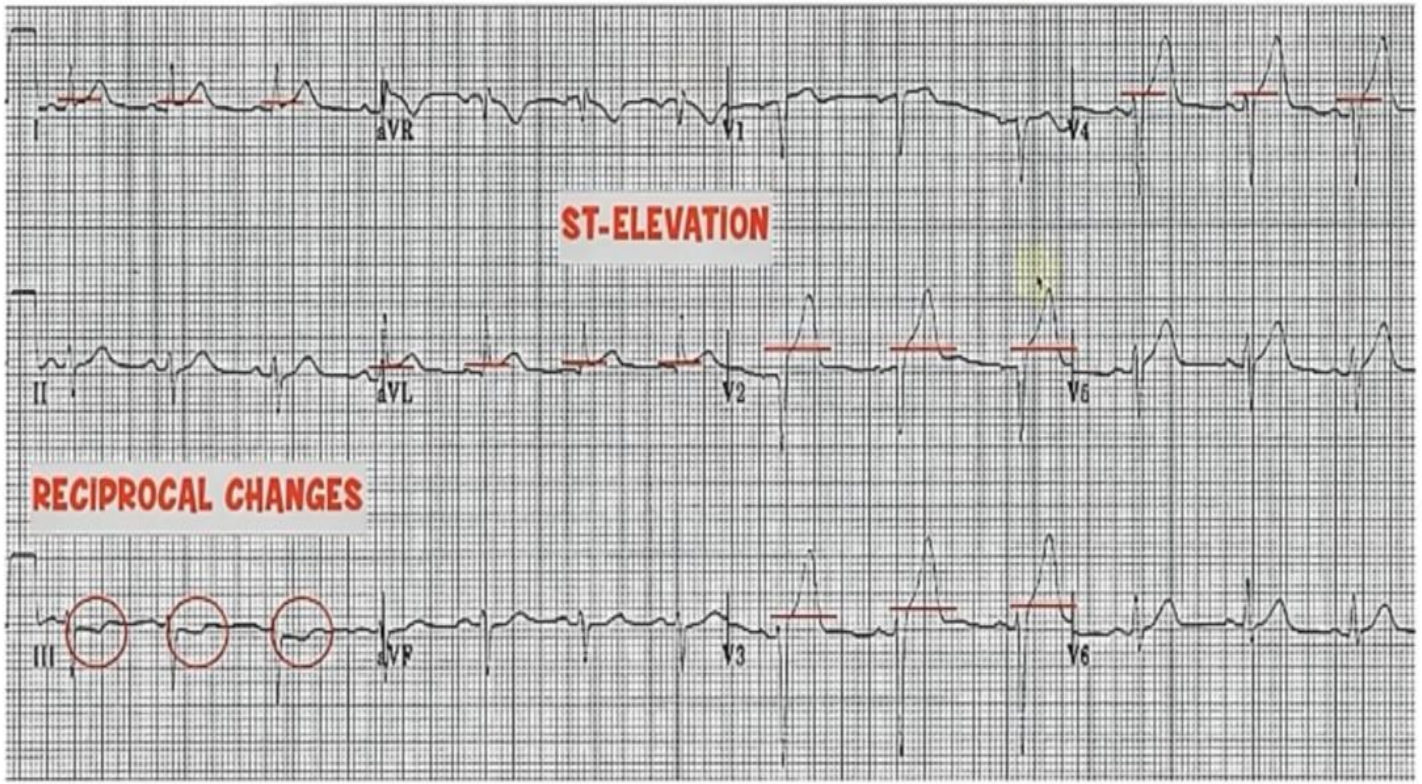
In old Ml : The only residual change is the pathological Q wave.



ECG
(ST elevation in Leads)

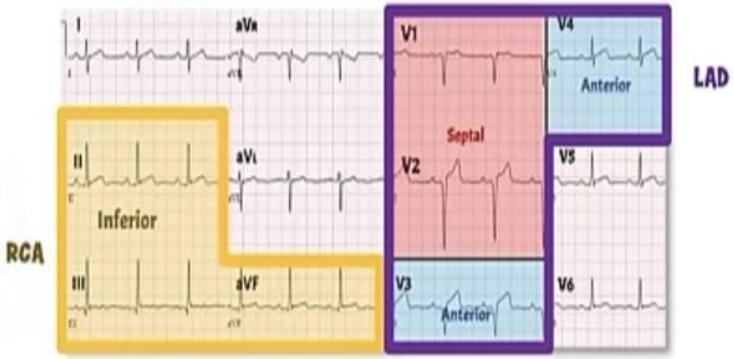
- Anterior (V1-V4) LAD

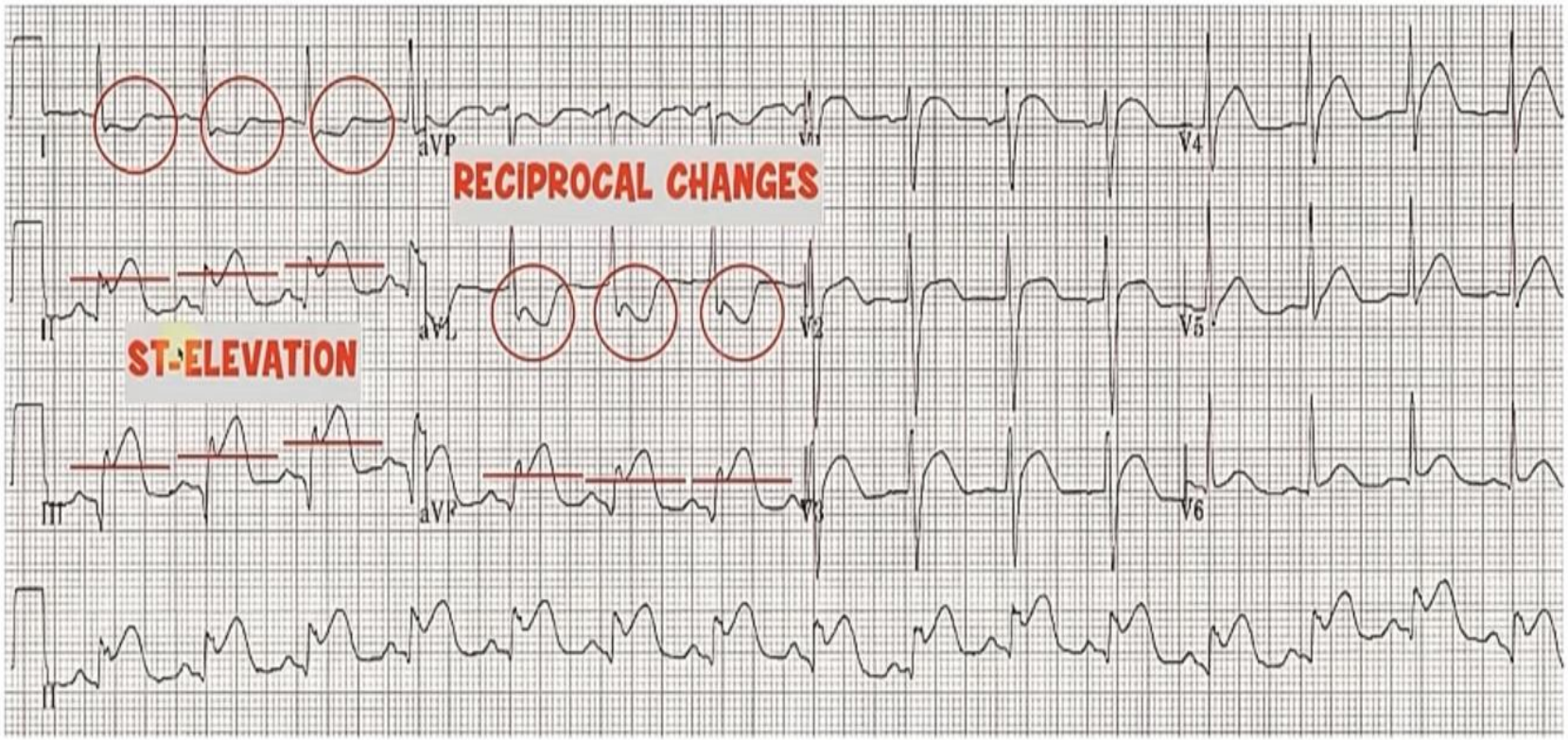




ECG
(ST elevation in Leads)

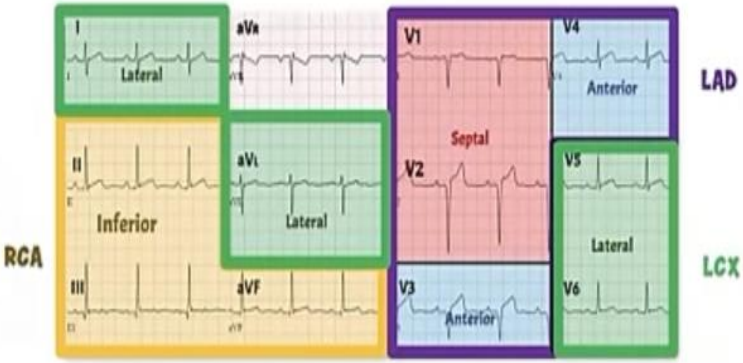
- Anterior (V1-V4) LAD
- Inferior (II,III, aVF) RCA

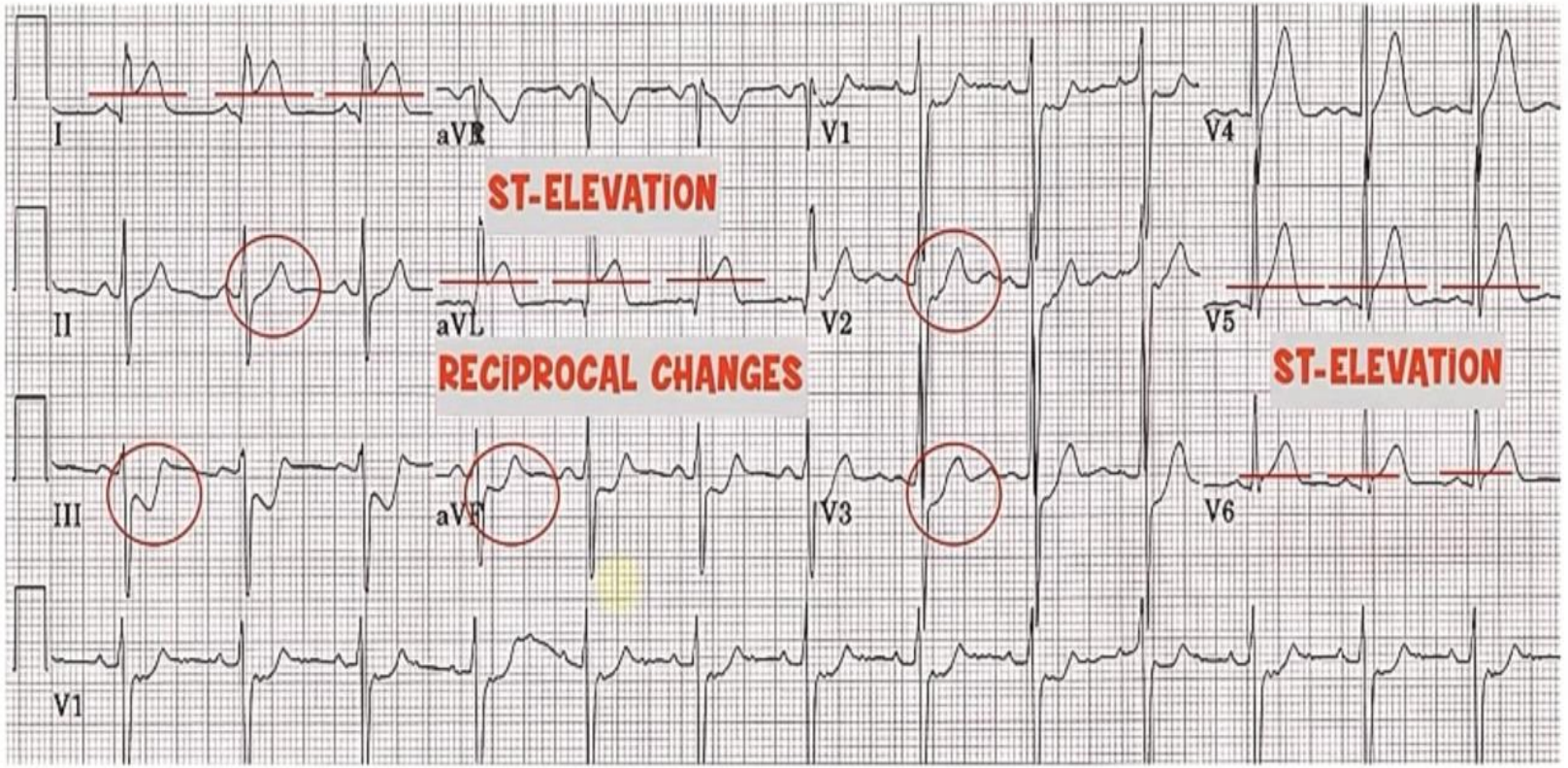




ECG
(ST elevation in Leads)

- Anterior (V1-V4) LAD
- Inferior (II,III, aVF) RCA
- Lateral (I, aVL, V5-V6) LCX





2. Cardiac enzymes are released into blood from necrotic heart muscle after an acute MI.

Marker	Initial rise	Return to normal	Notes
Creatine phosphokinase (*CPK*)	4-8 h	2-4 days	Non specific because it may rise in damaged skeletal muscles or brain.
CPK-MB	4-8 h	2-4 days	It's isoenzyme of CPK , specific to cardiac muscle
Lactic dehydrogenase (*LDH*)	10 h	1-2 weeks	Not specific .
Troponin (cTnT , cTnI)	3-12 h	1 week	Most sensitive & specific markers of myocardial damage .
Myoglobin	1-4 h	24 h	

- **3- Echocardiography** :

Ventricular wall motion abnormalities.

Complications: MR, myocardial aneurysm.

- **4- Cardiac scan** : (**Radioactive Thallium 201)**
  Thallium 201: is taken up by healthy myocardium & not by ischemic myocardium (cold spot)

- **5- Coronary angiography** (coronary catheter): reveals which vessels have been affected and the extent of damage.

- 6- **Leukocytosis** , ↑ **ESR**: as there is tissue damage.

Treatment

- Rapid transfer to hospital is a must (**Time lost is lives lost).**
- **Hospital care :**

1- General:

a. Admission to CCU (coronary care unit) with hemodynamic monitoring & continuous ECG

b. Oxygen inhalation .

c. Complete rest.

d. Diet: Light frequent meals & avoid constipation .

e. Sedative : Diazepam .

f. Aspirin : is now considered an essential element (325 mg initial dose then 75 mg daily-oral)

g. ACE Inhibitor: Oral therapy e.g. Lisinopril 5mg on dayl & 2 ,then 10 mg daily.

- ACE Inhibitors are vasodilator that reduce cardiac work & decrease myocardial energy requirement .
- ACE Inhibitors also have inhibitory effect on the cardiac remodeling

2- Relieving of chest pain :

a. Morphine (4 mg IV every 5 to 10 minutes as needed)

b. Nitroglycerine.

c. B blockers .

3- Thrombolvtic therapy :

- The earlier that thrombolytic therapy is given after the onset of chest pain, the greater the benefit (thrombolytic therapy is beneficial up to 6 hours but may be given for up to 12 hours)

Drugs :

- Streptokinase : 1.5 million units IV 9ver 60 min. may cause allergy.
- Alteplase, tenecteplase (tissue plasminogen activator - tPA)

- Anticoagulant (heparin) & antiplatetelet (aspirin) are given with & after thrombolytic therapy to reduce the risk of reocclusion.
- **Contraindications** : the major risk is Bleeding

➢ Bleeding disorders.

➢ Major surgery within past 2 weeks .

➢ Recent cerebral hemorrhage within past 12 months.

➢ Active internal bleeding e.g. peptic ulcer.

➢ Severe hypertension.

➢ Diabetic retinopathy with recent bleed.

➢ Aortic dissection.

4- Angioplasty : Percutaneous Transluminal Coronary Angioplasty (PTCA)

- Introduction of balloon or stent to dilate the stenotic artery (balloon-tipped catheter)

- More effective than thrombolytic therapy (fewer complication, shorter hospitalization).

5. CABG (Coronary Artery Bypass Graft) :

Grafting a piece of saphenous vein or internal mammary artery between the aorta & the coronary artery distal to any obstruction.

Indication of CABG :

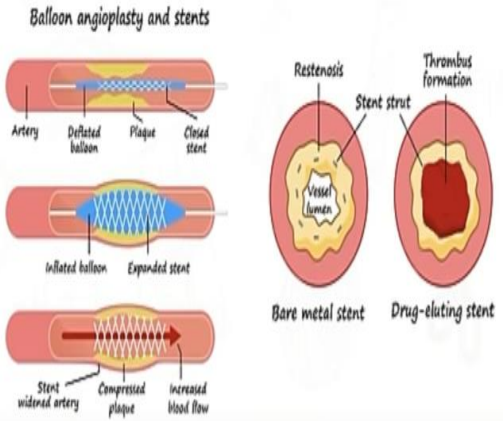
- ► Stenosis of 3 or more vessels.
- ► Stenosis of left main coronary artery.
- ► For diabetic patients with 2 or 3 - vessel disease.

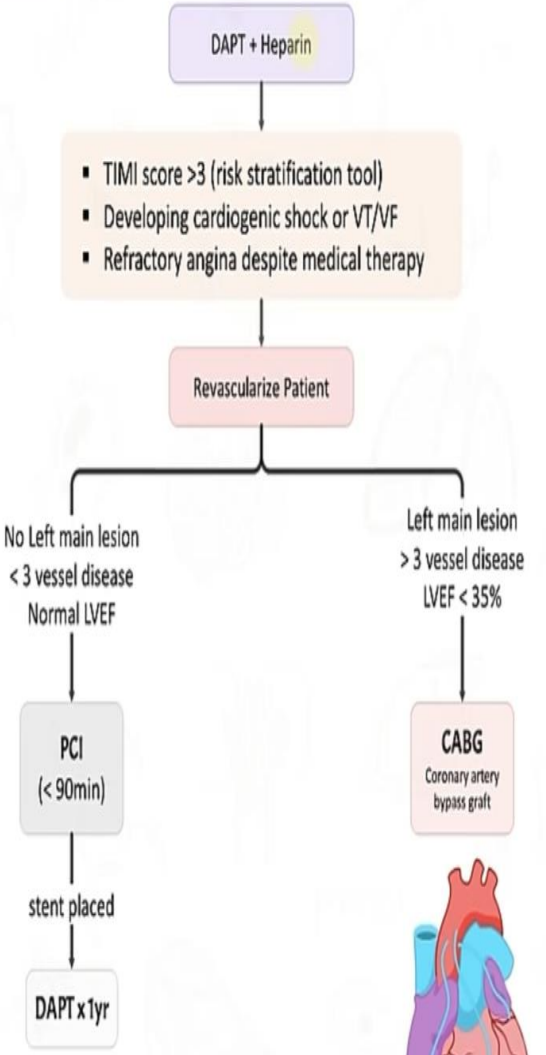
6- Treatment of early complications: e.g.

- Acute heart failure.
- Arrhythmia.
- cardiogenic shock

Treatment of Unstable Angina/NSTEMI

Type	Purpose of Treatment	Treatment
Unstable Angina & NSTEMI	Prevent thrombus **propagation**	- ASA PLUS - Clopidogrel PLUS **- Heparin**
	Reduction of Anginal chest pain	- Nitroglycerine - Beta Blocker **- Morphine**
	Revascularization of coronary vessel	- PCI or CABG
	Prevent stent thrombosis	- DAPT x 1 year
	Prevent coronary plaque progression	- Statins





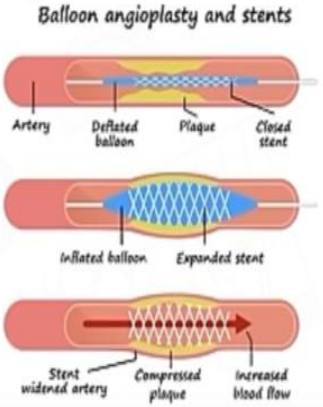
TIMI Risk Score for NSTEMI/UA

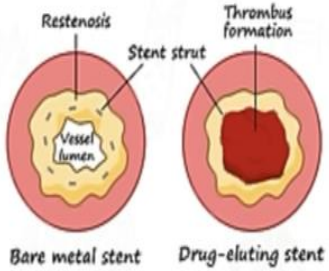
Age ≥ 65 years
≥ 3 Traditional CAD risk factors
CAD with ≥ 50% diameter stenosis
ECG ST-segment deviation of ≥ 0.5 mm
≥ 2 Anginal episodes in last 24 hours
Aspirin use in the past 7 days
Elevated cardiac biomarkers

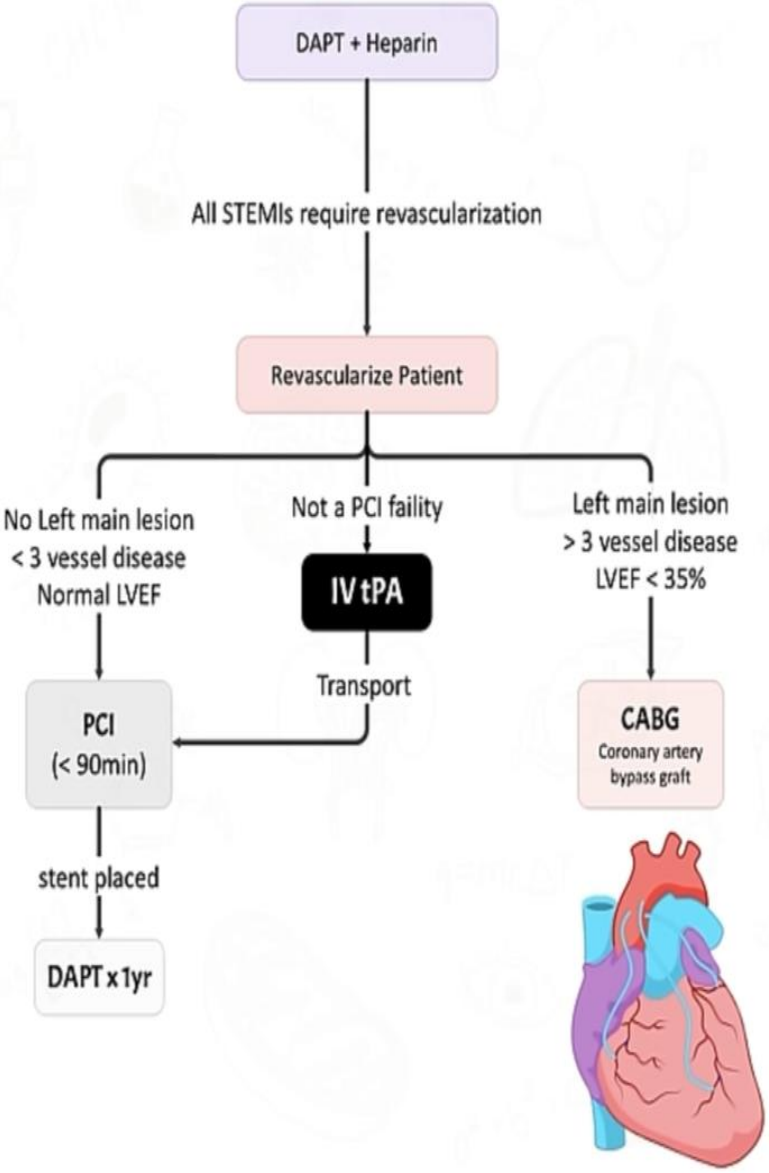
Score	Risk of death/MI/Revasc
0-1 points -	5%
2 points -	8%
3 points -	13%
4 points -	20%
5 points -	26%
6 points -	41%

Treatment of **STEMI**

Type	Purpose of Treatment	Treatment
STEMI	Prevent thrombus **propagation**	- ASA PLUS - Clopidogrel PLUS - **Heparin**
	Reduction of Anginal chest pain	- Nitroglycerine - Beta Blocker - Morphine
	Revascularization of coronary vessel	- PCI or CABG or **tPA**
	Prevent stent thrombosis	- DAPT x 1 year
	Prevent ventricular remodeling	- Ace-Inhibitors
	Prevent coronary plaque progression	- Statins







.After discharge :(ABCDE)

A : Aspirin. ACEIs.

B : B blockers., BP control.

C : Cholesterol control.

D : Diabetes control. diet.

E : Education., reassurance & rehabilitation


THANK
YOU