



Adult Health Nursing-I

Medical Surgical Nursing

*As per the Revised Syllabus
for BSc Nursing*



Sukhpal Kaur



Adult Health Nursing-I

(Medical Surgical Nursing)

As per the Revised Syllabus for BSc Nursing

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Coronary Artery Disease

Harmeet Kaur Kang, Fatima D'silva

"Exercise should be regarded as tribute to the heart."

—Irish Proverb

LEARNING OBJECTIVES

After going through the chapter, the learner will be able to:

- Define coronary artery disease.
- Describe the normal coronary circulation.
- List the risk factors for the development of coronary artery disease.
- Elaborate the pathophysiological process of acute coronary syndrome.
- Describe the treatment plan for acute coronary syndrome.

TERMS

- **Acute coronary syndrome:** Cluster of signs and symptoms that indicate acute episode of angina or myocardial infarction.
- **Atheroma:** Accumulation of abnormal materials composed of smooth muscle cells that are formed over the lipids within the arterial walls. This material protrudes into the central canal of blood vessel and obstructs the blood flow. It is also called plaque.
- **Atherosclerosis:** Abnormal deposition of lipids and fibrous tissue within the lumen of the coronary arterial walls.
- **Angina pectoris:** Sudden or recurrent chest pain due to the decreased blood supply to the myocardium.
- **Coronary artery bypass graft:** Surgical procedure in which the coronary artery circulation is restored by anastomosing a blood vessel above the level of the blockage. The blood vessels used as the graft are radial artery or saphenous artery or gastroepiploic artery.
- **High-density lipoprotein (HDL):** Protein-bounded lipid that helps in the transportation of cholesterol to the liver which is further excreted in the bile. It exerts a favorable effect on the body as protein is in higher proportion than lipid.
- **Ischemia:** Decreased oxygen supply to tissues due to low blood supply.
- **Low-density lipoprotein (LDL):** Protein-bound lipid that is responsible for the transportation of cholesterol to the tissues. It exerts a harmful effect on the body because there is a lower proportion of proteins as compared to fats/lipids.
- **Myocardial infarction:** Death of the cardiac tissues due to the decrease or complete cessation of blood supply to the myocardium.
- **Percutaneous coronary intervention (PCI):** Placement of a ballooned catheter in the coronary artery for the breakdown and removal of the plaque. After the breakdown of the plaque, a stent (preferably a drug-eluting stent) is placed to prevent the further occlusion of the coronary artery.
- **Stent:** A metallic mesh that helps provide the support to the lumen of coronary blood vessels to prevent the future occlusion.
- **Thrombolytic agent:** Used for the breakdown or lysis of the blood clots to reopen the blood vessels. It is also referred to as a fibrinolytic agent.
- **Troponin:** A cardiac biomarker or a heart protein that is elevated in the blood, whenever there is damage or death of cardiac muscles.

INTRODUCTION

Cardiovascular disease (CVD) is a group of diseases related to the heart and blood vessels. It includes coronary artery disease (CAD) and acute coronary syndrome (ACS). CAD is characterized by atherosclerotic plaque in the coronary arteries and can present with or without any symptoms while ACS is symptomatic and presents as unstable angina or myocardial infarction. CHD encompasses ACS and CAD.

Coronary heart disease is the number one killer disease of modern times. It strikes Indians early and kills many of them in their productive period of life. It is a progressive disease, as in recent times we come across an overwhelming number of patients seeking admission to hospitals with cardiovascular manifestations. Cardiovascular disease which was considered the disease of the affluent is no more considered so, as CVD is also seen affecting the poor due to the increase in the use of tobacco, low levels of education, lack of clarity of risk factors, and unhealthy lifestyle practices which are seen both in the urban as well as the rural settings. The prevalence of CHD has increased from 1 to 9–10% among urban population and from less than 1% to 4–6% among the rural population over the last 60 years.

Over the last few years, India has transitioned epidemiologically. There are changes happening in the demographic profile and other determinants due to which the burden of disease, disability, and death has changed from infectious and nutritional disorders to non-communicable lifestyle-related diseases. Though medical technology has advanced in the field of cardiovascular medicine yet control of heart diseases is doubtful as these technologies find limited application because of the high cost involvement and temporary effect. Studies have also revealed suboptimal control of cardiovascular risk factors. There is strong evidence to show that the escalating deaths from CHD and the progress of atherosclerotic changes can be significantly reduced by targeting patients with established CHD-promoting health behaviors through constant motivation.

CONCEPT AND DEFINITION

The major blood vessels supplying the heart muscles are the left coronary artery (LCA) and left main coronary artery (LMCA). These arteries originate from the aorta just near the aortic valve. The right coronary artery (RCA) gives off series of branches and supplies the right side of the heart. The left main coronary artery (LMCA) divides into two arteries, namely the left anterior descending artery (LAD) and left circumflex artery (LCx). LAD supplies to the anterior, bottom, and front part of the septum of the left heart. This artery branches in the right direction called the septal branches and some in the left direction called the diagonal branch. The LAD is bigger than RCA in size and is more important as it supplies blood to the left ventricle. LCx circles down the circumference of the heart on the left side. This is smaller than RCA. The LCx artery branches into Obtuse Marginal artery. The right coronary artery (RCA) majorly supplies the blood to the right side of the heart (**Fig. 43.1**).

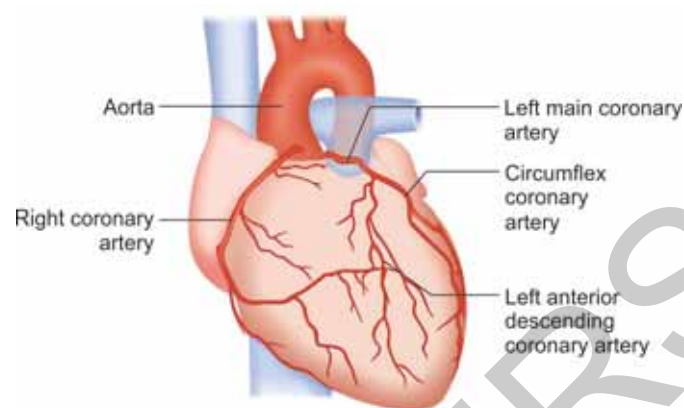


Fig. 43.1: Coronary arteries.

ATHEROSCLEROSIS

“The term atherosclerosis comes from the Greek word “athere” meaning “fatty mush” and “skleros” meaning “hard.” Coronary artery disease (CAD) or atherosclerotic heart disease, also referred as “heart attack” in layperson’s term, is caused mainly due to atherosclerosis. Atherosclerosis refers to the “hardening” or “narrowing” of the coronary arteries due to the deposition of fatty deposits called “plaques.” The plaques are usually made up of cholesterol and calcium which narrow the internal orifice (lumen) of the blood vessels. When the block is partial it results in a condition referred as Angina Pectoris presented by chest pain. This happens due to reduced blood flow (ischemia) and oxygen to the heart muscles. Hence, CAD is also referred to as “ischemic heart disease.”

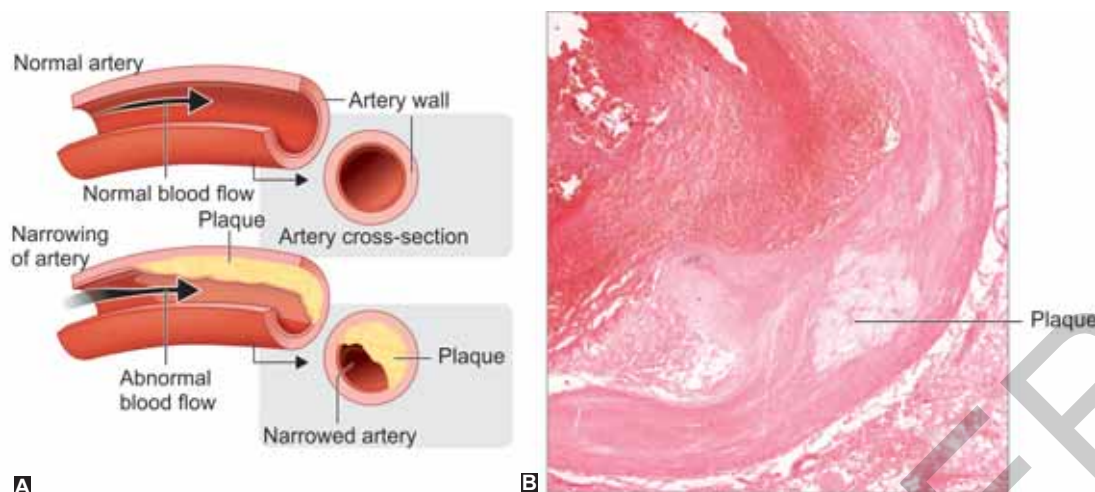
Atherosclerosis involves frequent inflammation of the artery wall due to the injury that results in changes in the structure and chemical composition of arterial walls (**Figs. 43.2A and B**).

Epidemiology

As per the National Center for Health Statistics (2018), a federal organization in the US, the number of adults diagnosed with heart disease is around 30.3 million. Cardiovascular disease, a common lifestyle disease accounts for approximately 17.9 million deaths yearly, representing approximately one-third of deaths worldwide. Out of these deaths, more than 75% of deaths occur in low-middle income countries. According to Global Burden of Diseases (GBD) study, 1/4th of all deaths in India occur due to cardiovascular diseases. CAD has now topped the list of diseases and burdened the health system to a great extent. The situation in India is more alarming. Indians are reported to be at higher risk for being diagnosed as coronary artery disease patients than their counterparts in White Americans, Chinese, and even Japanese. Kerala has the highest prevalence rate (82.8%) of CAD among the elderly whereas in North West India states such as Punjab, the younger population is significantly affected by this disease.

Etiology

Although genetic factors play a significant role in the occurrence of coronary artery disease, research has revealed



Figs. 43.2A and B: Atherosclerosis.

that the majority of the deaths due to coronary artery disease are attributed to behavioral or lifestyle factors. The risk factors of CAD can be classified as “modifiable”, which can be modified by bringing about changes in lifestyle and “non-modifiable”, which are attributed to genetics and other attributes, which cannot be modified (Table 43.1).

“Modifiable/contributing factors” are those factors that can be altered and prevented so that the further progress of heart disease can be arrested.

“Non-modifiable factors” are those factors that cannot be altered, or a person has no control over these factors.

The Framingham risk assessment tool is used to estimate the risk for occurrence of the cardiac event within the next 10 years. It is designed for adults above 20 years. The calculation is based on the individual’s risk factors, i.e., age, gender, lipid profile, smoking status, BP, and antihypertensive medications. The more the risk factors the greater is the likelihood of coronary artery disease.

TABLE 43.1: “Modifiable and non-modifiable risk factors for coronary artery disease.”

Non-modifiable risk factors	Modifiable risk factors	Contributing factors
Age: Increased age is related to a higher risk and severity of CHD. But Angina and Myocardial infarction (MI) can be seen in younger age groups too	Elevated serum lipid levels: In adults, total cholesterol level of 240 mg/dL is considered as high and 200–239 is considered borderline high. • People with high levels of High-Density Lipoproteins (HDL) also known as good cholesterol than Low-Density Lipoproteins (LDL) also known as bad cholesterol are at lower risk. • The ratio of total cholesterol to HDL and the LDL to HDL ratio is the best test for predicting CHD. • Total cholesterol >200 mg/dL • Triglycerides >150 mg/dL • LDL >160 mg/dL • HDL cholesterol <40 mg/dL in men and <50 mg/dL in women are predisposing risk factors.	Diabetes mellitus: A fasting blood glucose of >126 mg/dL or 7 mmol/L on two separate instances and a random blood glucose level of 180 mg/dL or 10.0 mmol/L points toward the diagnosis of diabetes which is thought to increase the risk of CHD by two to four-folds.
Gender: Men are significantly at higher risk of getting CAD than women. Furthermore, the risk for women increases significantly after attaining menopause due to deficiency of estrogen which is cardioprotective. The male to female ratio is 3:2.	Hypertension: BP >140/90 mm Hg increases the afterload of left ventricles and also causes stiffness of the blood vessels. Over time, this results in hypertrophy of the heart and finally heart failure.	Metabolic syndrome is a major risk factor for CAD presented by the following conditions: • Fasting blood glucose of more than 100 mg/dL or abnormal glucose tolerance test, which points toward insulin resistance. • Blood pressure consistently greater than 130/85 mm Hg • Dyslipidemia • Prothrombotic state (high fibrinogen levels) • Central obesity
Family history: The presence of disease in 1st-degree relatives is a risk factor for CAD.	Tobacco/Alcohol use: Active and passive smoking puts a person at significantly higher risk for CAD. It triples the risk of heart attack in women and doubles in men. Nicotine present in the smoke causes the excessive platelet aggregation and plaque formation in arterial walls. Furthermore, it also stimulates excessive production of epinephrine and norepinephrine which in turn causes peripheral vasoconstriction, high blood pressure and tachycardia which results in increased workload further leading to higher oxygen demand and deterioration of heart function.	Stress can predispose a person to obesity due to overeating or developing smoking habits.

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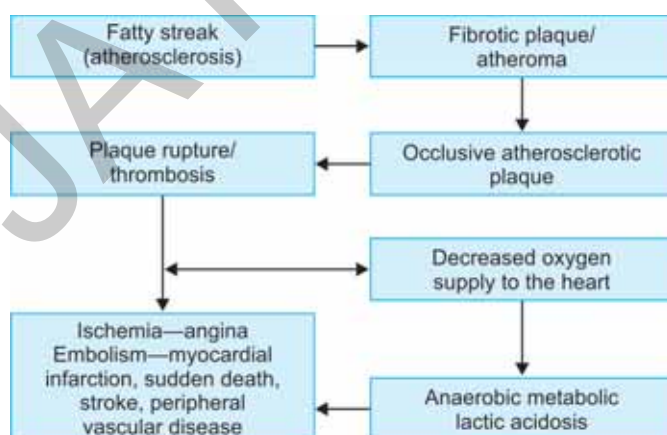
Non-modifiable risk factors	Modifiable risk factors	Contributing factors
Genetic: Genetic predisposition to diseases such as diabetes, hyperlipidemia, hypertension, and obesity increases the risk of CHD. It is estimated that genetic contribution to CAD is as high as 40–60%.	Sedentary lifestyle	Oral contraceptives
Race: Studies have pointed toward increased risk for CAD among African Americans.	Obesity: High BMI places a person at high risk as the heart has to do extra work to meet the oxygen demand of the body. Moreover, adipokines and free fatty acids contribute to atherogenic changes and are known to modify insulin action. Waist: Hip ratio is an important estimate for fat distribution. A high risk for CHD is seen among men with a waist measurement of >40 inches and for women if it is above 35 inches. • A BMI (body mass index) of 18.5–24.9 is considered healthy. • A person with BMI above 40 is considered to be obese.	Type A personality
	• Intake of high fatty foods/saturated fatty acids. • Lack of antioxidants in the diet. • Intake of high sodium-containing food. • Dietary supplements containing ephedrine alkaloids can raise the BP.	• Emotions—depression, anxiety • Elevated Homocysteine levels (amino acid produced by the body) • Increase in C-reactive protein is also a marker of coronary disease. • Clients with history of arthritis, peripheral arterial disease, carotid artery disease, abdominal aortic aneurysm, SLE, autoimmune diseases are prone for heart attacks • Sleep apnea increases the workload on the heart • Substance abuse—the use of illegal drugs such as cocaine and methamphetamines can produce coronary spasm

Pathophysiology (Flowchart 43.1)

Endothelial inflammation derived from a focal accumulation of cholesterol and lipid within the intimal walls of the coronary artery plays a key role in the progression of atherosclerosis. Smoking, high blood pressure, and other risk factors can also contribute to the injury. The left anterior descending artery and the circumflex artery are the two most affected arteries. The inflammatory response in the endothelial lining of the coronary arteries attracts white blood cells, mainly macrophages. These macrophages ingest the lipids and

become foam cells that transport lipid to the arterial walls. The toxins released by these activated macrophages injure the endothelial layer of the artery attributing to the oxidation of LDL (low-density lipoprotein). This causes damage to the endothelium and results in atherosclerosis. Following this, the proliferation of smooth muscles occurs, and lesions are formed due to inflammatory and lipids infiltrate, which is referred to as “atheroma” or “plaque.” The atherosclerotic lesions may be fixed or stable causing obstruction as in the case of stable angina or may be unstable, which can rupture and cause platelet adhesion and thrombus formation as in myocardial infarction or unstable angina. A thrombus in CAD is a combination of platelets, RBCs, vasoconstrictors, and fibrin matrix. The thin fibrin fibers thrombus is not properly lysed by the thrombolytic agents whereas the thick fibrin fibers thrombi are lysed well by the thrombolytic agents.

Flowchart 43.1: Pathophysiological changes in coronary artery disease.



ACUTE CORONARY SYNDROME

Acute coronary syndrome (ACS) can be described as a group of clinical manifestations resulting due to decreased blood supply to the heart ranging from ST-segment elevation myocardial infarction (STEMI) to Non-ST segment elevation myocardial infarction (NSTEMI). The major cause of acute coronary artery disease is the rupture of atherosclerotic plaque in the coronary artery and the formation of thrombus, which occludes the coronary artery fully or partially.

The patient presents with typical chest pain (angina), palpitations, dyspnea on exertion, diaphoresis and nausea/vomiting, etc.

ANGINA PECTORIS

Due to insufficient blood flow in coronary arteries, the cardiac muscles do not get proper blood supply and the oxygen demand of the heart is not fulfilled whenever the patient does physical exertion or experience psychological stress. In such a case, a set of clinical symptoms characterized by episodes of sudden and recurrent chest pain may be experienced by an individual, which is known as angina pectoris (**Fig. 43.3**).

Different Types of Angina

There are majorly five types of angina—**stable, unstable, refractory, variant, and silent angina**.

1. **Stable angina:** The chest discomfort/pain is caused by excessive physical exertion or in response to severe emotions. In this type of angina, the coronary arteries are partially occluded.
2. **Unstable angina:** The chest discomfort is not related to the activity. Symptoms may increase in severity and can occur even at rest. This type of angina occurs due to complete occlusion of the coronary artery attributing to plaque and thrombus rupture.
3. **Refractory angina:** This is also known as intractable angina which is characterized by sudden severe, unbearable, and debilitating chest discomfort/pain.
4. **Variant angina:** Variant angina is also known as Prinzmetal's angina which occurs due to coronary artery spasms resulting in constriction and decreased blood flow to the myocardium.
5. **Silent angina:** This type of angina results from a temporary reduction in blood supply to the myocardium and the patient does not experience any chest pain. In most cases, silent angina is experienced by diabetics.

Pathophysiology of Angina Pectoris

The coronary artery blockage may occur due to many factors such as atherosclerosis, atherosclerotic plaque rupture, and thrombosis or vasospasm. This blockage results in decreased blood supply to the myocardium. Whenever a person with

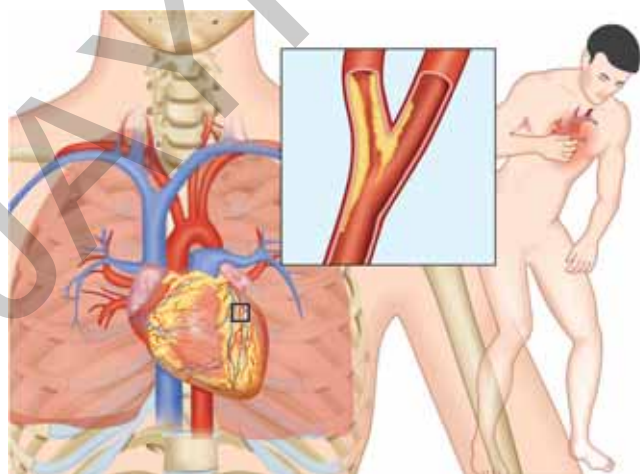
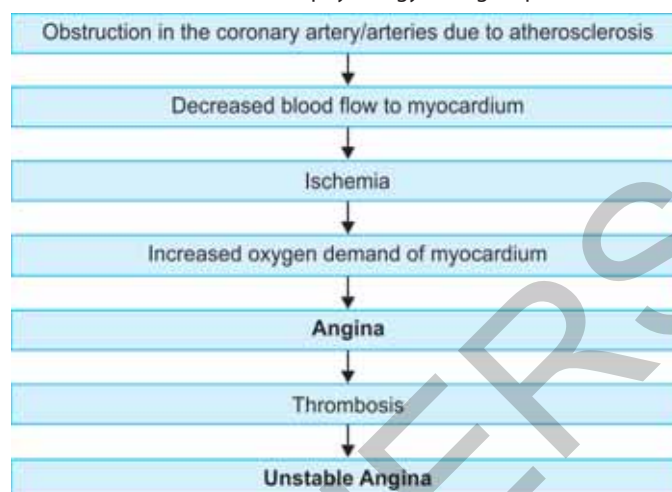


Fig. 43.3: Angina.

Flowchart 43.2: Pathophysiology of angina pectoris.



BOX 43.1: Predisposing factors for angina.

1. Excessive physical activity precipitates the angina as the myocardial oxygen demand increases.
2. Extreme emotional state (excessive sadness/stress or excessive elation) can result in catecholamine release leading to tachycardia and high blood pressure, which result in higher oxygen demand attributing to increased workload on heart.
3. Eating heavy meal can result in increased blood flow to the gastrointestinal system and decrease blood supply to the myocardium, which can result in anginal pain.
4. Exposure to extreme cold conditions can result in vasoconstriction further reducing the lumen of blood vessels and increasing the blood pressure causing the increased workload on myocardium.

obstructed coronary artery performs an excessive physical activity or is excited/stressed due to extreme emotions, the heart's activity increases. This activity causes increase in oxygen demand of the myocardium, but due to decreased blood supply, the balance between demand and supply of oxygenated blood is not maintained, which results in ischemia and chest pain. The chest pain exaggerated by excessive activity and relieved by rest or nitroglycerine is known as stable angina. On the other hand, if there is plaque rupture and thrombosis in the coronary artery then the full lumen of the artery may be blocked, which results in continuous pain without any relation to activity or rest; this type of chest pain is known as unstable angina (**Flowchart 43.2**). The predisposing factors of angina are depicted in **Box 43.1**.

ACUTE MYOCARDIAL INFARCTION

Complete occlusion of coronary arteries due to atherosclerosis and thrombus results in cessation of blood supply to the myocardium resulting in irreversible injury and death of tissue. The major symptom of myocardial infarction (MI) is severe anginal pain which is prolonged and not relieved by rest or nitroglycerine.

Types of Myocardial Infarction

Myocardial infarction can be classified based on the specific location of infarction.

1. **Anterior myocardial infarction:** Occlusion on LAD (left anterior descending) artery results in the death of tissue in the anterior wall of the left ventricle and interventricular septum. Anterior wall myocardial infarction can result in left ventricle dysfunction further causing congestive heart failure and cardiogenic shock.
2. **Inferior and posterior wall myocardial infarction:** This type of MI can result due to the occlusion of the right coronary artery and left circumflex artery. It can result in complications such as AV blocks and arrhythmias.
3. **Lateral wall myocardial infarction (LWMI):** Left circumflex artery blockage supplying to the lateral wall of the heart can cause lateral wall myocardial infarction. LWMI can cause conduction problems and mitral valve insufficiencies.
4. **Right ventricular myocardial infarction (RVMI):** Right ventricular MI occurs mainly in combination with inferior wall MI. RVMI is associated with higher mortality due to severe complications such as cardiogenic shock, complete AV blocks, and other mechanical complications.

Clinical Manifestations

- ❖ The patient experiences severe chest pain (characterized as constricting, squeezing, and crushing type) which is prolonged and is not relieved with nitroglycerine or rest. The patient may experience radiation of pain in the right arm, neck, jaw, and intrascapular region. Some patients complain of epigastric pain also.
 - ❖ The chest pain is mostly accompanied by other symptoms such as nausea, vomiting, breathlessness, and diaphoresis.
 - ❖ Females and elder patients may not experience typical chest pain symptoms but may experience palpitations, breathlessness, confusion, or syncope.
- If the timely reperfusion management is not given, then the myocardium undergoes irreversible damage and degeneration and can be replaced by infarcted tissue affecting myocardial functioning. Myocardial dysfunction can result in decreased cardiac output and lead to complications of heart failure and sudden cardiac death.

Diagnosis

Myocardial infarction is diagnosed based on the history, typical clinical manifestations, ECG changes, and elevation in cardiac biomarkers indicating the death of myocardial tissues.

- ❖ **ECG changes (Fig. 43.4):** Once patient reports in the emergency room with severe chest pain, a 12-lead ECG must be obtained within 10 minutes. The specific changes in ECG could be:
 - ST-segment elevation of more than 0.1 mV in two or more leads
 - New left bundle branch block
 - Development of abnormal Q wave

Special considerations: RVMI may not show the typical ECG changes in 12-lead ECG. But the patient may present with severe symptoms. In that case, right precordial ECG must be performed to rule out inferior/posterior/right wall MI (Fig. 43.5).

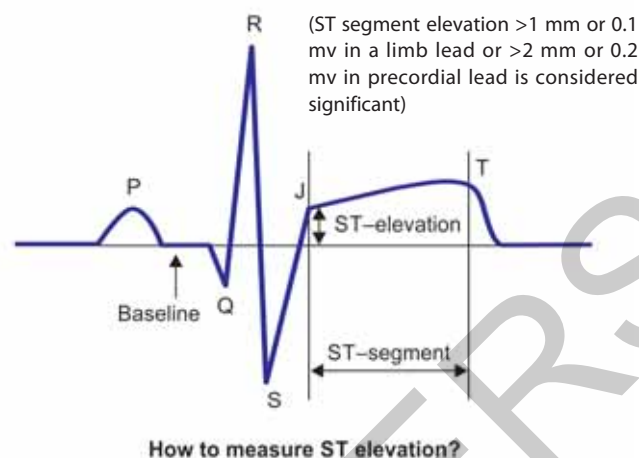


Fig. 43.4: ECG changes in myocardial infarction.

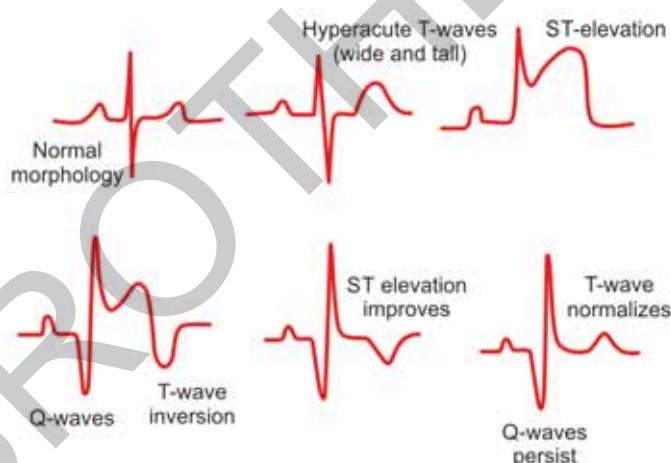


Fig. 43.5: Evolution of myocardial infarction.

Three zones of tissue damage are seen in myocardial infarction:

1. **Zone of necrosis**—due to absolute lack of blood flow
2. **Zone of injury**
3. **Zone of ischemia**

In the zone of injury and zone of ischemia, the blood flow can be re-established. The myocardial cells get damaged due to ischemia and are replaced by infarct. These cells do not participate in pumping action and also these cells lose the ability to conduct the impulse.

Normally, whenever there is a blockage in the main artery, small blood vessels originate and connect to that artery which helps in collateral circulation to the affected tissues. The growth of collateral circulation may depend on the following factors:

- Genetic susceptibility for the development of collateral circulation through new blood vessels
- Long-term ischemia in myocardium

In the case of long-term ischemic conditions, the growth of collateral circulation is better but when there is a sudden cardiac event, mostly the collateral circulation is not fully developed and is able to compensate; so severe ischemia or infarction may develop.

- ❖ **Cardiac biomarkers:** The increased level of cardiac enzymes is an important indicator of myocardial

infarction. Creatine Kinase (CK and CK-MB) are increased in blood 4–6 hours after the necrosis of the myocardium. Other biomarkers are Troponin I, Troponin T, and myoglobin. Troponin test is more sensitive and specific, thus preferred as a major cardiac biomarker. Myoglobin (heme protein) rises within 1–2 hours of symptoms but is not specific to infarction in cardiac tissues.

- ❖ **Echocardiography:** Echocardiography can be used to find out the abnormalities in the heart wall motion in relation to myocardial infarction. The specific location of abnormal heart wall motion can be identified. It can also help in ruling out other heart problems such as pericardial effusion and mitral valve insufficiencies. The findings of echocardiography can be useful for the diagnosis and for planning the management of MI.
- ❖ **Imaging studies:** Radionucleoid studies can be useful to identify the necrotic areas and areas at risk for myocardial infarction. Thallium and Technetium-99 radioisotopes are majorly used for radionucleotide studies. The radioisotopes are injected into blood and uptake by the myocardium is assessed, which help in identifying the areas of ischemia and necrosis.
- ❖ **Coronary angiogram:** Angiography is the most used diagnostic test to find out the blockage of specific coronary artery/arteries. The degree of blockage can also be ascertained.

Management

The management of myocardial infarction is planned with the objectives to:

- ❖ Re-establish the myocardial blood circulation
- ❖ Maintain the oxygenation
- ❖ Improve the left ventricular function

- ❖ Maintain the oxygen supply and demand of the heart
The patient must be assessed and diagnosed without wasting any time so that appropriate management can be provided on time and complications can be prevented.

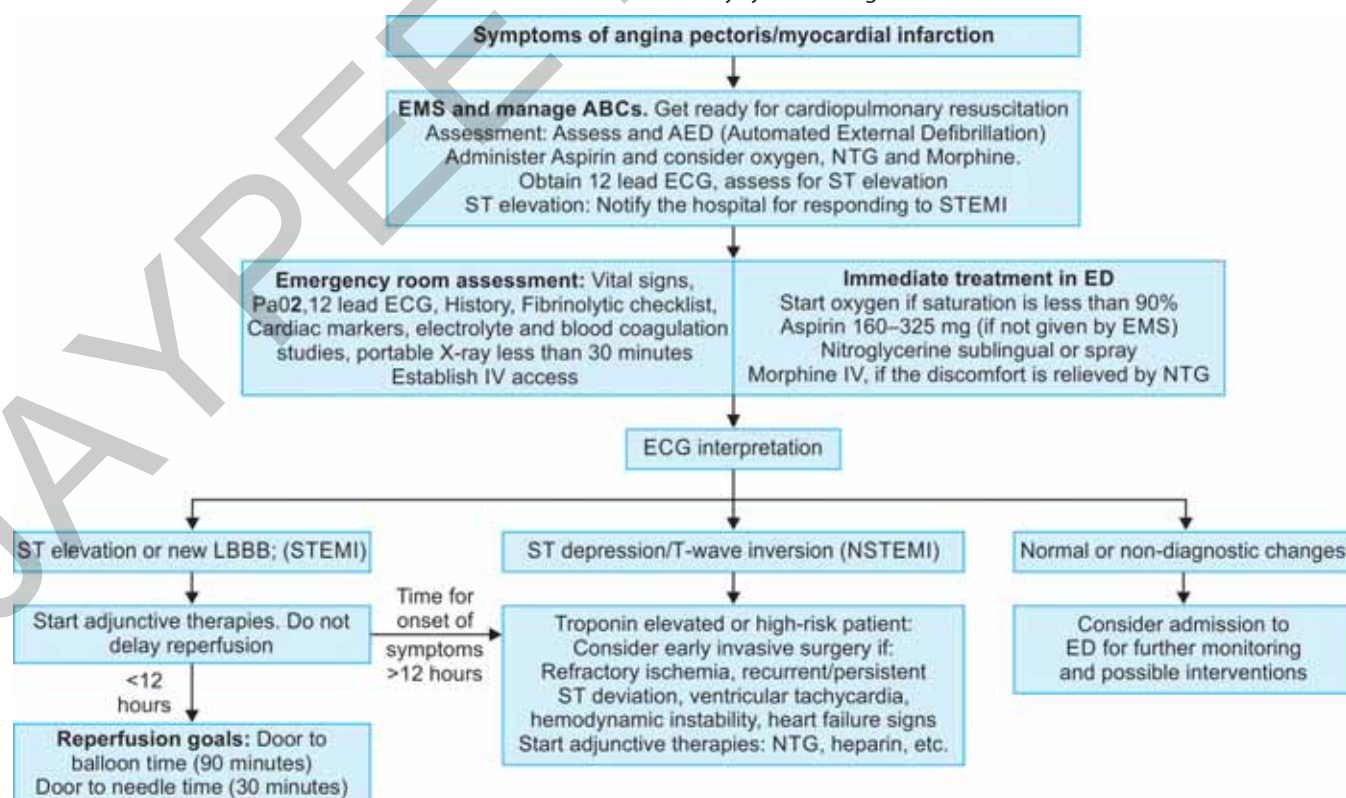
Medical Management

Medical management is based on improving the myocardial oxygen supply and reducing the oxygen demand.

The following are the important guidelines as per the American College of Cardiology and American Heart Association (**Flowchart 43.3**).

- ❖ Immediately transfer the patient to the hospital
- ❖ Obtain a 12-lead ECG and blood specimens for the cardiac biomarkers
- ❖ Provide Oxygen therapy by nasal prongs
- ❖ Administer medications:
 - **Morphine (analgesia):** Morphine is having dual function in the acute stage of MI. It helps in reducing the pain and anxiety and at the same time, it decreases the workload on the heart by decreasing the heart rate, arterial resistance, and venous return.
 - **Aspirin:** Aspirin is an antiplatelet drug, which helps prevent blood clots to develop in the coronary artery. It has been reported that Aspirin can decrease the risk of complicated myocardial infarction by more than 50%.
 - **Beta-adrenergic blockers:** Beta-adrenergic blockers block the beta-1 receptors in the myocardium and decrease the contractility and reduce the myocardial oxygen demand. For example, Propranolol, Metoprolol, etc.
 - **Nitrates:** Nitrates decrease the preload by vasodilation of peripheral blood vessels and afterload by coronary

Flowchart 43.3: Acute coronary syndrome algorithm.



artery vasodilation. This results in myocardial oxygen demand/supply balance. This helps in relieving chest pain. For example, Nitroglycerine, Sorbitrate, etc.

➤ **Lipid lowering drugs:** Commonly used lipid-lowering drugs in CAD are:

- HMG-CoA reductase inhibitors or Statins, e.g., Atorvastatin and Lovastatin. These drugs inhibit the synthesis of cholesterol by the liver and increase the LDL receptors in the liver. They also are anti-inflammatory and antithrombotic in nature.
- Side effects: Myalgia and arthralgia are common adverse effects. Myopathy and rhabdomyolysis are potential serious effects. It is contraindicated in liver disorders. The drug must be administered in the evening and also the client should monitor the liver functions.
- Niacin: It is a water-soluble vitamin B, and it helps in decreasing triglycerides and low-density lipoprotein by interfering with their synthesis and enhances high-density lipoprotein levels. Side effects include severe flushing, itching, orthostatic hypotension, and gastrointestinal symptoms such as nausea, vomiting, diarrhea, etc.
- Fibrates or fibric acid derivatives: These increase the elimination of VLDL, e.g., Psyllium, Fenofibrate. These are the most effective drugs to lower triglycerides and increase HDL levels. Side effects include diarrhea, flatulence, rash, and myalgia. Serious adverse effects include pancreatitis, hepatotoxicity, and rhabdomyolysis.
- Bile acid sequestrants, e.g., Cholestyramine. These drugs bind LDL with bile acids in the intestine making them insoluble and excreted in feces. Side effects of these drugs include GI upset, impotence, skin rashes, headache, painful extremities, blurred vision, cholestatic jaundice, angioedema, pancreatitis, etc.
- Omega-3 acid ethyl esters, e.g., Fish oil capsules. It inhibits triglyceride production in the liver. Side effects of these agents are gastrointestinal distress, backache, rashes, etc.
- Proprotein convertase subtilisin-kexin type 9 (PCSK9): This is a new class of drug recently approved by the US Food and Drug Administration. These are still under clinical trials and are said to be expensive drugs, hence are prescribed on a limited basis.

❖ **Antiplatelet drugs:** These prevent platelet aggregation at the site of arterial or venous injury and thus prevent clot formation. These drugs reduce the viscosity of blood. Side effects include gastrointestinal discomfort, nausea, vomiting, diarrhea, headache, hot flushes, skin rashes, vertigo, dizziness, hypotension, tachycardia, cholestatic jaundice, etc.

- Primary, e.g., Aspirin 75–325 mg/day. This reduces the risk of fatal or nonfatal MI by 71% during acute phase.
- Secondary, e.g., Ticlopidine, Clopidogrel.

❖ **Anti-anginal medication:** They act by improving the blood flow through the coronary arteries and reduce the work of the heart thus decreasing its demand for oxygen.

Side effects include throbbing headache, nausea, flushing, weakness, sweating, palpitations, dizziness, and blood disorders.

❖ **Antihypertensive:** These drugs control blood pressure. Nurses need to monitor the side effects of these drugs which include hypotension, dizziness, decreased white blood cells, and gastrointestinal upset such as nausea, vomiting, headache, gingival hyperplasia, skin rashes, peripheral edema, jaundice, etc. The antihypertensive is further classified as follows:

- **Beta-blockers:** These are the first-line drugs to reduce the anginal attacks and improve exercise tolerance. However, beta-blockers should not be used in patients with Prinzmetal's angina that occurs due to vasospasm in coronary arteries because these can aggravate the vasospasm. For example, atenolol, metoprolol, and propranolol.
- **Organic nitrates:** These are used in patients who are contraindicated with beta-blockers, e.g., isosorbide dinitrate, isosorbide mononitrate, nitroglycerine.
- **Calcium channel blockers:** Ca⁺⁺ channel blockers help in decreasing the workload on the heart but these agents should not be given to the clients with left ventricular dysfunction. For example, amlodipine, diltiazem, nicardipine, verapamil.
- **ACE inhibitors and angiotensin receptor blockers:** These are used to treat hypertension and congestive heart failure, prevent kidney failure, and reduce the risk of stroke. Examples of ACE inhibitors include captopril (Capoten), enalapril maleate (Vasotec), fosinopril sodium (Monopril), lisinopril (Prinivil, Zestril), ramipril (Altace), andtrandolapril (Mavik). Examples of angiotensin receptor blockers (ARBs) include losartan (Cozaar), valsartan (Diovan), irbesartan (Avapro), and telmisartan (Micardis). Common side effects of ACE inhibitors include cough, skin rash, and taste changes, and angioedema, etc. ARBs may cause dizziness. Both ACE inhibitors and ARBs are not recommended for use during pregnancy. They may cause hypotension, hyperkalemia, kidney failure, and harm to a fetus.
- **Diuretics:** These reduce the workload on the failing heart. Side effects include fluid and electrolyte imbalance, muscle cramps, hypotension, muscle weakness, weight loss, etc.

❖ **Glycoprotein IIb/IIIa receptor antagonists:** These prevent platelet aggregation.

❖ **Antioxidants:** Vitamin supplementation, e.g., Vit C and Vit E.

For pharmacological management (See **Box 43.2**).

- ❖ Evaluate for indications of reperfusion therapy
- ❖ Bed rest for at least 12–24 hours.

THROMBOLYTIC THERAPY

The most important management of CAD is the reperfusion of the blocked coronary artery without wasting any time so that perfusion of the myocardium can be restored and minimize any further damage to the myocardium. Patients with ST-segment elevation myocardial infarction and new

BOX 43.2: Pharmacological management.

- **Aspirin:** Aspirin is antiplatelet drug; it inhibits the platelet aggregation, thus reducing the further thrombus formation.
- **Heparin:** Anticoagulant activity of heparin prevents coagulation by interfering with formation of thrombin from prothrombin.
- **Nitrates:** Nitrates help in decreasing the preload through vasodilatation in the peripheral blood vessels and when given in higher doses decrease the afterload by causing arterial vasodilation also. This activity results in decreasing oxygen demand on the myocardium.
- **Beta blocking agents:** These agents block the beta-1 receptors in the myocardium which result in decreased myocardial contractility leading to decreased myocardial oxygen demand.
- **ACE inhibitors:** These agents act on renin angiotensin system and block the conversion of angiotensin I to angiotensin II which results in vasodilation leading to decreased myocardial oxygen demand.
- **Calcium channel blockers:** These agents block the calcium inflow into smooth muscles of blood vessels thus causing vasodilation, which result in increased oxygen supply to myocardium.
- **Glycoprotein IIb/IIIa receptor antagonists:** These agents prevent the platelet aggregation as these prevent fibrinogen binding, which result in decreased chances of further re-occlusion of coronary arteries.
- **Lipid lowering drugs:** The major categories of drugs used are (a) Bile acid binding resins: These drugs inhibit the synthesis of cholesterol by liver and increase the LDL receptors in the liver. (b) Nicotinic Acid (Niacin): These drugs decrease the level of triglycerides in blood by blocking the free fatty acids and decreased conversion of fatty acids into triglycerides. (c) HMG-CoA reductase inhibitors (Statins): These drugs help in reducing cholesterol synthesis and increasing the clearance of blood VLDL and LDL.

left bundle branch block are ideal cases for thrombolytic therapy, provided, the patient is eligible and there are no contraindications for the thrombolytic therapy. Thrombolytic therapy is beneficial for the treatment of MI in the initial 12 hours of symptoms onset.

The main aim of thrombolytic therapy is to restore the perfusion in the infarcted tissue fast. It is well-known that early reperfusion results in restoring the left ventricular function and it lowers mortality. All the eligible patients must be managed with thrombolytic therapy within 90 minutes of reaching the hospital.

❖ **Contraindications of thrombolytic therapy:** The absolute contraindications of thrombolytic therapy include:

- **Active bleeding:** It can result in excessive bleeding leading to the complication of hypovolemic shock due to blood loss.
- **Known bleeding disorder:** As the thrombolytic agents target the clotting mechanism, there are chances of excessive bleeding among patients with bleeding disorders.
- **History of hemorrhagic stroke:** These patients are potential for further rupture of blood vessels in the brain and can result in another episode of hemorrhagic stroke.
- **History of intracranial vessel malformation:** In such cases, the blood vessels are delicate and can rupture easily resulting in excessive bleeding in brain tissue.

- **Recent major surgery or trauma:** The patients who had undergone recent surgery or trauma are at risk of bleeding at the incision site or trauma site.
- **Uncontrolled hypertension:** Uncontrolled hypertension can result in the rupture of blood vessels in brain tissue further leading to the complication of hemorrhagic stroke.
- **Pregnancy:** Although there is no strong evidence of any major complication in pregnancy related to thrombolytic agents' use but keeping in mind the well-being of mother and fetus, the thrombolysis is contraindicated in pregnancy.
- ❖ **Thrombolytic agents:** The thrombolytic agents are primarily classified as fibrin-specific agents and non-fibrin-specific agents.
- ❖ **Fibrin-specific agents:** This category includes the agents such as alteplase/tPA, reteplase/recombinant plasminogen activator/rPA, and Tenecteplase. These agents limit the conversion of plasminogen to plasmin in the absence of fibrin. Alteplase is given as bolus with the dosage of 15 mg IV, followed by 0.75 mg/kg (maximum up to 50 mg) IV over half an hour, further followed by 0.5 mg/kg (maximum 35 mg) IV over 1 hour.
- ❖ **Non-fibrin-specific agents:** It includes the drug Streptokinase which causes systematic fibrinolysis. The streptokinase is given in the dosage of 1.5 million units in 50 mL of 5% dextrose in water and this is infused over 60 minutes. The patient should be observed continuously for any allergic reaction or bleeding; if any evidence of these is there, the infusion must be stopped and the physician must be informed.

For the treatment of myocardial infarction, these agents are administered through intravenous infusion. The major complications of thrombolytic therapy are bleeding/hemorrhage, allergic reactions, arrhythmias due to reperfusion, embolism, and hemorrhagic stroke (intracranial hemorrhage).

Nursing responsibilities: The following are the nursing responsibilities while the patient is on thrombolytics:

- Monitor the client for complications such as bleeding, hypotension, and dysrhythmias.
- Minimize the number of pricks.
- Avoid IM injections.
- Perform the procedures such as RT insertion, urinary catheterization, etc., if required before starting the thrombolytic therapy.
- Avoid the use of noninvasive blood pressure where it is continuously kept in place, which predisposes the patient to bleed.
- Monitor hematocrit and hemoglobin values.

Other Management Modalities

- ❖ **Revascularization procedures** such as percutaneous coronary intervention (PCI) such as PTCA (percutaneous transluminal coronary angioplasty), balloon angioplasty, drug-eluting stent implantation that reduces intimal hyperplasia, intracoronary radiation (inhibits cell proliferation and vascular lesion formation through impregnated stents or radiation catheter containing

a sealed source of radiation), atherectomy and thrombectomy, and coronary artery bypass graft (CABG).

- ❖ **CABG** may be considered as a choice of treatment for the patients who have severe disease and who have triple-vessel disease, due to which they are not suitable for PCI and who do respond well to medical management. CABG involves re-establishment of blood to the affected myocardium by using a venous or arterial graft to the site of occlusion. Internal mammary artery or gastroepiploic artery or saphenous vein are commonly used as graft in this procedure.

INTERVENTIONAL MANAGEMENT

Percutaneous coronary intervention (PCI): This is the minimally invasive procedure to open up blocked coronary arteries, allowing blood to circulate to the heart muscle. It is both diagnostic and therapeutic in nature. A stent or a wire mesh tube is also inserted during this procedure. Hollow catheters called “sheaths” are used which are inserted in the femoral and sometimes the radial artery through which a balloon-tipped dilation catheter is threaded to the aorta and the blocked coronary arteries. Angiography is performed using a radiopaque dye to identify the location and extent of blockage which is observed through fluoroscopy.

Indications of PCI

- ❖ Unstable angina
- ❖ Stable angina
- ❖ MI
- ❖ High-risk stress test findings

Contraindications for PCI

- ❖ Not able to tolerate the antiplatelet therapy for longer durations
- ❖ Any significant comorbid conditions that severely limit the lifespan of the patient
- ❖ Arteries <1.5 mm in diameter
- ❖ Diffusely diseased saphenous vein grafts or coronary artery structure not amenable to percutaneous coronary intervention.

Preparation of the Patient

Before the Procedure

- ❖ Perform a physical examination and take a medical history (allergy to shellfish or intravenous dye, or history of diabetes or kidney disease).
- ❖ Explain the procedure and its risks, and take informed consent.
- ❖ Keep the patient fasting for 6–8 hours.
- ❖ On the day of the procedure, the patient's complete blood count and renal function tests are performed. ECG is also taken before the surgery.
- ❖ An intravenous (IV) line is inserted. If needed, the patient is given a mild sedative.
- ❖ If the patient falls in high-risk category, the patient is admitted a night before the procedure. Hydration of the patient is maintained.

Care of the Patient After the Procedure

- ❖ After the sheath removal, good pressure is needed to be applied to the area for at least 15–30 minutes to prevent bleeding from the site.
- ❖ Once the bleeding is stopped, the area is covered with a gauze dressing.
- ❖ The patient is advised complete bed rest in CCU for 4–6 hours to prevent bleeding and hematoma formation. The head of the bed is placed below 30°.
- ❖ The patients are monitored for chest pain (can happen if the treated artery is closing due to spasms), bleeding at the insertion site, and signs of dye-induced kidney damage.
- ❖ The patients are advised to continue with aspirin or other antiplatelet therapy indefinitely after the procedure.
- ❖ Force fluids orally or intravenously to assist the body to excrete the contrast dye as it can cause renal necrosis.
- ❖ Monitor peripheral pulse to assess the perfusion.
- ❖ **Laser angioplasty:** This procedure involves the application of laser rays on the plaque through a catheter which results in vaporization of atherosclerotic plaques. Patients can experience complications such as embolism, perforation or dissection of coronary, and acute occlusion of the treated coronary artery.
- ❖ **Intracoronary stent implantation:** A coronary stent is a mesh-type structure made up of metal that provides structural support to the coronary vessel at risk of acute closure. These are available in different stent designs such as balloon-expandable or self-expandable tubes and are made of different materials ranging from stainless steel to bio-absorbable compounds. Some stents are medicated such as sirolimus or paclitaxel which minimizes the formation of thrombi or scar tissue and are found to be highly successful. Patients with stents receive antiplatelet drugs, usually aspirin or clopidogrel which is continued following stent implantation. Clopidogrel may be discontinued after a period of 1 year following stent implantation.
- ❖ **Atherectomy:** It is the removal of atheroma through different techniques such as follows:
 - **Rotational:** It is used for hard and calcified plaques using differential cutting method through athero-ablative technique.
 - **Directional:** This type of atherectomy is used to widen the lumen of coronary artery by excising and removing atheroma. This procedure is suitable for plaque/atheroma in the medium to large coronary arteries located in the proximal or middle portions of the vessels.
- ❖ **Transmyocardial revascularization:** This procedure is used for patients who are not candidates for CABG. A laser catheter is used to create 15–40, 1-mm channels/holes in the myocardium which promotes angiogenesis (growth of new blood vessels). Within a few weeks, the patient's angina is improved as the blood supply to the myocardium is improved through this technique.

Complications of PCI Procedure

- ❖ Coronary artery dissection
- ❖ Perforation

- ❖ Abrupt closure or coronary vasospasm
- ❖ Dysrhythmias, acute MI
- ❖ Retroperitoneal bleeding
- ❖ Hematoma at the site of insertion
- ❖ Pseudoaneurysm
- ❖ AV fistula
- ❖ Acute kidney injury

SURGICAL MANAGEMENT

The surgical management of CAD is aimed in the acute hours of MI to limit the infarction size and reduce mortality. Furthermore, the patients whose condition is not suitable for thrombolysis and percutaneous coronary intervention, open-heart surgery, i.e., coronary artery bypass surgery is the final choice for the management.

Coronary Artery Bypass Graft

This is an open-heart surgery where a temporary channel is made through additional grafts of the artery or vein which allows for the flow of blood to the heart. The common grafts include saphenous veins, internal mammary artery, or radial artery. CABG includes a median sternotomy. The patient is placed on a cardiopulmonary bypass (CPB) machine to stop the functioning of the heart temporarily using a cardioplegic solution (solution with high potassium content). The internal mammary artery is commonly used for this type of surgery. Fewer cardiac and pulmonary complications are reported in the minimally invasive group. Radial artery or internal mammary artery grafts are better than saphenous venous grafts because the former ones do not develop stenosis due to atherosclerotic changes quickly. The graft's one end is anastomosed to the ascending aorta and the other end to the coronary artery farthest to the lesion. Endovascular methods of vein harvesting have reduced complications such as wound dehiscence and infection. The patient must be observed for edema in the lower extremity from where the graft is taken (Fig. 43.6).

Indications of CABG

- ❖ Uncontrolled angina with PCI or medications
- ❖ Multivessel CAD or 50% of left coronary artery stenosis

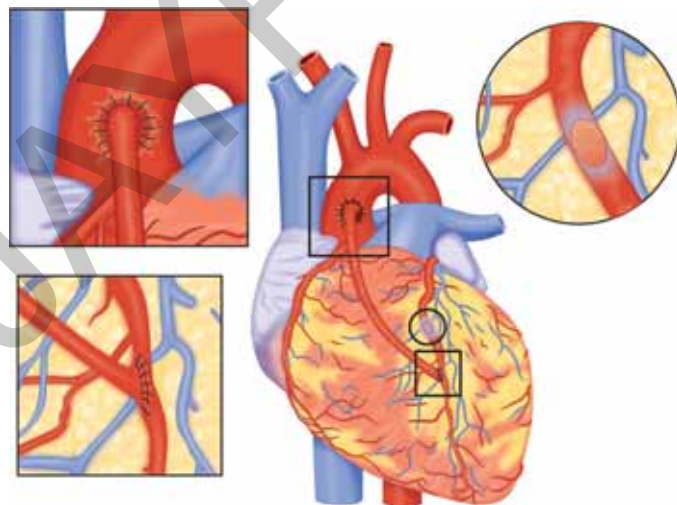


Fig. 43.6: Coronary artery bypass graft.

- ❖ For the management of myocardial infarction and prevention of associated complications such as arrhythmias and heart failure
- ❖ Unsuccessful PCI
- ❖ 70% of coronary occlusion

Types of CABG

- ❖ **Traditional CABG:** In the traditional CABG, sternotomy is performed medially, after the general anesthesia. The patient is connected to a cardiopulmonary bypass machine. For the cardiopulmonary bypass, a cannula is placed in the vena cava or atrium or femoral vein to withdraw blood from the body. The cannula is connected to tubing filled with isotonic crystalloid solution. The venous blood is filtered, oxygenated, cooled, or warmed by the machine and then returned to the body. The cannula returning the oxygenated blood is inserted in the ascending aorta or the femoral artery. The heart is stopped by potassium-rich cardioplegia solution in the coronary arteries. The patient is heparinized during the procedure to prevent the clotting of blood as it passes the CPB machine. During the surgery, hypothermia is maintained at a temperature of 28°C to reduce the basal metabolic rate and demand for oxygen. At the end of the surgery, protamine sulfate is administered to reverse the effects of heparin. Urine output, ABG, electrolytes, and coagulation studies are monitored during the surgery.
- ❖ **Off-pump bypass CABG:** The surgery is performed without the cardiopulmonary bypass, which means the surgery is performed while the heart is functioning. The surgeon infuses a beta-adrenergic blocker to slow down the heart rate. A myocardial stabilization device is used to hold the site still for the anastomosis of the bypass graft into the coronary artery. The advantages of off-pump bypass CABG include short-term postoperative morbidity and fewer complications.
- ❖ **Minimally invasive direct CABG:** It is performed through left anterior thoracotomy without cardiopulmonary bypass. These endoscopic techniques use smaller incision and a robotic system to place bypass grafts. It is an alternative to conventional CABG as it promotes speedy recovery and few complications.
- ❖ **Post access CABG:** Post access CABG is performed by cardiopulmonary artery bypass graft access from the femoral artery and vein. In this way, the heart is arrested and protected and a bloodless field is maintained, and the surgeon can use a very small incision known as mini-thoracotomy to perform the surgery.

Preparation of Patient Before Surgery

- ❖ Note the client's readiness for surgery.
- ❖ Reassurance and psychological preparation is highly important to relieve anxiety.
- ❖ Describe the surgical procedure, the length of surgery and stay in the hospital, and the details about the monitoring equipment that will be used in the ICU. Correct any misconceptions and provide adequate and appropriate information.
- ❖ Describe the preoperative preparation which includes:
 - Showering with antimicrobial soap

- Shaving of chest, abdomen, neck, and groin
- Special cardiac studies such as echocardiogram, ECG, cardiac catheterization
- Deep breathing and coughing exercise
- ❖ Describe comfort measures:
 - Pain reduction—use of opioids
 - Turning and Range of Motion exercise
 - Ambulation
 - Measures to promote sleep
- ❖ Advise the patient on the diet and activities that could be resumed after the surgery.

Management of the Patient After CABG

The early phase of the postoperative period focuses on maintaining hemodynamic stability and recovery from anesthesia. The following are the nursing diagnosis and interventions while caring for a patient with CABG:

❖ Acute pain related to incision and chest drains:

- Monitor pain intensity using a standard pain scale and assess the nature of pain along with verbal and nonverbal cues to provide relief of pain.
- Encourage pain medications for 24–72 hours through patient-controlled analgesia or continuous infusion. The major side effects of the pain medications such as CNS depression, tachycardia, and low BP must be observed.
- Premedicate the patient prior to any planned activities to improve client participation in care activities.
- Administer Oxygen, as oxygenation can reduce the pain which occurs due to hypoxia.
- Position the patient in a comfortable position to reduce chest discomfort and dyspnea.
- Relaxation methods can be utilized to distract the patient from experiencing pain.
- Ambulate the patient as early as possible as early mobilization relieves pain and enhances the recovery of the patient.

❖ Low cardiac output related to acute blood loss and decreased cardiac function:

- Monitor the client's level of consciousness, breath sounds, and vital parameters especially heart rate, temperature, and blood pressure. Furthermore, ECG should be taken to assess for arrhythmias. Hemodynamic monitoring is vital to observe adequate tissue perfusion.
- Auscultate heart and breath sounds on admission and every 4th hourly. A ventricular gallop, or S3, is an early sign of heart failure; an S4 may indicate decreased ventricular compliance.
- Monitor arterial line for BP, CVP, and pulmonary artery wedge pressure. Arterial BP is monitored every 15 minutes till the client is stable. In the case of manual assessment of BP check the BP every 1–4th hourly.
- Assess cardiac biomarkers as elevated levels may indicate myocardial damage.
- Observe the client for central and peripheral cyanosis. Also, assess the temperature of the skin.
- Administer medications to maintain cardiac output such as inotropic drugs (dopamine and dobutamine), calcium, and vasoconstrictors. It is imperative to

maintain normal cardiac parameters such as cardiac index/output/BP and heart rate.

- In case of blood loss, administer protamine and aminocaproic acid to prevent bleeding or restore blood volume with fresh frozen plasma, platelets, and fluids.
- Monitor for signs of cardiac tamponade such as elevated CVP, pulmonary artery pressure, decreased cardiac output, BP, muffled heart sounds, and pulsus paradoxus.
- Avoid clotting in the drainage tube as it can cause cardiac tamponade. The mediastinal drainage should be less than 200 mL/hour during the first 4–6 hours.
- Monitor ECG for any ischemic changes as this can occur with ischemia, hypoxia, bleeding, and acid-base as well as electrolyte imbalance.
- Place temporary pacing at the bedside to manage bradydysrhythmias.
- Monitor peripheral pulse for adequate tissue perfusion as the absence of pulse may indicate a thromboembolic arterial obstruction. Report immediately if there is acute chest or back pain, respiratory distress, cold extremities, pupillary changes, paralysis, or weakness.
- ❖ Diminished gas exchange related to CABG surgery:
 - Assess the patient's respiratory functions, rate and depth of respirations, use of accessory muscles, and chest expansion (symmetry), and auscultate the breath sounds frequently.
 - Monitor the ventilator settings and arterial blood gases. ABG analyzes the acid-base balance and the oxygenation status.
 - Chest X-ray is taken to verify ET tube placement and observe for any chest abnormalities (pneumothorax).
 - Monitor chest drains hourly for patency. Monitor oxygen saturation levels and administer oxygen to maintain oxygen saturation >93%.
 - Auscultate breath sounds to diagnose the early complications of the respiratory system.
 - Suction the ET tube whenever necessary.
 - Change position frequently.
 - Encourage ambulation when tolerated.
 - Apply sequential pneumatic compression and encourage passive and active exercises to prevent venous embolism.
 - Collaborate with respiratory therapists to assess the weaning parameters and decisions related to extubation (stable patient can be extubated as early as 2–4 hours after surgery), as early extubation prevents the risks of postoperative complications such as alveolar collapse and pulmonary infections. Once extubated, teach deep breathing, coughing, and turning. Encourage the proper use of incentive spirometry every 2 hours to improve pulmonary ventilation.
 - Instruct about splinting the chest while coughing.
- ❖ Sleep disturbances related to environment and use of multiple medications:
 - Limit environmental noise to promote sleep and maintain comfort using prescribed opioids.
 - Monitor the client for postoperative delirium which is seen 2–5 days of stay in the critical care unit. It is

characterized by restlessness, agitation, hallucinations, and paranoia. The most common contributing factors are anxiety related to disease, sleep deprivation, increased sensory input in ICU, various drugs, and metabolic imbalance and hypoxemia. Sedatives, behavioral interventions, and corrections of electrolyte imbalance can resolve the issue.

- Secure all invasive lines and catheters to prevent the injury or disruption of the equipment due to client disorientation.
- Assess for post-pericardiotomy syndrome characterized by pyrexia, body ache, pericardial effusion, arthralgia, and pericardial friction rub.
- ❖ **Ineffective thermoregulation related to infection or due to surgery:**
 - Assess the sternal wound and graft site in each shift. Record and report if you observe warmth, redness, swelling, and/or drainage from the site. Note for any gaps in the wound edges and signs of any infection or oozing of inflammatory fluid.
 - Core body temperature must be monitored in the first 8 hours following surgery.
 - Hypothermia is usually observed in these patients immediately after the surgery; hence care should be taken to keep the patient warm. If the patient is hypothermic, rewarming may be achieved using warm blankets, warm intravenous fluids, warm air mattresses, radiant heat lamps, etc.
 - Administer drugs such as morphine or diltiazem as prescribed to relieve the shivering and chills.
 - Use aseptic technique while changing dressings and suctioning. Maintain closed systems for IV and all arterial lines including catheterization.
 - The patient should be assessed for local (wound site) and systemic infection. Culture wound drainage and administer antibiotics as prescribed.
 - Ensure adequate calories and proteins in the diet to promote wound healing and boost the immune status.
 - Provide incisional care (dressings for the first 48 hours) and control the blood glucose levels to prevent the risk of infection. The wound is left open after 48 hours or covered with Steri-Strips. Exposure to wound after 48 hours promotes wound healing.
 - Monitor blood pressure as hypothermia temporarily increases the BP. Administer vasodilators to lower the blood pressure. The commonly used vasodilators are nitrates.
- ❖ **Knowledge deficit related to self-care activities and therapeutic regime:**
 - Reorient the client to the setting, timing, and procedures being performed.
 - Speak in a clear and calm voice. Encourage the patient to ask questions and respond appropriately to clear any misconceptions.
 - Educate the patient about healthy lifestyle changes and motivate him to full involvement in the cardiac rehabilitation or secondary prevention program by setting mutually agreeable goals.
- ❖ **Risk for impaired renal function related to low cardiac output:**

- Monitor the weight/intake—output as body weight and urine output is a reliable indicator of fluid balance. Record the urine output every half an hour up to 4 hours in the critical care unit (CCU). Urinary output of 0.5 mL/kg/hour is an indicator of adequate renal and cardiac perfusion.
- Monitor for peripheral edema, heart sounds, and lung sounds for crackles.
- Laboratory reports are monitored for Hb, hematocrit, platelet count, blood glucose, serum creatinine and blood urea, prothrombin time, partial thromboplastin time, and ABGs.

❖ **Potential for fluid and electrolyte imbalance related to decreased cardiac output:**

- Monitor BP every 8th–12th hourly until hospital discharge. Monitor urine output 8th hourly and continue to monitor the other hemodynamic parameters such as electrolytes, ABG, etc.
- Monitor electrolyte levels especially calcium and potassium.
- Administer colloids or blood products in case of blood loss.
- Assess for clinical signs of fluid overload [increased central venous pressure (CVP), edema, crackles, or S3 gallops] or fluid depletion (tachycardia, signs of dehydration, dry mucous membrane, decreased CVP, and decreased urine output).
- Monitor the infusion rates of parenteral fluids closely.

Post Discharge Management

- ❖ Perform exercises three times per week for a duration of 20–40 minutes for 2–3 months. Exercise should be done at an intensity of 70–85% of the baseline exercise heart rate.
- ❖ Activity levels are increased gradually based on the client's tolerance limits.
- ❖ Instruct the client to report immediately if any complications arise such as incisional pain, breathlessness, chest pain, etc.

Possible Complications of CABG

- ❖ **Cardiovascular:** Dysrhythmias, decreased cardiac output, cardiac tamponade, persistent hypotension, heart failure, and MI are commonly observed in patients with cardiac surgery due to preload and afterload alterations. Preload alterations cause very little blood to return to the heart while afterload abnormalities are seen when the arteries are constricted increasing the workload on the heart. Electrolyte imbalances can also result in cardiovascular complications such as dysrhythmias. The most common types of dysrhythmias observed in the postoperative period include atrial fibrillation, bradycardia, tachycardia, and ectopic beats.
- ❖ **Hematologic:** Bleeding and clotting abnormalities are common because of cardiopulmonary bypass, trauma from surgery, and anticoagulation used during the CABG procedure. In case of low CVP, BP, and tachycardia administer blood products or IV fluids.
- ❖ **Fluid and electrolyte imbalance** such as edema, high or low levels of electrolytes such as potassium, magnesium, calcium, and high blood glucose levels are highly

detrimental to the patients in the postoperative period after CABG. Electrolyte imbalances can occur due to inadequate intake, nasogastric drainage, perioperative stress response, diuretics, hemolysis from CPB, etc. Implementing an insulin infusion regime has been found to be effective in treating hyperglycemia following cardiac surgery and promoting wound healing and survival after surgery.

- ❖ **Renal failure:** Urine output <0.5 mL/kg/hour points toward the diminished renal perfusion which may occur due to decreased cardiac function and output. Inotropic drugs such as dobutamine and diuretics could be administered to improve renal function. Dialysis or continuous renal replacement therapy can be thought of if indicated.
- ❖ **Pulmonary:** Pulmonary complications may include inadequate breathing and oxygenation and atelectasis due to incisional pain. The patient may exhibit the signs such as restlessness, tachycardia, and anxiety due to decreased oxygenation.
- ❖ **Neurologic:** Hypoperfusion or micro-emboli during or following cardiac surgery may produce brain injury. Cerebral hypoxia presents with symptoms such as restlessness, confusion, dyspnea, hypotension, cyanosis, etc.
- ❖ **Integumentary:** Wound dehiscence and infection (mediastinitis) are manifested in the form of elevated body temperature. A meticulous aseptic technique must be used to prevent infection of the sites.
- ❖ **Hypothermia:** This may occur due to cardiopulmonary bypass and the effect of anesthesia.

REHABILITATION

Cardiac rehabilitation is an important part of the management of coronary artery disease and its main aim is reducing the functional and emotional effects of cardiac disease, lowering the mortality by reducing the future atherosclerotic events and reinfarction, and improving the feeling of well-being.

The cardiac rehabilitation must begin immediately after the MI event to promote the adaptation process. After the CABG within 3–5 days, the education of the patient must start so that patients must understand the need for the lifestyle changes after the discharge. The nurses in concert with the physician must evaluate the patient for the disease severity and stability of the patient. Based on the patient's condition, the patient may be classified into low, medium, or high-risk groups and the activities of cardiac rehabilitation must be planned as per individual patient's clinical stability and risk. The main components of cardiac rehabilitation are summarized in **Box 43.3**. As per American Heart Association secondary prevention guidelines are blood pressure management, lipid management, physical activity counseling, diabetes management, weight management, and medication adherence.

Dietary Management

Dietary modification is of utmost importance in the progress and prevention of the disease. The client should be advised as follows:

BOX 43.3: American Heart Association secondary prevention/ cardiac rehabilitation guidelines.

Blood pressure:

Goal: To maintain the blood pressure below 140/90 mm Hg or below 130/90 for diabetics and chronic renal failure patients.

Lipids management:

Goal: Low density lipoproteins (LDL) below 100 mg/dL, triglycerides below 200 mg/dL.

Smoking:

Goal: Complete cessation. No passive smoking.

Physical activity:

Goal: At least 30 minutes of exercise (minimum 5 days a week).

Weight management:

Goal: Body Mass Index to be maintained between 18 and 25 kg/m² and waist circumference below 89 cm for women and below 102 cm for men.

Medication adherence:

Goal: Patients must adhere to medications prescribed for preventing further complications due to cardiovascular disease.

- ❖ Advise the client to avoid intake of high carbohydrate and fat-containing diet (saturated and trans-fatty acids). Avoid foods containing high cholesterol levels such as animal products—egg yolk, meat, and cheese and milk and milk products such as ghee, cream, butter, chocolates, paneer, curds, etc. Saturated foods include animal products, whole milk, dairy products, butter, cheese, cream, ice cream, coconut, palm oil, and pastries. Trans-fats are found in baked and fried foods.
- ❖ The total serum cholesterol levels are to be maintained at <200 mg/dL, LDL <160 mg/dL if fewer than two other risk factors present, <130 mg/dL if two or more risk factors are present, and HDL levels to be >40 mg/dL. The triglyceride levels are to be <150 mg/dL.
- ❖ The carbohydrate intake should preferably be 55% of the total calories, which should include complex carbohydrates, less than 30% of fats and 15% of proteins (American Heart Association Step 1 diet).
 - Choose low-fat proteins—legumes—beans, peas, and lentils.
 - Eat meals slowly and chew well.
 - Avoid snacks between the meals.
 - Avoid large meals; eat small meals and more frequently.
 - Use water preferably while cooking as it contains no fat, is 100% mineral, and is good for health.
- ❖ The patient must be educated to increase the intake of fiber in the diet. For example, oatmeal, carrots, oranges, grapefruit, pears, peaches, bananas, and apples are good sources of soluble fiber. 20–30 g of fiber is recommended per day.
- ❖ Lowering weight lowers LDL level. Lose 250 g/week or 2–3 kg/month. Eat low-calorie foods. Sugary foods must be avoided. Try starting with a weight loss of 10% of your current body weight over 6 months.
- ❖ Avoid excess alcohol.
- ❖ Consume foods rich in polyunsaturated and monounsaturated fats. Sources of these oils include Flaxseed, Canola, Pumpkin, Walnut, Soya beans, fish oils—Salmon, Mackerel, Cod, Black Currant, etc.

- ❖ Increase intake of antioxidants, namely vitamin A, C, E, beta-carotene, Garlic, etc.
- ❖ Brown bread is preferred to white bread as it is made of whole wheat rather than Maida and its fiber content is high. It is even good for diabetics and is a weight-reducing snack.
- ❖ Brown rice has more fiber than white rice. The calories of rice can be decreased by removing starch.
- ❖ Patients with a sedentary lifestyle must be educated to consume not more than 500–750 mL of oils in a month.
- ❖ Patients must be advised to eat five or more servings of fruits and vegetables in a day or 400 g/day.
- ❖ Patients must include six or more servings per day of whole-grain products in the diet.
- ❖ In the case of non-vegetarians, eat at least two servings of fish per week and lean meats. Red meat must be avoided.
- ❖ In the case of diabetics, the recommended goal for HbA1C should be <7%.

The American Heart Association has recommended the following levels of fasting lipid profile:

- ❖ LDL <100 mg/dL (<70 mg/dL for very high-risk patients)
- ❖ Total cholesterol <200 mg/dL
- ❖ HDL cholesterol >40 mg/dL for males and >50 mg/dL for females
- ❖ Triglycerides <150 mg/dL.

Exercise/physical activity: The patient is educated to follow a designated physical activity plan to improve physical fitness by following the FITT formula: Frequency of exercise, Intensity (how hard), type of exercise (Isotonic), and Time (duration of exercise). 30 minutes of daily walk is advisable. The patient is advised to increase “everyday” activity such as walking a small distance and then increasing distance, and then stairs. Sedentary time must be reduced and undertaking frequent, less strenuous activities can help in improvement. Start the exercise with a warm-up period of 3–5 minutes (arm circles, toe raising, trunk twist, side-bending, and stretching exercise) and a cool-down phase of 5–10 minutes. Activity should be balanced by a period of rest. The patient should not overwork the heart and must call for help as well as take rest whenever one feels fainting or palpitations. The patient must be educated to avoid any form of activity after a heavy meal and should wait for at least 2–3 hours to begin any form of exercise. One must wear comfortable clothing while going for a walk. Avoid a shower/bath immediately after the activity. Do not exercise in extreme heat or cold. Avoid activity that involves holding your breath.

American Heart Association (AHA) recommends 30–60 minutes of brisk walking 5–7 days of the week.

Abstinence from smoking: Quitting smoking decreases the risk of dying from coronary artery disease by 50% in the first year after quitting irrespective of the age or severity of the disease.

The patient is instructed to anticipate and plan for the challenges he will face while quitting. He should be advised of the following:

- ❖ To remove cigarettes and other tobacco products from his home, car, and workplace
- ❖ The patient should be educated that when one stops smoking within 3–5 days, one will likely experience the

following symptoms, such as restlessness, headache, increased irritability, violent attacks, difficulty in concentration, and anxiety, decreased or increased appetite, etc.

The following tips can be suggested to the patient to deal with the above symptoms:

- ❖ **Staying active:** The patient must keep himself distracted and occupied. Go for regular walks. Keep hands/fingers busy by squeezing balls, pencils, or paper clips to substitute the need for tactile stimulation. Keep the mind busy. Read a book or magazine or listen to music you love. Find oral substitutes—mints, hard candy, carrot, gum, etc. Drink lots of water to minimize the symptoms. Stop smoking now or cut back gradually. If you cannot quit the first time, keep trying. If you do not smoke, do not start. Complementary therapies such as acupuncture, guided imagery, and hypnosis have also helped patients to refrain from smoking.
- ❖ **Medication adherence:** The patient should be informed regarding the prescribed medications’ timings, action, side effects, and special considerations. It is important to emphasize the need for medication adherence during each follow-up visit. The patient must be educated on the need for reporting to the physician in case of certain symptoms, which may be experienced by patients due to side effects of various medications. It should also be emphasized that the patient should not stop or change the dosage of any medication without the consultation of the physician.

Stress Management

Stress means worry, tension, fear, anxiety, anger, sorrow, lack of satisfaction, and so on. Stressful events at home, at the workplace are the immediate causes of a heart attack, and it potentiates coronary artery disease. Anxiety, depression, irritability, and sleeplessness are the external expressions of stress and need to be controlled or prevented as these are accompanied by negative lifestyle behaviors which can adversely affect the cardiovascular system. Excessive stress can lead to increased blood pressure, heart rate, high blood sugar levels, spasm of coronary arteries, arrhythmias, etc. Patients should be advised to follow an active lifestyle, meditation, breathing exercises, etc.

GERIATRIC CONSIDERATIONS

In elderly persons with comorbid conditions such as diabetes or heart failure, persons with Coronary Artery Disease usually present with shortness of breath. They may not exhibit typical manifestations of angina or MI because of the diminished pain transmission that occurs because of aging. Hence, recognition and diagnosis present a clinical challenge in the elderly. Aggressive treatment of hypertension and hyperlipidemia stabilizes plaques in older clients. Anti-anginal medications should be administered with caution in older adults because they are associated with an increased risk of adverse reactions. Activity performance, endurance, and ability to bear stress are improved in these patients with a planned program of physical activity. Physical activity also enhances self-esteem, emotional well-being, and improves body image. Guidelines recommended for older clients

regarding physical activity include longer warm-up periods, longer period of low-level activity, longer rest periods between sessions, avoiding extremes of temperature while exercising, and taking precautions to safeguard oneself from the risk of falling or else exercise can be performed under supervision.

Case Scenario

1. A 65-year-old woman comes to the cardiology unit with a history of repeated syncope. On assessment, it was found that the client had bradycardia with a pulse rate of 54/min and blood pressure of 110/60 mm Hg. She was a known case of diabetes, hypertension, and COPD and was on antihypertensive. She was advised for a planned angiogram which revealed a triple-vessel disease and was advised for coronary angioplasty.

Answer the following questions regarding the above case:

- a. Is coronary angioplasty the right treatment option? If so, why?
 - b. What are the possible drugs that the patient would be administered with this condition?
 - c. Would beta-blockers be the right choice of antihypertensive in this patient? If no, why?
2. A 67-year-old male was brought to the emergency unit with a history of excruciating chest pain radiating to his jaw and right hand. On physical examination, the patient had a pulse rate of 100/min and blood pressure of 100/60 mm Hg. His ECG findings revealed an ST elevation and a pathological Q wave. Blood results revealed elevated troponins and cardiac enzymes. Chest X-ray revealed a right pleural effusion.
- Answer the following questions regarding the above case:
- a. What are the characteristics in this patient which are suggestive of myocardial infarction? What may be the other possible manifestations seen?
 - b. What are the most possible complications the patient may likely have during his admission?
 - c. What may be the possible reason for pleural effusion in this patient?
 - d. As an emergency nurse, how would you manage this patient?

SUMMARY

Patients with CAD may undergo various modalities of treatment based on their clinical condition. The major nursing responsibilities involve ongoing monitoring and follow-up of these patients for signs of recurring manifestations and complications to the treatment plan. Monitoring of hemodynamic status of these patients is highly critical. Patient teaching must occur at every stage of the hospitalization and recovery process. Assessment of the client's learning needs helps to set goals that are realistic. Anticipatory guidance prepares the patient and the caregivers to meet their expectations during treatment, recovery, and rehabilitation. Cardiac rehabilitation programs are beneficial but maintaining contact with the patient is the key to success of these programs.

MULTIPLE CHOICE QUESTIONS

1. **Coronary angioplasty is a procedure that involves:**
 - a. Dilating the coronary artery via a stent
 - b. Grafting the diseased coronary vessel
 - c. Excising the atheromatous plaque
 - d. Administering medications via the coronary vessel
2. **Which among the following cholesterol is recommended to be at lower levels in a person diagnosed with CAD?**
 - a. Triglycerides
 - b. VLDL
 - c. HDL
 - d. LDL
3. **Which among the following is the most specific biomarker of cardiac injury?**

- a. CK-BB
 - b. CK-MM
 - c. Troponin I
 - d. Myoglobin
4. **The nurse informs the cardiac surgeon immediately when she observes which of the following parameters in the first postoperative period of a patient with CABG?**
 - a. Urine output <0.5 mL/kg/hour
 - b. Temperature of 99°F
 - c. Chest drainage of 100 mL over 4–6 hours
 - d. Pain at the incision site
 5. **Which among the following is the drug of choice for a patient admitted to the emergency unit with coronary artery disease?**
 - a. Diazepam
 - b. Phenytoin
 - c. Aspirin
 - d. Unfractionated heparin
 6. **A patient reports that he experiences chest pain, whenever he performs activities, but it is relieved by taking rest. This is an example of:**
 - a. Unstable angina
 - b. Stable angina
 - c. Variant angina
 - d. Prinzmetal angina
 7. **How do ACE inhibitors help in managing coronary artery disease?**
 - a. These agents block the calcium channels
 - b. These agents prevent the conversion of angiotensin I to angiotensin II
 - c. These agents decrease the heart's contractility
 - d. These agents cause vasoconstriction of coronary arteries
 8. **Which of the following diagnostic tests is the most used for determining the location of myocardial infarction?**
 - a. Cardiac enzymes
 - b. Echocardiogram
 - c. Electrocardiogram
 - d. Cardiac catheterization
 9. **These are the absolute contraindications for thrombolysis, except:**
 - a. Pregnancy
 - b. Recent head injury
 - c. Recent surgery
 - d. Osteoarthritis
 10. **Following are the goals of cardiac rehabilitation, except:**
 - a. To maintain the blood pressure >140/80 mm Hg
 - b. To exercise at least 30 min/day, minimum 5 days a week
 - c. To maintain a cholesterol level of less than 200 mg/dL
 - d. To adhere to a medication regimen

ANSWERS

- | | | | |
|------|-------|------|------|
| 1. c | 2. d | 3. c | 4. a |
| 5. c | 6. b | 7. b | 8. c |
| 9. d | 10. a | | |

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Adult Health Nursing-I

Medical Surgical Nursing

Salient Features

- This book on medical surgical nursing is a comprehensive guide for the undergraduate nursing students and can be used as a reference book by the postgraduates and the teachers as well.
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- Each chapter begins with the learning objectives and key terms; and ends with case scenario, multiple choice questions and references.
- Anatomy and physiology of each system has been discussed separately.
- Each disease condition is accompanied by a case scenario for critical analysis by the nursing students to maximize their learning potential.
- All the contributors of the book are the carefully selected nursing and medical experts pan India and internationally.
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- Throughout the book, the text has been supported with number of pertinent colored illustrations, figures, tables, boxes and flowcharts for a better understanding of the subject matter by the students.

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