

CHAPTER – 2

Cardiovascular system

Introduction— cardiovascular system includes the hearts and the blood vessels. Heart is the vital organ in the body, which is pump the blood and blood are flow through the vessels in whole body. Any obstruction or manifestation occurs in the heart or blood vessels then it leads to many of problems. Disease affecting the heart may be structural and functional.

Anything that damages the heart, makes it less efficient, reduces its ability to fill and pump, or decrease the heart supply of oxygen will disrupt the coordinated relationship between the heat, kidney, and blood vessels and will harm not only the heart but the rest of the body as well.

Clinical consideration—

- **Hypertension.**
- **Angina pectoris.**
- **Myocardial infraction.**
- **Hyperlipidemia.**
- **Congestive heart failure.**

Heart disease may occurs due to	
Alcohol use, cocaine use, smoke	Anabolic steroid use
Atherosclerosis	Auto immune conditions
Bacterial/viral infection	Congenital abnormalities
Injury or trauma conditions	Diabetes
Thyroid dysfunction	Anabolic steroidal use
Toxin like mercury & chemotherapy drugs like HIV/AIDS drugs	
Unbalanced diet, high in fat and cholesterol (major cause)	

Hypertension.

Definition—Hypertension is defined as the high blood pressure than the normal blood pressure.

Normal value— Systolic pressure— 110 to 140 mmHg
Diastolic pressure— 60 to 80 mmHg.

When the systolic and diastolic pressure remains elevated above 150 mmHg and 90 mmHg respectively then considered as the hypertension. Commonly there is increase only in systolic pressure, it is called as systolic hypertension.

Types of hypertension—

1. Primary/Essential hypertension.
2. Secondary/systemic hypertension.

Etiopathogenesis—**Primary hypertension** seen as the common types of the hypertension arises due to the increased peripheral resistance or external factors in the absence of any underlying diseases.

After the long term (without any precaution) it leads to develop the vascular damage, small blood vessels damage, cerebral hemorrhage, retinal hemorrhage and renal failure.

It varies— 100 mmHg to 250 mmHg. It can control but cannot cure.

Secondary hypertension arises due to some underlying disorders. It may be occurs during the body organs are not work proper or imbalance manner due to any internal effects or any infections. It is cured by treating the disease which responsible for hypertension.

Ex-

- Cardiovascular hypertension- it arises due to the any arterial blockage.

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- Renal hypertension- it arises due to obstruction of renal artery or improper glomerular filtration (glomerulonephritis).
- Endocrine hypertension- it is arises due to the hyper activity of the endocrine glands.

Clinical manifestations—

- Renal failure.
- Myocardial infraction.
- Arrhythmia.
- Cerebrovascular accident (strokes).
- Retinal hemorrhage.
- Left ventricular failure.
- Dyspnea (shortness of breath).
- Epistaxis (nose bleeds).

Pharmacological managements—

1. **Calcium channel blockers**— which block the calcium channels in myocardium and thereby, reduce the contractility of myocardium. Ex- phenylalkylamine, benzothiazepine, dihydropyridines.
2. **Vasodilators**— reduce the blood pressure by the vasodilation. Ex- sodium nitroprusside, hydralazine, minoxidil, fenoldopam, diazoxide.
3. **Diuretics**— diuretics cause diuresis and reduce the ECF volume and blood volume. Ex-
4. Angiotensin converting enzyme inhibitors (**ACE inhibitors**)— it reduce the blood pressure by blocking the formation of angiotensin.
5. **Angiotensin (AT1) receptor blocker**— Ex- losartan, telmisartan, melavimus, valsartan, eprosartan.
6. **Sympathetic inhibitors**—
 - a) Alpha Beta adrenergic blockers— arotinolol, labetalol, carvedilol, bucindolol.

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- b) Alpha adrenergic blockers— Prazosin, doxazosin, naftopidil, phenoxybenzamine.
- c) Beta adrenergic blockers— Atenolol, metoprolol, timolol, oxprenolol, nipradilol.
- d) Central sympatholytics— methyldopa, reserpine, clonidine.

Non pharmacological management—

- Follow the proper routine of the regular activities (wake up, sleeps, natural urges).
- Follow regular exercise and workout (prevents the fat deposition and remove the excessive fats).
- Follow the yoga and meditation (which maintain the oxygen and carbon dioxide level).
- Make the proper diet chart after consulting the specialist and follow them. (Take- green vegetables, natural fruit juice, less fatty substance, and avoid the street food items).
- Avoid the polluted area and spend the time where fresh air blown.

Angina and Myocardial infarction.

Definition & Etiopathogenesis.

Angina pectoris— Any obstruction in the coronary artery of the heart due to deposition or blockage, leads to chest pain or any discomfort and ischemia in the heart muscles called as the angina pectoris.

The word **angina** means a type of chest caused by reduced blood flow to the heart. It is not a disease it is only a condition which occurs in the heart disease.

Medical conditions, such as Atherosclerosis, cause the walls of the blood vessels to become narrow, thereby decreasing the flow of blood. During resting, the narrowed arteries allow enough blood to reach the heart. However, the heart requires more blood than it receives during emotional stress or strenuous physical

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activity. Such conditions require the heart to work harder, thereby causing angina pectoris.

It is mainly three types—

1. **Stable angina**— Deposition of the fatty material in the inner wall of the coronary artery (atherosclerosis).
2. **Unstable angina**— Any damage in the coronary arteries, causing blood clot and partial blockage (atherosclerosis with clot).
3. **Variant angina**— variation in the coronary artery diameter by any condition leads to variant angina also called as coronary spasm. Also known as Prinzmetal's variant angina or Angina inversa. It is usually rare and typically occurs in younger patients who have other pre-existing heart conditions.

Myocardial Infraction— It is also called as the **Heart Attack or myocardial necrosis**. It is the critical condition arises due to the myocardial tissue death due to lack of the blood supply. It begins when any blockage/obstruction occurs in the arteries.

Stages of myocardial infections.

Types	Clinical consideration
Type-1 MI	Spontaneous MI due to rupture/damage of coronary artery.
Type-2 MI	Appear due to either increase oxygen demand or decreased blood flow.
Type-3 MI	Due to starting myocardial necrosis.
Type-4 MI	Due to thrombotic occlusion of a coronary stent.
Type-5 MI	Associated with cardiac surgery.

Clinical manifestations—

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- Chest pain
- Dyspnea
- Fatigue
- Arrhythmia.
- Increased sweating
- Weakness
- Nausea
- Anxiety.
- Palpitation

Pharmacological managements—

- Beta blockers**— metoprolol, propranolol, atenolol, alprenolol.
- Potassium channel openers**— nicorandil
- Calcium channel blockers**—amlodipine, verapamil, mibefradil, bevantolol, diltiazem, nitrendipine.
- Nitrates**—
 - Long acting nitrates—isosorbide dinitrate, molsidomine.
 - Short acting nitrates— nitroglycerin, erythryl tetranitrate.
- Other drugs**— oxyfedrin, ivabradine, trimetazidine, dipyridamole, acadesine.

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Hyperlipidaemia.

Definition— **Lipids** is an important nutritional components required in the optimum measures for our diet. When the lipids or fats (such as cholesterol and triglycerides) level increase from the optimum level then it accumulates in the blood vessels and increase viscosity of blood and leads to many organs blockage (mainly hearts) like diseases.

Cholesterol is the organic molecule, a type of lipid which are the essential component for the cell. When their level are increase in the blood then it accumulate or passively flow in the blood vessel depends upon their density.

Etiopathogenesis—

1. **Primary/familial/hereditary hyperlipidemia**— It is genetically present in the child. Hereditary disorders in lipid metabolism include Tay-Sachs disease, Gaucher disease, metachromatic leucodystrophy, Fabry disease, Refsum disease etc. it further divides in many class.

Class	Increased lipoprotein
Type-I (Chylomicronemia)	Chylomicrons
Type-IIa (Hypercholesterolemia)	LDL
Type-IIb (Combined hyperlipidemia)	LDL & VLDL
Type-III (Dysbetalipoproteinemia)	LDL
Type-IV (hypertriglyceridemia)	VLDL
Type-V (mixed hyperlipidemia)	VLDL & chylomicrons

2. **Secondary/acquired hyperlipidemia**— it occurs after birth due to any abnormality or disease.

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- a. **Hypercholesterolemia**— hypothyroidism, nephrotic syndrome, and drugs use.
- b. **Hypertriglyceridemia**— DM, alcohol, gout, chronic renal failure.
Common symptoms—
 1. **Less production of bile juice**— lipids or fats are not easily digested by the gastric glands, so bile juice are one of the liver secretion which are responsible for absorption of the lipid. Bile juice breakdown the large lipid molecule into smaller particle.
 2. **Liver dysfunction**— liver is responsible for the lipid metabolism and convert into the LDL and HDL. Any abnormality occur in the liver then it lead to hyperlipidemia.

Clinical manifestations—

Hyperlipidemia usually does not cause symptoms. Sometime normal symptoms seen

- Loss of appetite.
- Arrhythmia.
- Diarrhoea.
- Abdominal pain.
- Eye disorders.
- Vomiting

But very much high level of lipids or triglycerides can leads to.

- Heart attack.
- Stroke.
- Atherosclerosis.
- Xanthoma.
- Pancreatitis.

Pharmacological managements—

- (3-hydroxy-3-methyl glutaryl CoA)HMG-CoA reductase inhibitors— lovastatin, simvastatin, atorvastatin, rosuvastatin.
- Bile acid sequestrants— Cholestyramine, colestipol,
- Fibric acid derivatives— fenofibrate, bezafibrate, gemfibrozil.
- Nicotinic acid.

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Congestive heart failure.

Definition— Heart failure or congestive heart failure is an abnormal condition involving impaired cardiac pumping. In this condition heart is fail to pump the sufficient blood to our organs due to the less nutrients and oxygen supply to the myocardial destruction (less ability of cardiac muscle).

Types of heart failure—

- Left-sided heart failure— most common form of heart failure. Fluid may back up in your lungs, causing shortness of breath.

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- Right-sided heart failure— often occurs with left sided heart failure. Failure may back up into your abdomen, legs and feet, causing swelling.
- Systolic heart failure—the left ventricle cannot contract vigorously indicating a pumping problem.
- Diastolic heart failure—the left ventricle cannot relax or fill fully, indicating a filling problem.

Congestive heart defects may be diagnosed before birth, right after birth, during childhood or not until adulthood. It is possible to have a defect and no symptoms at all.

Etiopathogenesis—

1. **Coronary artery disease (CAD)** — it is major cause for the heart disease. The usual causes are the build-up of plaque. This causes coronary arteries to narrow, limiting blood flow to the heart.
2. **Auto immune disease**— one of the cause of heart disease. It may be congenital or acquired.
3. **Heart valve disease**— valve is responsible for the proper flow of direction of blood common valve (tricuspid, bicuspid, pulmonary, aortic valves).when the coordination of these valve disturbed then it leads to disease.
4. **Alcohol or cocaine abuse**— Alcohol has a variety of short term and long term effects on heart. When you drink something, your blood pressure increase and your pulse rate quickens. Heavy drinking may have a long term negative impact on your cardiovascular system, including possible heart and blood vessel manage.
Hypertension, an elevated heart rate, and a greater chance of irregular heartbeat are all side effects of drinking. Too much alcohol can lead to an accumulation of LDL or poor cholesterol.
5. **Pregnancy**— During the pregnancy anemic condition is normal so, deficiency of the iron/anemic condition blood cell production is obstructed and leads to many types of disease like heart disease.

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6. **A common infection**— during any infection (bacterial infection or viral infection or any other) disturbance appears in our normal physiological activities and leads to the heart disease.
7. **Nutritional deficiency**— For proper growth and development, nutrition is required in proper ways (quantitatively and qualitatively both). When any deficiency occurs then it leads to the heart disease
8. **An endocrine/metabolic disorder**— due to manifestation in the metabolism and hormonal secretion also leads to heart disease.

Clinical manifestations—

- Tachycardia
- Oedema (swelling in ankles, legs and abdomen).
- Cachexia and muscle wasting.
- Crepitations or wheeze.
- Third heart sound
- Hepatomegaly.
- Pulses alterations
- In infant and children common symptoms occurs- cyanosis, poor weight gain, recurrent lung infections, inability to exercise, fast breathing and poor feeding.

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