# Hypertension

Hypertension is an abnormal elevation in arterial pressure that can be fatal if sustained and untreated. The blood pressure is the product of cardiac output and peripheral resistance and is dependent on the heart and vasculature, autonomic nervous system, endocrine system and kidneys. In adults, a sustained systolic blood pressure of 130 mmHg or greater and/or a sustained diastolic blood pressure of 80 mmHg or greater is defined as hypertension. The **systolic pressure** is the force that the blood exerts on the artery walls as the heart contracts to pump the blood to the peripheral organs, while the **diastolic pressure** is residual pressure exerted on the arteries as the heart relaxes. The difference between diastolic and systolic pressures is called **pulse pressure**. **Mean arterial pressure** is roughly defined as the sum of the diastolic pressure plus one-third the pulse pressure.

## Etiology

### Primary/Essential/Idiopathic Hypertension

Primary/essential hypertension is the most common type of hypertension and accounts for about 90% of all cases presenting with high blood pressure with no readily identifiable cause for their disease. This type of hypertension has a genetic link and is often associated with cardiovascular risk factors, smoking, obesity, lipid problems, and diabetes.

### Secondary Hypertension

Secondary hypertension is always due to an underlying cause such as intrinsic renal diseases, renovascular disease, Pheochromocytoma, Cushing's syndrome, thyroid or parathyroid disease, heavy alcohol consumption, chronic corticosteroid therapy, chronic NSAIDS therapy, or long-term oral contraceptive use can lead to secondary hypertension. The secondary hypertension patient experiences symptoms quite early on compared to the primary/essential hypertension patient and the symptoms are more severe. Many patients with secondary hypertension may be cured after treatment of the underlying cause.

# Classification of Hypertension Adults and Recommendations for Follow-Up

The American Cardiology Association and the American Heart Association defined BP in four stages: normal, elevated, stage 1, and stage 2 (Table 1). These stages reflect the health risks associated with BPs higher than 115/75 mm Hg, and help to encourage early interventions that could prevent adverse outcomes associated with high BP such as stroke and myocardial infarction (MI) and kidney disease.
For every increase in BP of 20 mm Hg systolic and 10 mm Hg diastolic, the risk of death related to ischemic heart disease and stroke doubles.

**TABLE 1 Classification of Blood Pressure (BP) in Adults and Recommendations for Follow-Up**

| BP Classification | Systolic BP (mm Hg) | | Diastolic BP (mm Hg) | Recommended Follow-Up |
|---|---|---|---|---|
| Normal | <120 | And | <80 | Recheck in 2 years. |
| Elevated | 120–129 | Or | <80 | Recheck in 1 year. |
| **Hypertension** | | | | |
| Stage 1 | 130–139 | Or | 80–89 | Confirm within 2 months. |
| Stage 2 | ≥140 | Or | ≥90 | Evaluate or refer to source of care within 1 month. For those with higher BP (e.g., >180/110 mm Hg), evaluate and treat immediately or within 1 week, depending on the clinical situation and complications. |

Note: If there is a disparity in category between the systolic and diastolic pressures, the **higher value** determines the stage.

## Lifestyle risk factors modifying hypertension

Lifestyle can play an important role in the severity and progression of hypertension; obesity, excessive alcohol intake, excessive dietary sodium, and physical inactivity are significant contributing factors.

## Clinical features

Hypertension may remain an asymptomatic disease for many years, with the only sign being an elevated BP. **Symptoms** headache, tinnitus, visual disturbances, and dizziness. These symptoms are not specific for hypertension and may be experienced just as commonly by normotensive persons. **Signs** include elevated BP reading, retinal changes, left ventricular hypertrophy, proteinuria and hematuria.

Blood pressure is measured with the use of a **sphygmomanometer** (Fig. 1). The diagnosis is based on an average of two or more properly measured, seated blood pressure readings on each of two or more office visits.


FIG. 1 (**A**) Standard blood pressure cuff (sphygmomanometer) and stethoscope, (**B**) and (**C**) automated blood pressure devices.

The manual technique for recording blood pressure includes the following steps:

1. Patient has empty bladder, not eaten or smoked should be avoided for 30 min before measurement.
2. Allow the patient to sit comfortably seated without the legs crossed for as long as possible (at least 5 minutes).
3. Palpate right brachial pulse before placement of the cuff.
4. Place sphygmomanometer cuff on right upper arm with about 3 cm of skin visible at the antecubital fossa: The standard cuff typically has a mark or arrow that designates the midpoint of the bladder, which is centered above the previously palpated brachial artery.
5. The stethoscope is placed over the previously palpated brachial artery at the bend of the elbow in the antecubital fossa (not touching the cuff)
6. Inflate the cuff slowly to about 200–250 mmHg, or until the pulse is no longer palpable.
7. Deflate cuff slowly while listening with stethoscope over the brachial artery over skin on inside of arm below cuff.
8. Record the systolic pressure as the pressure when the first tapping sounds appear **(Korotkoff sounds).**
9. Deflate cuff further until the tapping sounds become muffled (diastolic pressure) and then disappear.
10. Record blood pressure as systolic/diastolic pressures.

FIG 2 Blood pressure cuff and stethoscope in place.

**Management**

Hypertension is diagnosed by standardized serial blood pressure measurements. Investigations to identify a 'secondary' cause and assess end-organ damage (also called target organ damage) include chest radiography (cardiomegaly is suggestive of hypertensive heart disease); ECG (may indicate ischemic heart diseases); serum urea and electrolytes (deranged in hypertensive renal disease and endocrine causes of secondary hypertension); urine testing (blood and protein suggests renal disease).

Patients with a diagnosis of elevated BP are encouraged to adopt lifestyle modifications to decrease their risk of developing the disease.

- **Lifestyle modifications** include weight management; adopting a diet rich in vegetables, fruits, and low-fat dairy products; reducing intake of foods high in cholesterol and saturated fats; decreasing sodium intake; limiting alcohol intake; quitting smoking; and engaging in daily aerobic physical activity.

If lifestyle modifications are found to be inadequate for achieving desired BP reduction, drug therapy is initiated.

- **Antihypertensive therapy:** the minimum dose should be used with minimum side effects.

**Note:** About 20% of patients with untreated stage 1 hypertension have what is called **white coat hypertension**, which is defined as consistently elevated BP only in the presence of a health care worker but not elsewhere. In these patients, accurate BP readings may require self-measurement at home or 24-hour ambulatory monitoring. Persons with BP elevation in this setting are at lower risk for hypertensive complications than are those with sustained hypertension.

**Antihypertensive agents**

- **Diuretics**; these include **Thiazide diuretics** like Chlorothiazide, **Loop diuretics** like Furosemide, **Potassium-sparing diuretics** like Amiloride, **Aldosterone receptor blocker** like Spironolactone, or a **combination** like Aldactazide.
- **Angiotensin-converting enzyme** (ACE) **inhibitors**; like Captopril, Enalapril, ramipril).
- **Angiotensin receptor blockers** (ARBs); like Candesartan and Losartan.
- **Beta-adrenergic blockers**; these are either **Cardioselective** like Atenolol, or **Nonselective** like propranolol.
- **Calcium-channel blockers** (CCBs); like Amlodipine, Nifedipine, Verapamil.
- **Alpha1-adrenergic blockers**; like Doxazosin, Prazosin.
- **Combined alpha and beta blockers**, like Carvedilol.
- **Central alpha2-agonists and centrally acting drugs (Sympatholytics);** like (Clonidine, methyldopa).
- **Vasodilators**; like Hydralazine, and Minoxidil.

## Hypertensive crisis

When BP is greater than 180/120, the condition is called acute hypertension or hypertensive crisis. Two categories of hypertensive crisis are defined: hypertensive urgency or hypertensive emergency. A **hypertensive urgency** occurs when BP is greater than 180/120 mm Hg in the absence of progressive end-organ dysfunction. These persons may exhibit symptoms (headache, dyspnea, nosebleeds, or severe anxiety) and often are found to be noncompliant, under stress, or have an inadequate medication regimen. In contrast, a **hypertensive emergency** is characterized by a BP 180/120 mm Hg with evidence of impending or progressive target organ dysfunction (i.e., hypertensive encephalopathy, intracerebral hemorrhage, eclampsia, acute MI, left ventricular failure with pulmonary edema, or unstable angina pectoris). A hypertensive emergency can be associated with chest pain, dyspnea, change in mental status, visual disturbance, or a neurologic deficit. Early treatment is required for patients with a hypertensive emergency. Urgent hospital admission with the aim to reduce the blood pressure slowly with oral antihypertensives. Rarely, intravenous antihypertensives (sodium nitroprusside) are used but a sudden drop in blood pressure may result in a stroke (cerebral infarction), thus it should be avoided.

**Dental management**

- The first task is to identify patients with hypertension, both diagnosed and undiagnosed. A medical history, including the diagnosis of hypertension, treatment, identification of antihypertensive drugs, compliance of the patient, the presence of symptoms and signs associated with hypertension, and the level of stability of the disease, should be obtained.

- Blood pressure measurements should be routinely performed for all new patients and at recall appointments, also for patients who are not compliant with treatment, who are poorly controlled, or who have comorbid conditions such as heart failure, previous MI, or stroke.

- The main concerns when one is providing dental treatment for a patient with hypertension:
  1. During the course of treatment, the patient might experience an acute elevation in blood pressure that could lead to a serious outcome such as stroke or MI. This acute elevation in blood pressure could result from the release of endogenous catecholamines in response to stress and anxiety, from injection of exogenous catecholamines in the form of vasoconstrictors in the local anesthetic, or from absorption of a vasoconstrictor from the gingival retraction cord.
  2. Potential drug interactions between the patient's antihypertensive medications and the drugs prescribed and oral adverse effects that might be caused by antihypertensive medications.

Hypertension is regarded as a minor clinical predictor of increased perioperative cardiovascular risk.

- Risk assessment

In the practice guidelines, the determination of risk includes the evaluation of **three factors**:

(1) The risk imposed by the **patient's cardiovascular disease** (major,intermediate, and minor risk categories (Table 2).

(2) The risk imposed by the **surgery or procedure** (high, intermediate , and low risk)

In general, risk is greatest with vascular or emergency surgery, prolonged procedures, and procedures associated with excessive blood loss and general anesthesia. Head and neck surgery, which may include major oral and maxillofacial procedures and extensive periodontal procedures, is classified as intermediate risk. Superficial surgical procedures, which include minor oral and periodontal surgery and nonsurgical dental procedures, are classified as low risk. It appears that the risk associated with most general, outpatient dental procedures is very low.

(3) The risk imposed by the **functional reserve or capacity of the patient.**

**Table 2 Clinical Predictors of Increased Perioperative Cardiovascular Risk***

**Major Risk Factors (also known as "Active Cardiac Conditions")**

- Unstable coronary syndromes
  - Acute or recent myocardial infarction† with evidence of important ischemic risk in clinical signs and symptoms or noninvasive study
  - Unstable or severe angina (Canadian class III or IV)† ‡ §
- Decompensated heart failure
- Significant arrhythmias
- Severe valvular disease

**Intermediate Risk Factors**

- History of ischemic heart disease
- History of compensated or previous heart failure
- History of cerebrovascular disease
- Diabetes mellitus
- Renal insufficiency

**Minor Risk Factors**

- Advanced age (>70 years)
- Abnormal ECG (left ventricular hypertrophy, left bundle branch block, ST-T abnormalities)
- Rhythm other than sinus rhythm
- Uncontrolled systemic hypertension (blood pressure ≥180/110 mm Hg)

➢ Based on blood pressure measurements, the dental management is as follows:

| **Blood pressure** | **Dental management** |
|---|---|
| ≤120/80 **(Normal)** | Any treatment can be provided. |
| ≥120/80 but < 130/80 **(Elevated)** | Any treatment can be provided but Encourage patient to see physician |
| ≥130/80 but <140/90 **(Stage1)** | Any treatment can be provided but Encourage patient to see physician |
| ≥ 140/90 but < 160/100 **(Low level stage2)** | Any treatment can be provided but encourage the patient to seek medical consultation. |
| ≥ 160/100 but < 180/110 **(upper level stage 2)** | Any treatment: consider intraoperative monitoring of blood pressure, treatment should be terminated if blood pressure rises above 179/109. The patient should be referred to physician promptly. |

| | |
|---|---|
| ≥ 180/110 **(Severe uncontrolled)** | Any elective treatment is deferred, and the patient is referred to a physician. Only emergency treatment is provided; the patient should be managed in consultation with the physician, and measures such as intraoperative blood pressure monitoring, electrocardiogram monitoring, establishment of an intravenous line, and sedation may be used. The decision must always be made as to whether the benefit of proposed treatment outweighs the potential risks. |

- **Once it has been determined that the hypertensive patient can be safely treated, the following should be considered:**

- ✓ **Stress/anxiety** reduction by **good rapport** with dentist and staff and discuss fears concern and question regarding dental treatment (Stress management is important for patients with hypertension to lessen the chances of endogenous release of catecholamines during the dental visit).
- ✓ Short, morning appointments.
- ✓ Consider premedication with **sedative/anxiolytic** like Diazepam 2-5 mg the night before surgery and/or 1 hour before surgery.
- ✓ Consider the use of **nitrous oxide/oxygen** (conscious sedation), always ensure adequate oxygenation, especially at the termination of administration. Hypoxia is to be avoided because of the resultant elevation in blood pressure that may occur.
- ✓ **Slow position changes** to prevent orthostatic hypotension.
- ✓ Consider periodic **intraoperative blood pressure monitoring** for patients with upper level stage 2 hypertension; terminate appointment if blood pressure rises above 179/109.
- ✓ Obtain **excellent local anesthesia** (Profound local anesthesia is critical for pain and anxiety control and is especially important for patients with hypertension or other cardiovascular disease to decrease endogenous catecholamine release.); adrenalin in modest amounts is acceptable. One or two cartridges of 2% lidocaine with 1:100.000 adrenalin are of little clinical significance in most patients with hypertension. Use of more than this amount may well be tolerated but with increasing risk for adverse hemodynamic changes. Intravascular injections should be avoided by **aspirating syringes**.
- ✓ **Avoid the use of adrenalin-impregnated gingival retraction cord** because these cords contain highly concentrated adrenalin, which can be quickly absorbed through the gingival sulcular tissues, resulting in tachycardia and elevated blood pressure.
- ✓ **Noradrenalin and levonordefrin should be avoided** in patients with hypertension because of their comparative excessive alpha1 stimulation.
- ✓ The use of **adrenalin is generally not advised in patients with uncontrolled or severe hypertension**, however, if urgent treatment becomes necessary, a decision must be made about the use of adrenalin, which will be dictated by the situation.
- ✓ The other concern is for the adverse **interactions between vasoconstrictors and the nonselective beta-blocking agents** (such as propranolol) or peripheral adrenergic antagonists (such as Reserpine and Guanethidine). Available reports and clinical experience suggest that adrenalin in small doses of one to two cartridges containing 1:100.000 adrenalin can be used safely in most patients.

- ✓ After the procedure, allow the patient to sit in an upright position for several minutes before dismissing to avoid dizziness.
- ✓ Avoid long-term (>2 weeks) use of NSAIDs because these agents may interfere with effectiveness of some antihypertensive medications (NSAIDs for a few days in these patients, does not significantly affect cardiovascular status).

**Oral Manifestations**

No oral complications have been associated with hypertension itself.

- ➢ Patients with **malignant hypertension** (systolic >200 mmHg, diastolic >130 mmHg) have been reported to occasionally develop facial palsy.
- ➢ Patients with **severe hypertension** have been reported to bleed excessively after surgical procedures or trauma.
- ➢ Patients who take **antihypertensive drugs**, especially diuretics, may report dry mouth.
- ➢ **Lichenoid reactions** have been reported with thiazides, methyldopa, propranolol, and labetalol.
- ➢ **ACE inhibitors** may cause neutropenia, resulting in delayed healing or gingival bleeding, non-allergic angioedema and burning mouth.
- ➢ All **calcium channel blockers** may cause gingival hyperplasia

## Ischemic Heart diseases

**Ischemic Heart Disease (IHD)** also called **Coronary Artery Disease (CAD**) is the most common and important cardiac disease and it is the most common cause of death. IHD is cause by Atheroma (Atherosclerosis, also called Arteriosclerosis), it is characterized by the accumulation of cholesterol and lipids in the intima of arterial walls (The atherosclerotic process results in a narrowed arterial lumen with diminished blood flow and oxygen supply), and can lead to thromboses, which sometimes break off and move within the vessels to lodge in and occlude small vessels (embolism). Atheroma can thus lead to IHD (angina, myocardial infarction ”MI”), cerebrovascular disease and stroke. It also affects other arteries and can cause, for example, ischemic pain in the calves whilst. Atheroma results from a combination of genetic and lifestyle factors**.**

**Etiology:**

Coronary atherosclerosis is the result of inflammation and cholesterol buildup in the intimal layer of the arterial wall. This disease is related to a variety of risk factors:

- ❖ **Irreversible (fixed) risk factors** include increasing age, male gender and family history of atheroma.
- ❖ **Potentially reversible risk factors** for atheroma include:
  - Cigarette smoking. Persons who smoke 20 or more cigarettes daily have a two or fourfold increase in coronary artery diseases.
  - Elevation in serum lipid levels is a major risk factor for atherosclerosis (low-density lipoprotein (LDL), cholesterol and triglyceride).
  - Hypertension.
  - Diabetes mellitus. There is a two to eightfold higher rate of cardiovascular events.
  - Obesity and lack of exercise.
  - Diet.
  - Mental stress, depression
  - Infections and systemic inflammation

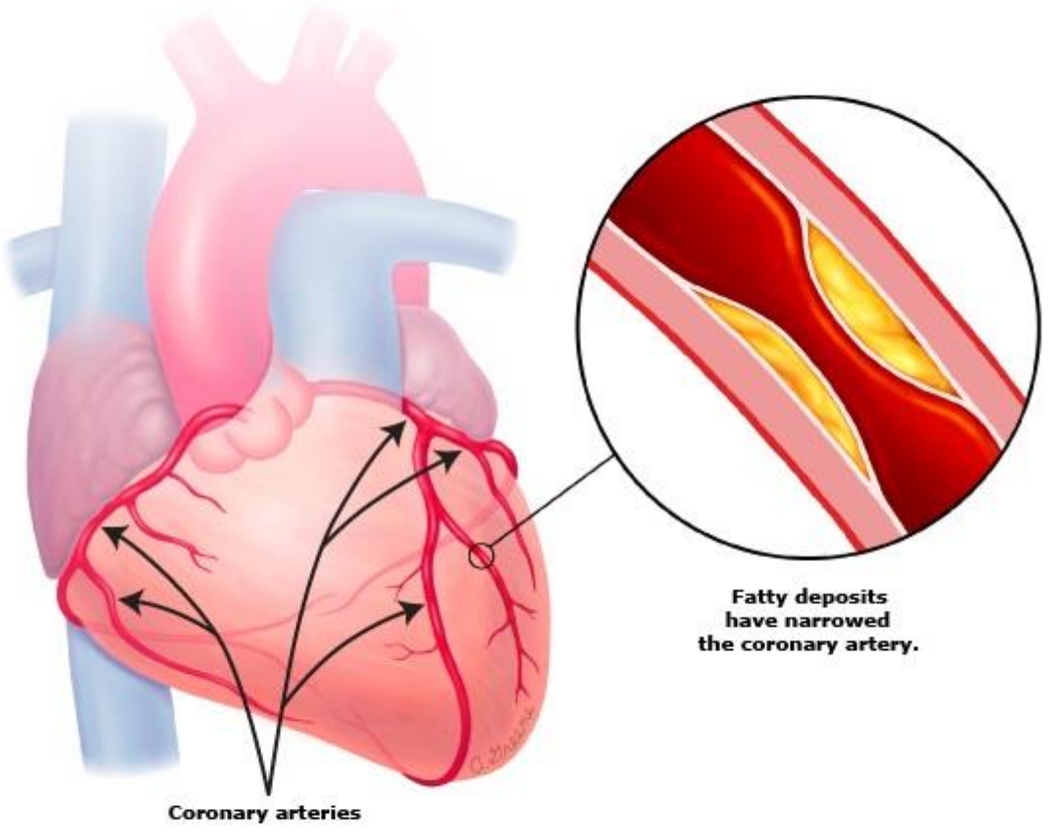



**Fig. 3** Atherosclerosis

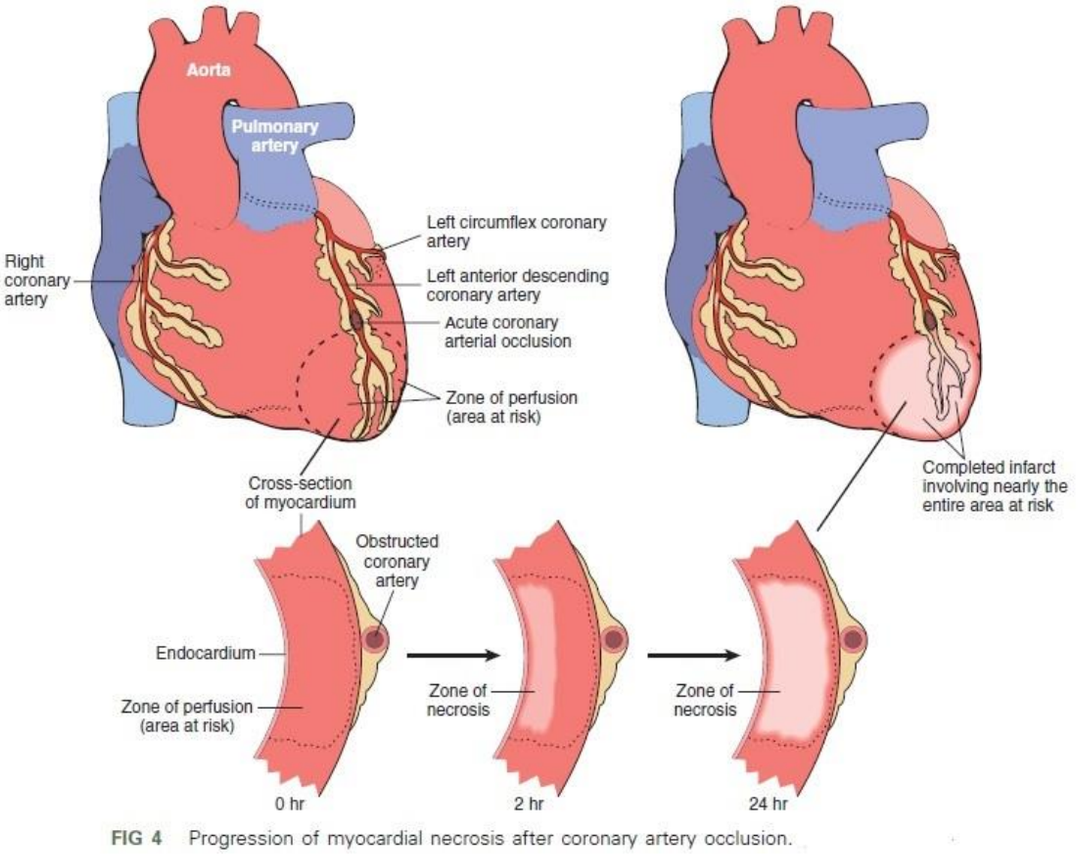



FIG 4 Progression of myocardial necrosis after coronary artery occlusion.

## Angina pectoris

Episodes of chest pain caused by myocardial ischemia, results from an imbalance between the supply of oxygen-rich blood and the oxygen demand of the muscle, its prevalence increases with age. Atherosclerotic narrowing of the coronary arteries is an important cause of this imbalance. Arterial spasm alone may, rarely, be responsible. The mortality rate in angina is about 4% per year, the prognosis depending on the degree of coronary artery narrowing. **The most common precipitating causes of angina pain** are physical exertion (particularly in cold weather); emotion (especially anger or anxiety); and stress caused by fear or pain, leading to adrenal release of catecholamines (epinephrine and norepinephrine) and consequent tachycardia, vasoconstriction and raised blood pressure. Consequently, an increased cardiac workload is accompanied by a paradoxical drop in blood flow and myocardial ischemia occurs resulting in angina.

### Clinical features of angina

- Chest pain described as a pressure sensation, fullness or squeezing in the mid-portion of the thorax, the pain lasts for less than 10-15 minutes about 2-5 minutes in most cases, relieved by rest or glyceryl trinitrate.
- Radiation of chest pain into the shoulder, left or right arm, neck, or lower jaw.
- Occasionally associated with dyspnea or shortness of breath, epigastric discomfort or sweating.

### Types of angina

- **Stable angina:** induced by effort, stress or sometimes eating, it is relieved by rest or Nitroglycerin.
- **Unstable angina**: (crescendo) angina of increasing frequency or severity, occurs on minimal exertion or at rest, the pain is not readily relieved by Nitroglycerin, there is increased risk of MI.
- **Variant or Prinzmetal's angina**: caused by coronary artery spasm.

The term acute coronary syndromes (ACS) are a term used in unstable angina and evolving MI which share a common underlying pathology; plaque rupture, thrombosis and inflammation.

### Tests

- ✓ Resting ECG; ST depression, flat or inverted T wave.
- ✓ Exercise ECG.
- ✓ Thallium-201 scan; highlights ischemic myocardium.
- ✓ Ambulatory (Holter) electrocardiography and exercise echocardiography,
- ✓ Cardiac catheterization and Coronary angiography.

### Management

- ❖ Identify and correct **risk factors**; stop smoking, encourage exercise and weight loss, control hypertension and diabetes.
- ❖ **Pharmacologic management**
- Antiplatelet drugs like aspirin 75-325 mg/24 h and\or clopidogrel.

- β blockers; atenolol 50-100 mg/24h, unless contraindicated (asthma, COPD, bradycardia, coronary artery spasm).
- Nitrates: for symptoms give glyceryl trinitrate (GTN) spray or sublingual tablets 0.3 mg to reduce the peripheral vascular resistance and reduce oxygen demands. Also, long-acting nitrates isosorbide mononitrate 20-40 mg twice daily or slow-release nitrate.
- Calcium antagonists: amlodipine, diltiazem, especially when β-blockers are contraindicated.
- Potassium channel activator; nicorandil.

❖ **Revascularization**

- Percutaneous transluminal coronary angioplasty (PTCA) with stenting; aims to open up the coronary blood flow by inserting a balloon- tipped catheter through the groin up into the area of arterial blockage.
- Coronary artery bypass grafts (CABG) are vascular grafts made to bridge the obstructions in the coronary blood vessels.

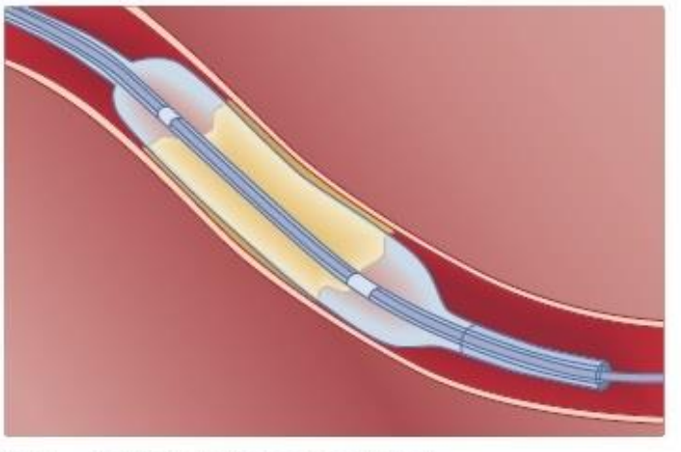
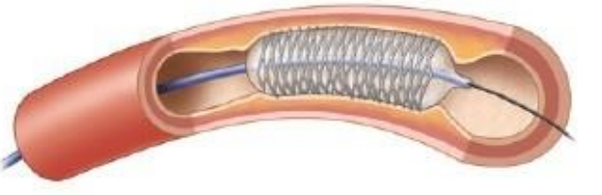


FIG .5 Balloon angioplastv catheter.



Expandable metallic stent. The stent is left in place after deflation and withdrawal of the balloon catheter.

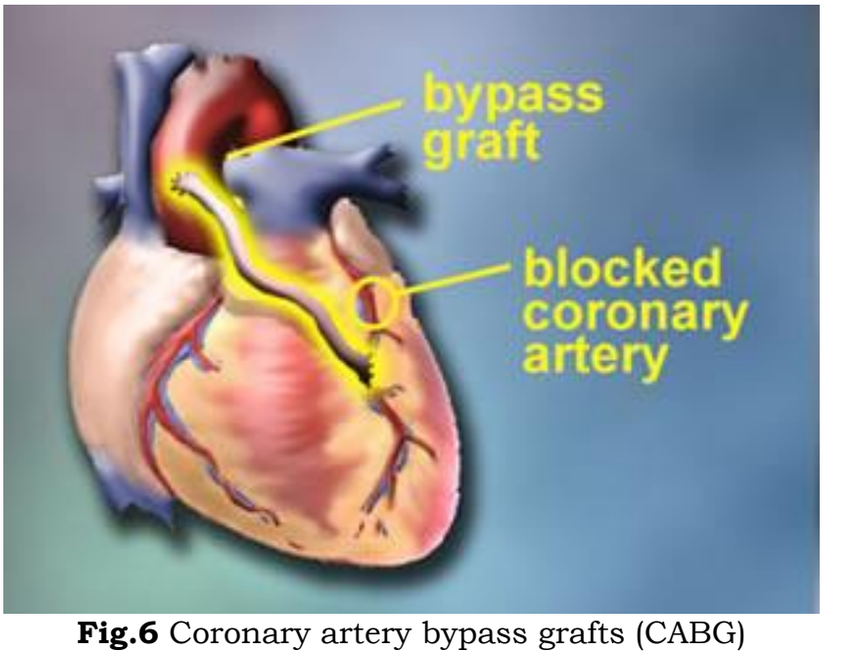



**Fig.6** Coronary artery bypass grafts (CABG)

## Myocardial Infarction (MI)

Myocardial infarction results from the complete occlusion (blockage) of one or more coronary arteries. It arises when atherosclerotic plaques rupture causing platelet activation, adhesion and aggregation with subsequent thrombus formation within the coronary circulation. Angina may progress to MI but fewer than 50% of patients with MI have any preceding symptoms. **Complications** of MI include weakened heart muscle, resulting in acute congestive heart failure, post-infarction angina, infarct extension, cardiogenic shock, pericarditis, and arrhythmias. Causes of death in patients who have had an acute MI include ventricular fibrillation, cardiac standstill, congestive heart failure, embolism, and rupture of the heart wall or septum.

**Clinical features of myocardial infarction**

- Chest pain described as a pressure sensation, fullness or squeezing in the mid-portion of the thorax. 10-20% of individuals have silent (painless) MI.
- Radiation of chest pain into the jaw/teeth, shoulder, arm, and/or back.
- Associated dyspnea or shortness of breath.
- Associated epigastric discomfort with or without nausea and vomiting.
- Associated diaphoresis or sweating.
- Syncope or near-syncope without other cause.
- Impairment of cognitive function without other cause.

50% of the patients die within the first hour of MI and a further 10-20% within the next few days.

**Diagnosis of MI;** is by clinical features, ECG (large Q wave, ST elevation and T inversion), change in the serum levels of cardiac enzymes which include; Troponin, Creatine Kinase MB (CK-MB), Aspartate transaminase (AST) and Lactic dehydrogenase (LDH). Troponin assays are the most sensitive and specific in differentiating cardiac muscle damage from trauma to skeletal muscle or other organs and are virtually absent in the plasma of normal persons and are found only after cardiac injury.

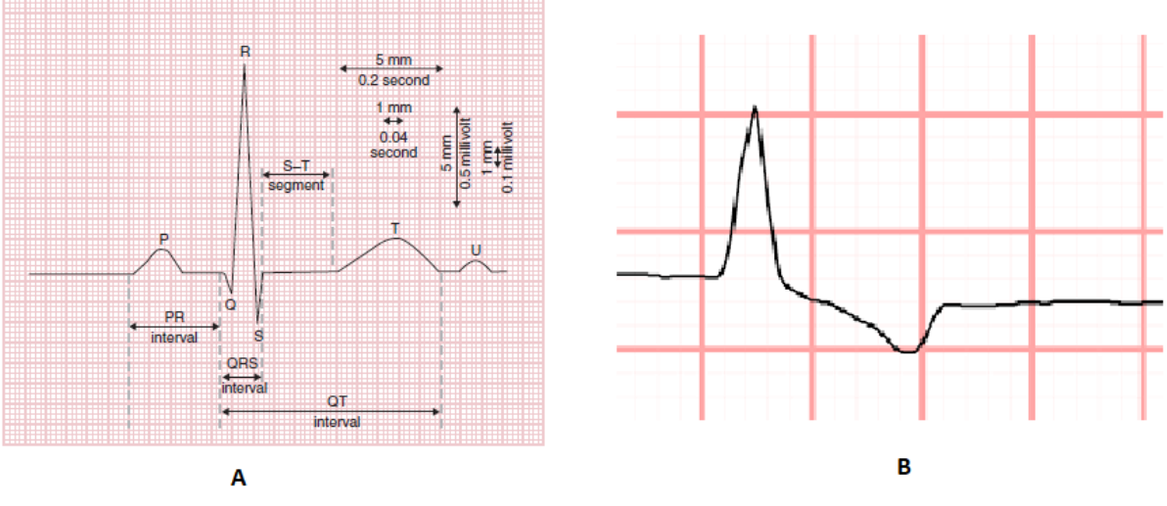



**Fig.7 A.** Normal ECG, **B.** ECG in Pt with angina or MI

**Management**

- Alert **emergency services** (if in community) or cardiac arrest team (if in hospital).
- Dual antiplatelet therapy (aspirin in daily doses of 75-325 mg plus either clopidogrel, prasugrel, or ticagrelor) is used to reduce risk of morbidity and mortality**.**
- **Rest and reassure.**
- **Pain relief:** opioid analgesia (diamorphine) is usually necessary.
- **Oxygen** administration.
- Early **Revascularization**

✓ **Thrombolytic therapy** (Streptokinase, Urokinase, Alteplase or Reteplase), the greatest benefit is realized when patients receive thrombolytic drugs within the first 3 hours after infarction; however, modest benefit is possible even up to 12 hours after the event. The early use of thrombolytic drugs may decrease the extent of necrosis and myocardial damage and dramatically improve outcome and prognosis.

✓ **Primary percutaneous intervention** to dissolve the coronary thrombus provided the patient is not at risk of a life-threatening hemorrhage.

✓ **Coronary artery bypass grafting** (CABG)

- **Insulin** infusion to prevent stress hyperglycemia.
- General **pharmacologic measures** for patients with acute MI include the use of nitrates, beta blockers, calcium channel blockers, ACE inhibitors, and lipid-lowering agents. Antiplatelet drugs are significant in decreasing morbidity and mortality.
- **Sedatives and anxiolytic** medications also may be used.
- Prompt **treatment of complications**, particularly cardiac arrhythmias. During the first several weeks after an infarction, the conduction system of the heart may be unstable, and patients are prone to serious arrhythmias and re-infarction.

**Dental management**

➢ Identification of patients with a history of ischemic heart diseases, and if the patient is not under medical control, we have to refer him to a physician for an evaluation and control.

➢ The potential problem related to the dental procedure is that the stress and anxiety during the dental procedure, and excessive amount of vasoconstrictor in local anesthesia may precipitate the attack of angina pectoris, MI, arrhythmia, or sudden death.

➢ In general, recent MI and unstable angina are classified as clinical predictors of **major risk** for perioperative complications like serious arrhythmias and re-infarction. Stable (mild) angina and past history of MI are identified as clinical predictors of **intermediate risk** for perioperative complications.

## Patients with stable angina or past history of MI more than 30 days [Intermediate risk]

- Identify all medications and drugs being taken or supposed to be taken by the patient.
- Examine the patient for signs and symptoms of disease and obtain vital signs.
- Review recent laboratory test results or images required to assess risk.
- Confirm patient has a primary care provider and has taken cardiac medication(s) today.
- Obtain a medical consultation (i.e., refer to physician) if the patient is poorly controlled or is undiagnosed.
- If vital signs indicate well control, routine dental procedures can be performed without special precautions.
- Short Morning appointment with comfortable chair position and avoid rapid position changes.
- Pretreatment vital signs should be recorded including pulse rate and blood pressure as a base line record.
- Nitroglycerin sublingual tablets should be readily available and, in some cases, prophylactic preoperative nitroglycerin is advisable especially when the patient has angina more than once a week.
- Stress-reduction measures which include:
  - ✓ Good communication
  - ✓ Oral sedation (e.g., Diazepam 2-5 mg on the night before and 1 hour before the appointment)
  - ✓ Intraoperative Nitrous oxide and oxygen but hypoxia should be avoided.
  - ✓ Ensure profound local anesthesia
- Limited use of vasoconstrictor (maximum 0.036 mg adrenalin, 0.20 mg levonordefrin), not more than two cartridges containing 1: 100.000 adrenalin, especially if patient is taking a nonselective beta-blocker. Avoid intravascular injections using aspirating syringe.
- Avoidance of adrenalin-impregnated retraction cord
- Avoidance of anticholinergics (e.g., scopolamine, and atropine)
- Adequate postoperative pain control.
- Patients with ischemic heart disease, coronary artery stents, or CABG surgery do not require antibiotic prophylaxis.
- Patients may require long-term anticoagulant medication, but most patients are on aspirin or clopidogrel rather than warfarin.
- If a patient experiences chest pain in the dental surgery, dental treatment must be stopped, the patient should be given nitroglycerin sublingually and oxygen, and be kept sitting upright. Vital signs should be monitored. The pain should be relieved in 2–3 min; the patient should then rest and be accompanied home. If chest pain persists after three doses of nitroglycerin given every 5 min, that lasts more than 15–20 min, or that is associated with nausea, vomiting, syncope or hypertension is highly suggestive of MI, oxygen should be continued, and 300 mg of aspirin should be chewed.

## Patients with unstable angina or recent MI within past 30 days) [Major risk]

- Avoid elective care, only emergency treatment should be provided, consult with physician and limit treatment to pain relief, treatment of acute infection, or control of bleeding (best treated in a hospital dental clinic or special care facility).
- Prophylactic nitroglycerin sublingually is advisable.
- Placement of intravenous line.
- Sedation and oxygen.
- Frequent monitoring of blood pressure and vital signs, using a pulse oximeter and continuous electrocardiographic monitoring
- Avoid use of adrenalin in local anesthetic, local anesthesia without adrenalin can be used but if necessary, not more than two cartridges containing 1: 100.000 adrenalin using aspirating syringes.
- Adrenalin-impregnated retraction cords are avoided.
- If the patient experiences pain during treatment, the management is the same as above.

### The use of antiplatelet and anticoagulation drugs

Patients who take **aspirin or another platelet aggregation antagonist** such as clopidogrel can expect some increase in bleeding. This effect generally is not clinically significant, and bleeding may be controlled through local measures. Discontinuation of these agents before dental treatment is not necessary and can increase the risk of thrombosis, MI, or death.

Patients who are taking warfarin for anticoagulation can safely undergo dental or surgical procedures, provided that the international normalized ratio (INR) is 3.5 or less and they are managed after consultation with physician. The INR results should be performed within 24-72 hours within the scheduled invasive procedure depending on the level of INR stability.

The Local hemostatic measures that are used to control bleeding include the use of hemostatic agents in the sockets (gelfoam, surgicel), suturing and gauze pressure packs.