Ischemic heart Disease (IHD)

Chronic stable angina

Ischemic heart disease (IHD) is also called coronary heart disease (CHD) or coronary artery disease (CAD). The term ischemic refers to a decreased supply of oxygenated blood, in this case to the heart muscle.

IHD is caused by the narrowing of one or more of the major coronary arteries that supply oxygen-rich blood to the heart, most commonly by atherosclerotic plaques. Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood. Over time, plaque hardens and narrows the arteries. As a result, it may impede coronary blood flow to cardiac tissue and results in an imbalance between myocardial oxygen supply and oxygen demand. Common clinical manifestations of IHD include:

1- Chronic stable angina
2- Acute coronary syndromes (ACS) [ACS include : unstable angina, non–ST-segment elevation myocardial infarction (MI), and ST-segment elevation MI].

Angina pectoris, or simply angina, is the most common symptom of IHD.

Definitions

Angina pectoris: is a cardiac-induced pain (or discomfort) in the chest and/or an adjacent area resulting from a mismatch between myocardial oxygen supply and Demand (myocardial ischemia).

Stable angina: is defined as a predictable occurrence of chest discomfort with physical exertion (or other conditions that increase oxygen demand) and is predictably resolved with rest or administration of sublingual nitroglycerin.

Variant or(Prinzmetal) angina: Angina caused by spasm of the coronary arteries (with no or minimal atherosclerotic disease) and it is less common type.

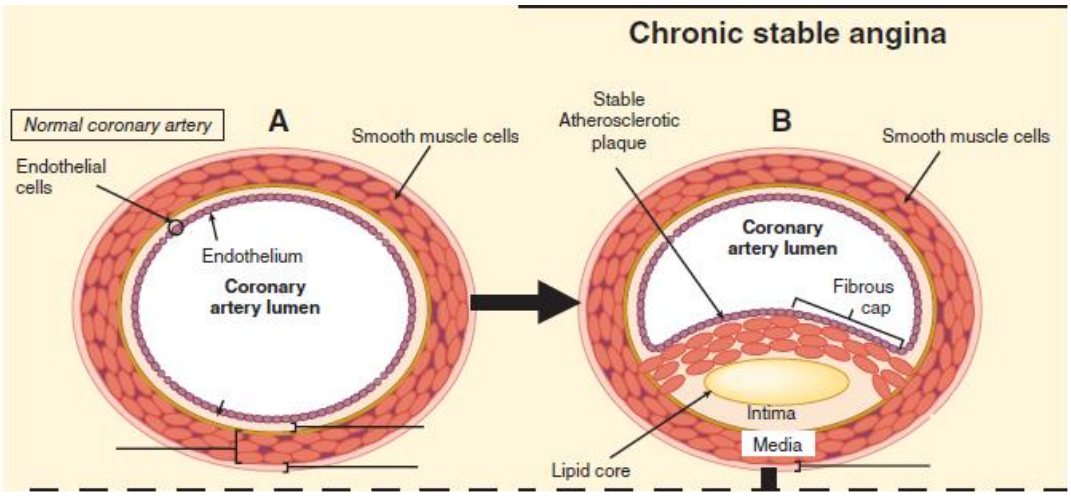
Unstable angina: angina which increases rapidly in severity and occurs at rest.

Pathophysiology

Angina pectoris typically occurs when myocardial oxygen demand exceeds myocardial oxygen supply (perfusion). The underlying pathologic condition is the presence of atherosclerosis in one or more of the coronary arteries. Atherosclerosis is a progressive inflammatory disorder of the arterial wall that is characterized by focal lipid-rich deposits of atheroma (Atheroma: degeneration of the walls of the arteries caused by accumulated fatty deposits and scar tissue, and leading to restriction of the circulation and a risk of thrombosis) that remain clinically silent until they become large enough to impair tissue

perfusion, or until ulceration and disruption of the lesion result in thrombotic occlusion or distal embolization of the vessel [i.e. reductions in coronary blood flow (secondary to atherosclerotic plaques)]

Stable angina normally arises when narrowing of the coronary artery lumen exceeds 50% of the original luminal diameter. While at rest, there is usually an adequate blood flow to the myocardium; however, under stress, such as exercise, the blockage prevents an adequate blood flow and results in the characteristic symptoms.



Risk factors:

Modifiable	Nonmodifiable
Cigarette smoking Dyslipidemia • Elevated LDL or total cholesterol • Reduced HDL cholesterol Diabetes mellitus Hypertension Physical inactivity Obesity (body mass index greater than or equal to 30 kg/m^2) Low daily fruit and vegetable consumption Alcohol overconsumption	Age 45 years or greater for men, age 55 years or greater for women Gender (men and postmenopausal women) Family history of premature cardiovascular disease, defined as cardiovascular disease in a male first-degree relative (i.e., father or brother) younger than 55 years old or a female first-degree relative (i.e., mother or sister) younger than 65 years

HDL, high-density lipoprotein; LDL, low-density lipoprotein.

Precipitating factors

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Mild, moderate, or heavy exercise, depending on patient
Effort that involves use of arms above the head
Cold environment
Walking against the wind
Walking after a large meal
Emotions: fright, anger, or anxiety
Coitus

Clinical Findings

The diagnosis of angina pectoris depends principally upon the history, which should specifically include:

1. Characteristics of the discomfort: Patients often do not refer to angina as “pain” but as a sensation of tightness, burning, or pressing and breathlessness on exertion; symptoms are relieved promptly by rest.

2. Circumstances that precipitate and relieve angina: Angina occurs most commonly during activity and is relieved by resting.

3. Location and radiation: In most cases, the discomfort is felt behind or slightly to the left of the mid sternum. It radiates most often to the left shoulder and upper arm, frequently moving down the arm to the elbow, forearm, wrist, or fingers. It may also radiate to the right shoulder or arm, the lower jaw, the neck, or even the back.

4. Duration of attacks: Duration of attack is usually 0.5–30 minutes. Attacks lasting more than 30 minutes are unusual and suggest the development of unstable angina, myocardial infarction, or an alternative diagnosis.

5-Nitroglycerin Relief: Relief of pain occurring within 45 seconds to 5 minutes of taking Nitroglycerin.

Notes:

Variant angina usually occurs at rest, especially in the early morning hours. Symptoms may be more variable and unpredictable. Although vasospasm is generally transient, vasospasm may persist long enough to cause MI.

Some patients, most commonly women, the elderly, and patients with diabetes, may present with atypical symptoms including indigestion, gastric fullness, back pain, and shortness of breath. In some cases, ischemia may not produce any symptoms and is termed "silent ischemia.".

Diagnosis

1- ECG.

2-Coronary angiography: Coronary angiography is regarded as the definitive test as it demonstrates the presence of occlusions, their position and their severity. This technique uses a catheter inserted into the patient's arterial circulation. When the tip of the catheter reaches the coronary arteries, radiocontrast dye is injected into the coronary arteries and the location and extent of atherosclerosis can be determined.

Treatment

Desired Outcomes

The major goals for the treatment of IHD are to Prevent progression of the disease (Prevent ACS and death), alleviate acute symptoms of myocardial ischemia and prevent recurrent symptoms of myocardial ischemia.

Risk factors Modification

Modifiable risk factors include smoking, hypertension, dyslipidemia, obesity, and sedentary lifestyle. These factors should be identified and treated when possible.

Hypertension is the most common and a powerful contributor to CAD. The blood pressure goal for treatment of hypertension in patients with established ischemic heart disease should be <130/80 mmHg.

Interventional Approaches

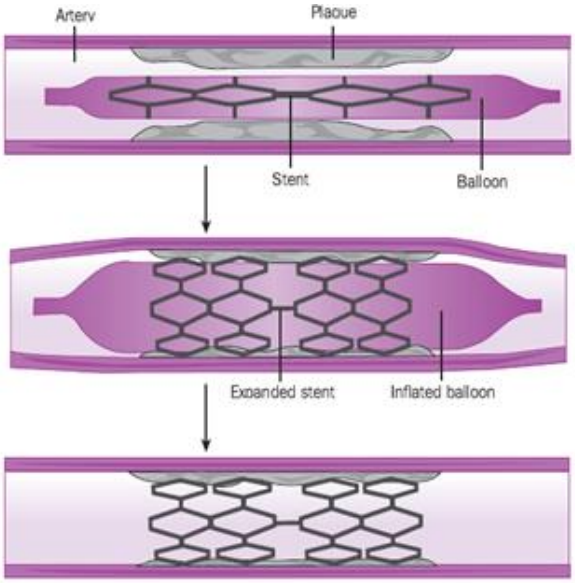
A-Percutaneous Coronary Intervention (PCI).

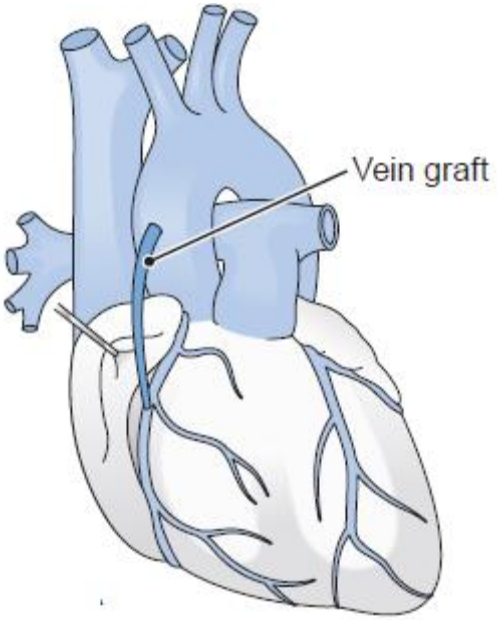
Optimal medical therapy is the preferred initial strategy for patients with stable IHD. When optimal medical therapy fails or if extensive coronary atherosclerosis is present, PCI is often performed to restore coronary blood flow and relieve symptoms.

During PCI, a catheter is introduced into the blocked coronary artery and a balloon at the end of the catheter is inflated inside the artery at the site of the stenosis to restore the normal myocardial blood flow. Most PCI procedures involve the placement of a small stent at the site of stenosis.

B-Coronary Artery Bypass Graft Surgery (CABG):

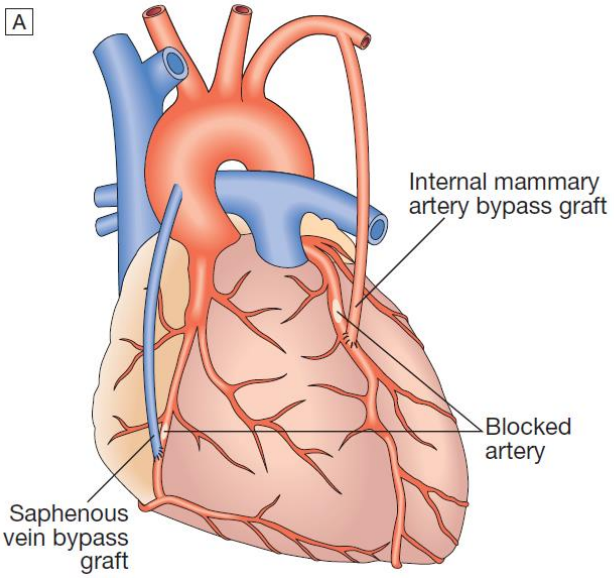
As an alternative to PCI, CABG surgery, or open-heart surgery, may be performed. Coronary artery bypass grafting (CABG) is a surgical procedure during which an atherosclerotic vessel is bypassed using a graft blood vessel (from the leg or from the arm or chest) to allows blood to flow past the obstruction.





(PCI)

(GABG)



Pharmacologic Therapy:

Optimal medical therapy is the preferred initial strategy for patients with stable IHD. The current national guidelines recommend that all patients be given the following unless contraindications exist:

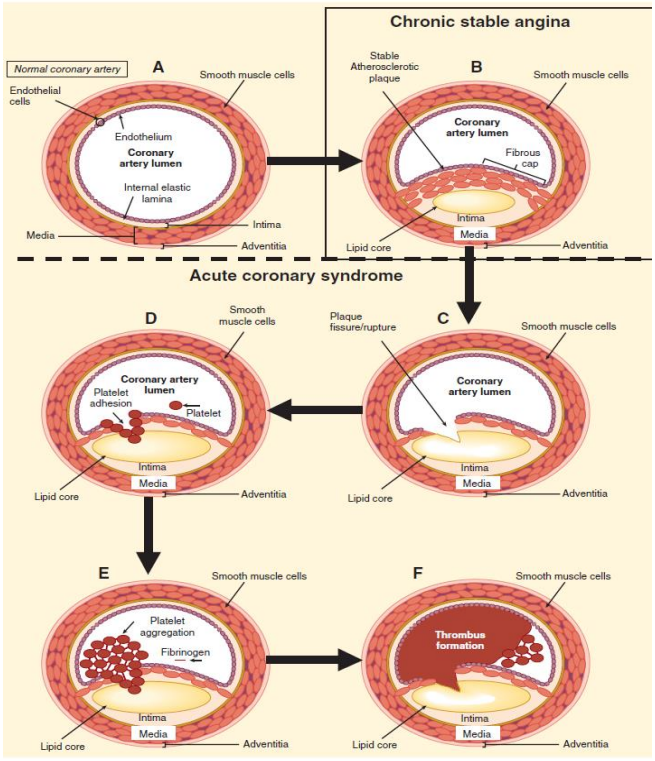
- **Sublingual nitroglycerin** for immediate relief of angina.
- **Aspirin** (or Clopidogrel in patients with aspirin hypersensitivity or intolerance).
- **β- blockers.**
- **Calcium antagonists** or **long-acting nitrates** [isosorbide dinitrate (ISDN) or isosorbide mononitrate (ISMN)]for reduction of symptoms when β-blockers are

contraindicated (or they may be used in combination with β-blockers when initial treatment with β-blockers is not successful).

- **LDL-lowering therapy:** for patients with coronary artery disease (CAD) and a high LDL concentration (to be lowered to less than 100 mg/dL)**.**

A-Aspirin therapy:

The common etiology leading to an ACS is a clot occurring at the site of coronary artery stenosis, often after a plaque rupture. Aspirin therapy has been demonstrated to reduce the incidence of MI and sudden cardiac death in patients with chronic stable angina.



In the absence of contraindications aspirin (75–150 mg daily) should be prescribed for all patients with angina. Aspirin acts via irreversible inhibition of platelet cyclooxygenase 1 (COX-1) and thus thromboxane production.

This antiplatelet action is apparent within an hour of taking a dose of 300 mg. The effect on platelets lasts for the lifetime of the platelet, around 8–10 days. Clopidogrel, prasugrel or ticagrelor are alternative in aspirin-intolerant patients.

B-β-Adrenergic Blocking Agents:

In stable angina, much of the drug treatment is directed towards decreasing the workload of the heart and, to a lesser extent, improving coronary blood supply; this provides symptomatic relief and improves prognosis. Therapy to decrease workload is targeted at both decreasing afterload and controlling heart rate. Evidence suggests a prognostic benefit when the resting heart rate is controlled below 70 beats/min

β -Blockers are considered first-line therapy for patients with chronic stable angina pectoris. They reduce heart rate and force of contraction, allowing greater time for perfusion and decreased demand for oxygen. When β-blockers are used to treat angina, a

goal resting heart rate should be between 55 and 60 beats/min. Cardio-selective beta-blockers, such as atenolol and metoprolol, are preferred.

β-Blockers have little or no role in the management of variant angina as they may induce coronary vasoconstriction and prolong ischemia. β-blockers with intrinsic sympathomimetic activity (eg, pindolol) have partial β-agonist effects and may produce lesser reductions in myocardial oxygen demand and should be avoided in patients with IHD.

C-Nitrates:

Nitrate therapy may be used to terminate an acute anginal attack, to prevent effort- or stress-induced attacks, or for long-term prophylaxis. Sublingual, buccal, or spray nitroglycerin products are preferred for alleviation of anginal attacks because of rapid absorption.

Nitroglycerin spray has the advantage of being more convenient for patients who have difficulty handling the pills and of being more stable.

In the event of an acute attack, patients should be instructed to sit or lie down, place the dose (spray or tablet) under the tongue, and not swallow the tablet. Relief of pain should occur within 5 minutes. If the pain persists or is unimproved 5 minutes after the first dose of NTG, the patient should call an ambulance transport as they may be experiencing an MI. If patient needs more than one tablet, he can take a maximum of three tablets in 15 minutes.

The sublingual preparations may elicit the two principal side effects of nitrates: hypotension (with dizziness and fainting), and a throbbing headache. To minimize these effects, patients should be advised to sit down, rather than lie or stand, when taking short-acting nitrates, and to spit out or swallow the tablet once the angina is relieved.

Sublingual glyceryl trinitrate (GTN) tablets have a very short shelf-life on exposure to air, need to be stored carefully and replaced frequently.

Chewable, oral, and transdermal products are acceptable for long-term prophylaxis of angina. The main limitation to long-term nitrate therapy is tolerance, which can be limited by using a regimen that includes a minimum 8- to 10-hour period per day without nitrates (nitrate-free interval).

Adverse effects include postural hypotension, reflex tachycardia, headaches and flushing.

D-Calcium Channel Antagonists:

Calcium channel blockers positively alter myocardial oxygen supply and demand, mainly through direct arterial vasodilatation. CCBs with myocardial rate control as well as vasodilatory properties, for example, diltiazem, and those with predominantly rate-

controlling effects, for example, verapamil, have also been shown to improve symptom control, reduce the frequency of anginal attacks and increase exercise tolerance. The non-dihydropyridines (verapamil and diltiazem) also exhibit negative chronotropic and inotropic effects, thus further lowering myocardial oxygen demands (Because of their negative chronotropic effects, verapamil and diltiazem are generally more effective antianginal agents than the dihydropyridine CCBs). Good candidates for calcium channel antagonists include patients with contraindications or intolerance to β-blockers, Prinzmetal's angina, and peripheral vascular disease.

Because calcium channel antagonists may be more effective, some authorities consider them the agents of choice for *variant angina*. Nifedipine, verapamil, and diltiazem are all equally effective. A patient unresponsive to calcium channel antagonists alone may have nitrates added.

E-Statins:

Statins lower cholesterol but are also thought to have antithrombotic and anti-inflammatory properties. They have benefits even in those with 'normal' cholesterol.

The current guidelines published by the ACC-AHA recommend using high-intensity statins to reduce the LDL-cholesterol levels by more than 50%.

To effectively achieve a greater than 50% LDL-cholesterol reduction in CAD patients utilizing currently available pharmacologic agents, the most recent treatment guidelines suggest high-intensity statin (either atorvastatin 40 to 80 mg or rosuvastatin 20 to 40 mg).

F-Others antianginal agents:

Nicorandil (10–30 mg twice daily orally): a potassium-channel activator with a nitrate component, has both arterial and venous vasodilating properties and is licensed for the prevention and long-term treatment of angina and has the advantage that it does not exhibit the tolerance seen with nitrates. Nicorandil may produce additional symptomatic benefit in combination with other antianginal drugs [unlicensed indication].

Ivabradine: represents a class of antianginal agents which block the I_f current. I_f is a mixed Na+–K+ inward current activated by hyperpolarization and modulated by the autonomic nervous system. This regulates pacemaker activity in the sinoatrial node and controls heart rate. Inhibition, therefore, reduces heart rate without affecting the force of contraction. It is licensed for the treatment of angina in patients who are in normal sinus rhythm in combination with a beta-blocker, or when beta-blockers are contraindicated or not tolerated.