Ischemic Heart Disease (IHD)

There are two coronary arteries – left & right – originate from the root of ascending aorta .

1- **Left coronary artery** : Passes forward & to the left in the left atrioventricular

groove for a short distance & then divides into :

a) **Anterior descending artery :** passes downward in anterior interventricular groove to the apex & then turns backward to meet *posterior descending artery* .

b) **Circumflex artery :** runs posteriorly in the left atrioventricular groove to meet the *right coronary* .

2- **Right coronary artery** : runs in right atrioventricular groove to the posterior surface of the heart to meet the *circumflex artery*.

posteriorly , it gives the **posterior descending artery** which runs in the posterior interventricular groove to meet the *anterior descending artery*.

Balanced circulation:

- The left coronary artery supplies :

LA , LV , anterior wall of interventricular septum .

- The right coronary artery supplies :

RA , RV , posterior wall of interventricular septum .

Left coronary predominance :

-The left coronary supplies also: posterior wall of right ventricle.

Right coronary predominance :

- The right coronary supplies also: posterior wall of left ventricle .

□ Asymptomatic (*silent*).

□ **Angina**.

□ **Myocardial infarction**.

□ Heart failure.

□ Arrhythmia.

□ Sudden death

Angina Pectoris

Definition :

It is a **clinical syndrome** of chest pain due to imbalance between oxygen supply & demands of the myocardium.

Etiology :

I.

1) Decrease in **quantity** :

a) **Coronary artery disease** :

□ **Atherosclerosis**. (*most common cause*)

□ **Arteritis** : polyarteritis nodosa , SLE .

□ **C**oronary spasm .

□ **C**oronary embolism .

□ **C**oronary osteial stenosis of syphilis .

□ **C**ongenital anomalies .

b) **As a part of LCOP** : AS , LSHF .

2) Decrease in **quality** :

□ Anemia.

□ Hypoxia.

II.

☐ Ventricular hypertrophy .

☐ Tachycardia .

Risk factors for atherosclerosis:

Non modifiable :

☐ Age .

☐ Sex : male > female .

☐ +ve family history .

Modifiable :

☐ **Hyper**tension : cause endothelial damage.

☐ **Hyper**glycemia

☐ **Hyper**lipidemia especially LDL .

☐ **Hyper**uricemia .

☐ **S**edentary life style .

☐ **S**moking.

☐ **S**tress & type A personality .

Clinical picture :

Symptoms : Chest pain with the following **7** criteria :

Common (*classic*) Less common Never

1) Site : ☐ **Retrosternal**

Often the patient places his

clenched hand over the upper

sternum.

Any site of i chest:

☐ Scapular.

☐ Infraclavicular.

☐ Epigastrium.

☐ Left infra mammary

☐ *Patient never*

points with his

finger.

2) Character: ☐ Compressing.

☐ Constricting.

☐ Heaviness.

☐ Squeezing.

☐ Burning. ☐

☐ Discomfort.

☐ Stitching.

☐ Pricking.

3) Radiation : ☐ Left shoulder &

inner side of the left

arm up to little

finger.

☐ Neck, jaw or teeth.

☐ Right shoulder .

☐ Back.

☐ Epigastric area.

☐ Below epigastrium.

4) Duration : Less than 15 min More than 15 min Never seconds or

hours.

5) Precipitating factors :

- Exercise. - Cold weather. - Heavy meals. - Smoking.

- Sexual intercourse - Stress .

N.B : Many patients report a fixed threshold for angina, which occurs

predictably at a certain level of activity.

6) Relieving factors :

- Rest, but occasionally the pain disappears with continued exercise (walk through angina)

- Sublingual nitrates.

7) Association :

- Sweating - Dizziness - Dyspnea :may occur due to LVF .

- Fear of death *(angor animi)* - Eructation at the end of the attack.

Signs: (*during the attack*) *usually* no *abnormal finding*

o Pallor , tachycardia & hypertension (secondary to sympathetic stimulation).

o S_1 : weak .

o S_2 : reversed splitting .

o S_3 : due to LVF .

o Murmur of MR : due to papillary muscle dysfunction.

o In between the attacks : Physical examination is important to exclude anemia &

valvular stenosis.

NB : *I can say that the great significance of cardiac examination in a case of Angina is just*

for reassurance & no one can blame me !!!!!!!

Types of Angina :

1) Stable angina: *(typical)*

o The pain is relatively constant as regard to severity, precipitating factors & relief.

o Same amount of exercise always reproduces the pain & relieved by rest.

2) Unstable angina : *(is considered intermediate syndrome between stable angina & MI)*

i. Change in the character of existing chronic angina:↑ frequency,severity or duration

ii. Angina of **r**ecent onset .

iii. Angina at **r**est .

iv. Post infarction angina is considered unstable angina .

3) Variant angina : (*Prinzmetal's angina*)

☐ Caused by **spasm** of coronary artery with or without underlying atherosclerosis .

☐ Unpredictable , at rest .

☐ Transient ST **elevation** on ECG .

☐ Treatment :

☐ β blockers are **contraindicated** (↑ *coronary spasm*) .

☐ Nitrate & Ca Channel blockers are drugs of choice.

Decubitus Angina : usually on lying down (occurs in HF).

Nocturnal Angina : It awakens the patient from sleep , associated with dreaming .

Angina of Lewis : in cases of AR , it is nocturnal & prolonged .

Acute coronary syndrome :MI & unstable angina .

Investigation :

1- ECG :

A) Resting ECG :

☐ **In between the attacks :**

☐ usually normal.

☐ ECG of old MI .

☐ **During the attack:**

☐ ST segment : depressed. (*more than 1mm*)

☐ T wave : Inverted .

B) Exercise ECG : (in between the attacks only)

- The patient is exercises on a treadmill & ECG changes & vital signs are recorded.

- *Stress test can be done with dobutamine in patients unable to do exertion.*

- Stress test is considered +ve when : *one or more* of these changes are present :

☐ **Symptom** : Typical anginal pain during the test.

☐ **Sign** : Fall in blood pressure (*10 mmHg or more*) suggests ischemia

☐ **ECG** : Depressed ST segment > 1mm .

NB : Exercise test can be **misleading** as there are :

☐ False negative test : So normal test doesn't exclude IHD .

☐ False positive test :especially in patients with left ventricular hypertrophy.

Stress test is contraindicated in :

- Acute attacks. - Severe AS.

- Severe hypertension. - Congestive heart failure.

- Orthopedic problems.

2- Echo & dobutamine Echo : may show abnormal motion of the myocardium .

3- Cardiac scan : (Radioactive Thallium 201)

Thallium 201: is taken up by healthy myocardium & not by ischemic myocardium (*cold spot*)

4- Coronary angiography : (coronary catheter)

☐ To detect the site & severity of coronary occlusion.

☐ It's generally used to determine whether mechanical revascularization (*CABG*

or PTCA) is possible & to guide this therapy.

5- Laboratory investigations:

☐ For risk factors :Blood glucose level , Plasma lipid (cholesterol).

☐ Cardiac enzymes : normal .

Treatment : 4

☐ Reassurance & sedation. ☐ No smoking.

☐ Treatment of hyperlipidemia. ☐ Control of hypertension.

☐ Control of diabetes. ☐ Weight loss.

☐ Change of life style (regular exercise program).

<p align="center">in between the attacks</p>

i. Nitrates :

Action :

☐ Venodilator ☐ ☐ preload (venous return) ☐ ☐ myocardial oxygen demand.

☐ Coronary dilatation ☐ increase coronary blood flow. (mild effect)

Preparation :

☐ Nitroglycerine (*nitromack*) : 2.5 mg twice daily orally or transdermal patches.

☐ Isosorbid dinitrate (*dinitra*) : 10-20 mg twice daily.

☐ Isosorbid mononitrate (*effox*) : 20-40 mg twice daily.

Side effects :

☐ **H**eadache.

☐ **H**ypotension.

☐ Tolerance : so start with minimal effective dose with nitrate free interval periods.

ii. β blockers :

Action :

Reduce oxygen demand since they reduce heart rate, blood pressure & contractility.

Preparation :

☐ Propranolol (indral) : non selective β blocker .

☐ Atenolol (ateno), Metoprolol (betaloc) , Bisoprolol (concor) : Selective β blockers.

☐ Carvedilol (cardilol) : β blocker with an arteriolar vasodilating action.

Side effects :

☐ Lung : **B**ronchospasm.

☐ Heart : **B**radycardia , Heart **b**lock.

☐ Depression , Impotence.

iii. Calcium channel blockers :

Action :

☐ Reduce oxygen demand by : ☐ -ve inotropic action.

☐ ☐ afterload (arteriolar dilators).

☐ Coronary dilator : increase coronary blood flow (*effective in variant angina*)

Preparation :

☐ Verapamil (*Isopten*) : great -ve inotropic & weak vasodilator: 80 mg t.d.s.

☐ Diltiazem : 60 mg twice daily.

☐ Nifedipine (*adalat*) : mainly vasodilator & weak -ve inotropic: 10 – 20 mg t.d.s.

☐ Recently : **Amlodipine** (*norvasc*) : mainly vasodilator .

Side effects :

☐ Headache.

☐ Hypotension.

☐ Precipitation of Heart failure.

☐ **Peripheral edema**.

☐ Verapamil & Diltiazem : bradycardia & heart block.

iv. Antiplatelet :

☐ **Aspirin** : 75 mg single dose : it improves the prognosis.

☐ Clopidogrel (*plavix*) :expensive.

Indications :

☐ Angina not responding to medical treatment.

☐ Post infarction angina to improve the prognosis.

Techniques :

1- PTCA (**P**ercutaneous **T**ransluminal **C**oronary **A**ngioplasty):

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

Indication of PTCA :

Stenosis of one or two vessels only (except left main coronary artery)

2- CABG (**C**oronary **A**rtery **B**ypass **G**raft) **:**

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.

☐ Complete rest.

☐ Nitroglycerine (0.5 mg) or isosorbide dinitrate (5mg) sublingually & repeated up to **3**

times successively with interval of **3** minutes.

NB : *If the patient is not relieved after the use of 2-3 tablets ,the patient should be* ***immediately***

transferred to hospital & evaluated for the possibility of myocardial infarction.

Myocardial infarction

Definition :

Ischemic necrosis of part of the cardiac muscle due to sudden , persistent & complete

cessation of its blood supply.

Etiology :

☐ **Thrombosis on top of atherosclerosis.** ♫♫

☐ Coronary embolism (rare).

☐ Severe coronary spasm.

Pathology :

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. 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: like angina & may also associated with complications.

NB: **Painless infarction:**

o Elderly.

o Diabetic neuropathy.

o Patient under anesthesia.

o Transplanted heart (denervated).

II.   6 early & 6 late

Early complications : 6 items

1- Shock : see p133

Cardiogenic shock Neurogenic 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.

ttt: The same as acute pulmonary edema &

mechanical assist devices: intraaortic

balloon counterpulsation.

Prognosis : very bad.

Caused by severe pain (vagal stimulation).

C/P : Hypotension, bradycardia .

ttt : morphine .

Prognosis : good .

2- Acute heart failure : with normal heart size.

3- Arrhythmia :

- 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 : 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 : 6 items

1- Post infarction syndrome : (Dressler's syndrome) within 4 weeks or more

Autoimmune phenomenon in response to necrotic cardiac tissue characterized by :

- **P**ericarditis - **P**leurisy - **P**neumonitis -fever.

2- Post infarction angina :

Due to affection of other diseased coronaries.

3- Myocardial aneurysm : *(dilatation of the scar tissue of MI)*

☐ On examination : double apex .

☐ ECG : persistent ST segment elevation .

☐ Fate : - **R**efractory heart failure.

- **R**upture aneurysm.

- **R**ecurrent embolism.

- **R**ecurrent arrhythmia.

4- Thrombo-embolism :

☐ **Mural thrombosis** :(*infarction ☐ rough surface ☐ thrombosis☐*

systemic emboli)

☐ **DVT** : due to prolonged recumbency ☐ pulmonary embolism .

5- Frozen shoulder : stiffness with limitation of movement due to :

Pain ☐ reflex arteriolar spasm & ischemia.

☐ may be psychic.

6- Complications of treatment: anticoagulant , prolonged bed rest,….

Signs : (not specific) nothing or anything

☐ The physical examination may be entirely normal.

☐ **P**allor , sweating , nausea , vomiting & fever.

☐ **P**ulse :

o Tachycardia : sympathetic stimulation , cardiogenic shock .

o Bradycardia : neurogenic shock , HB , inferior MI.

o Irregular : arrhythmias.

o weak : LVF .

NB *: Bradycardia is often seen with inferior MI because the right*

coronary artery

supplies the SA node.

☐ **B**lood pressure :

o Hypertension : sympathetic stimulation .

o Hypotension : LVF , shock .

☐ **C**ardiac auscultation :

o S1 : weak.

o S2 : reversed splitting.

o S3 : due to LVF.

o S4 : due to decreased myocardial compliance.

o Murmur : of MR , VSD .

o Pericardial rub : Dry pericarditis.

☐ **Congested neck vein** : in right ventricular infarction.

Differential Diagnosis :

Causes of acute chest pain :

o Ischemic heart diseases : Angina , MI.

o Pulmonary embolism.

o **Aortic dissection**.

o Pneumothorax.

o **Acute dry pericarditis**.

o Cardiac neurosis.

o Esophageal spasm , Perforating peptic ulcer , Cholecystitis.

Investigations:

1- Cardiac enzymes :

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) 2-6 h 1 week Most sensitive & specific

markers of myocardial

damage .

2- ECG :

□ **In transmural infarction (ST Elevation MI):**

1. Convex **elevation** of ST segment .

2. **T wave :**

□ 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.

□ **In subendocardial infarction (Non ST Elevation MI) :**

1. ST segment : normal or depressed.

2. No pathological Q waves (non Q wave MI)

3. T wave : inverted.

NB: The ECG may be normal during the first few hours of infarction .

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

3- Echocardiography :

□ Ventricular wall motion abnormalities.

□ Complications : MR , myocardial aneurysm.

4- Cardiac scan : Like angina .

5- Coronary angiography :

reveals which vessels have been affected and the extent of damage.

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

Treatment : 3 □ □

I. □

1- Rapid transfer to hospital is a must (Time lost is lives lost) .

2- Oxygen inhalation.

3- Analgesics for pain □ Morphine 5 - 10 mg **IV**

4- For ventricular arrhythmias ☐ Lidocaine 50 – 100 mg **IV** ??

5- For heart block ☐ Atropine 0.5 – 1 mg **IV** .

II. ☐

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. **A**spirin : is now considered an essential element (325 mg initial dose then 75 mg daily-oral)

g. **A**CE Inhibitor: Oral therapy e.g. Lisinopril 5mg on day1 & 2 ,then 10 mg daily.

NB : *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. β blockers .

3- Thrombolytic therapy : (time is muscle)

- 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 :

o *Streptokinase* : 1.5 million units IV over 60 min. may cause allergy .

o *Urokinase* .

o *Alteplase* (tissue plasminogen activator – tPA)

The important issue in thrombolytic therapy is not which drug to use, but how quickly to use it .

- Anticoagulant (*heparin*) & antiplatetelet (*aspirin*) are given with & after thrombolytic

therapy to reduce the risk of reocclusion.

Contrindication : *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.

☐ Sever hypertension.

☐ Diabetic retinopathy with recent bleed.

☐ **Aortic dissection.**

☐ **Pericarditis.**

4- Angioplasty : Percutaneous **T**ransluminal **C**oronary **A**ngioplasty (PTCA) :

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

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

to relieve pain of post infarction angina.

5- Treatment of early complications : e.g. :

☐ Acute heart failure .

☐ Arrhythmia.

☐ Cardiogenic shock.

III.   ☐

1. Reassurance & rehabilitation (*gradual return to normal activity*) .

2. Treatment of post infarction angina.

3. Treatment of precipitating factors e.g. hyperlipidemia .

4. Treatment of late complications e.g. myocardial aneurysm :
aneurysmectomy .

5. **A**spirin & **β** blockers (*decrease the risk of post infarction angina &*
reinfarction).

Acute coronary syndrome :

1- Unstable angina.

2- ST elevation MI.

3- Non ST elevation MI.

Percutaneous **T**ransluminal **C**oronary **A**ngioplasty

(PTCA)

N.B: S*ource:*

In Capsule Series

Internal Medicine

Cardiology

Second edition

By :

Dr. Ahmad M.Mowafy