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Pharmacotherapeutics
Chapter 2 (a) : CARDIOVASCULAR SYSTEM DISORDERS

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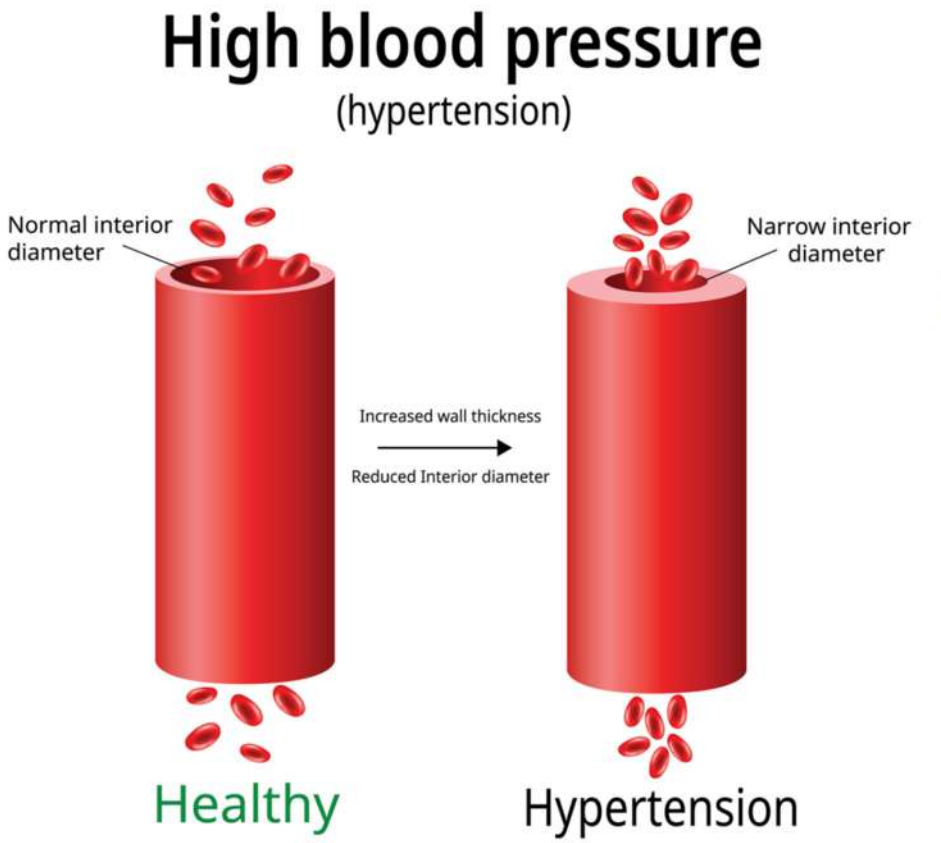
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Chapter 2 (a)

CARDIOVASCULAR SYSTEM DISORDERS

Hypertension

- Hypertension (or high Blood Pressure, BP) is a common condition in which the long-term force of the blood against artery walls is high enough that it may eventually cause severe health complications mainly related to heart disease.
- A condition in which the blood pressure of the systemic artery increases beyond the normal pressure is known as hypertension.
- Therefore, to deliver blood to tissues, the heart works harder to overcome the increased systemic pressure. This increased systemic arterial pressure puts strain on the heart and other anteries that result in high blood pressure.



Classification of Blood Pressure for Adults

Blood Pressure Classification	Systolic BP	Diastolic BP
Normal	Less than 120	Less than 80
Prehypertension/Elevated	120 - 129	Less than 80
Stage 1 Hypertension	130 – 139	80 – 89
Stage 2 Hypertension	140 or higher	90 or Higher
Hypertensive Crisis	Higher than 180	Higher than 120

Types of hypertension on the basis of causes

- ⇨ Primary (Essential) Hypertension
- ⇨ Secondary Hypertension
- ⇨ Hypertension Crisis

Primary or essential Hypertension : This is the most common type of hypertension , (about 90-95 %). The exact cause of high blood pressure is not identified .

Etiology of Primary Hypertension

The exact reason of this type of hypertension is not clearly identified ,any of the following factors may be consider a cause :

- Hyperactivity of sympathetic nerve stimulation (because it increases heart rate , and constrict some blood vessels)
- Vasoconstriction due to release of vasoactive substances from endothelial cells .e.g. nitric acid , endothelin etc.
- Increase in cardiac output .
- Too much sodium (salt) in diet .
- Family history of Hypertension .

Secondary Hypertension : This is less common type of hypertension (about 5-10%) . this type of hypertension occurs due to other diseases like tumour , kidney disease , endocrine and cardiac disorder .

Etiology of Secondary Hypertension

This type of hypertension occurs due to other diseases like :

- Genetic problems
- Kidney diseases
- Hyperthyrodism (over production of thyroid gland hormone it increases heart rate) .
- Hypothyrodism (it increases cholesterol level) .
- Sleep apnea (sudden fall in sleep , change in heart rate)
- NSAIDs , estrogen , sympatomimetics , steroids , etc.

Hypertension Crisis :

- → It is a severe condition in which increased blood pressure may lead to heart stroke.
- → In this condition, blood vessels get damaged due to increased systolic blood pressure (180mmHg or higher) and increased diastolic pressure (120mmHg or higher).
- → Thus, the heart fails to pump blood effectively to the body.

Pathogenesis of Hypertension

Pathogenesis The blood pressure is regulated by following theories :

1. Sympathetic nervous system activities.
2. Activity of Vascular endothelium
3. Activity of renal system (Fluid Volume Regulation)

1) Sympathetic nervous system activities

- ➢ Over activation of SNS increase adrenaline sec retion then heart rate then cardiac output increased which leads to hypertension.

2) Activity of Vascular endothelium

- ➢ Endothelium dysfunction increase vasoactive substances (nitric acid) secretion which causes vasoconstriction and then hypertension . or decrease vasodilator nitric oxide it also case BP.

3) Activity of renal system

- ➢ The kidney release renin which help Anginotensinogen to convert into angenotensin and then it convert into anginotensin I and then anginotensin II and constrict blood vessels . anginotensin II also help to make aldosterone which increases blood volume by retaining sodium and water that increase blood preassure.

Clinical Manifestation of Hypertension

- Severe headache
- Chest pain
- Bleeding from nose
- Blurred Vision
- Difficulty In Breathing
- Irregular heart beat
- Confusion
- Nausea and vomiting
- Dizziness
- Pain in neck and back 11) Seizure

Non Pharmacological Management of Hypertension

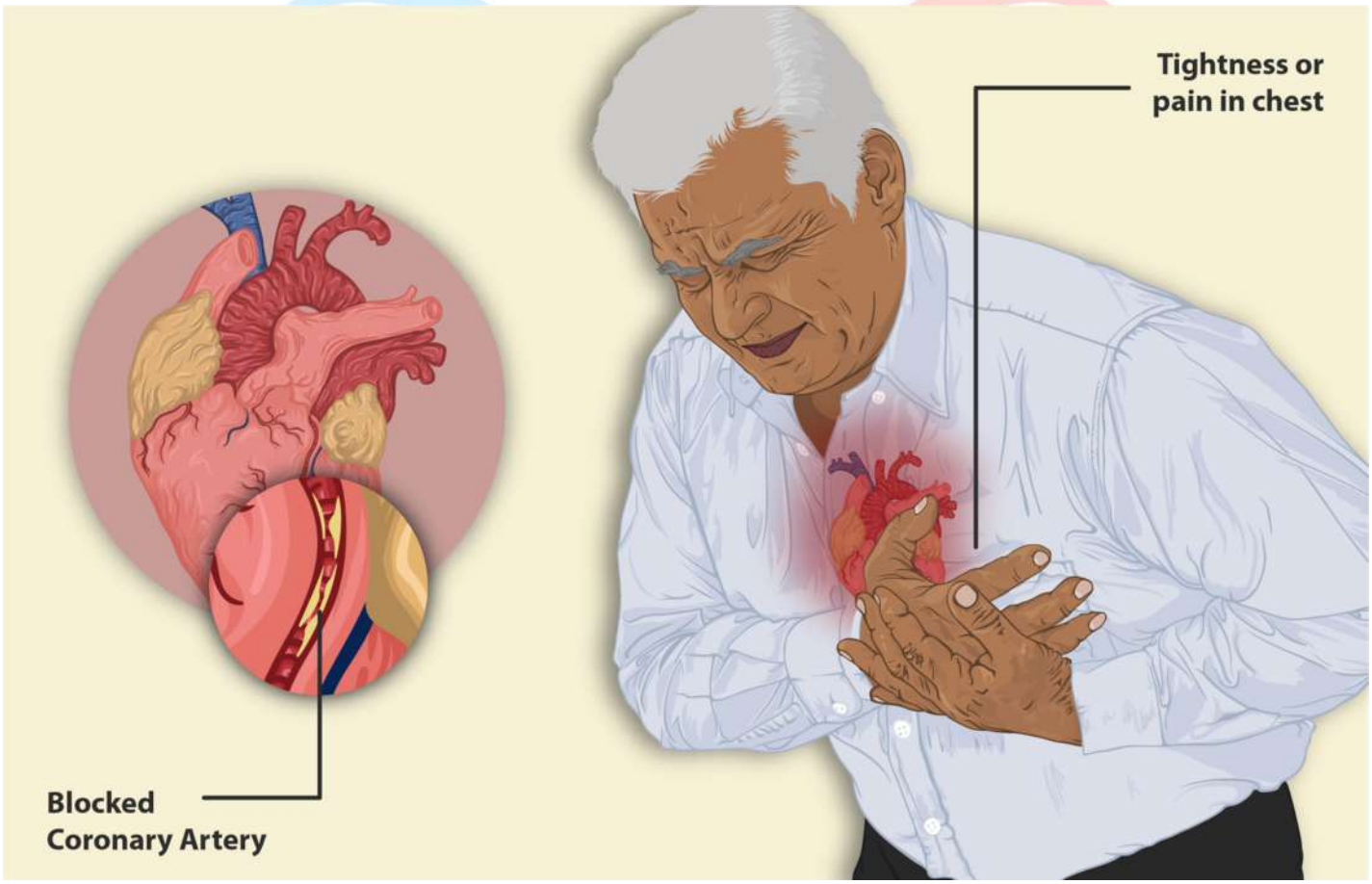
- **Dietary Changes :** A prehypertension (elevated) can be control with healthy diet , taking a diet low in sodium and high in potassium . It is called DASH (Dietary Approaches to Stop Hypertension)
- **Exercise :** Physical activity is can lower blower BP by decreasing bad cholesterol , obesity and overweight.
- **Stress Management :** Eliminating Stress is also an important way to manage BP , because in stress condition in which adrenal gland produces Cortisol hormone , and it increases blood sugar level to manage stress , that causes Hypertension . Stress Can be manage by Exercise and meditation .
- **Stopping Smoking :** Smoking Increases Sympathetic nerve activity , which increases heart rate and causes High BP.
- **Stopping Alcohol :** Drinking a lot of alcohol constrict blood vessels and increases blood pressure.

Pharmacological Management of Hypertension

- **Diuretics :** chlorothiazide , Furesimide , Spironolactone .
- **α Blocker :** Prazosin , Phenoxibenzamine
- **ß Blocker :** Atenolol , Propranolol .
- **α +ß Blocker :** labetlol , carvedilol .
- **Calcium channel Blocker :** Amlodipine , Nifedipine , Verapamil .
- **Angiotensin - converting enzyme (ACE) Inhibitors :** Captopril , Ramipril .
- **Angiotensin Receptor Blocker :** Losartan , valsartan .
- **Vasodilators :** Hydralazine , minoxidil

Angina Pectoris

- → Angina is a term used for chest pain caused by reduced blood flow to the heart muscles.
- → It is a symptom of coronary artery disease, and is typically described as squeezing, pressure, heaviness, tightness, or pain in chest.
- → Angina is experienced during physical stress and relieved after rest, but in severe conditions, it may be observed on minimum physical work or at rest.
- → Generally it is indication of coronary artery disease.
- → It is a very strong sign that someone at high risk of cardiac arrest, heart attack, and sudden cardiac death.



Types of Angina Pectoris

1. Stable / Chronic
2. Unstable Angina
3. Microvascular angina
4. Variant Angina

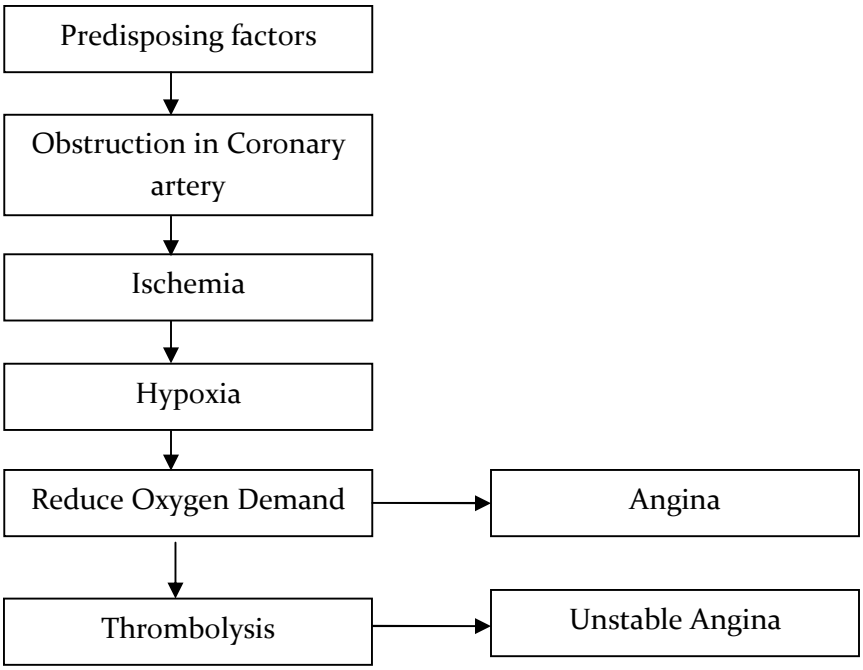
1. **Stable / Chronic :** This type of angina follow a regular pattern due to stable plaque in coronary arteries and occurs when work load of heart increased due to any reason like exercise ,playing foot ball . It is less dangerous than unstable Angina . This is relieved by rest and medication.
2. **Unstable Angina :** This type of angina does not follow a regular pattern due to unstable (dynamic) plaque in coronary arteries and occurs even at resting condition , rest and medication is not enough for its relief.
3. **Microvascular Angina :** This type of angina occurs when any one more smallest coronary arteries are blocked , and it commonly occurs due to thrombosis part of unstable angina.
4. **Variant Angina :** This type of angina occurs due to coronary spasm , and it follows a pattern , and spasm occurs due to external reasons like smoking , Cold weather , certain medicines , and stress . It is commonly occurs in younger people.

Etiology of angina Pectoris

The main causes of angina pectoris are

- Coronary Artery diseases
- Plaque In Coronary arteries : (It is also called Athreosclerosis) More than 60 % of blocking of coronary arteries become unable to fulfill the demand of increased blood oxygen by the heart muscles.
- Narrowing of Coronary arteries.
- Spasm In coronary arteries.

Pathogenesis



Clinical Manifestations Angina pectoris

- Pain in Chest
- Weakness
- Heartburn
- Cramping.
- Sweating
- Indigestion,
- Nausea,
- Shortness of breath

Non Pharmacological Management of angina Pectoris

- To stop smoking
- Controlling Weight
- Avoiding heavy work in case of blockage .
- Controlling Hypertension
- Avoiding Heavy meals
- Avoiding Stress
- Avoiding alcohol
- Adding fruits , vegetable , high density lipoproteins , in diet

Pharmacological management of angina Pectoris

- **Nitrates :** Nitroglycerine , Isosorbide Dinitrate , they open the coronary arteries , and are given by sublingual route to obtain one set of action .
- **ß Blockers :** Atenolol , propranolol , they decrease BP and slow down the heart rate.
- **Calcium Channel Blocker :** Amlodipine , Nifedipine , Verapamil . they also act like ß blockers.
- **Thrombolytic Drugs (Antiplatelet drugs) :** Steptokinase , Urokinase , prourokinase , they prevent blood clotting.

Myocardial Infarction (MI, Heart Attack)

- → Myocardial Infarction (MI) or Acute Myocardial Infarction (AMI) or heart attack is a condition characterised by death of cardiac tissue due to disturbed obstructed blood supply.
- → It can also be described as irreversible death of hear cells due so ischemia.
- → Myocardial infarction or a heart attack is a condition in which the blood flow to a part of heart stops or is highly inadequate, causing that part of heart muscle to die and fail to pump blood.



Types

- Transmural Myocardial Infarction
- Non-Transmural Myocardial Infarction

Transmural MI : In this type of MI all the Three layer of heart muscles are affected by Ischemic Necrosis.

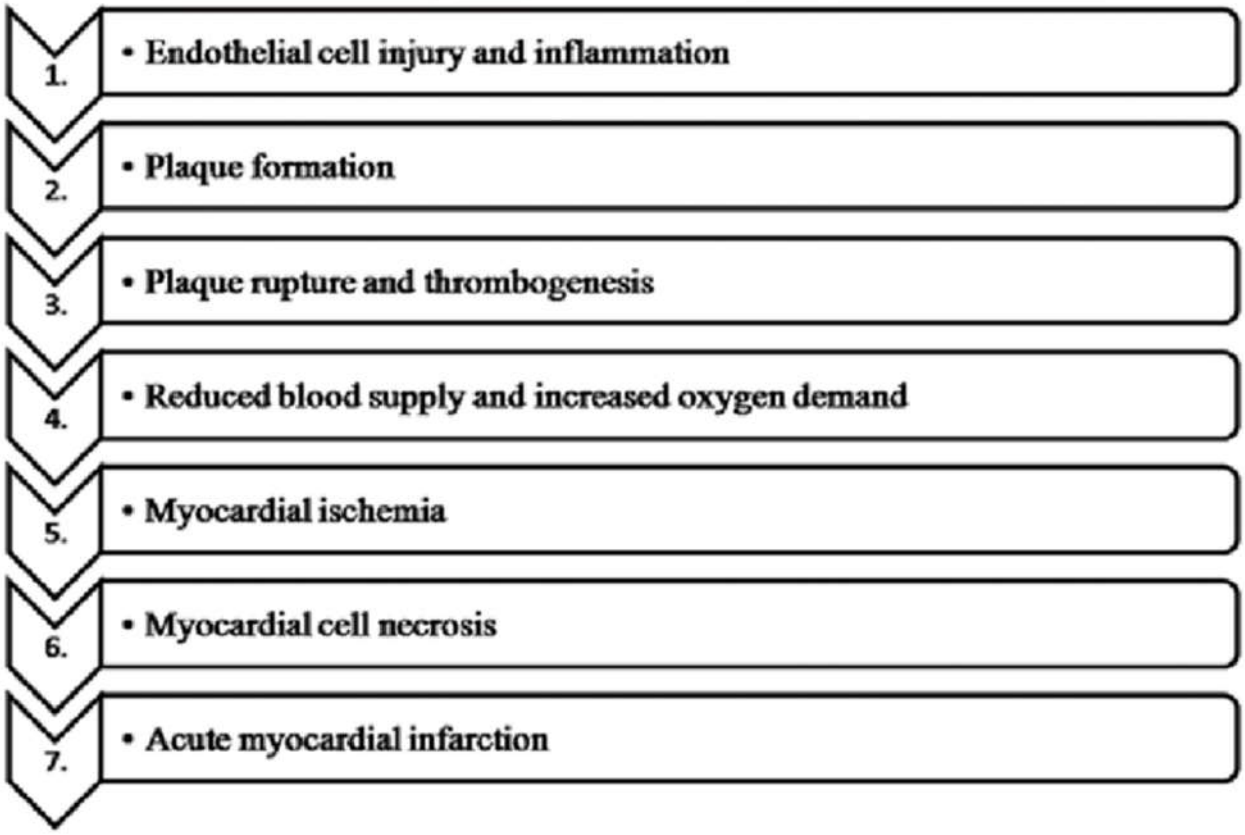
- Endocardium (inner Layer)
- Myocardium (middle layer)
- Epicardium (outer layer)

Non-Transmural MI : In this type of MI the Ischemic Necrosis affected ares is limited to endocardium or to myocardium

Etiology of Myocardial Infarction

- Coronary Artery diseases
- Plaque In coronary arteries
- Narrowing of Coronary arteries
- Spasm In coronary arteries
- Ischemia
- Hypoxia (due to carbon monoxide or pulmonary disorder)
- Increase After load and decrease blood supply

Pathogenesis



Clinical Manifestations

- Sudden chest pain,
- Shortness of breath,
- Anxiety,
- Sweating.
- Nausea and vomiting.

Non Pharmacological Management of Myocardial Infarction

- To stop smoking.
- Diet : avoiding meat and dairy products , and increasing unsaturated fats Like olive oil , canola oil , Almonds , fish.
- To control Body weight and obesity.
- Physical activity.

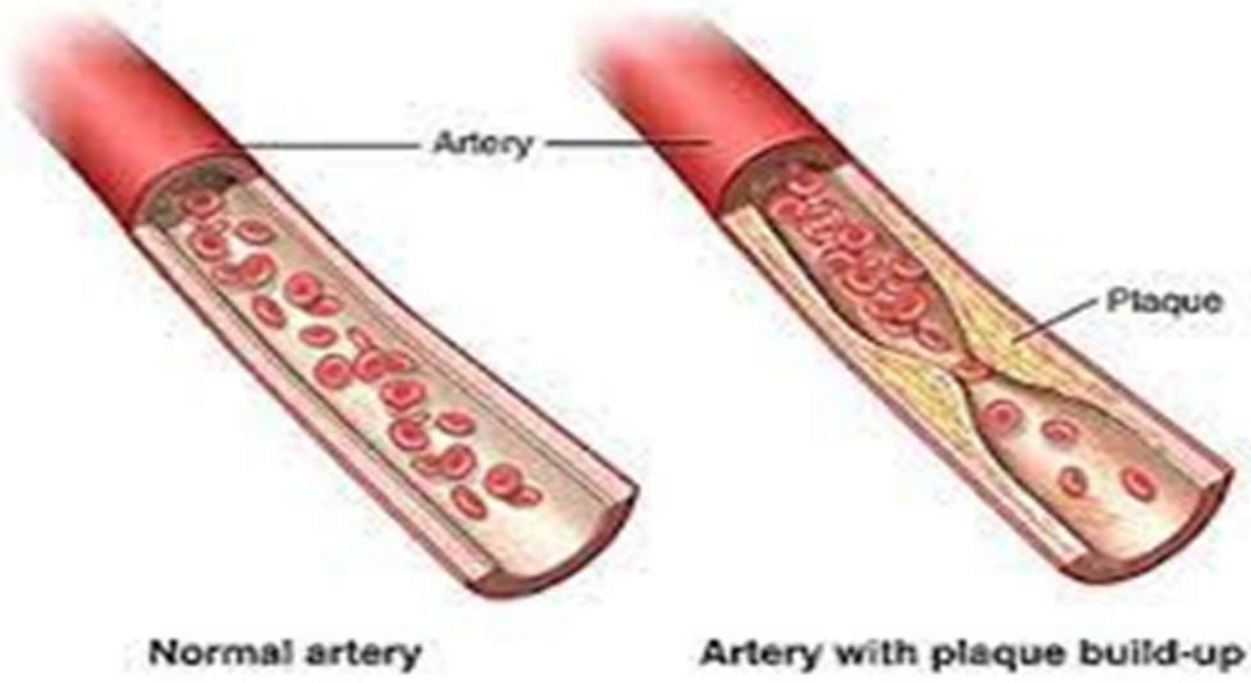
Pharmacological Management of Myocardial Infarction

- The blocked artery of heart is treated by a surgical procedure called Angioplsty , in which a catheter is inserted with a balloon into the artery an d balloon is inflated at location of blockage to expand the artery . Then a ring called stent placed there which holds the open the artery . After angioplasty a heart patient requires following medicines :
  - **Blood thinners :** Aspirin , pradaxa
  - **Thrombolytic :** streptokinase , urokinase (these dissolve clots)
  - **Antiplatelet drugs :** clopidogrel (they prevents the formation of new clots)
  - **Nitrates :** Isosorbide dinitrate , Notroglycerine
  - **ß blockers :** propranolol
  - **ACE Inhibitors :** ramipril , captopril , Losartan , valsartan

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Hyperlipidaemia

- → Hyperlipidemia is a condition in which the levels of fats (lipids) in blood, including cholesterol and triglycerides, increases abnormally
- → It is most commonly caused by lifestyle factors (poor diet and insufficient physical activity)



Etiology of Hyperlipidamia

- Too much alcohol consumption .
- Taking foods , high in saturated fat
- No physical activity , spending most time sitting .
- Genetic problem

Some drugs that can increase cholesterol levels

- ß blockers
- Diuretics
- Hormonal birth control pills
- Steroids

Some diseases can increase cholesterol levels

- Hypothyrodism
- chronic kidney disease
- diabetes
- HIV

Pathogenesis

- Liver produces homones as well as cholesterol to help in digestion.
- However cholesterol can also be obtained from meat and dairy products.
- The cholesterol included in foods is unnecessary because liver can manufacture all of the cholesterol required in the body
- Excessive cholesterol is harmful because it can block the arteries transporting blood throughout the body, and result in organ damage.
- The most hazardous type of cholesterol is bad cholesterol, which causes hardened cholesterol deposits (plaque) to form inside the blood vessels.
- This makes it more difficult for the blood to flow, thus increasing the risk for a stroke or heart attack

Types of Cholesterol	Normal Range
Total Cholesterol	< 200 mg/dl
Bad (LDL) Cholesterol	< 100 mg/dl
Good (HDL) Cholesterol	At least 60mg/dl
Triglycerides	< 150 mg/dl

Clinical Mainifestions

Hyperlipidamia does not show any symptoms , although at high level .but may lead to other condition like :

- High blood pressure
- Heart attack
- Stroke (reduce blood supply to brain)
- Weight gain
- Depression, etc.

Non-Pharmacological Management

- Exercising
- Quitting smoking.
- Limiting alcohol consumption
- Getting at least 7 hours of sleep every night.
- Keeping stress under control.
- Consuming nutritious foods.
- Losing a few pounds to achieve a healthy weight

Pharmacological Management

- **Statins :** These drugs prevent liver from producing cholesterol e.g. atorvastatin , Fluvastatin
- **Cholesterol Absorption Inhibitors :** These drugs prevent cholesterol absorption from intestine. These drugs work in combination with statins .e.g. Ezetimibe , simvastatin .
- **Nicotinic Acids :** It reduce LDL and triglyceride , and increases HDL . e.g. Niacin .
- **Fibrates :** Clofibrates , Fenofibrates .
- **Resins :** Colestipol , Colesevelam

Congestive Heart Failure (CHF)

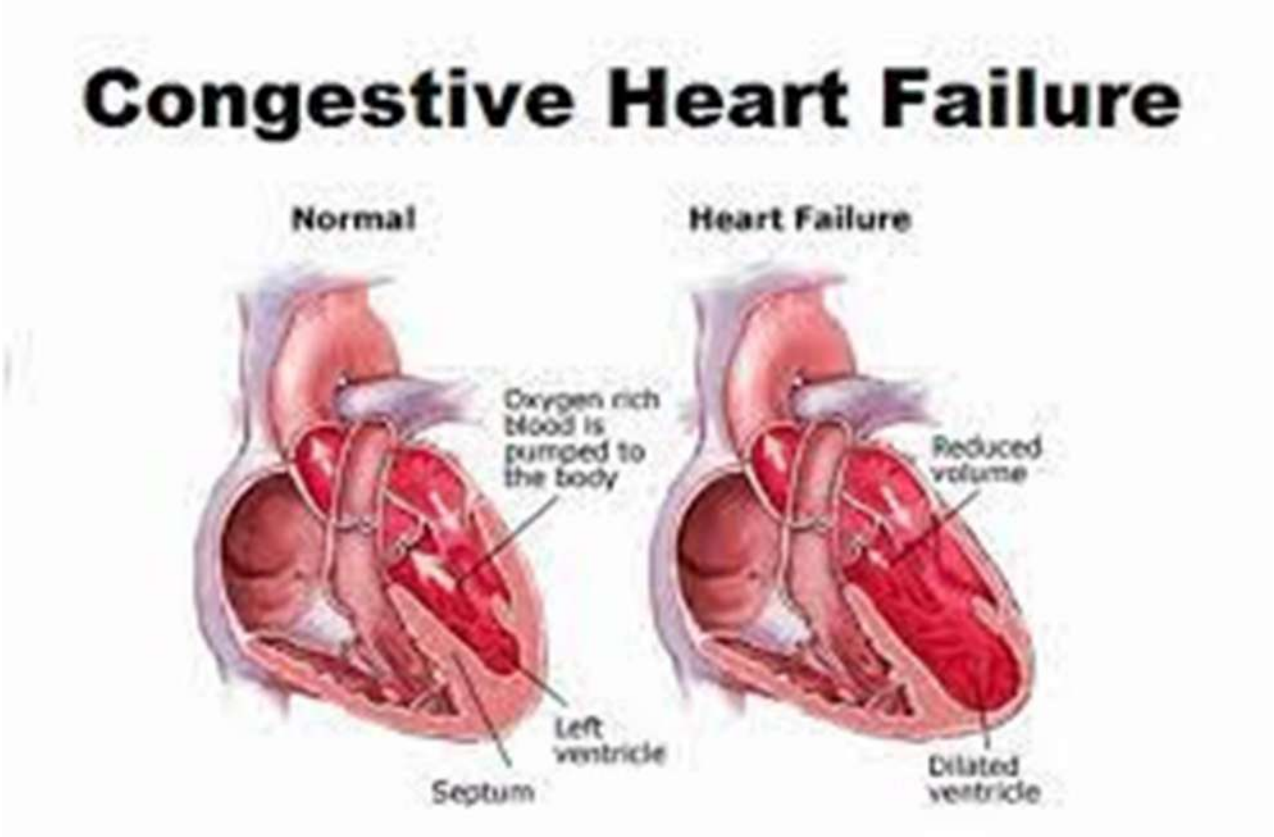
→ Congestive Heart Failure is a condition in which a heart fails to pump blood in a quantity sufficient to fulfil the body requirements.

Or

→ It is a Condition in which heart is unable to generate enough cardic output to fulfill minimum requirement of the body.

→ Narrowed heart arteries (coronary artery disease) or high blood pressure, makes the heart too weak or stiff to fill and pump efficiently.

→ Thus, these conditions give rise to CHE.



Types

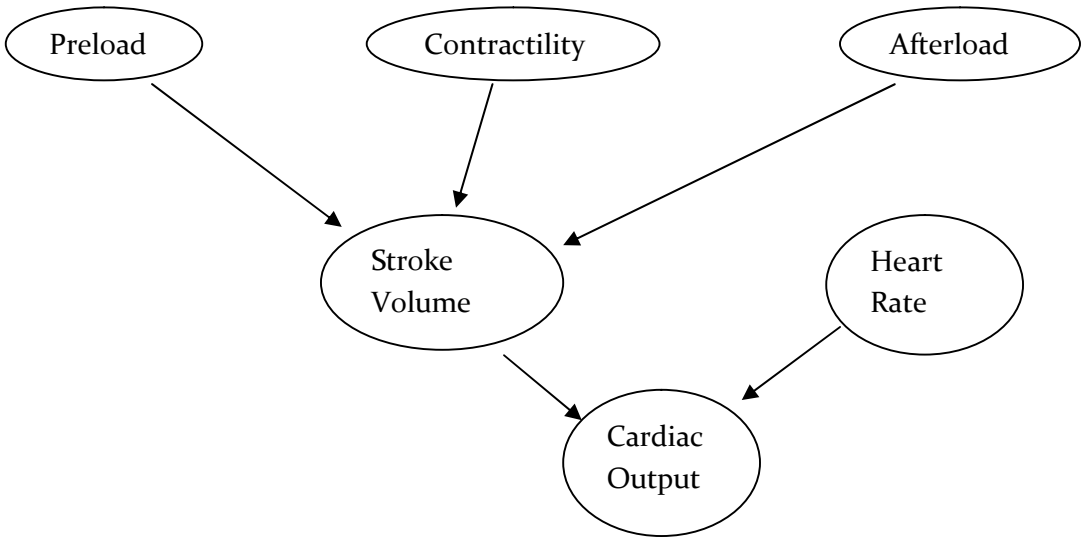
1. **Left-Sided Heart Failure :** Fluid back-up in the lungs, causing shortness of breath.
2. **Right-Sided Heart Failure :** Fluid back-up in e abdomen, legs, and feet causing swelling.
3. **Systolic Heart Failure :** The left ventricle fails to contact vigorously, indicating a pumping problem.
4. **Diastolic Heart Failure :** Also known as heart failure with preserved ejection fraction. The left ventricle fails to relax or fill completely, indicating a filling problem.

Etiology

- Too much preload
- Too low preload
- Too much afterload
- Slow or high heart rate
- Valve dysfunction
- Contractility disorder (intrinsic health of heart muscle)
- Cardiomyopathy (Diseases of the heart muscles)
- Any heart valve disease (due to high BP or Fever)
- Any congenital heart defect

Pathogenesis

- When preload or contractility or afterload or heart rate affected badly due to any reason then heart become unable to generate enough cardiac output to fulfill minimum requirements of the body and occurs Congestive Heart Failure.



Clinical Manifestations

- Breathing problems.
- When active, the patient may feel tried and weaknes in legs.
- Swollen ankle, leg, and abdomen.
- Weight gain.
- Urge to urinate at night.
- Palpitations (rapid or irregular heartbeats).
- A dry, hacking cough.
- A bloated or hard stomach, appetite loss, or nausea.

Non-Pharmacological Management

- **Diet :** He should take healthy diet , and avoid too much salt .
- **Fluid :** He should take limited fluid substance.
- **Alcohol :** he should avoid alcohol .
- **Smoking :** He should avoid smoking
- **Heavy work :** He should avoid heavy work

Pharmacological Management

- **ACE inhibitor :** Losartan , valsartan captopril , ramipril . (they make easy the blood flow.
- **ß Blockers :** Propranolol .
- **Diuretics :** Chlorthiazide , acetazolamide , spironolactone