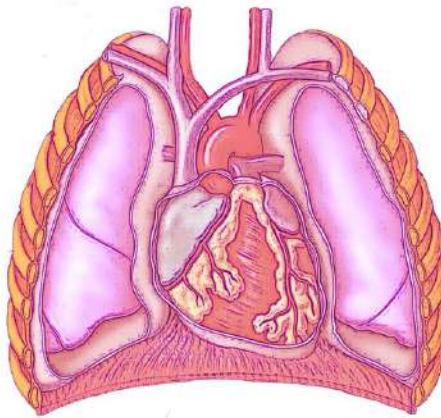




Internal Medicine



Topic : Ischemic Heart Diseases Notes
Done by : Johainah Taha

1 Introduction, slide 1-8 :

Ischemic heart disease

Definition

myocardial ischemia occurs when there is **imbalance** between the **supply** of oxygen (and other essential myocardial nutrients) and the myocardial **demand** for these substances

The coronary blood flow may be reduced by

1-mechanical obstruction

- a-atheroma (plaque)
- b-thrombosis (blood clot)
- c-embolus (Moving Clot)
- d-DISSECTING AORTIC ANEURYSM (tear in Aorta → blood leakage)

e-coronary ostial stenosis (Narrowing)

- a-VASCULITIS
- b-inflammation
- c-coronary arteritis
- d-SLE
- b-BEHCETS DISEASE
- c-KAWASKI → Common in children.

NON- OBSTRUCTIVE CORONARY

- prevalence 7%
- common in F > M

decreased coronary blood flow

ANGINA DUE TO INCREASE DEMAND

HYPOXIA → ↓ O₂

ANEMIA → ↓ Hb → ↓ O₂

Coronary Artery spasm

cocain abuse → they have spasm

coronary artery ectasia → slow flow

slow cor. flow

micro-vascular disease → example DM can lead to dysfunction

tachycardia → HR (100-130) = more O₂ needed

thyrotoxicosis → thyroid issues → tachycardia

LVH (left ventricular hypertrophy) → ↑ BP

HTN → ↑ BP

AS → Aortic Stenosis → the heart work harder

heavy exertion → normal coronary at rest → ↑ BP → ↑ O₂ demand

Coronary artery disease CAD

commonest cause IHD-world wide.

-It is the largest single cause of death in UK.

the main pathological lesion in CAD is

coronary athero-sclerosis:

PLAQUE ULCERATION → FISSURE → RUPTURE → platelet aggregation → occlusion

CAD presents clinically as:-

1-Chronic coronary syndrome : stable angina pectoris

↳ Chest pain with exertion or even heavy meals.

2- Acute coronary Syndrome: unstable angina - Myocardial infarction

Very important

CAD risk factors

↳ Male > Female, when young ↳ history of heart diseases or Sudden Premature death.

Fixed → Age, gender, family history

Changeable →

Hyperlipidemia

Smoking

Hypertension

Diabetes mellitus

SEXUAL IMPOTANCE → one of the first signs of IHD.

Alcohol

POLUTION

microalbuminurea → Do urine analysis. ↳ kidney damage indicator

-HR-CVA- CKD ↳ tachycardia presented also in Anemia and thyrotoxicosis

Homocysteinemia → Lead to thrombosis

Personality

lack of exercise-

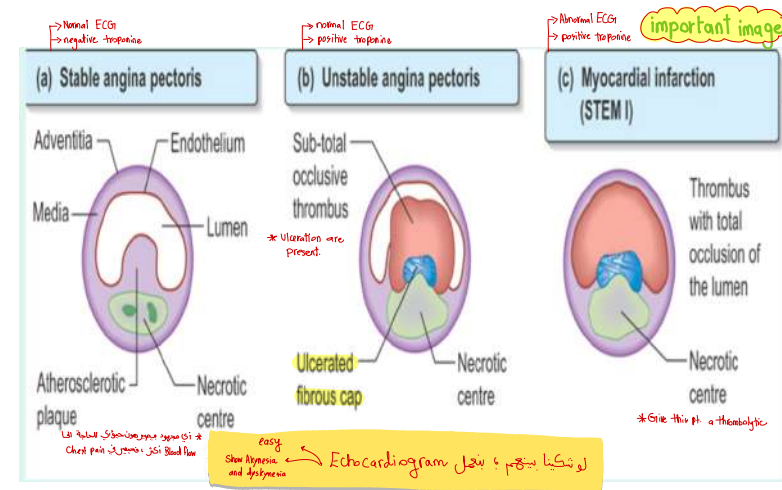
Obesity

Gout → Linked to metabolic syndrome

Drugs -COCAIN → Causes artery spasm.

* Micro albumin urea :-

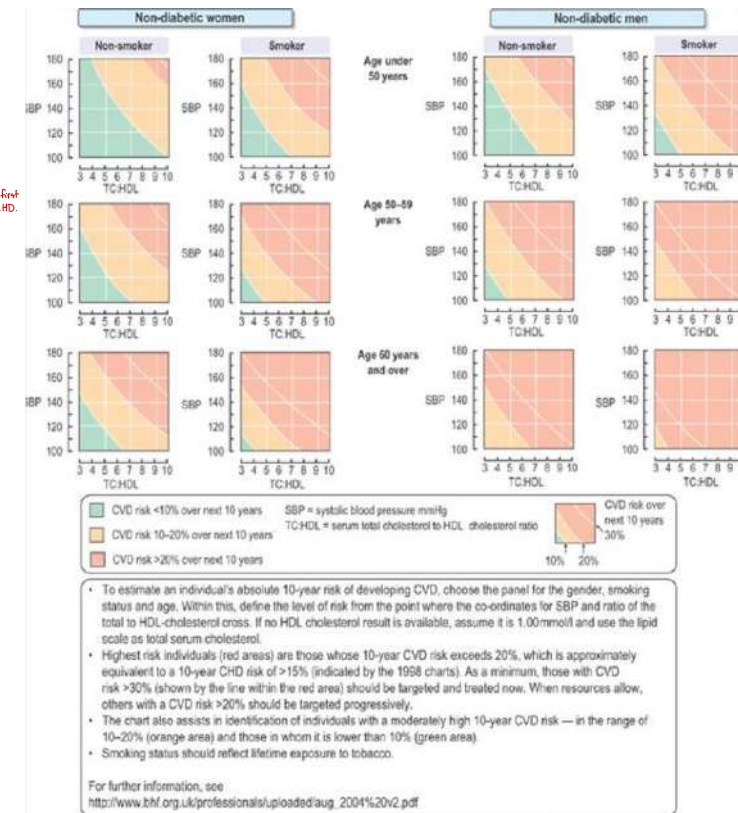
- ↳ Nephritis
- ↳ Diabetic nephropathy
- ↳ vascular endothelial dysfunction



medical history → HTN, DM, Lipid, gout

Social history → smoking, alcohol, exercise, obesity, pollution

systemic diseases → homocystenemia/CKD/ CVA/microalbumin urea.



2 Angina Pectoris, slide 9-24

- It is the most important cause of recurrent chest discomfort
- it is **syndrome** not disease
- only 15% has typical **presentation** characterized by:

central chest pain

Site: Retrosternal

Radiation: to left, right or both arms, throat or jaw and rarely to the back or epigastrium

Duration and Timing: short duration usually lasting less than 10 min.

Character: tightness

Severity: usually not severe

Aggravation: exertion - heavy exercise - walking against cold air - heavy meal

Relieved by: GTN OR by REST

Onset: Sudden.

E C H O
exercise cold air heavy meals over exertion

Types

(mnemonic: DEN-VU)

- 1- **Decubitus angina**: occurs on lying down
- 2- **ANGINA EQUIVALENT**: SOB after exertion
- 3- **Nocturnal angina**: occurs at night
- 4- **Variant (prinzmetal's) angina**: occurs at rest
- 5- **Unstable angina**: refer to angina of recent onset, worsening angina or post-infarction angina- or angina at rest

On examination

- usually NO finding
- may have 4th. Heart sound
- signs of associated RISK factors

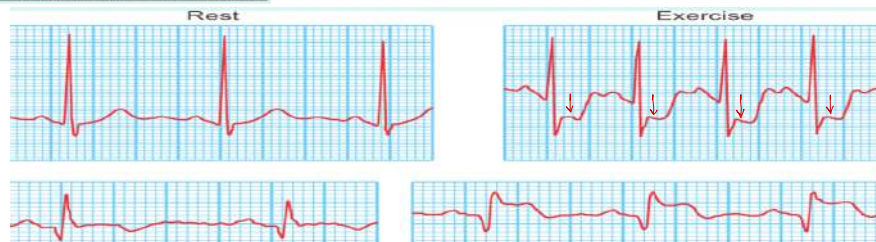
Angina pectoris

Investigations

1 NON-INVASIVE

1 **Cardiac scintigraphy** (myocardial perfusion scan)

2 **EX- ECG- TREADMEL TEST**



Resting ECG

usually normal between attacks

may show ^① ST depression or ^② T inversion during attack

Exercise ECG

treadmel test

ST segment depression of > 1 mm is positive

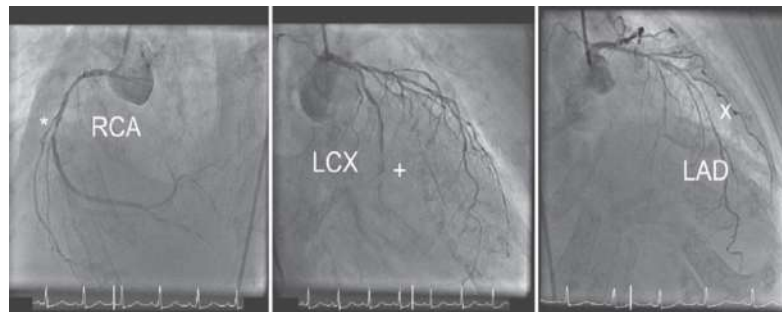
3 **Echocardiography**

4 **STRESS-ECHO**

5 **Cardiovascular magnetic resonance (C-MRA)**

2 INVASIVE

→ **Coronary angiography** Gold standard for diagnosis.



Treatment of angina

Symptomatic treatment

Glyceryl trinitrate (GTN) → vasodilation → ↓ preload and myocardial O₂ demand.

-sublingual tablet or spray: action peaks 4-8 minutes and last 20-30 minutes

-transdermal: last up to 24 hours

-(isosorbide-mononitrate): long acting

-Beta- blockers

-negative inotropic (reduce myocardial contractility)
-negative chronotropic (slow heart rate)

-common beta blockers and their dosage :

Atenolol → 50 -100 mg once daily

Metoprolol → 25-50 mg twice daily

Bisoprolol, Nibevolol

IVABRADINE

-Targets SA node to reduce heart rate.

With beta blockers, it reduces HR to <70.

-Mechanism of Action in Angina :

- 1- reduce metabolic O₂ requirement and demand of myocardium (by decreasing heart rate and contractility)
- 2- increase diastolic time for more coronary blood flow and increase O₂ supply to myocardium
- 3- together, it will reduce and relieve angina symptoms

Calcium channel blockers

DIHYDROPYRIDINE:

↳ Reduces the afterload and oxygen demand.

-Nifedipine - amlodipine

-Lercanidipine :3rd generation

NONDIHYDROPYRIDINE:

-Verapamine

-Diltiazem

Trimetazidine

-A Metabolic treatment

-Inhibits fatty acid oxidation (FFA), shifting myocardial energy metabolism towards glucose oxidation, which is more oxygen-efficient.
↳ uses less oxygen.

-no hemodynamic effect

-no hypotension

Prophylactic medication

1- Antiplatelet Therapy:

Aspirin

-is used in **all** patients with angina

-75 mg daily

2- Lipid lowering therapy.

A-Reduction of (1mmol cholesterol = 39mg) will reduce CVD by 20%

B-HMG-CoA reductase inhibitors (statin) :

atorvastatine-simvastatine

C-PCSK9 Inhibitors :

INCLISIRAN

EZETIMIBE

For high-risk patients

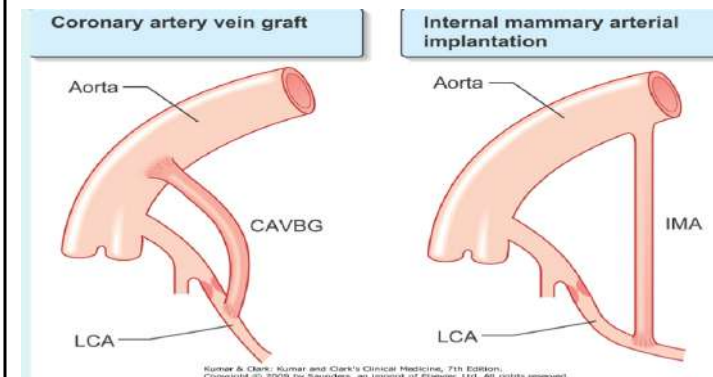
3-LDL targets based on Cardiovascular risk :

High risk ▶ LDL <70mg/dl

Very high risk ▶ LDL <55mg/dl

Extremely high risk ▶ recurrent CVA - LDL < 39mg/dl

Coronary artery bypass grafting (CABG)



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Percutaneous coronary intervention (PCI)

-Invasive procedure.

-Procedure : The process of dilating a coronary artery stenosis with stent implantation using an inflatable balloon introduced into the CORONARY artery via the femoral, radial or brachial artery.

-PCI criteria and Indication :

- 1- symptom relief : reduce angina symptoms
- 2- medication reduction : reduces the requirement for anti-anginal drug therapy.
- 3- improve exercise capacity
- 4- optimal outcome : the best outcome in cases with a discrete, short and soft lesion in a straight vessel without involving a bifurcation

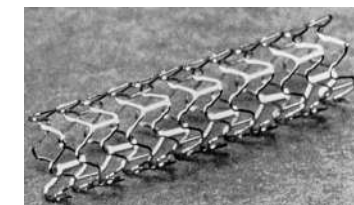
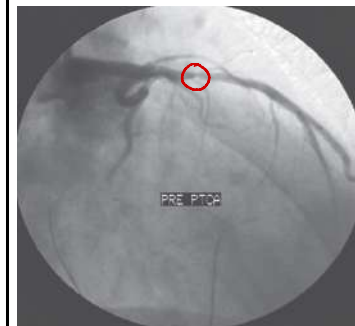
-Risks and complication:

- 1- acute MI
- 2- Restenosis and stent thrombosis
- 3- blood vessel dissection

↳ how to ↓ the risk

-Drug-Eluting stents :

these complications has been reduced with the introduction of drug eluted stent



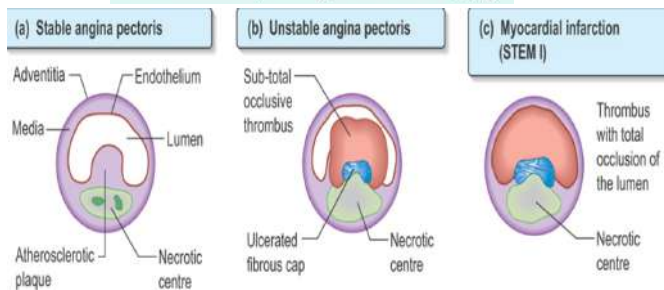
③ Acute coronary syndrom, slide 25-34

three clinical conditions resulting from myocardial ischemia due to coronary artery occlusion or severe narrowing:

Unstable angina

NSTEMI STEMI

Pathophysiology



Clinical presentation

1- Chest Pain :

- *new onset chest pain
- *severe chest pain at rest or deterioration of pre- existing angina

2- Atypical Symptoms

- *epigastric pain (you have to ask about Abdominal pain in history)
- *dyspnea (SOB)
- *Pulmonary edema
- *pre-syncope or syncope
- *UNCONSCIOUS SHOCK.

on examination :

- 1- low BP → due to decreased output.
- 2- tachycardia as compensation to maintain perfusion
- 3- basal crackles
- 4- S4 gallop → late diastolic heart sound, caused by distal aortic valve against LV wall, not significant left ventricle
- 5- cardiac systolic murmurs (mitral regurgitation) to indicate qualitative mitral dysfunction

ACUTE coronary syndromes

Electrocardiogram

- may be **normal** → early ACS
→ repeat when symptoms persist.
- presence of ST depression and T inversion → highly suggest ischemia (NSTEMI or unstable angina)
- repeat ECG when patient is in pain → persistent ST elevation or new bundle branch block → it indicates complete coronary artery occlusion (STEMI)
↳ if it persists beyond weeks → consider Ventricular aneurysm or pericarditis.

- transient ST elevation → coronary vasospasm or **Prinzmetal's angina**. (Temporary vasospasm rather than fixed coronary obstruction)
↳ transient ST elevation

Biochemical markers

1- Cardiac-specific markers: (Most specific to MI)

- Cardiac troponin (I, T and C)

2- Other markers (less specific):

- AST and ALT (↑ in both heart & liver)
→ raised in liver
→ raised in liver
→ raised in liver
- LDH
- Creatinine kinase -MB → useful for re-infarction
- Myoglobin → earliest marker
- Inflammatory markers : CRP- ESR- WBC
→ to differentiate between Pericarditis and MI

Management

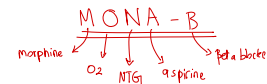
1-Immediate chest pain management :

- *Rest in bed
- *Analgesia: Morphine or Diamorphine 2.5-5 mg IV for severe pain.
- *Oxygen

2- Antiplatelet Therapy : 2

*Aspirin :

- Loading Dose : 150 -300 mg orally
- Maintenance Dose : 75-100 mg daily



*P2Y12- inhibitor

1-Clopidogrel :

- Loading dose : 300mg
- Maintainance dose : 75 mg daily

2-Prasugrel or Ticagrelor

3- Antithrombin

*Unfractionated Heparin :

- Keep up the dose
- Bolus Dose : 5000 units IV
- Infusion : .25 units/kg/hour

*Low molecular weight heparin (LMWH)

1- Enoxaparin : (Lower risk for bleeding)

- Dose : 1 mg/kg s.c. twice daily (every 12 hours)

4. Coronary Vasodilation

- ***Glyceryl Trinitrate (GTN):** 2-10 mg/hour IV, buccal, or sublingual (for symptom relief and vasodilation).

5. Beta-Blockers (Reduce Myocardial Oxygen Demand)

- ***Atenolol:** 5 mg IV → then 25-50 mg orally daily.

- ***Other options:** Metoprolol, Bisoprolol, Nebivolol, Ivabradine.

Avoid them in : * bradycardia * Acute heart failure
hypotension

6. Coronary Intervention (Revascularization)

*Percutaneous Coronary Intervention (PCI) or Coronary Artery Bypass Grafting (CABG)

- Recommended for high-risk ACS patients.

*Glycoprotein IIb/IIIa Inhibitors (Adjunct to PCI for

to prevent further clot formation.

ACUTE coronary syndromes

7. Plaque Stabilization & Ventricular Remodeling

*Statins (Lipid-lowering therapy): → ↓ plaque progression.

- 1-Simvastatin 20-40 mg daily.
- 2-Pravastatin 20-40 mg daily.
- 3-Atorvastatin 20-40 mg daily.
- 4-PCSK9 Inhibitors (Inclisiran) for high-risk patients.

*ACE Inhibitors (Cardioprotective & Prevent Remodeling):

- 1-Ramipril: 2.5-10 mg daily.
- 2-Lisinopril: 5-10 mg daily.

*Angiotensin II Receptor Blockers (ARBs) (Alternative to ACEi):

→ in cases of cough, angioedema, hyperkalemia, kidney issues.
Valsartan, Candesartan, Telmisartan.

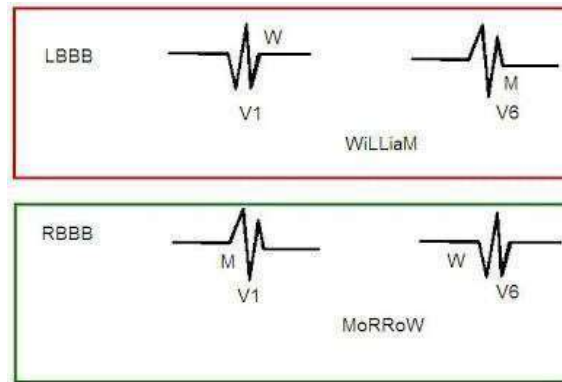
8. Secondary Prevention (Post-ACS Risk Factor Modification)

- *Smoking cessation.
- *Blood pressure control: Target <130/85 mmHg.
- *Diabetes management: Maintain tight glycemic control.
- ***Lipid management:**
LDL <70 mg/dL for high-risk patients.
LDL <55 mg/dL for very high-risk patients.
LDL <39 mg/dL for extremely high-risk or recurrent CVA patients.
- *Consider **Ezetimibe** as an adjunct to **statins** for **LDL reduction**.
- *Dietary modifications: Low-fat diet.

9. Discharge Medications (Long-term Management)

Every patient should be discharged on:

- ✓ Aspirin → Antiplatelet
- ✓ Clopidogrel (or alternative P2Y12 inhibitor)
- ✓ Beta-blocker → ↓ HR, O₂ demand
- ✓ ACE inhibitor → prevent ventricular remodeling
- ✓ Statin → ↓ cholesterol and stabilize the plaque
- ✓ GTN spray (for symptom relief as needed)



✓ Link Medications to Their Purpose

- **Antiplatelets** → Prevent clot formation.
- **Antithrombins** → Prevent clot progression.
- **Beta-Blockers** → Reduce heart strain.
- **Statins** → Reduce plaque buildup.
- **ACE Inhibitors** → Prevent heart remodeling.

→ Structural and functional changes like hypertrophy, ventricular dilation, fibrosis.
→ can lead to HF

④ STEMI, slide 35-

ST-elevation myocardial infarction (STEMI)

- cardiac myocytes death due to prolonged ischaemia.

Diagnosis

- *clinical history : prolonged classical chest pain.
- *ECG findings : ST elevation in infarcted leads.
- *Biochemical markers : elevated troponin I/T and CK-MB.

mortality of MI

- first month mortality may be as high as 50%
- 50% of deaths occur in first few hours because of **arrhythmia** (VT, VF, cardiac arrest).

Clinical

- ✓ Typical Symptoms:
 - Severe, prolonged chest pain (lasting 20 min) **not relieved by sublingual GTN.**
 - Radiation to left arm, neck, or jaw.

- ✓ Atypical Symptoms (**More common in elderly & diabetics**):

- Acute pulmonary edema
- Fatigue, pre-syncope, syncope, **shock** → Ask about urine output.
- Sudden cardiac arrest, stroke (CVA), vertigo
- Epigastric pain, **vomiting** → Ask about nausea.

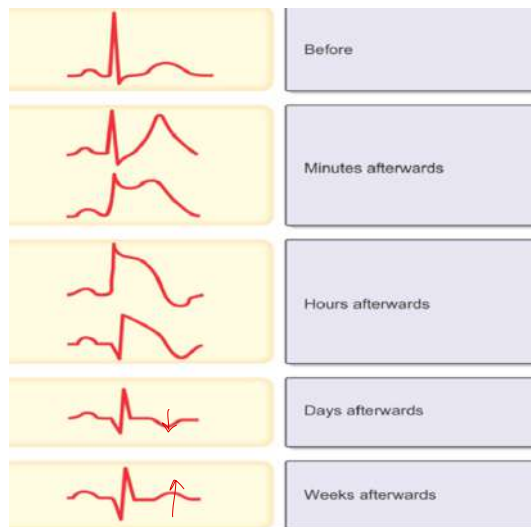
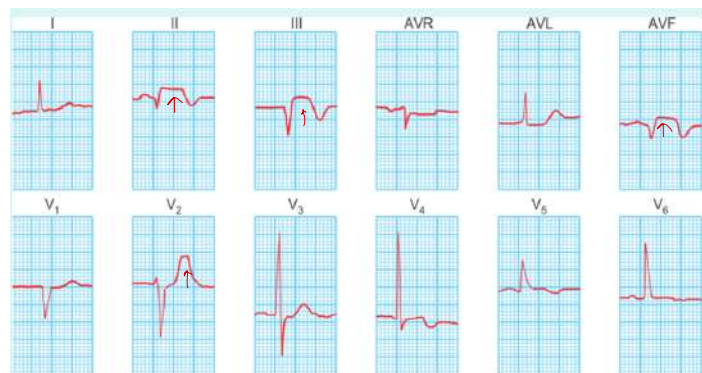
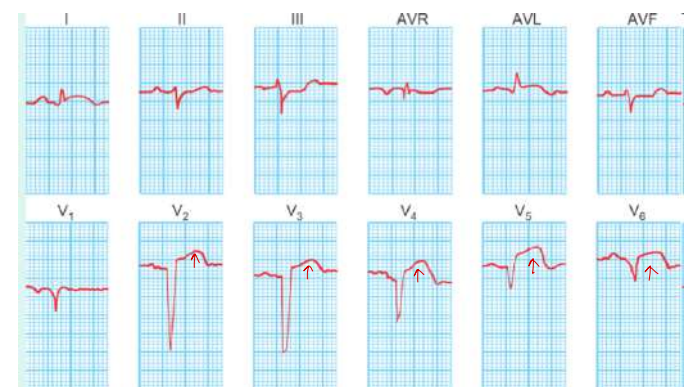
- ✓ Examination Findings:

- Pale, clammy, sweaty patient
- Thread small-volume pulse, tachycardia, hypotension

ST- elevation myocardial infarction

Electrocardiography

- ECG should be performed on admission (usually abnormal)
- If initial ECG is normal, **repeat every 15 min** while the patient is in pain.
- ST-segment elevation in leads corresponding to the infarcted myocardium.
- New Left Bundle Branch Block (LBBB) is diagnostic.
- Continuous cardiac monitoring due to risk of life-threatening arrhythmias.



Investigation

*Blood sample should be taken.

***Cardiac enzymes** : troponin I or T level or CK-MB

***Other Blood tests** :

- 1-Full blood count
- 2-serum electrolytes
- 3-glucose and lipid profile

***ECHO**:

- LV Dysfunction (hypokinesia/akinesia).
- Assesses LV wall motion abnormalities

Early medical management

Accident & emergency

✓ Initial Steps in Emergency Department (A&E):

- Bed rest.
- Oxygen therapy (if $SpO_2 < 90\%$).
- IV access and blood sampling for cardiac markers.
- Pain relief**: IV Morphine or Diamorphine (2.5-5 mg) + **antiemetic** (e.g., Metoclopramide 10 mg IV).
- Antiplatelet therapy**:
 - Aspirin 150-300 mg loading dose.
 - Clopidogrel 300 mg OR newer P2Y12 inhibitors (Ticagrelor 180 mg).
- Sublingual GTN** (0.3-1 mg) - repeated as needed.
- Beta-blockers** to reduce myocardial oxygen demand.
- Urgent **PCI** referral (if available).
- Consider **GP IIb/IIIa inhibitors** (Abciximab, Eptifibatide, Tirofiban) before PCI.
- If PCI is unavailable → Administer **fibrinolysis** for ST elevation , MI , new LBBB

Fibrinolysis

*Fibrinolytic agents promote clot breakdown by activating

plasminogen → **plasmin**.

*Indications: ST-elevation MI, New LBB

***Fibrinolytic Agents**:

- 1-Streptokinase (it is initially used and rarely used due to allergic reactions).^{خطر الحساسية}
- 2-Tissue Plasminogen Activator (t-PA).
- 3-Retepase (r-PA).^{سريع}
- 4-Tenecteplase (TNK-tPA).^{→ given as single bolus.}

***Adjunctive therapy**:

- 1-Aspirin should be continued.
- 2-Heparin is recommended with t-PA ^① or tenecteplase ^②, but not with streptokinase

ST- elevation myocardial infarction

Percutaneous coronary intervention

- ✓ Primary PCI (within 90 minutes) is the gold standard.
- ✓ Door-to-balloon time should be <120 minutes.
- ✓ Rescue PCI if fibrinolysis fails.
- ✓ Glycoprotein IIb/IIIa inhibitors (Abciximab) before PCI to reduce early complications (death, MI, urgent revascularization)

* they are given IV before PCI.

Coronary artery bypass surgery.

- ✓ Reserved for:

- 1-Failed PCI.
- 2-Severe multi-vessel disease.
- 3-Complications of STEMI (e.g., mechanical defects, refractory angina).

Complications of myocardial infarction

1. Heart Failure & Cardiogenic Shock

Treatment:

- IV Furosemide (for volume overload). *→ ↑ urine output → ↓ overload*
- ACE inhibitors (to reduce afterload). *→ ↓ resistance to heart to pump blood*
- IV inotropes (e.g., dopamine) if there is severe heart failure. *→ ↑ heart pumping force*
- Intra-aortic balloon pump (IABP) may be required in cardiogenic shock. *→ ↑ blood flow to heart & afterload*

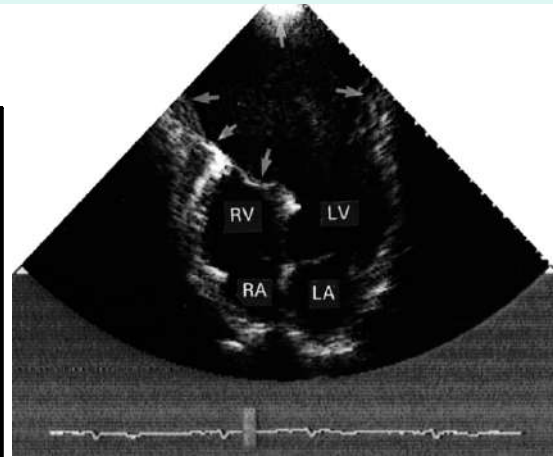
2-Myocardial rupture & aneurysmal dilatation

Requires surgical intervention.

3-Ventricular septal defect (VSD) → Managed with IABP (intra-aortic balloon pump and Coronary angiography, followed by surgical repair.

4-Mitral regurgitation → Surgical repair/replacement *→ when papillary muscle ruptures*

5-Right Ventricular Infarction (common in inferior MI) → Causes hypotension, shock, high JVP.



6. Cardiac Arrhythmias

-Ventricular tachycardia (VT) → IV beta-blockers (e.g., Metoprolol 5 mg IV).

-Ventricular fibrillation (VF) → Immediate defibrillation (DC shock).

-Atrial fibrillation (AF) →

- 1-Rate control : beta-blockers or digoxin.
- 2-Rhythm control : amiodarone, flecainide, or propafenone.
- 3-Cardioversion (DC shock) if unstable.

7. Conduction disturbances (heart block) →

- 1-Atropine for symptomatic bradycardia.
- 2-Temporary pacemaker may be required.

8. Post-MI Pericarditis & Dressler's Syndrome

*Post-MI Pericarditis:

- 1-May lead to pericardial tamponade.
- 2-NSAIDs or colchicine are used for treatment.

***Dressler's Syndrome** (autoimmune pericarditis post-MI):

Treated with NSAIDs or corticosteroids.

Post – MI lifestyle modification

- 1-Low-fat diet.
- 2-Smoking cessation.
- 3-Regular exercise (20-30 minutes/day).
- 4-Weight reduction (if overweight).
- 5-Blood pressure control: Target <130/85 mmHg.
- 6-Diabetes management: Maintain HbA1c < 7%.

Post-MI drug therapy

- 1-**Aspirin**: 75-100 mg/day.
- 2-**Beta-blockers**: Metoprolol 50 mg twice daily.
- 3-**ACE inhibitors** (or **ARBs** if intolerant):
Ramipril 2.5 mg twice daily. *↓* Valsartan 20 mg (if using ARBs).
- 4-**Statins**: Simvastatin 20-80 mg/day.

