

ISCHAEMIC HEART DISEASE

IHD I : Chronic Ischaemic 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 a mechanical obstruction:

- Atheroma
- Thrombosis
- Embolus
- Dissecting aortic aneurysm
- Coronary ostial stenosis
- Vasculitis
 - Inflammation – coronary arteritis
 - SLE – Behcet's disease – Kawasaki

Non-obstructive Coronary Disease

- Prevalence 7% – common in F > M

A – Decreased Coronary Blood Flow

- Hypoxia
- Anemia
- Coronary artery spasm (cocaine abuse)
- Coronary artery ectasia
- Slow coronary flow – microvascular disease

B – Angina Due to Increased Demand

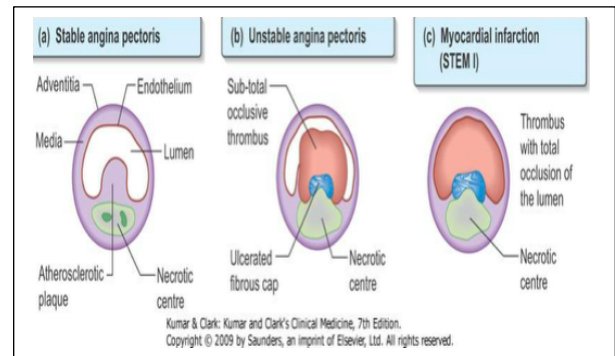
- Tachycardia
- Thyrotoxicosis
- LVH – HTN – AS
- Heavy exertion

Coronary Artery Disease (CAD)

- Commonest cause of IHD worldwide
- CAD is the largest single cause of death in the UK
- Main pathological lesion in CAD : **coronary atherosclerosis**
 - Plaque ulceration
 - Fissuring
 - Rupture
 - Platelet aggregation
 - Occlusion

Clinical Presentations

1. Chronic coronary syndrome – stable angina pectoris
2. Acute coronary syndrome
 - Unstable angina
 - Myocardial infarction



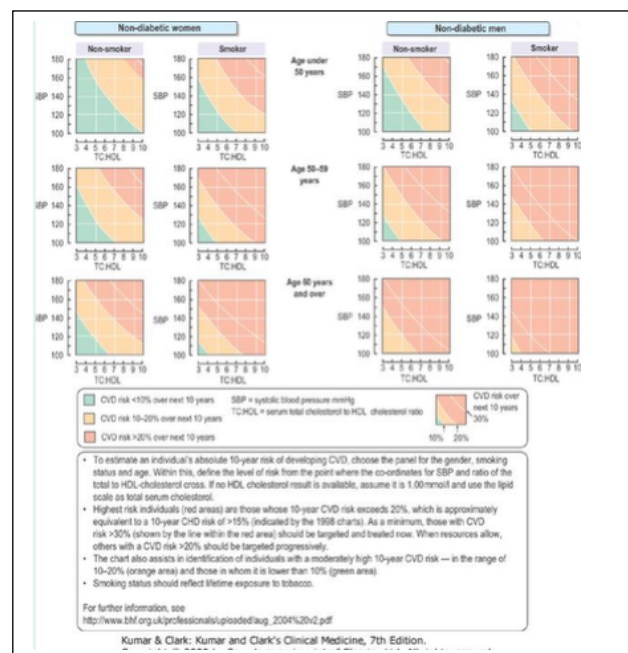
CAD Risk Factors

Fixed

- Age
- Gender
- Family history

Changeable

- Hyperlipidemia
- Homocysteinemia
- Smoking
- Personality
- Hypertension
- Lack of exercise
- Obesity
- Diabetes mellitus
- Gout
- Sexual impotence
- Alcohol
- Air pollution
- Microalbuminuria
- Drugs – cocaine
- HR – CVA – CKD



Angina Pectoris

A syndrome (not a disease), most important cause of recurrent chest discomfort.
Only 15% has typical presentation.

Characteristics

- Central chest pain which may radiate to: left/right/both arms, throat, jaw, rarely back or epigastrium
- Short duration (<10 minutes)
- Tightness, is usually not severe
- Aggravated by exertion, heavy exercise, walking against cold air, heavy meal
- Relieved by GTN or rest

Types

- **Decubitus angina:** occurs on lying down
- **Angina equivalent:** SOB after exertion
- **Nocturnal angina:** occurs at night
- **Variant (Prinzmetal's) angina:** occurs at rest
- **Unstable angina:** recent onset, worsening, post-infarction, or at rest

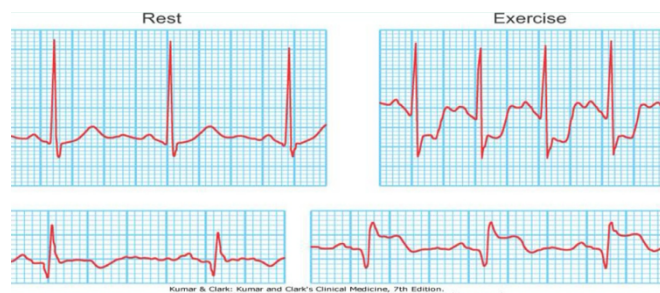
Examination

- Usually no findings
- May have 4th heart sound
- Signs of associated risk factors

Investigations

ECG

- Resting ECG
- Usually normal between attacks
- May show ST depression or T inversion during attack
- Exercise ECG - Treadmill test
- ST depression > 1 mm = positive

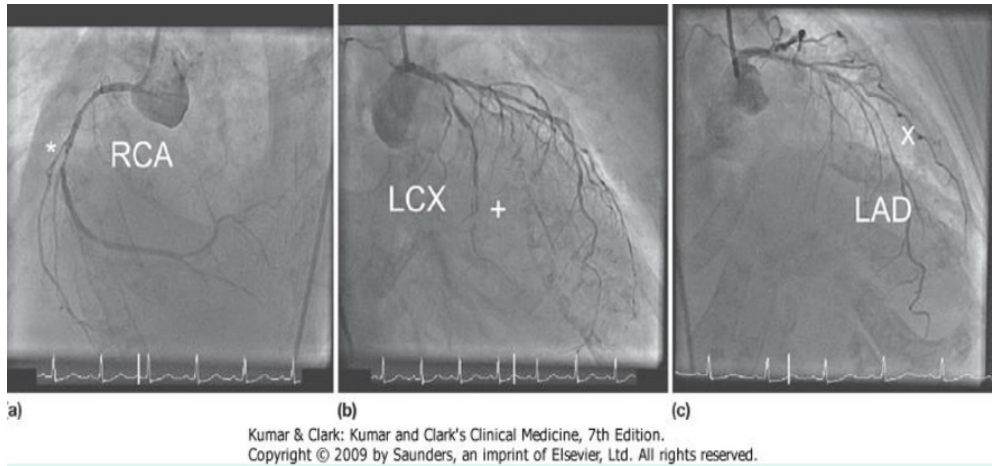


Non-Invasive

- Cardiac scintigraphy (myocardial perfusion scan)
- Exercise ECG – Treadmill test
- Echocardiography – stress echo
- Cardiovascular magnetic resonance (C-MRA)

Invasive

- Coronary angiography



Treatment of Angina

General Management

- Assurance and education – lifestyle
- Treat underlying problems:
 - Anemia
 - Hypertension
 - DM – AS
 - Hyper/hypothyroidism
 - Stop alcohol, smoking
- Treat hypercholesterolemia
- Weight reduction
- Regular exercise

Medical Treatment

Symptomatic Treatment

Glyceryl trinitrate (GTN)

- Sublingual tablet/spray
- Peak 4–8 minutes, lasts 20–30 minutes
- Transdermal GTN last up to 24 hours
- Long acting: isosorbide mononitrate

Beta-blockers

- Negative inotropic and chronotropic
- Atenolol 50–100 mg daily
- Metoprolol 25–50 mg twice daily
- Bisoprolol
- Nebivolol
- Ivabradine - SA-node
- With beta-blocker — both are very useful in reducing HR to <70
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- First reduce metabolic O₂ requirement and demand of myocardium
- At same time increase diastolic time for more coronary blood flow
- Increase O₂ supply to myocardium
- So will reduce angina symptoms

Calcium Channel Blockers

Dihydropyridines:

- Nifedipine, amlodipine, lercanidipine (3rd gen)

Non-dihydropyridines:

- Verapamil
- Diltiazem

Trimetazidine

- Metabolic treatment, inhibits FFA oxidation
- ↓ myocardial O₂ requirement
- No hemodynamic effects
- No hypotension

Prophylactic Medication

- **Aspirin** is used in all patients with angina 75 mg daily
- **Lipid lowering therapy:**
 - Reduction of 1 mmol cholesterol = 39 mg → ↓ CVD by 20%
 - Statins: atorvastatin, simvastatin
 - Inclisiran – PCSK9 inhibitor
 - Ezetimibe
- High-risk patient: LDL <70 mg/dl
- Very high risk: LDL <55 mg/dl
- HDL > 40 mg/dl
- TG <150 mg/dl → a fibrate is indicated if elevated

Percutaneous Coronary Intervention (PCI)

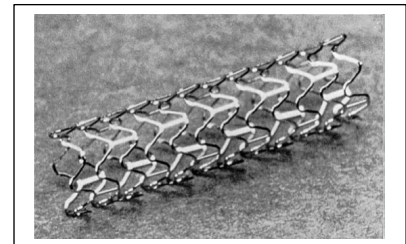
Procedure: Dilating a coronary artery stenosis with stent implantation using a balloon via femoral, radial, or brachial artery

Criteria

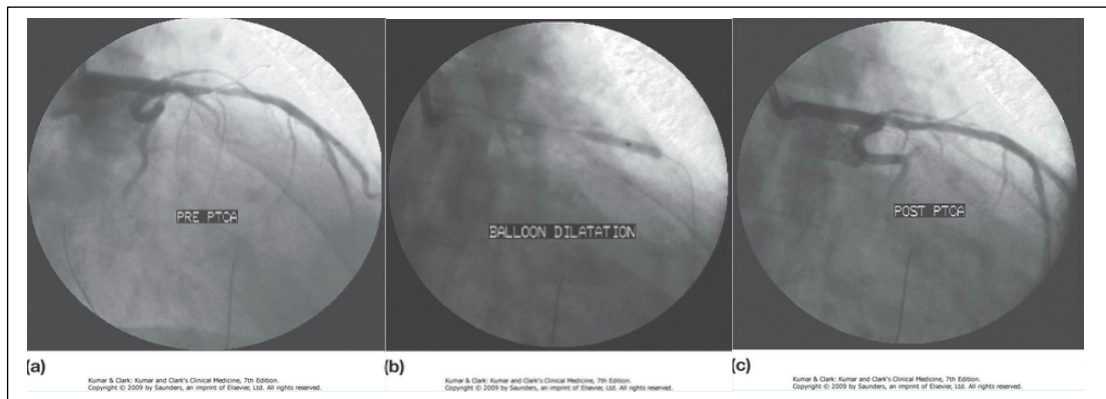
- It can reduce angina symptoms
- It reduces the requirement for antianginal drugs
- It increases exercise capacity
- Best outcome: discrete, short, soft lesion in straight vessel without involving a bifurcation

Risks

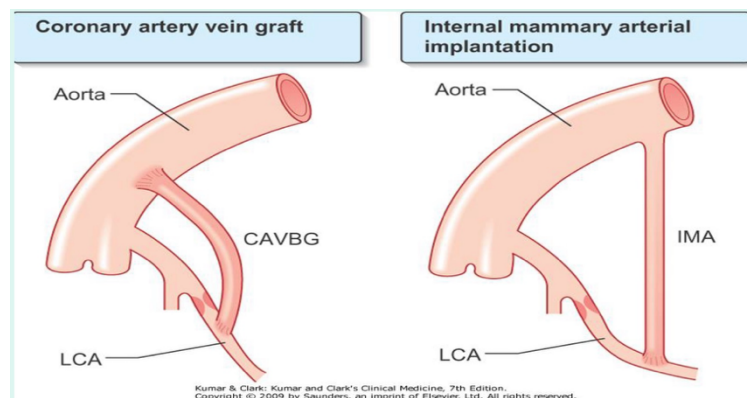
1. Acute MI
2. Restenosis and stent thrombosis
3. Blood vessel dissection



These complications have been reduced with the introduction of drug-eluted stents



Coronary Artery Bypass Grafting (CABG)



IHD II – Acute Coronary Syndromes (ACS)

Includes:

- Unstable angina
 - Non ST elevation myocardial infarction (NSTEMI)
 - ST elevation myocardial infarction (STEMI)
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Clinical Presentation

- New onset chest pain
- Severe chest pain at rest or worsening angina
- May present with epigastric pain, SOB, pulmonary edema
- Pre-syncope, syncope, unconsciousness, shock

Examination

- Low BP
 - Tachycardia
 - Basal crackles
 - S4
 - Cardiac systolic murmurs – MR
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ECG Findings

- May be normal
 - ST depression and T inversion → highly suggestive
 - Repeat ECG when patient is in pain -> Persistent ST elevation or new bundle branch block → it indicates complete coronary artery occlusion (STEMI, transmural MI)
 - Transient ST elevation is seen with coronary vasospasm or Prinzmetal's angina
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Biochemical Markers

- Cardiac Troponin (I, T, C)
 - AST, ALT
 - LDH
 - Creatine kinase – CPK-MB
 - Myoglobin
 - Others: CRP, ESR, WBC
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Management

All Patients need chest pain treatment

- Analgesia
- Rest in bed
- Oxygen

Antiplatelet

- Aspirin 150–300 mg → then 75–100 mg daily
- Clopidogrel 300 mg → then 75 mg daily
- P2Y₁₂ inhibitors: prasugrel, ticagrelor

Antithrombin

- Heparin 5000 units IV then 0.25 units/kg/hr
- LMWH (enoxaparin) 1 mg/kg SC twice daily

Other

- PCI
- Glycoprotein IIb/IIIa inhibitors
 - Abciximab 0.25mg/kg i.v. then 0.125mcg/kg/min.
 - Eptifibatide 180mcg/kg then 2 mcg/kg/min.
 - Tirofiban 0.4 mcg/kg/min. then 0.1mcg/kg/min.
- Analgesia: morphine or diamorphine 2.5–5 mg IV
- Beta-blockers:
 - atenolol 5 mg IV then 25-50 mg orally daily
 - metoprolol, bisoprolol, nebilet (nebivolol), ivabradine
- Coronary Vasodilators: GTN 2-10 mg/hr IV / buccal / sublingual

Plaque Stabilization & Ventricular Remodelling

- Statins
 - simvastatin 20-40 mg daily
 - pravastatin 20-40 mg daily
 - atorvastatin 20-40 mg daily
- PCSK9 inhibitors (inclisiran)
- ACE inhibitors
 - Ramipril 2.5 – 10 mg daily
 - Lisinopril 5-10 mg daily
- ARBs (valsartan, candesartan, telmisartan)

Coronary Intervention

- PCI and CABG recommended in high-risk ACS

Post-ACS

Risk factor modification

- Stop smoking
- Treat hypertension to a level <130/85
- Tight diabetic control
- Low-fat diet with statins and Ezetimibe to reduce LDL cholesterol to less than 70 mg/dl in high risk patients OR less than 55mg/dl in very high risk patients

Discharge Medications

- Aspirin
- Clopidogrel
- Beta-blocker
- ACE inhibitor
- Statin
- GTN spray on need

ST-Elevation Myocardial Infarction (STEMI)

There is cardiac myocyte death due to prolonged ischaemia.

Diagnosis Made based on:

- Clinical history :Prolonged classical chest pain
- ECG findings of MI
- Elevated biochemical markers : Troponin I and T / CK-MB

Mortality

- First-month mortality of MI may be as high as 50%
- 50% of deaths occur in the first few hours → Due to arrhythmias: VT, VF, Cardiac arrest

Clinical Features

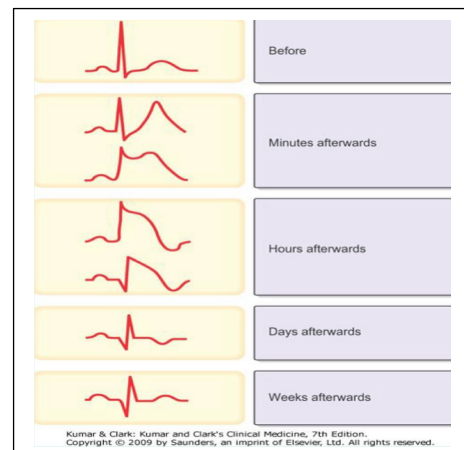
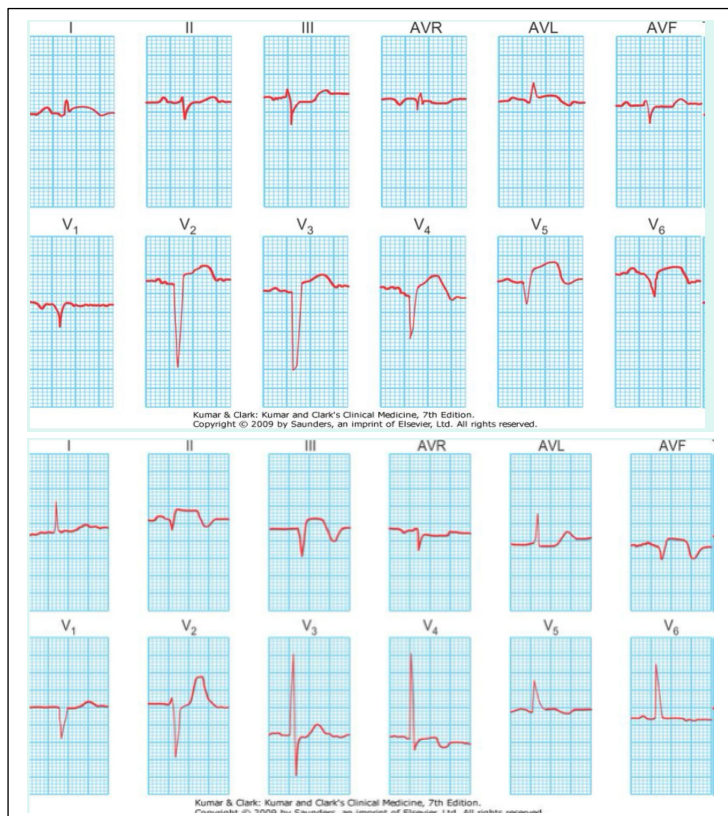
- Severe prolonged chest pain lasting 20 mins, not responding to sublingual GTN
- Radiation to left arm, neck, jaw
- Atypical symptoms: pulmonary edema, fatigue, pre syncope/syncope , shock, sudden death, cardiac arrest , vertigo, CVA, vomiting, epigastric pain

Exam

- Pale , clammy , Sweaty
- Thread small volume pulse
- Tachycardia
- Hypotension

ECG

- ECG on admission is usually abnormal, if not it should be repeated every 15 minutes while the patient remains in pain
- ECG changes (new ST elevation) are usually confined to the leads that face the infarction
- New LBBB is compatible with the diagnosis of MI
- Continuous cardiac monitoring is required because of the likelihood of significant arrhythmia



Investigations

- Blood sample should be taken for cardiac enzymes troponin I or T level or CK-MB level
- Full blood count, serum electrolytes, glucose and lipid profile should be obtained
- ECHO
 - LV dysfunction – HK / AK / dyskinetic segment
 - May be helpful to confirm a diagnosis of myocardial infarction and any abnormal LV wall motion

Early Medical Management in Accident & Emergency

- **Initial Measures**
- Bed rest
- Oxygen therapy
- Intravenous access + blood for markers
- I.V. opiates e.g. diamorphine or morphine 2.5–5 mg + antiemetic, e.g. metoclopramide 10 mg
- **Anti-platelet Therapy**
- Aspirin 150–300 mg
- Clopidogrel 300 mg
- New anti-platelet P2Y₁₂: Ticagrelor
- **Anti-anginal Therapy**
- Sublingual GTN 0.3–1 mg, repeated
- Beta-blockers
- **Reperfusion Treatment**
- Refer for PCI if available, preceded by giving (GPIIb/IIIa) inhibitors
- Alternatively give thrombolysis for ST-elevation MI – new LBBB

Fibrinolysis

- Fibrinolytic agents enhance the breakdown of occlusive thromboses by the activation of plasminogen to form plasmin.
 - **Streptokinase** is initially used, it causes allergy.
 - **Tissue plasminogen activator (t-PA), r-PA (reteplase), TNK-tPA (tenecteplase).**
 - Aspirin should be used with fibrinolysis.
 - Heparin is recommended with t-PA or tenecteplase but not with streptokinase.
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PCI

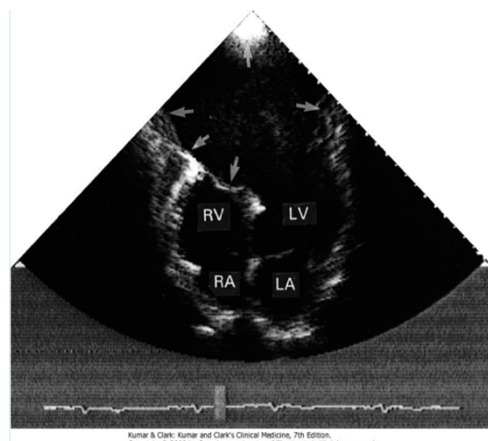
- It needs a specialized expert cardiology center – Door-to-needle.
- Earlier referral gives the better result.
- The use of abciximab (GP IIb/IIIa inhibitor) prior to PCI reduces immediate outcome (death, myocardial infarction, urgent revascularization).
- Rescue PCI after failed fibrinolysis.

Coronary Artery Bypass Surgery (CABG)

- This is usually reserved for the complication of myocardial infarction – failure of PC

Complications of Myocardial Infarction

1. **Heart Failure** : Treated with Furosemide IV , ACE inhibitors , IV inotropes such as dopamine
If cardiogenic shock: intra-aortic balloon pump may be required
2. **Myocardial Rupture and Aneurysmal Dilatation** : Treatment is Surgical
3. **Ventricular Septal Defect (VSD)** : Treated with Intra-aortic balloon pump and Coronary angiography then surgery
4. **Mitral Regurgitation** : Treated surgically
5. **Right Ventricular (RV) Infarction** : Complication of inferior MI , Presents with shock and high JVP
6. **Cardiac Arrhythmias**
 - Ventricular tachycardia (VT): treated with IV beta-blockers (metoprolol 5 mg)
 - Ventricular fibrillation (VF): require Defibrillation (DC)
 - Atrial fibrillation (AF): treated with Beta-blockers, digoxin, amiodarone, flecainide, propafenone; DC may be needed
7. **Conduction Disturbances** : Most commonly heart block , Treated with atropine or temporary pacemaker
8. **Post-MI Pericarditis** : Can lead to pericardial tamponade , Includes Dressler's syndrome



Post-MI Lifestyle Modification

- Low fat diet
- Stop smoking
- Active Exercise for 20–30 min/day
- Weight reduction
- Treat HTN to $<130/85$
- Treat DM to maintain (HbA1c $<7\%$)

Post-MI Drug Therapy

- Aspirin 75–100 mg/day
- Beta-blocker (metoprolol 50 mg twice daily)
- ACE inhibitors (ramipril 2.5 mg twice daily) , if intolerant use ARB (Valsartan 20 mg twice daily)
- Statins (simvastatin 20–80 mg/day)

