UNIT-II

CARDIOVASCULAR SYSTEM

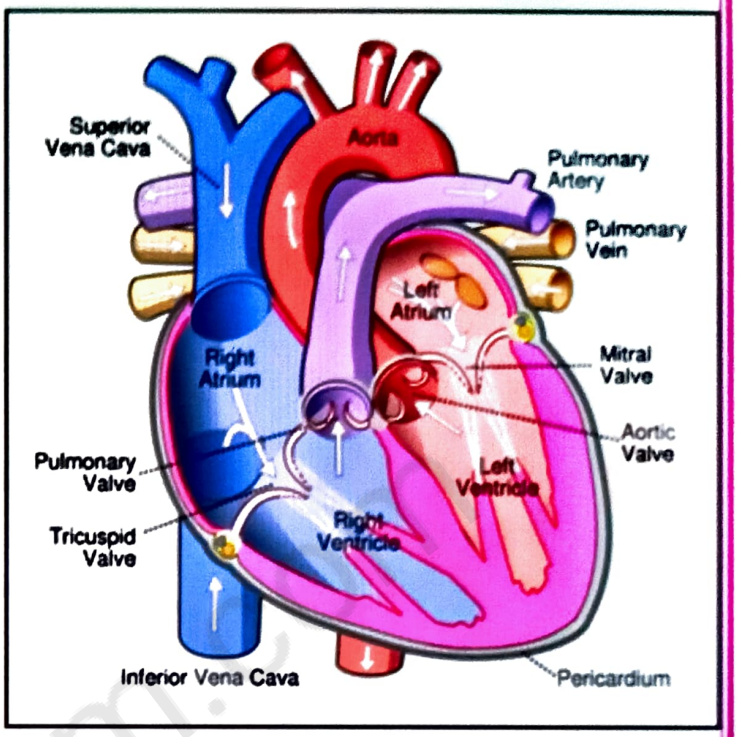
Points to be covered in this topic

- ❑ HYPERTENSION
- ❑ CONGESTIVE HEART FALIURE
- ❑ ISCHEMIC HEART DISEASE
  - 1. ANGINA PECTORIS
  - 2. MYOCARDIAL INFRACTION
  - 3. ATHEROSCLEROSIS AND ARTERIOSCLEROSIS

❑ CARDIOVASCULAR SYSTEM

❖ Introduction

- Heart is a **muscular pump.** The weight of heart in an **adult male is 300-350gm** and **in an adult female is 250-350gm.**
- The heart is located in the chest **between the lungs behind the sternum** and above the diaphragm.



❖ Layers of heart

1. Epicardium

It is the **outermost layer** of heart. It is a thin layer of **connective tissue and a fat.**

2. Myocardium

It is a **middle layer** of heart wall that contain the cardiac muscle tissues. The cardiac muscle is similar to skeletal muscle but not under voluntary control. It is composed of cardiac muscle cells called **cardiomyocytes** that receive nervous stimulation from the **sinoatrial (SA) and atria ventricular (AV) node via the purkinje fibres.**

3. Endocardium

The **inner layer** of heart is endocardium, composed of **endothelial cells** that provide a **smooth, elastic, non-adherent surface** for blood collecting and pumping. The endocardium may **regulate metabolic wastes removal** from heart tissues and act as a barrier between the blood and the heart muscle.

❑ HYPERTENSION

❖ Introduction

Hypertension is an **intermittent or sustained elevation** of **diastolic or systolic blood pressure.** Generally, a **sustained systolic blood pressure of 120 mm Hg** or higher or a diastolic blood pressure of **80 mm Hg or higher indicates hypertension.**

STAGES	SYSTOLIC BP	DYSTOLIC BP
Pre hypertension	120 – 139mm Hg	80 – 89 mm Hg
Hypertension stage I	140- 159 mm Hg	90 – 99 mm Hg
Hypertension stage 2	More or equal to 160 mm Hg	More or equal to 100 mm Hg
Severe	≥ 180	≥ 110

❖ Epidemiology

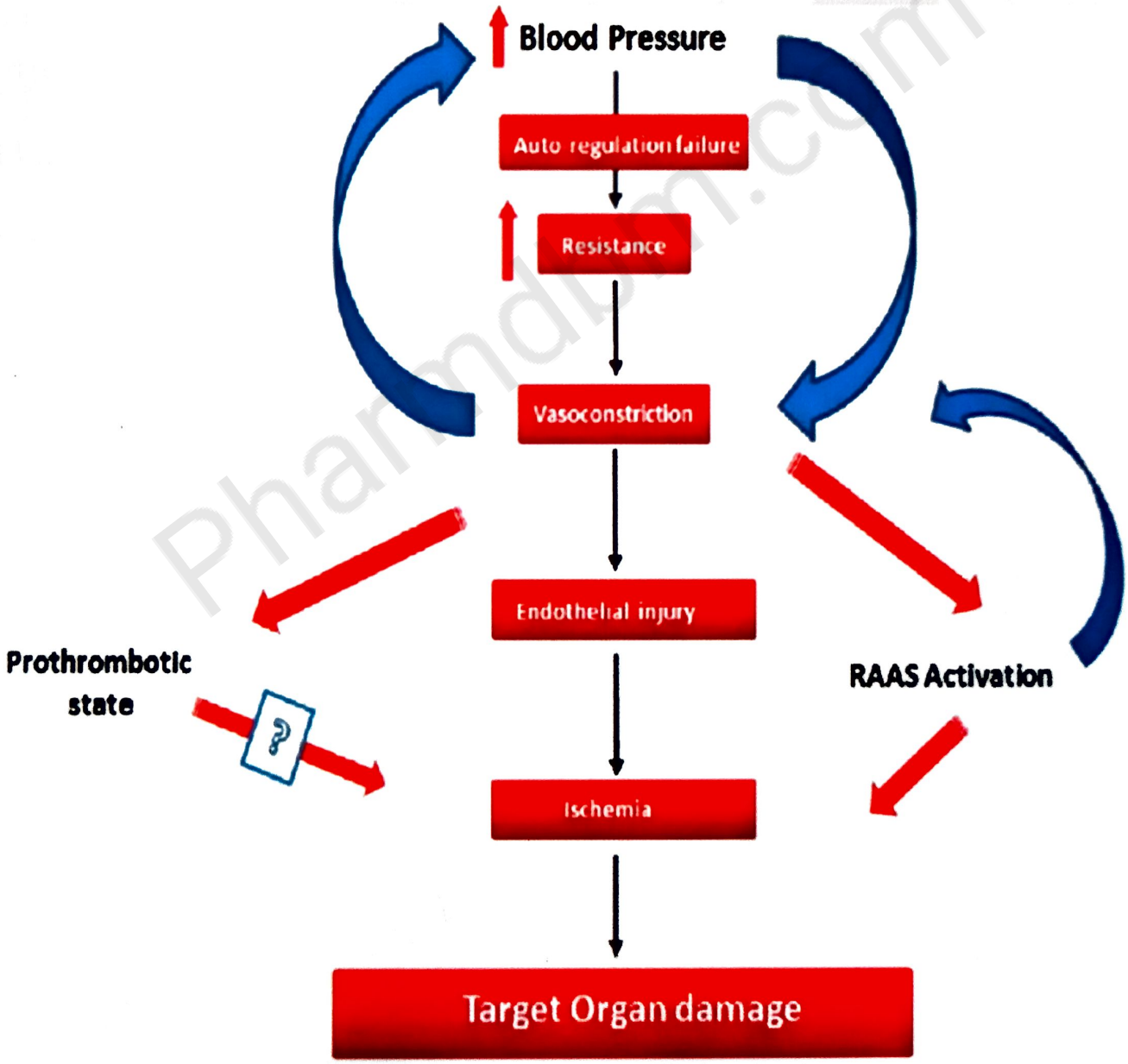
- In India, **23.10% men** and **22.60% women** over 25 years old suffer from hypertension, says the WHO.
- Recent studies show that for every known person with hypertension in India it is estimated that **16% of ischemic heart disease, 21% peripheral vascular disease, 24% of myocardial infarction, 29% of strokes** are attributable of hypertension.

❖ Causes

- Obstructive sleep apnea
- Kidney disease
- Adrenal gland tumors
- Thyroid problems

- Certain medications, such as **birth control pills, cold remedies,** decongestants, **over-the-counter pain relievers** and some prescription drugs
- **Illegal drugs**, such as cocaine and amphetamines.
- Cirrhosis of liver.
- Overweight, salt consumption, smoking and stress
- Endocrine disorder like causing syndrome, **sleep apnea.**
- Certain defects you're **born with (congenital) in blood vessels**

❖ Pathogenesis



✓ **Depends on four mechanisms**

1. **Sympathetic nervous system activities**
2. **Activities of vascular endothelium**
3. **Activities of renal system**
4. **Activities of endocrine system**

1. SYMPATHETIC NERVOUS SYSTEM ACTIVITIES

- When the **blood pressure is decreasing the activation of** sympathetic nervous system will occur.
- The **increased sympathetic nervous system activity increases the heart rate and cardiac contraction.**
- The **increased the heart rate and cardiac contraction produce vasoconstriction** in the peripheral arterioles and promotes the release of renin from kidney.
- The **net effect of sympathetic nervous system activation is to increase the arterial blood pressure** by increasing cardiac output and systemic vascular resistance.

2. ACTIVITIES OF VASCULAR ENDOTHELIUM

- The vascular endothelium is a single cell layer that lines the blood vessel.
- It will produce vasoactive substances and growth factors like nitric acid, endothelin etc.
- These substances are potent vasoconstrictors and causes increases blood pressure level.

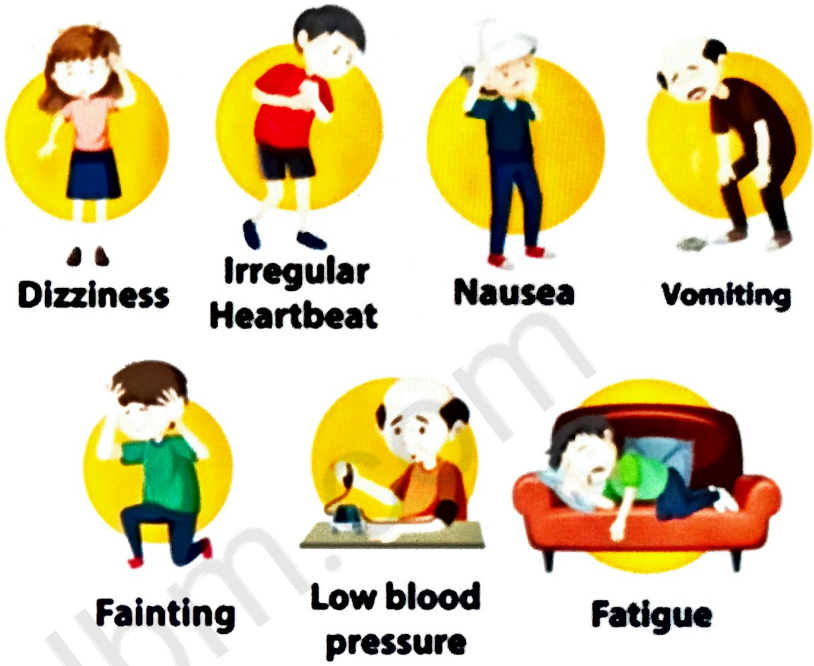
3. ACTIVITIES OF ENDOCRINE SYSTEM

- When the angiotensin-II is stimulated in the adrenal cortex, it will secrete aldosterone.
- The aldosterone will stimulate the kidneys to retain sodium and water thus the blood pressure and cardiac output will get increased.

4. ACTIVITIES OF RENAL SYSTEM

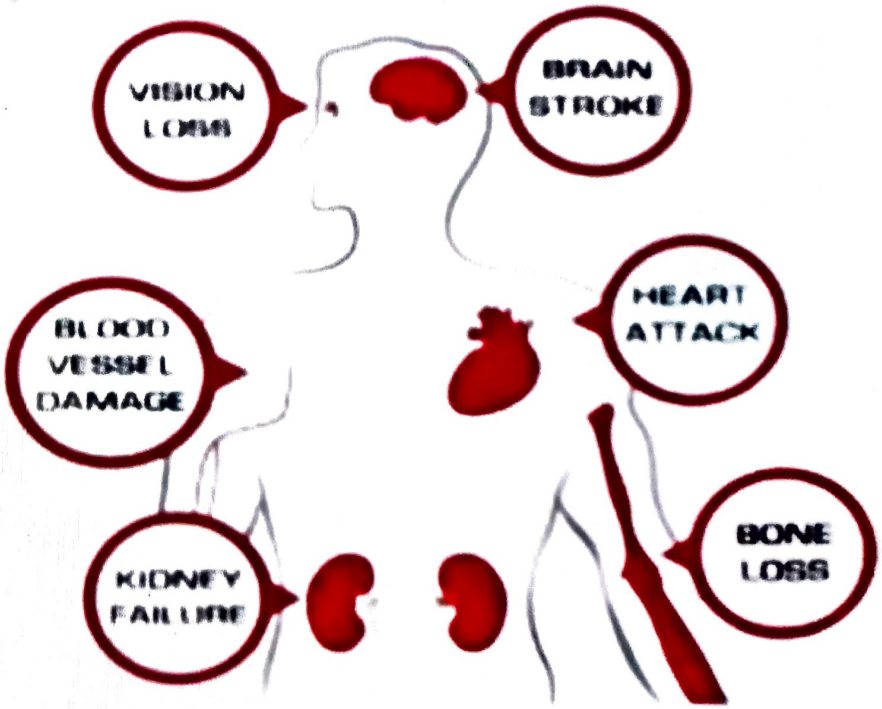
- Aldosterone causes the tubules of the kidneys to increase the reabsorption of sodium and water into the blood.
- This increases the volume of fluid in the body, which also increases blood pressure

❖ Signs and symptoms



- Severe headaches
- Nosebleed
- Fatigue or confusion
- Vision problems
- Chest pain
- Difficulty breathing
- Irregular heartbeat
- Blood in the urine
- Pounding in your chest, neck, or ears

❖ Complications



- Heart attack or stroke.
- Aneurysm.
- Heart failure.
- Kidney problems.
- Eye problems.
- Metabolic syndrome.
- Changes with memory or understanding.
- Dementia.

❖ Management

➢ Non- Pharmacological management

Non-pharmacologic therapy (life style modification)

1. **Weight loss** : In patients who are overweight, weight loss results in reduction in **blood pressure of about 2.5/1.5mmHg/kg.**
2. **DASH Plan** : The DASH diet (Dietary Approaches to Stop Hypertension) was evaluated in a **clinical trial and found to lower blood pressure** significantly **(4.5/2.7mmHg)** compared with a typical US diet.
3. **Dietary salt restriction** : This diet emphasizes **fruit, vegetables, and low-fat dairy produce** in addition to **fish, low-fat poultry and whole grains** while minimizing red meat, confectionary and sweetened drinks. Reduce their salt intake.
4. **Exercise** : **Regular aerobic exercise, at a level appropriate** to the individual subject, at least 3 times a week for at least **30 min derives maximum benefit**. This results in improved physical fitness as well as a reduction in blood pressure.
5. **Limited alcohol intake** : Alcohol intake should be **restricted to two (females) or three (males) units per day.**
6. **Patient education.**
7. **Other non-pharmacologic therapies Vitamin D supplementation, adequate potassium intake, cessation of smoking,** and limiting the use of non-steroidal anti- inflammatory drugs and acetaminophen.

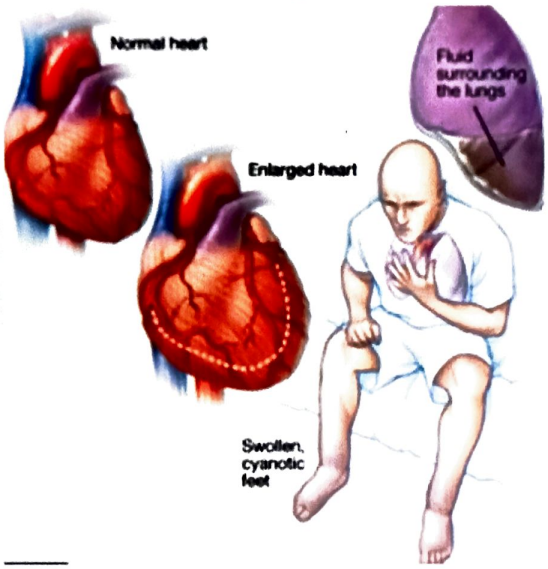
➢ Pharmacological management

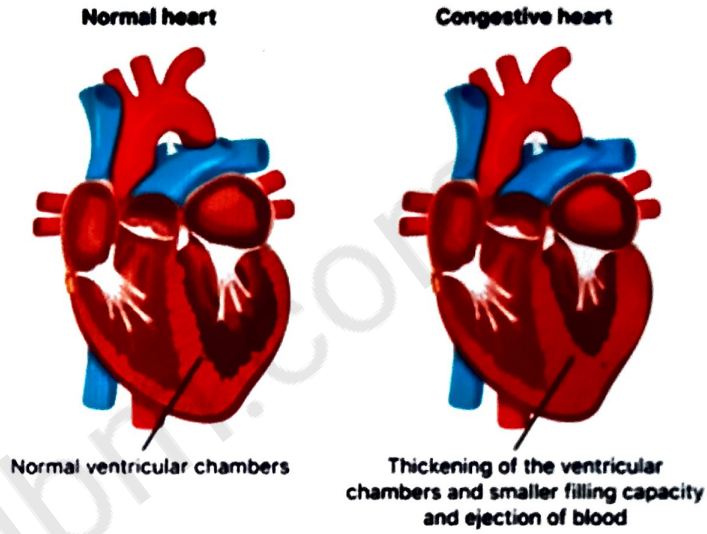
- **DIURETICS** – Chlorothiazide, furosemide, hydrochlorothiazide, indapamide, spironolactone, eplerenone.
- **BETA BLOCKER** - Atnolol, propranolol,
- **ALPHA BLOCKER** – prazosin, terazosin
- **ALPHA + BETA BLOCKER**- labetalol, carvedilol
- **VASODILATORS**- nitroglycerine, sodium nitroprusside, minidoxil
- **ACE INHIBITORS**- captoprolol, ramipril, enalapril, lisinopril
- **CALCIUM CHANEL BLOCKER**- amlodipine, verapamil

❑ CONGESTIVE HEART FALIURE

❖ Introduction

- CHF is a serious disease characterized by a **reduction in the hearts pumping capacity**.
- CHF is also known as "**heart failure**".
- Fluids build up around the heart in CHF, and the **heart begins to pump insufficiently.**





❖ Epidemiology

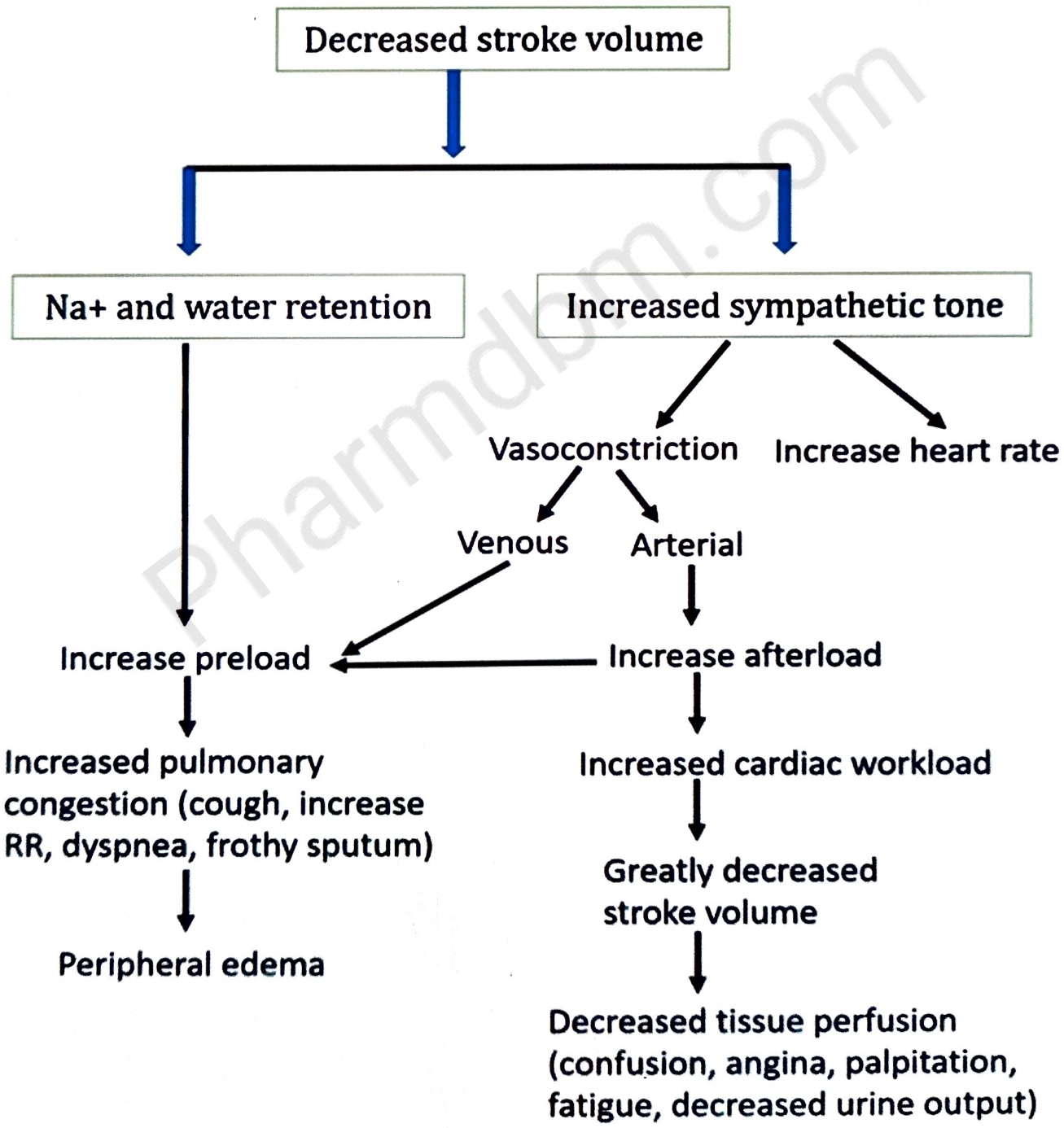
- **Five millions** Americans have CHF
- **550,000 New cases every year**. 800,000 Patients with CHF hospitalized every year. 250,000 die every year
- 50% Patients die with in five years.
- Incidence and associated **morbidity and mortality** is expected to increase in future

❖ Causes

- Ischaemic heart disease 62%
- Cigarette smoking 16%
- Hypertension (high blood pressure) 10%
- Obesity 8%
- Diabetes 3%
- Valvular heart disease 2% (much higher in older populations)

- **Viral myocarditis** (an infection of the heart muscle) Infiltrations of the muscle such as amyloidosis
- HIV cardiomyopathy (caused by human immunodeficiency virus)
- Connective tissue diseases such **as systemic lupus erythematosus**
- **Abuse of drugs such as alcohol and cocaine** Pharmaceutical drugs such as chemotherapeutic agents
- Arrhythmias

❖ Pathogenesis



❖ Signs and symptoms

- Shortness of breath.
- Feeling tired (fatigue) and having leg weakness when you're active.
- Swelling in your ankles, legs and abdomen.
- Weight gain, Chest pain
- Dyspnea
- Swelling in abdomen (ascites)
- Need to urinate while resting at night.
- Rapid or irregular heartbeats (palpitations).
- A dry, hacking cough.
- A full (bloated) or hard stomach, loss of appetite or upset stomach
- Increased frequency of wheezing and pink- frothy sputum
- Exercise ability is hampered

❖ Complications

Pleural effusion, dysrhythmias, left ventricular thrombus, impaired liver function, acute pulmonary edema, headache, vomiting, allergic colour vision (green & yellow) & diarrhoea.

❖ Management

Non- Pharmacological management

- Patients will be taught how to regulate their own symptoms using a procedure and methodology.
- Patients must have advanced heart failure action plan along with details of emergency contact of health professionals etc.
- Patient must have an idea about benefits of their regular medications, devices and side effects.
- Examples include diuretics dose must be adjusted in an episode of vomiting or diarrhea.
- The lifestyle pattern must be systematic
  - ✓ No smoke
  - ✓ Regular exercise

- ✓ **Exercise training** improves exercise tolerance, life quality and **reduces hospitalizations**
- ✓ Healthy diet must be preferred with **low in salt and weight must be maintained**
- ✓ **Alcohol intake should be minimized**
- ✓ Dietary restrictions such as fluid restriction
- ✓ Excessive fluid intake must be avoided
- ✓ Fluid intake must be **adjusted especially in hot weather**

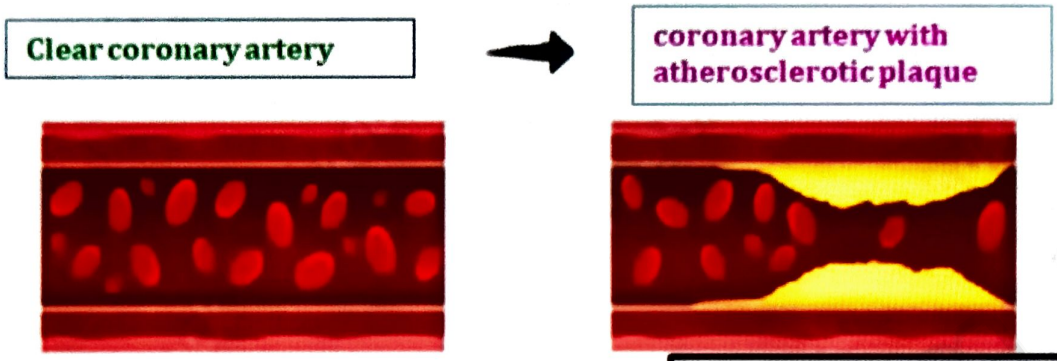
Pharmacological management

- **Angiotensin converting enzyme inhibitor** – Captopril, Enalapril, Benazepril, Ramipril, lisinopril etc.
- **Beta adrenergic blocker** – Metoprolol, Bisoprolol, Nebivolol, Carvedilol
- **Angiotensin receptor blocker** - losartan, Candesartan, Telmisartan, Valsartan, Irbesartan, Olmesartan etc.
- **Diuretics** – furosemide, Hydrochlorothiazide, Bumetanide, Torsemide, Spironolactone, metolazone etc.
- **Vasodilators** – Sodium nitroprusside, Glyceryl trinitrate, Isosorbide dinitrate etc.
- **Cardiac glycoside** – Digoxin, Digitoxin, Ouabain etc.

❑ ISCHEMIC HEART DISEASES (ANGINA PECTORIS)

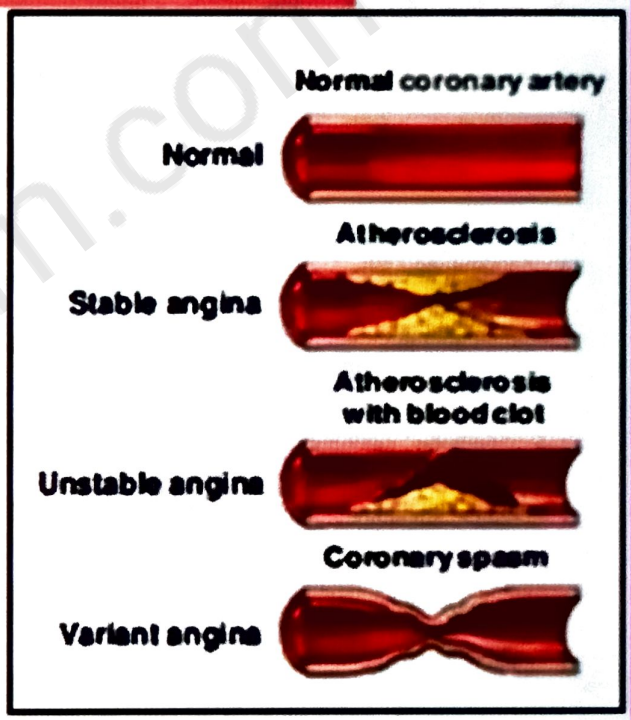
❖ Introduction

- Angina pectoris is a symptom which arises when **there is an imbalance between the demand for oxygen** by, and its supply to the myocardium.



❖ Types of angina pectoris

1. **Stable angina**
2. **Unstable angina**
3. **Prinz metal angina (variant)**



1. Stable angina

- Pain occurs when the **heart works harder** during physical exercise.
- Pain is relieved by **proper rest or medication.**
- Chest pain may spread to arm, back and other areas.
- Instable angina, a coronary artery has been severely narrowed due to the **build up of plaques.**
- **Other causes are:** Aortic stenosis, Coronary, vasospasm, Aortic insufficiency

✓ Risk factors

- Overweight, High cholesterol or high blood pressure, Diabetes, Smoking

✓ Symptoms.

- Shortness of breath, Nausea, Fatigue, Dizziness & Anxiety

2. Unstable angina

- It is also called **Crescendo angina.**
- The pain of unstable angina occurs during **periods of rest, while sleeping and suddenly**
- Unstable angina can occur without physical exertion and is **not relieved by rest and medicine.**
- Coronary heart disease caused by a **build up of plaques** along the walls of arteries one of the principal cause of unstable angina. Atherosclerosis in coronary artery may produce **vasospasm, thrombosis**

✓ Risk factors

- High blood pressure
- High low-density lipoprotein (IDI) and low-high density lipoprotein (HDL) (Cholesterol)
- Using any form of tobacco

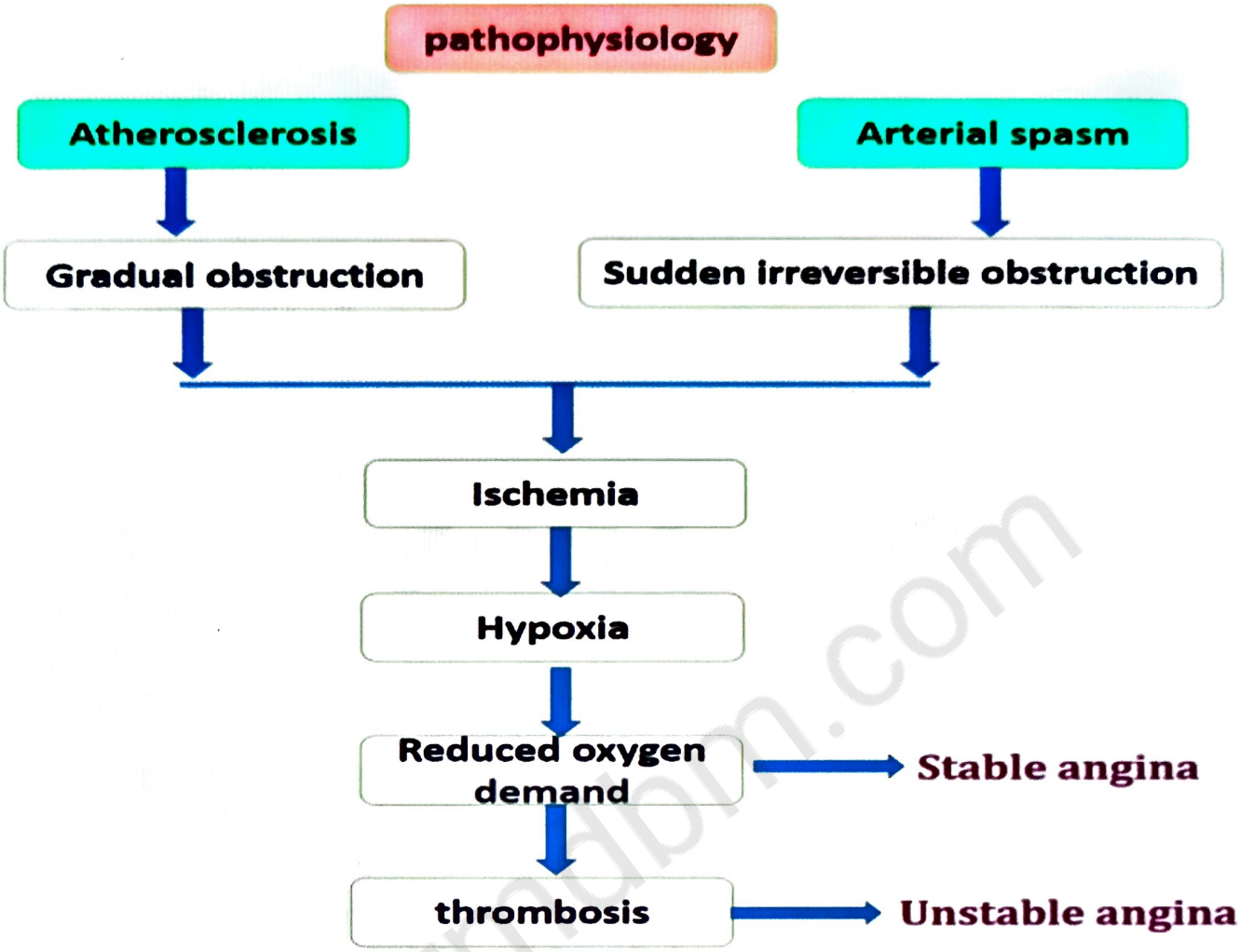
✓ Symptoms

- The main symptom of angina is chest pain, but this sensation can vary on the person.
- Squeezing, Sweating, Shortness of breath & Anxiety

3. Prinzmetal (variant) angina

- The pain of variant angina occurs at **rest during the night and early morning hours.**
- It is a rare type of angina caused by a **spasm in a coronary artery**.
- This spasm causes the walls of the **artery to tighten**. In turn, this narrows the artery causing the blood flow to the heart to slow or stop.
- This spasm makes the diameter of the artery smaller, **restricting the supply of blood and oxygen** to the heart.

❖ Pathogenesis



❖ Management

➢ **Non- Pharmacological management**

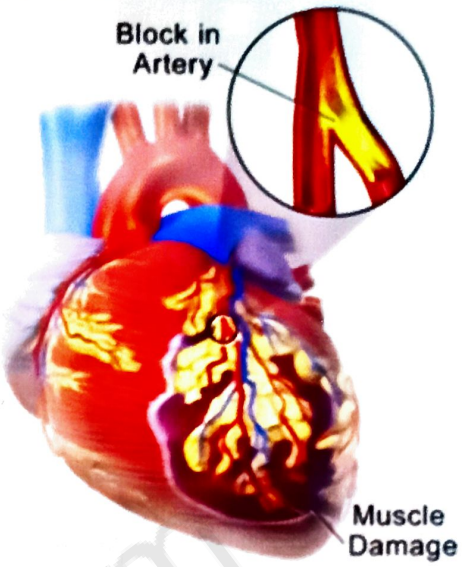
- Limit alcohol
- No high saturated fat/high cholesterol foods
- Maintain normal blood lipid levels
- Maintain **blood pressure within normal range**
- Regular exercise
- Optimal weight, No tobacco
- Maintain blood **glucose within normal range**

Pharmacological management

- **NITRATES** – nitroglycerine, Isosorbide dinitrate, amyl nitrate.
- **BETA BLOCKER** – propranolol, metoprolol, atenolol.
- **POTASSIUM CHANNEL BLOCKER** – Nicorandil
- **CALCIUM CHANNEL BLOCKER** – verapamil, diltiazem, amlodipine
- **ASPIRIN**
- **STANINS**
- **OTHER DRUGS** – trimetazidine, ranolazine, ivabradine, dipyridamole.

❑ ISCHEMIC HEART DISEASES (MYOCARDIAL INFRACTION)

❖ Introduction



- Myocardial infraction is defined as a diseased condition which is **caused by reduced blood flow in a coronary artery** due to **atherosclerosis and occlusion of an artery by an embolus or thrombus.**
- MI is the **irreversible damage of myocardial tissue** caused by prolonged ischemia & hypoxia.

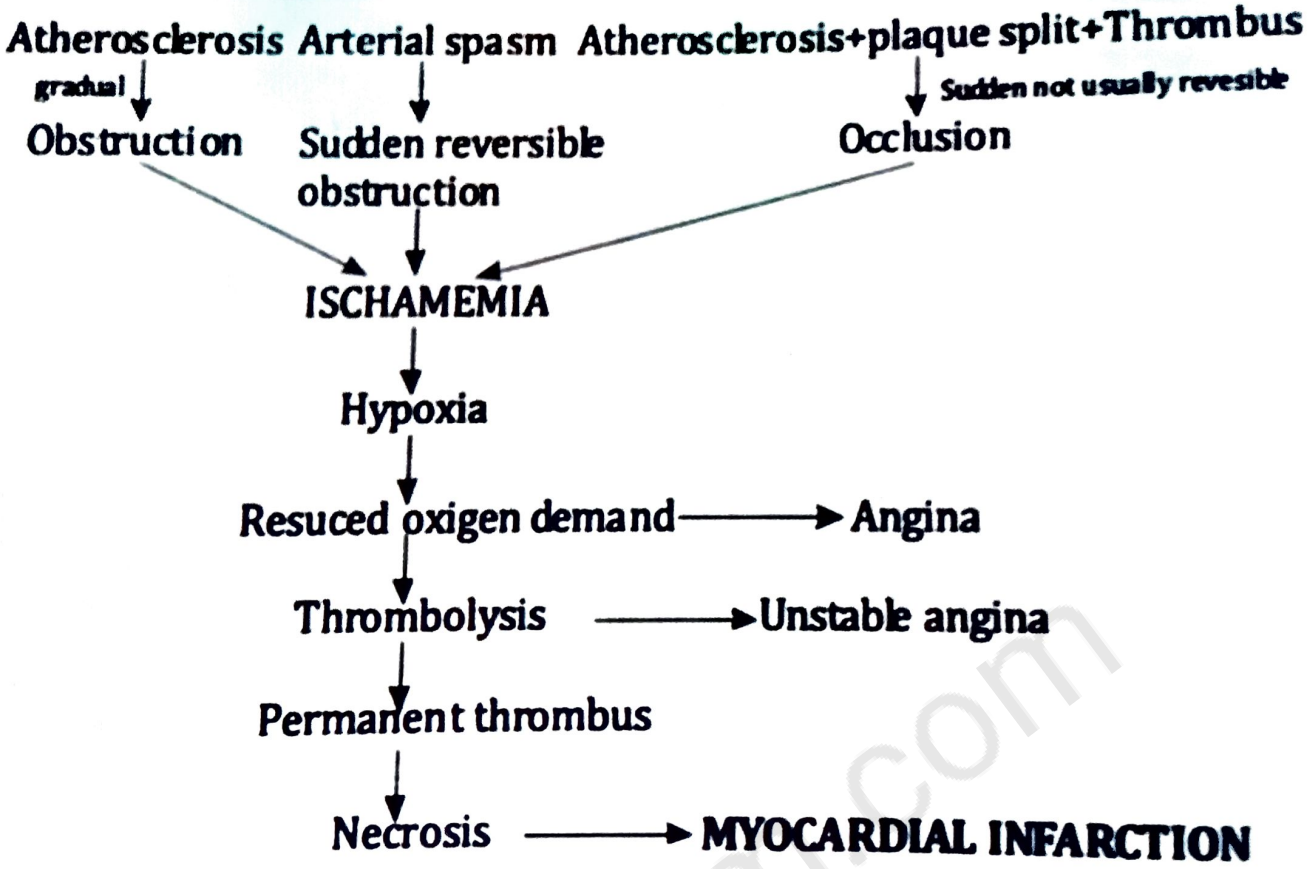
❖ Epidemiology

- Myocardial infarction (MI) **under the age of 40 years** accounts for around **3%-10% of cases** of coronary artery disease.
- Incidence of MI is approximately 8 times lower in patients 18 to 45 years than in older patients
- Approximately **1 in 6 people in united states died** of acute myocardial infraction.

❖ Causes

- The primary cause for MI is coronary artery occlusion.
- Tobacco smoking
- Hypertension
- Drug abuse
- Obesity
- Stress
- Alcohol

❖ Pathogenesis



❖ Signs and symptoms

- Chest pain / chest discomfort
- Dyspnea
- Fatigue
- Other symptoms include: **Increased sweating, Weakness, Nausea, Vomiting, Light-headedness, Palpitation**
- Anxiety, sleeplessness, hypertension or hypotension, arrhythmia.
- Chest pain is less in women, their common symptoms are **weakness, fatigue & dyspnea.**

❖ Management

Non- Pharmacological management

- **Avoiding tobacco smoking**
- **Eating a well-balanced diet that is low in saturated fat** and refined carbohydrates

- Undertaking **regular physical activity** - maintaining appropriate body weight, and moderating
- Use **plant sterols and plant stanols in enriched foods** such as **yoghurt, milk and margarine**
- Do not add salt to cooking or meals
- A balanced diet, which is **high in vegetables and legumes**, low in meat, low in dairy except yoghurt and cheese, includes daily consumption of nuts, and has most of its fat from olive oil, is the most proven dietary intervention, and these should be recommended.

Pharmacological management

1. **Oxygen:** Used to maintain blood oxygenation as well as tissue and cardiac O_2 levels.
2. **Aspirin:** If administered when myocardial infarction is detected, the antiplatelet properties of aspirin may reduce the overall size of the infarction.
3. **Thrombolytic therapy** :If employed in the first 1 to 4 hours following the onset of a myocardial infarction, these drugs may dissolve clots in coronary blood vessels and re-establish blood flow.
4. **Vasodilator drugs**: Intravenous nitroglycerin can increase blood flow to the myocardium and reduce myocardial work.
5. **ß -Blockers:** Blunt the effect of catecholamine release on the myocardium, reduce heart rate and myocardial work.
6. **Pain management**: Sublingual nitroglycerin, morphine if necessary
7. **Antiarrhythmic drugs:** To treat and prevent a number of potentially life-threatening arrhythmias that might arise following a myocardial infarction.
8. **ACE inhibitors**: the negative effects of vasoconstriction and salt and water retention on the myocardium.

❑ ISCHEMIC HEART DISEASES (ATHEROSCLEROSIS & ATERIOSCLEROSIS)

❖ Introduction

- Atherosclerosis is the **buildup of fats, cholesterol** and other substances in and on the artery walls. This buildup is **called plaque.**
- The plaque can cause arteries to narrow, blocking blood flow.
- It is responsible for **myocardial infarction.** The atherosclerosis is the most common form of arteriosclerosis.
- Arteriosclerosis can occur because of fatty deposit on the inner lining of arteries (atherosclerosis). **Changes in lipid, cholesterol and phospholipids metabolism** within the **tunica intimae** also contribute to arteriosclerosis.

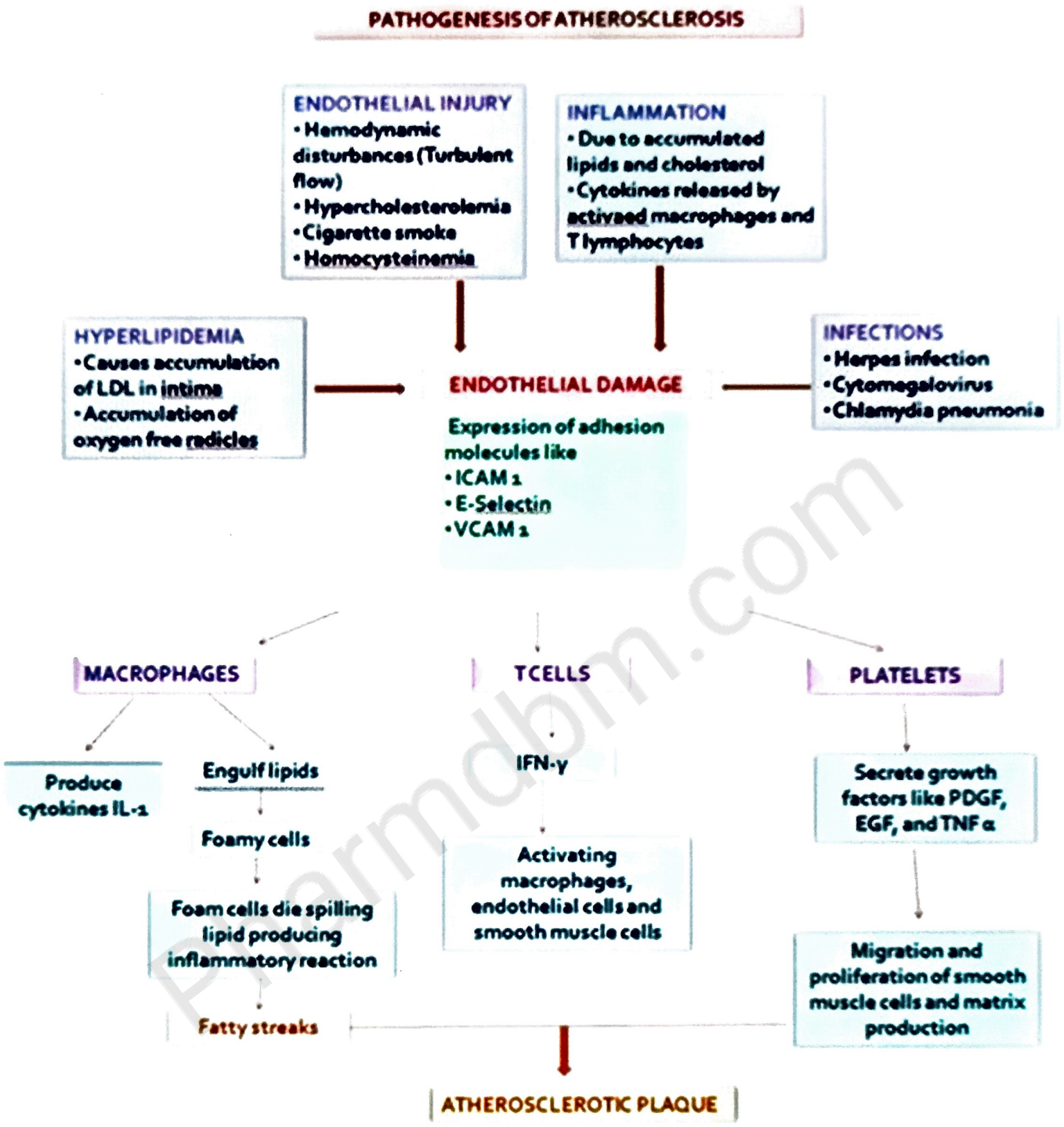
❖ Epidemiology

- Epidemiology of atherosclerosis is studied in terms of ischemic heart disease. Atherosclerosis is most common in western countries and developed worlds.
- It is leading cause of mortality worldwide. Atherosclerosis is more prevalent in South America, Africa and Asia and more prevalent in United States and Japan.

❖ Causes

- **High blood pressure.**
- High cholesterol.
- **High triglycerides, a type of fat (lipid) in the blood.**
- Smoking or chewing tobacco.
- Diabetes.
- Insulin resistance.
- **Obesity.**
- Inflammation from an unknown cause or from diseases such as arthritis, lupus, psoriasis or inflammatory bowel disease.

❖ Pathogenesis



❖ Signs and symptoms

- **Chest pain** or angina
- Pain in your leg, arm, and anywhere else that has a blocked artery
- **Shortness of breath and fatigue**

- **Confusion**, which occurs if the blockage affects circulation to your brain
- **Muscle weakness** in your legs from lack of circulation
- Weak pulse
- Rough and turbulent blood flow sound in narrow artery

❖ Complications

- **Calcification Plaque hemorrhage** and rupture
- Plaque erosion/ulceration
- **Thrombosis**
- Embolization of atheromatous material (atheroemboli) Aneurysm **formation and rupture**

❖ Management

➢ Non- Pharmacological management

- Eating a healthy diet that's low in saturated fat and cholesterol.
- Avoiding fatty foods.
- **Adding fish to your diet twice per week.**
- Exercising for 30 to 60 minutes per day, six days per week.

- **Quitting smoking** if you're a smoker.
- Losing weight if you're overweight or obesity.
- Treating conditions associated with atherosclerosis, such as hypertension, high cholesterol, and diabetes.

Pharmacological management

- **Cholesterol-lowering medications** (lipid lowering drugs), including statins and fibric acid derivatives.
- **Anti-platelet drugs and anticoagulants**, such as aspirin, to prevent blood from clotting and clogging your arteries.
- **Beta blockers or calcium channel blockers** to lower blood pressure.
- **Diuretics**, or water pills, to help to lower blood pressure.
- **Angiotensin converting enzyme (ACE) inhibitors**, which prevents narrowing of arteries.

UNIT-II

RESPIRATORY SYSTEM

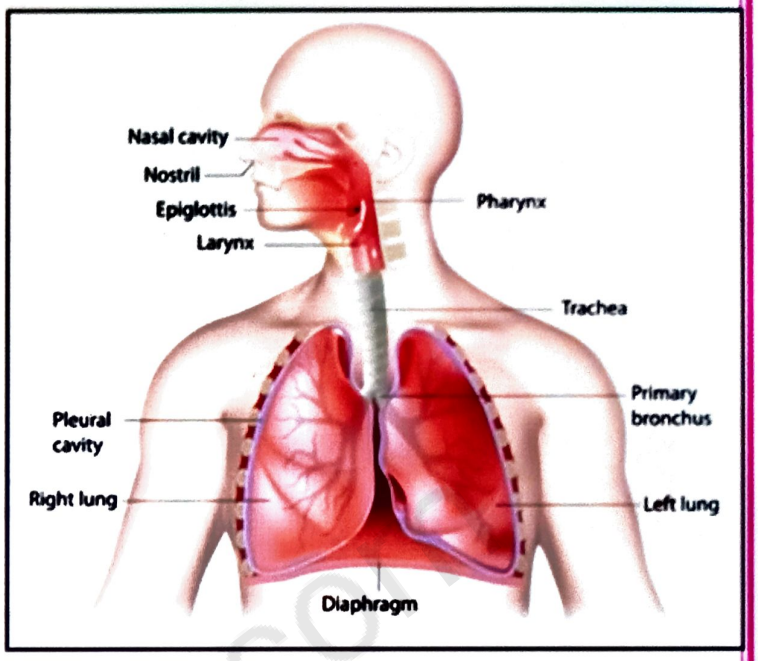
Points to be covered in this topic

- ❑ ASTHMA
- ❑ CHRONIC OBSTRUCTIVE PULMONARY DISEASE

❑ RESPIRATORY SYSTEM

❖ Introduction

Respiration is the **physiological catabolic process** in which gaseous exchange occurs in lungs. Thus, respiration is a physiochemical process. On the exterior at which **exchange of gases** occur is called respiratory surface, and the compounds has oxidized during respiration is called respiratory substrate.

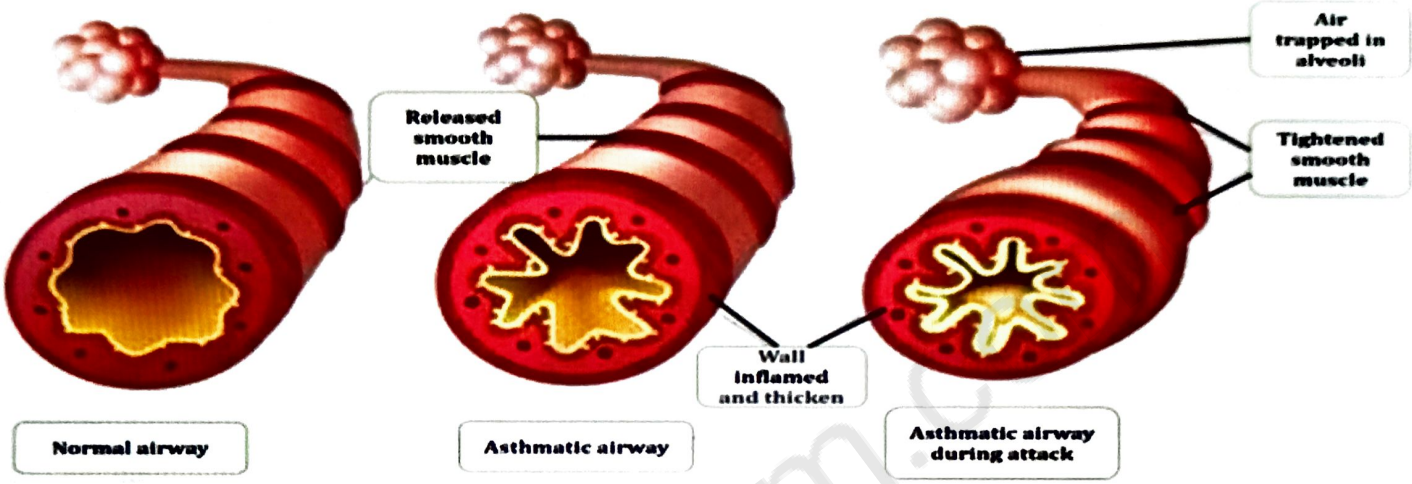


- The automatic breathing is subconsciously controlled by **respiratory center present at the base of the brain.**
- The normal breathing rate is **about 15 per minute**, which can be increased or decreased as per the levels of oxygen and carbon dioxide in blood.
- The Defence mechanism of the respiratory system is **multistage** and plays an important role to free the inhaled air from **dust, microbes, smoke or any other foreign material.**
- The particles of size **greater than 10 µm** in diameter are usually removed by **nostrils and nasopharynx** while particles of diameter **lesser than 5 µm** are eliminated by alveolar clearance.
- In addition, **cough reflex, mucociliary clearance** from terminal bronchioles to larynx (using mucus and cilia action) are also useful.
- About 20% of inhaled particles **between 0.1-0.5 µm in size** reach the alveoli where most of them are engulfed by alveolar macrophages.

❑ ASTHMA

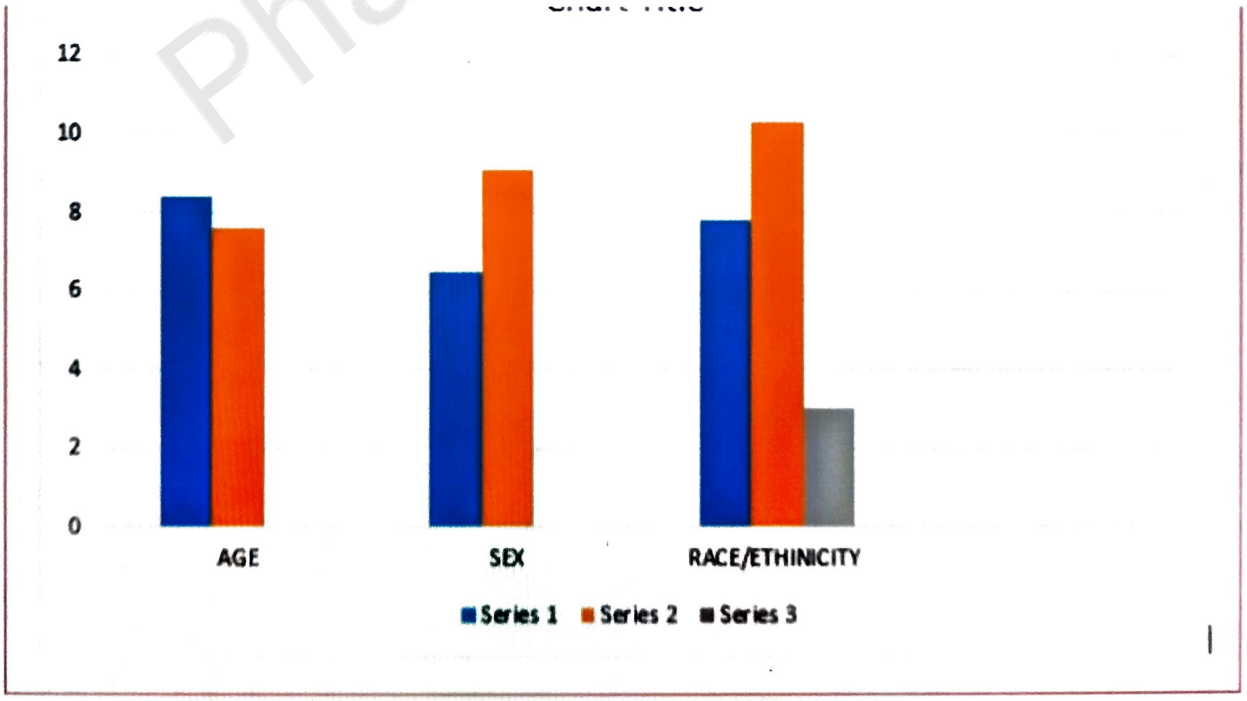
❖ Introduction

Asthma is a chronic inflammatory disease of airways. The inflammation is characterized by increase responsiveness of airways which leads to breathlessness, chest tightness, cough. (Particularly at night or early in morning).



❖ Epidemiology

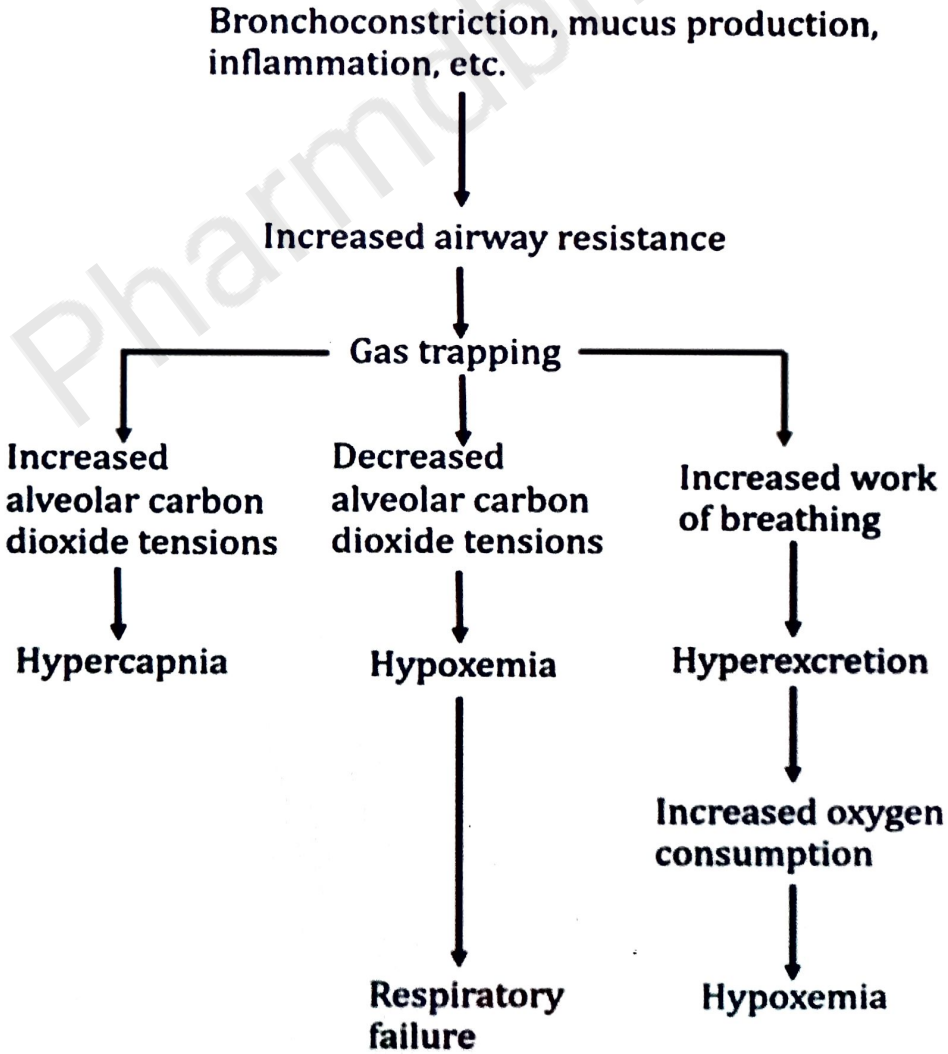
- Asthma is a chronic respiratory disease involving inflammation and narrowing of the airways that is one of the major non-communicable disease worldwide



❖ Causes

- Air pollution
- Tobacco smoke
- Exercise
- Cold air or changes in the weather, such as temperature or humidity
- Gastroesophageal reflux disease (GERD)
- Strong emotions such as anxiety, laughter, sadness, or stress
- Medications such as aspirin
- Food preservatives called sulfites, found in things like shrimp, pickles, beer and wine, dried fruits, and bottled lemon and lime juices
- Infections like sinusitis, colds, and the flu
- Allergens such as pollens, mold, pet dander, and dust mites Irritants like strong odors from perfumes or cleaning solutions

❖ Pathogenesis



❖ Signs and symptoms

- Shortness of breath
- **Chest tightness or pain**
- Wheezing when exhaling, which is a common sign of asthma in children
- Trouble sleeping caused by **shortness of breath, coughing** or wheezing
- Coughing or **wheezing attacks** that are worsened by a respiratory virus, such as a cold or the flu.
- Coughing that won't stop, Very rapid breathing
- Chest pain or pressure
- **Tightened neck and chest muscles**, called retractions
- Difficulty talking
- **Feelings of anxiety or panic**
- Pale, sweaty face
- Blue lips or fingernails

❖ Management

➢ Non- Pharmacological management

- Avoidance of known allergenic triggers can improve symptoms and reduce medication use.
- Environmental triggers should be avoided in sensitive patients.
- Smoker should be encouraged to stop.
- Patients with acute severe asthma should receive supplemental oxygen therapy to maintain arterial oxygen saturation above 90%.
- Avoid tobacco smoke
- Identify irritants in the workplace
- Control of extrinsic factors which cause allergy like pets, molds and certain food stuffs, particularly in childhood.
- **Avoid beta – blockers, aspirin and NSAIDs.**
- Avoid vehicle emission.

Pharmacological management

1. **Bronchodilators**

   - **β sympathomimetic drugs** – salbutamol, Terbutaline, Bambuterol, Salmeterol, Formoterol, Ephedrine etc.
   - **Methyl xanthine** - Theophylline, Aminophylline, Choline theophylline, Hydroxyethyl theophylline, Doxophylline etc.
   - **Anticholinergics** – Ipratropium bromide, Tiotropium bromide etc.

2. **Leukotrienes** – Montelukast, Zafirlukast
3. **Mast cell stabilizers** – Sodium cromoglycate, Ketotifen
4. **Corticosteroids**

   - **Systemic** – Hydrocortisone, Prednisolone, Other glucocorticoids
   - **Inhalational** – Beclomethasone, Budesonide, Fluticasone, Flunisolide etc.

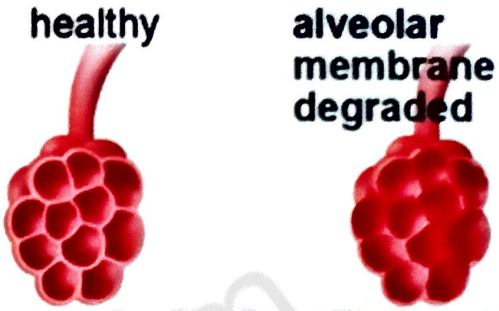
❑ CHRONIC OBSTRUCTIVE PULMONARY DISEASE

❖ Introduction

Chronic obstructive pulmonary disease, or COPD, refers to a group of diseases that cause **airflow blockage** and **breathing-related problems.**

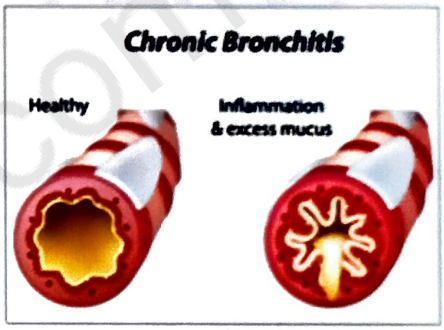
- It includes emphysema and chronic bronchitis, COPD.

Emphysema:



Emphysema is a lung condition that **causes shortness of breath**. The **elasticity of lung tissue is reduced** in emphysema.

Chronic bronchitis:



It is defined as a **productive cough** that lasts at least three months, **with recurring bouts occurring for** at least two consecutive years.

❖ Epidemiology

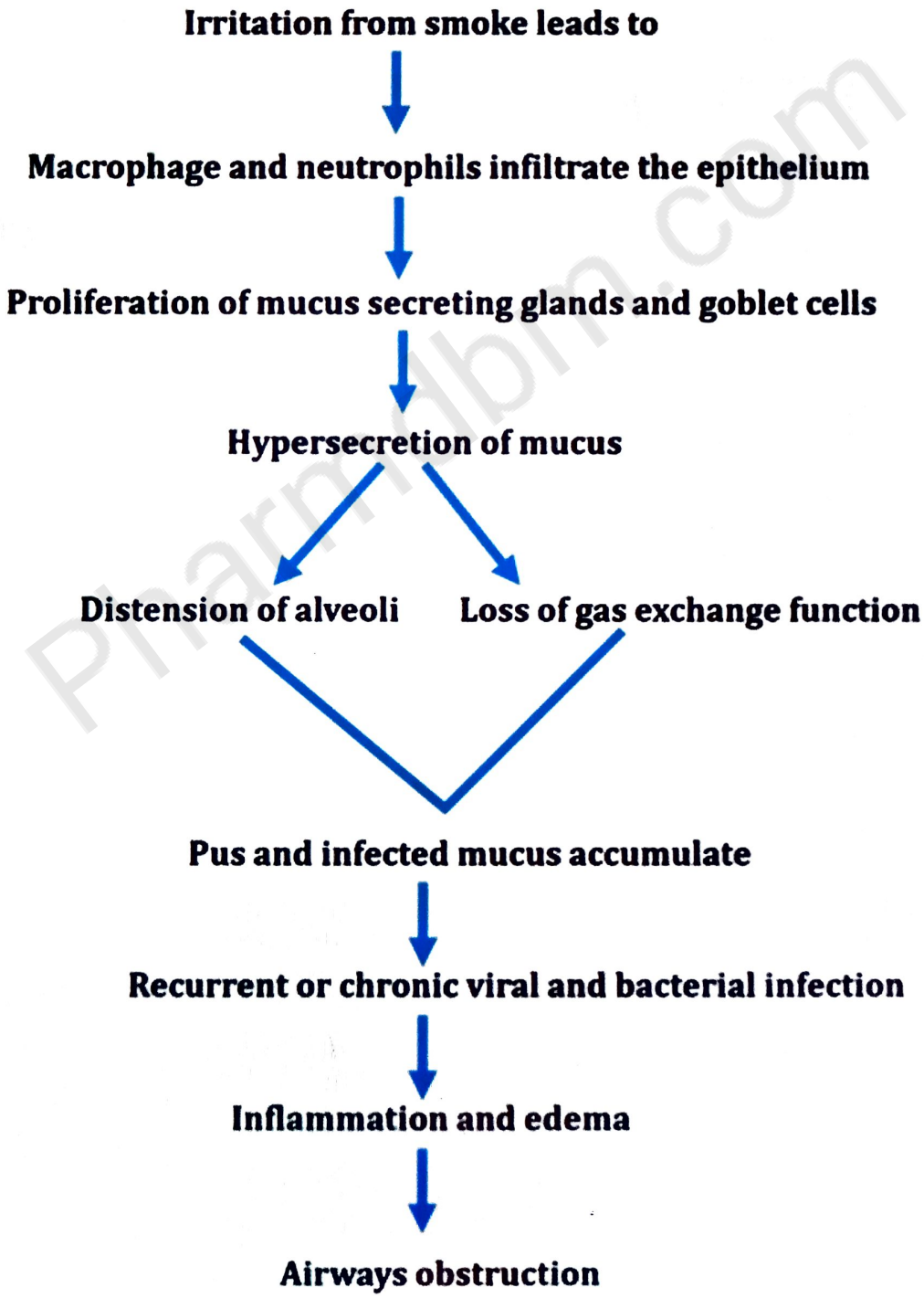
- Depression or other mental or emotional conditions.
- If activity limitations such as difficulty walking or **climbing stairs associated with anyone.**
- Have other chronic diseases such as **arthritis, congestive heart failure, diabetes coronary heart disease, stroke, or asthma**
- Need special equipment such as **portable oxygen tanks**

❖ Causes

- Cadmium dust and fumes.
- Grain and flour dust.
- Silica dust.
- Welding fumes.
- Isocyanates.
- Coal dust.

- **Cigrate smoking**
- Natural ageing process f lungs
- Occupational chemical fumes
- Dust
- Oxidative stress
- Inflammation
- Protease/ antiprotease imbalance

❖ Pathogenesis



❖ Signs and symptoms

- Breathing difficulties,
- Cough, mucus (sputum) production
- Wheezing sound
- Exposure to irritating gases or particulate matter

❖ Management

➢ Non- Pharmacological management

- Improves exercise capacity.
- Reduces the perceived intensity of breathlessness.
- Can improve health-related quality of life.
- Reduces the number of hospitalizations and days in the hospital.
- Reduces anxiety and depression associated with COPD.
- The lifestyle pattern must be systematic
  - ✓ No smoke
  - ✓ Regular exercise

➢ Pharmacological management

1. **Short-acting bronchodilators:-** Albuterol, Levalbuterol, Ipratropium, Albuterol etc.
2. **Corticosteroids:** – Fluticasone, Budesonide, Prednisolone etc.
3. **Long-acting bronchodilators–** Aclidinium, AR formoterol, Formoterol, Indacaterol etc.

UNIT-II

RENAL SYSTEM

Points to be covered in this topic

- ❑ RENAL SYSTEM
- ❑ ACUTE RENAL FALIURE
- ❑ CHRONIC RENAL FALIURE

❑ RENAL SYSTEM

❖ Introduction

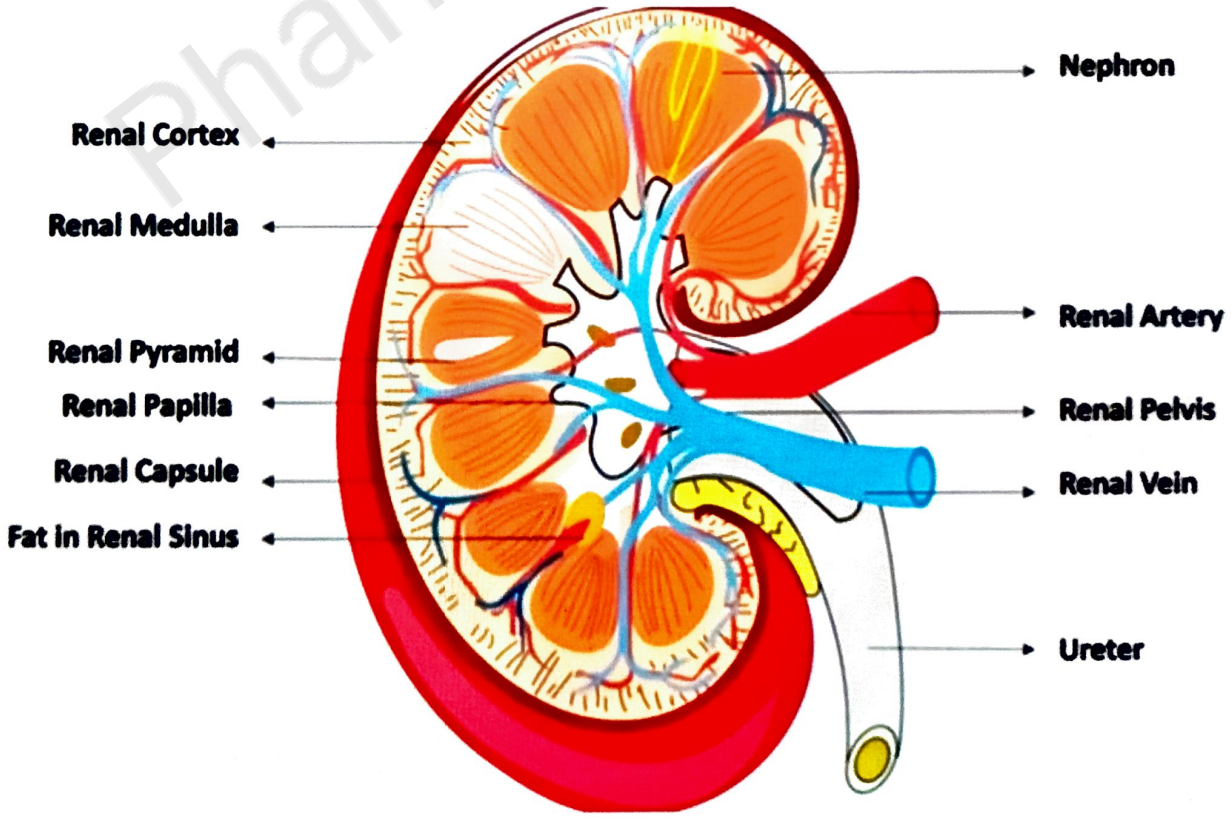
- Renal failure is defined as a significant **loss of renal function in both kidneys to the point** where less than 10 to 20% of normal GFR remains.

- Renal failure may occur as an acute and rapidly progressing process or may present as a chronic form in which there is a progressive loss of renal function over a number of years.

- Renal failure is that when the kidneys **cannot remove the body's metabolic wastes** or perform their regulatory functions.

- The substances normally eliminated in the **urine accumulate** in the body fluids as a result of impaired renal excretion, leading to a **disruption in endocrine and metabolic functions** as well as fluid, electrolyte, and acid-base disturbances.

- It is a systemic disease and is a final common pathway of many different kidney and urinary tract diseases.



❑ ACUTE RENAL FALIURE

❖ Introduction

ACUTE RENAL FAILURE

- Sudden decrease in renal function.
- Acute Renal Failure classified as :
  - ➢ Pre-renal failure
  - ➢ Intra-renal failure
  - ➢ Post-renal failure

➢ **PRE-RENAL FAILURE** – Results from impaired or reduced blood flow to the kidney – **Possible causes** : shock, hypotension, anaphylaxis, ischemic formation

➢ **INTRA-RENAL FAILURE** – Results from acute damage to renal structures – **Possible causes** : acute glomerulonephritis, pyelonephritis. May also result from acute tubular necrosis (ATN), damage of kidney structure from exposure to toxins, solvents, drugs and heavy metals; ATN is the most common cause of acute renal failure

➢ **POST-RENAL FAILURE** – Results from conditions block of urine outflow – **Possible causes** : obstruction of urine outflow by calculi, tumors, prostatic hypertrophy

❖ Epidemiology

- Kidney diseases are an internationally recognized public health problem affecting 5-10% of the world population.
- In the India and United States, there is a rising incidence and prevalence of kidney failure, with poor outcomes and high cost (see Epidemiology). In India, it has been recently estimated that the age-adjusted incidence rate of ESRD to be 229 per million population (pmp), and >100,000 new patients enter renal replacement programs

❖ Causes

1. Prerenal causes

- Organic vascular obstruction such as polyarteritis nodosa, malignant hypertension, hemolytic uremic syndrome (HUS), bilateral renal artery obstruction by thrombosis, embolism or compression.
- DIC with renal cortical necrosis
- Shock

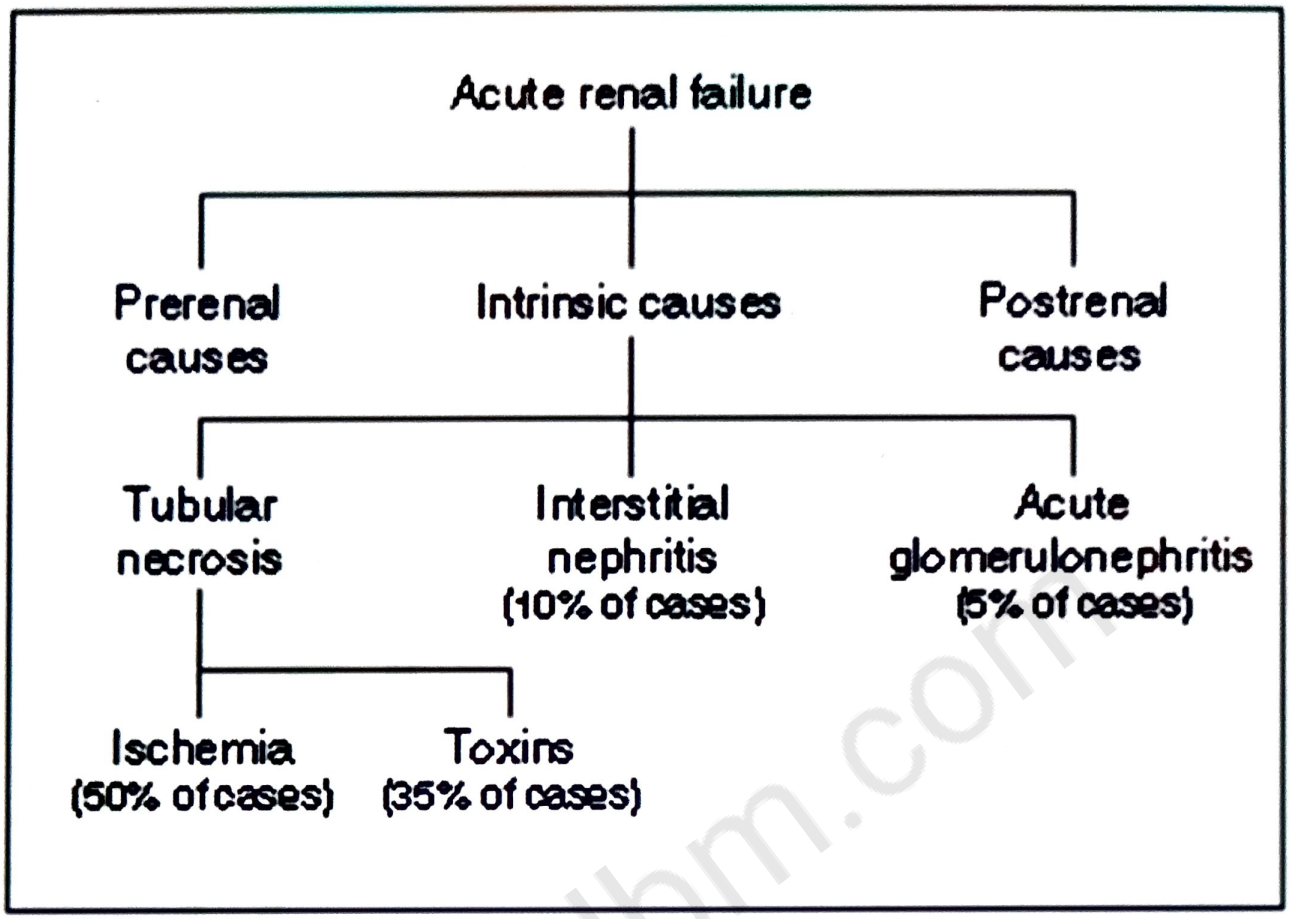
2. Renal causes

- Acute tubular necrosis
- Severe glomerular disease e.g. RPGN
- Acute tubulointerstitial nephritis e.g. drug induced
- Massive pyelonephritis e.g. papillary necrosis

3. Post renal causes

- Urinary tract obstruction or obstructive uropathy by tumors, blood clots or BEP.
- Disorders that cause clotting within the kidney blood vessels
- Infections that directly injure the kidney, such as acute pyelonephritis or septicemia.
- Urinary tract blockage.
- Illicit drugs such as cocaine and heroine.
- Medicines including non-steroidal anti-inflammatory drugs (NSAIDs), antibiotics and antihypertensive, intravenous contrast (dye), some cancer and HIV drugs.

❖ Pathogenesis



❖ Signs and symptoms

- Decreased kidney function (electrolyte imbalance)
- Obstruction in the urinary tract
- **Blood in urine Reduced urine output**
- Dehydration
- Detectable abnormal mass
- **Pale skin**
- Poor appetite.

❖ Complications

- Hyperkalemia
- Metabolic acidosis
- Hypocalcemia
- Hyperphosphatemia

- Infections
- Uremic gastro intestinal erosions
- Pleural effusion
- Heart failure
- Bleeding problems

❖ Management

➢ Non- Pharmacological management

- Oxygen therapy
- Ventilation
- **Urinary catheterization**
- Central line procedure
- Water restriction -less than 1L per day
- **Sodium restriction**- less than 2-3g/ day
- Restriction of potassium rich diet
- Dialysis Renal transplantation

➢ Pharmacological management

DRUG	CATEGORY	MODE OF ACTION
Furosemide	Loop diuretic	Inhibit reabsorption of sodium and water at proximal and distal convoluted tubule
Metalazone	Thiazide diuretic	Inhibit reabsorption of sodium and water at distal convoluted tubule
Calcium Gluconate (10%)	Antidote for Hyperkalemia	Stabilizes myocardial instability due to high potassium levels
Glucose (50%)	Glucose elevating agent	Stimulate intracellular potassium uptake
Sodium bicarbonate	Alkalinizing agent	Reacts with excess H^+ ions and decreases acidity
Calcium carbonate	Mineral supplement	Balances negative calcium ion levels in the blood
Vitamin D	Vitamin supplement	Stimulate calcium and phosphorus absorption from intestine, stimulate calcium secretion from bone in to blood

❑ CHRONIC RENAL FALIURE

❖ Introduction

CHRONIC RENAL FAILURE

- Progressive and irreversible loss of renal function over time; based on a gradual decline in the GFR and creatinine clearance ,frequently leading to end stage renal disease (ESRD).
- End stage renal disease : A clinical state or condition in which there has been an irreversible loss of renal function, and these patients usually need to accept renal replacement therapy in order to avoid life-threatening uremia.

STAGES OF CRF

1) **Reduced Renal reserve** – Blood urea nitrogen is high or normal (BUN) - 40 to 75 % loss of nephron function.
2) **Renal Insufficiency** - 75 to 90 % loss of nephron function - Impaired urine concentration - Nocturia, mild anemia, increased creatinine and BUN
3) **Renal failure** - Severe azotaemia - Impaired urine dilution - Severe anaemia -Electrolyte Imbalances Hypernatremia Hyperkalaemia Hyperphosphatemia
4) **End Stage Renal Disease** -10 percentage nephrons functioning - Multisystem dysfunction

❖ Causes

- Type 2 or type 1 diabetes
- Polycystic kidney disease
- Interstitial nephritis
- High blood pressure
- Vesicoureteral reflux
- Pyelonephritis

❖ Signs and symptoms

- Oliguria due to decreased GRF
- Tachycardia
- Flat neck veins, lethargy
- Cool, clammy skin
- Confusion due to altered cerebral perfusion and azotemia
- Hematuria, petechiae and ecchymosis.

❖ Complications

- Chronic renal failure
- Ischemic parenchymal injury
- Intrinsic renal azotemia
- Electrolyte imbalance
- Metabolic acidosis
- Pulmonary edema
- Hypertensive crisis
- Infection