PATHOPHYSIOLOGY

UNIT 2 NOTES

CARDIOVASCULAR DISEASES

- HYPERTENSION
- CONGESTIVE HEART FAILURE
- ISCHEMIC HEART DISEASES

RESPIRATORY DISEASES

- ASTHAMA
- COPD

RENAL DISEASES

- ACUTE RENAL FAILURE
- CHRONIC RENAL FAILURE

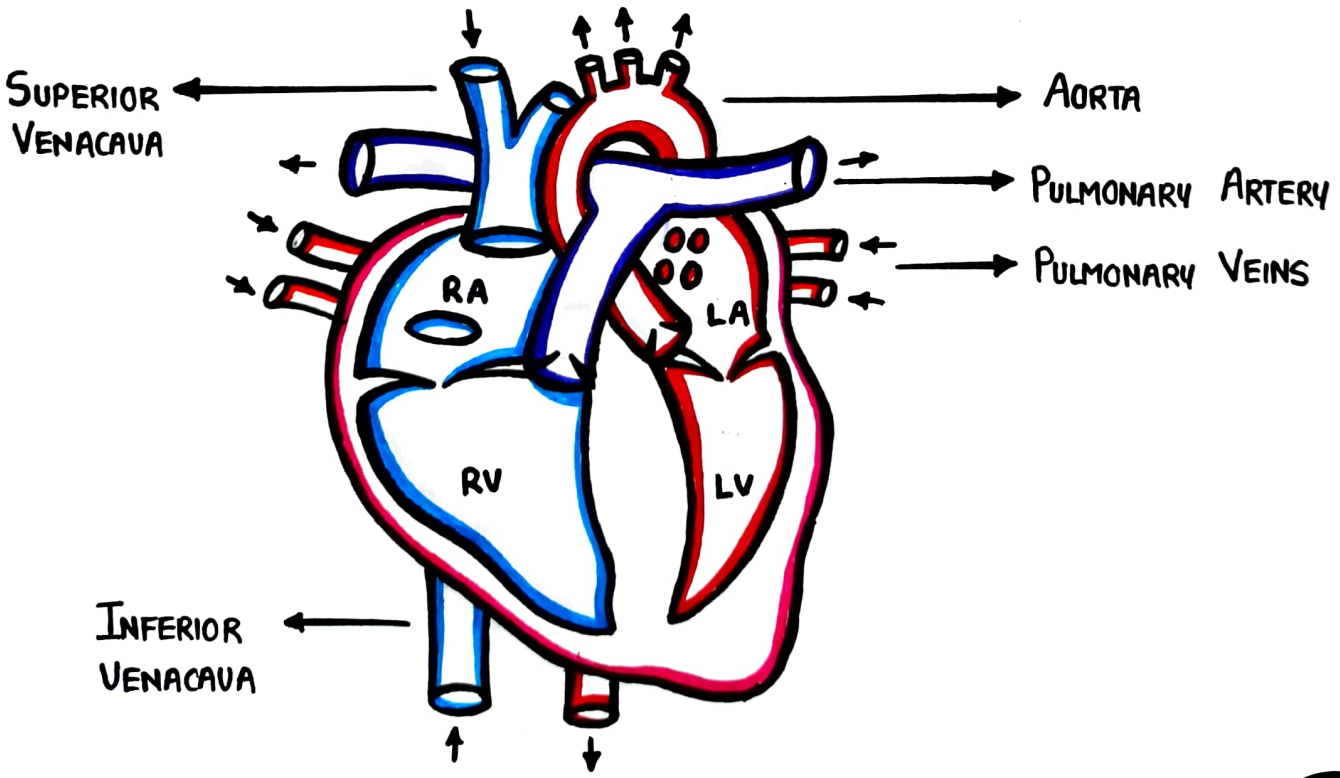
IMPERFECT PHARMACY

CARDIOVASCULAR SYSTEM

- The Human Cardiovascular System is a system of organs that includes heart, blood vessels & blood.
- Heart pumps the blood into blood vessels & blood vessels circulate the blood throughout the whole body.
- Heart is the major organ of circulatory (cardiovascular) system.

HEART

Heart is a hollow muscular organ that pumps the blood.
It is a cone shaped structure & located into the mediastinum.
Its weight is about 250 g in females & 300 g in males.



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Layers Of Heart

Heart wall consist of 3 layers

① Pericardium
② Myocardium
③ Epicardium

Chambers Of Heart

Heart consist of 4 chambers:

① Right Atrium
② Left Atrium
③ Right Ventricles
④ Left Ventricles

Cardiovascular Diseases

The diseases & disorders that are related to heart & blood vessels are known as cardiovascular diseases.

Some most common cardiovascular diseases are as follows:

- Hypertension
- Congestive Heart Failure
- Ischemic Heart Disease
- Angina Pectoris
- Myocardial Infarction
- Atherosclerosis

HYPERTENSION

- The term Hypertension referred to 'High Blood Pressure'.
- It is a chronic medical condition that arises when blood pressure is abnormally high.
- It occurs when blood vessels gets narrowed & cause blood to exert more pressure on heart's wall.
- Heart & Blood vessels can tolerate high blood pressure for months & years but eventually high B.P. ended up damaging walls of heart that leads to Heart Failure.
- As per the world health statistics, approx 1.5 billion adult population across the world is suffering from Hypertension.

STAGES OF HYPERTENSION

	STAGES	SYSTOLIC BP	DIASTOLIC BP
•	Normal	< 120 mm Hg	< 80 mm Hg
•	Pre - Hypertension	120 - 139 mm Hg	80 - 89 mm Hg
•	Stage I	140 - 159 mm Hg	90 - 99 mm Hg
•	Stage II	≥ 160 mm Hg	≥ 100 mm Hg

TYPES OF HYPERTENSION

Hypertension is of mainly two types :

① Primary Hypertension

② Secondary Hypertension

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Primary Hypertension

- It is also known as Essential Hypertension.
- 95% people with High B.P. suffered with Primary Hypertension.
- Generally causes behind this are unidentified.

Secondary Hypertension

- Secondary Hypertension is often arised by other medical conditions such as kidney, artery, heart or endocrine system disorders.
- It's less common than primary hypertension affecting 5-10% of Hypertensive patients.
- It's more common in younger people.

Etiology / Causes Of Hypertension

As we discussed early, it is very difficult to find the exact cause of Hypertension. But here are some following reasons that can be responsible for Hypertension.

- Inactive Life Style
- Stress
- Obesity
- High sodium (salt) diet
- Alcohol
- Smoking
- kidney Diseases.
- Diabetes
- Age
- Family History
- Certain Medications

PATHOGENESIS OF HYPERTENSION

Pathogenesis of hypertension is often multifactorial & complex, it can be described by following mechanism

- Increased Arteriolar Resistance
- Chronic Renal Failure
- Sympathic Activation
- Activation of RAAS System

① Increased Arteriolar Resistance

- An increase in arteriolar resistance can lead to Hypertension by raising blood pressure within arteries.
- An increase in arteriolar resistance can be occur due to many reasons including thining & fracturing of elastin, increased collagen deposition & increased wall thickness.
- It further increases risk of stroke, coronary artery disease & CHF.

② Chronic Renal Failure

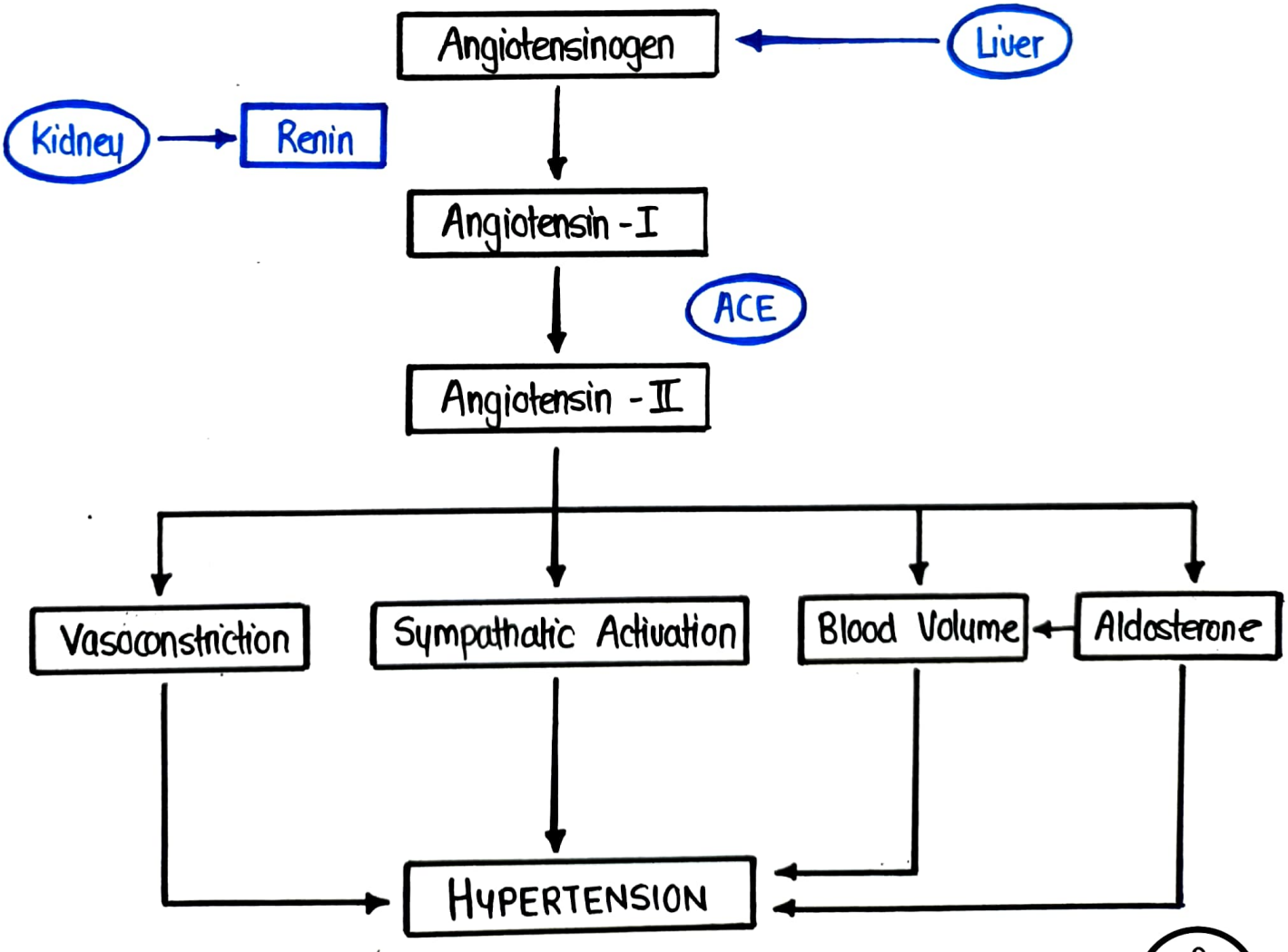
- When kidney doesn't function properly then it fails to excrete normal amount of sodium that leads to sodium retention.
- Now this sodium retention causes water retention that increases the blood volume that leads to Hypertension.

③ Sympathatic Activation

- Stress & various other factors leads to the activation of sympathatic nervous system that causes increased release of nor-epinephrine
- Now this leads to increase cardiac output & systemic vascular resistance.

④ Activation Of RAAS System

- RAAS stands for Renin Angiotensin Aldosterone System.
- Renin is a harmone released by kidney while Angiotensin is released by liver & when they both combines activates Aldosterone.



Sign & Symptoms

- Headache
- Dizziness
- Blurred Vision
- Nausea & Vomiting
- Fatigue
- Chest Pain
- Irregular Heartbeat

Complications

- Heart Attack
- Heart Failure
- kidney Failure
- Stroke
- Retinopathy

Treatment / Management

① Non Pharmacological

- Weight Loss
- Exercise
- Meditation
- Healthy Diet

② Pharmacological

- Diuretics
- α, β Blockers
- Vasodilators, ACE Inhibitors

Congestive Heart Failure

- Congestive Heart Failure is defined as failure of heart capacity to pump sufficient blood that required for proper functioning of body.
- The term CHF used for chronic form of Heart Failure.
- Heart Failure leads the blood to move through body & heart at slower rate.
- CHF is the end result of various forms of serious heart disease.
- It can be further classified into 3 types :

① Left Sided Heart Failure
② Right Sided Heart Failure
③ Both Sided Heart Failure

Types Of CHF

Congestive Heart Failure is of mainly two types :

① Systolic Heart Failure
② Diastolic Heart Failure

Systolic Heart Failure

- In systolic heart failure Heart muscles becomes too weak & enlarged & fails to contract properly.
- In systolic heart failure.

- Stroke Volume ↓
- Cardiac Output ↓
- Ejection Factor ↓

Diastolic Heart Failure

- In diastolic heart failure Heart muscles becomes stiff, thick & enlarged hence the ventricles fails to fill properly.
- In Diastolic Heart Failure :
- Preload ↓
- Cardia Output ↓
- Stroke Volume ↓

Etiology / Causes

- Ischemic Heart Disease / Coronary Artery Disease
- Hypertension
- High Sodium Diet
- Diabetes
- Overweight
- Smoking
- Alcohol
- Myocarditis
- Arrythemia

PATHOGENESIS

Failure of Heart is frequently seen in elderly patients suffering from Hypertension, Angina pectoris etc. Following factors can be responsible for Heart Failure.

① Intrinsic Pump Failure

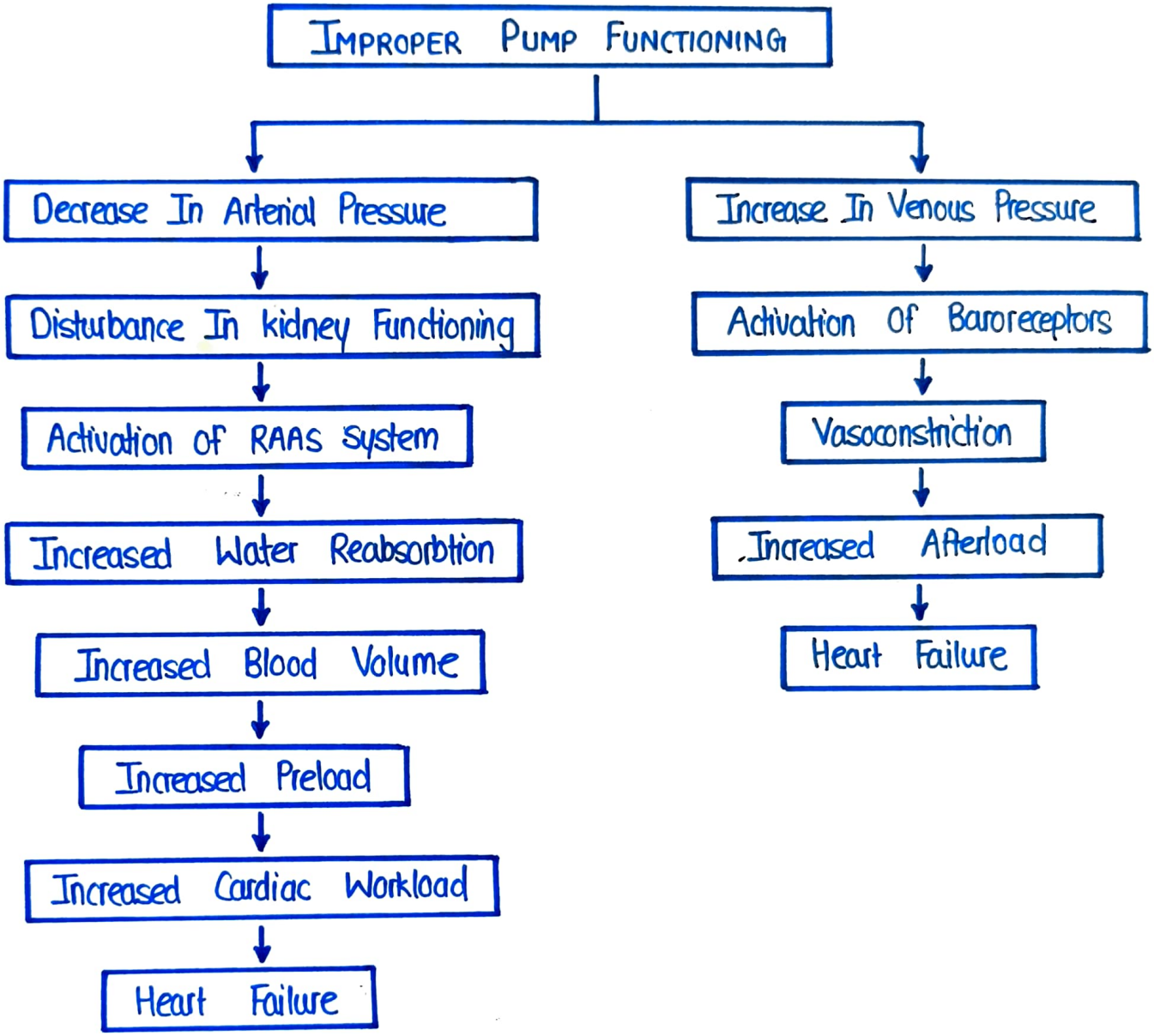
- The most common & most important cause of Heart Failure is weakening of ventricular muscle due to various diseases that leads to failure of efficient pumping of blood by heart.
- It can be occur due to :
  - Ischemic Heart Disease
  - Myocarditis
  - Beriberi Disorder
  - Various kidney Diseases

② Increased Workload On Heart

- An Increase in the workload on Heart can also be a major cause of Heart Failure.
- It can be occur due to :
  - Increased Pressure Load
  - Increased Volume Load

③ Improper Pump Functioning

Improper pump functioning can leads to heart failure through following mechanism.



Sign & Symptoms

- Chest Pain
- Fatigue
- Irregular Heartbeat
- Headache
- Blurred Vision
- Cough
- Shortness of Breath
- Swelling

Complications

- kidney Damage
- Lungs Disorders
- Heart Attack
- Liver Damage
- Heart Valve Problems

Treatment / Management

① Non Pharmacological :

- Exercise
- No Smoking
- Healthy Diet / Proper Lifestyle

② Pharmacological :

- β Blockers
- ACE Inhibitors
- Diuretics / Vasodilators

Ischemic Heart Disease

- Ischemic Heat Disease is also known as Coronary Artery Disease.
- It is a condition in which supply of oxygen to the muscles of heart get reduced.
- IHD / CAD develops when coronary artery become diseased or damaged.
- In IHD blood supply reduced according to demand of myocardium.
- Building of Plaque & Inflammation in arteries are the major causes of Ischemic Heart Disease.
- Ischemic Heat Disease is further responsible for following heart diseases as follows :

① Angina Pectoris
② Myocardial Infarction
③ Atherosclerosis

Angina Pectoris

- Angina is a term used for 'Chest Pain' caused by reduced blood flow to the heart muscles.
- It is a symptom or complication of 'Coronary Artery Disease'.
- It is a condition that arised when there is an imbalance between the demand for oxygen and its supply to myocardium.

Types Of Angina Pectoris

① Stable Angina
② Unstable Angina
③ Variant Angina

STABLE ANGINA

- It is also known as Chronic Angina.
- It generally occurs when heart is working harder than it works in normal conditions i.e., during exercises.
- It occurs due to building of plaque / fat deposition in Coronary Arteries.
- Pain of stable angina releived by proper rest or medication.

UNSTABLE ANGINA

- The pain of unstable angina occurs even during period of rest, sleeping or suddenly.
- It is considered more serious than stable angina as rest or medication is not enough for its relief.
- It generally occurs due to rupturing of coronary arteries.

VARIANT ANGINA

- It is a rare type of angina, its pain generally occurs at resting stage.
- It occurs due to narrowing of coronary arteries.
- This narrowing or spasm leads to decreased blood flow to the heart and increases the risk of Heart Attack.

Myocardial Infarction

- The death of cardiac tissues due to disturbed or less supply of blood is known as Myocardial Infarction.
- It can also be termed as Heart Attack.
- It generally occurs due to prolonged ischemic heart disease
- Myocardial Infarction can be described as irreversible death of heart cells due to Ischemia.

Types Of Myocardial Infarction

It is of generally two types

① Transmural MI

② Non- Transmural MI

Transmural MI

- In this type, the affected muscle segment undergoes ischemic necrosis which extends from endocardium to epicardium through myocardium.
- Transmural MI refers to complete blockage of coronary artery.

Non Transmural MI

- In this type necrosis is limited to endocardium or maximum to myocardium.
- Non- transmural MI refers to partial blockage of coronary artery.

ATHEROSCLEROSIS

- Atherosclerosis is a condition where fatty deposits build up on the inner walls of arteries, leading to narrowing & hardening of arteries.
- The build up of fats, cholesterol & other substances is termed as Plaque. This Plaque can cause arteries to narrow & block the blood flow.
- Atherosclerosis becomes the major cause of various other heart diseases i.e., Heart Attack, Coronary Artery Disease etc.

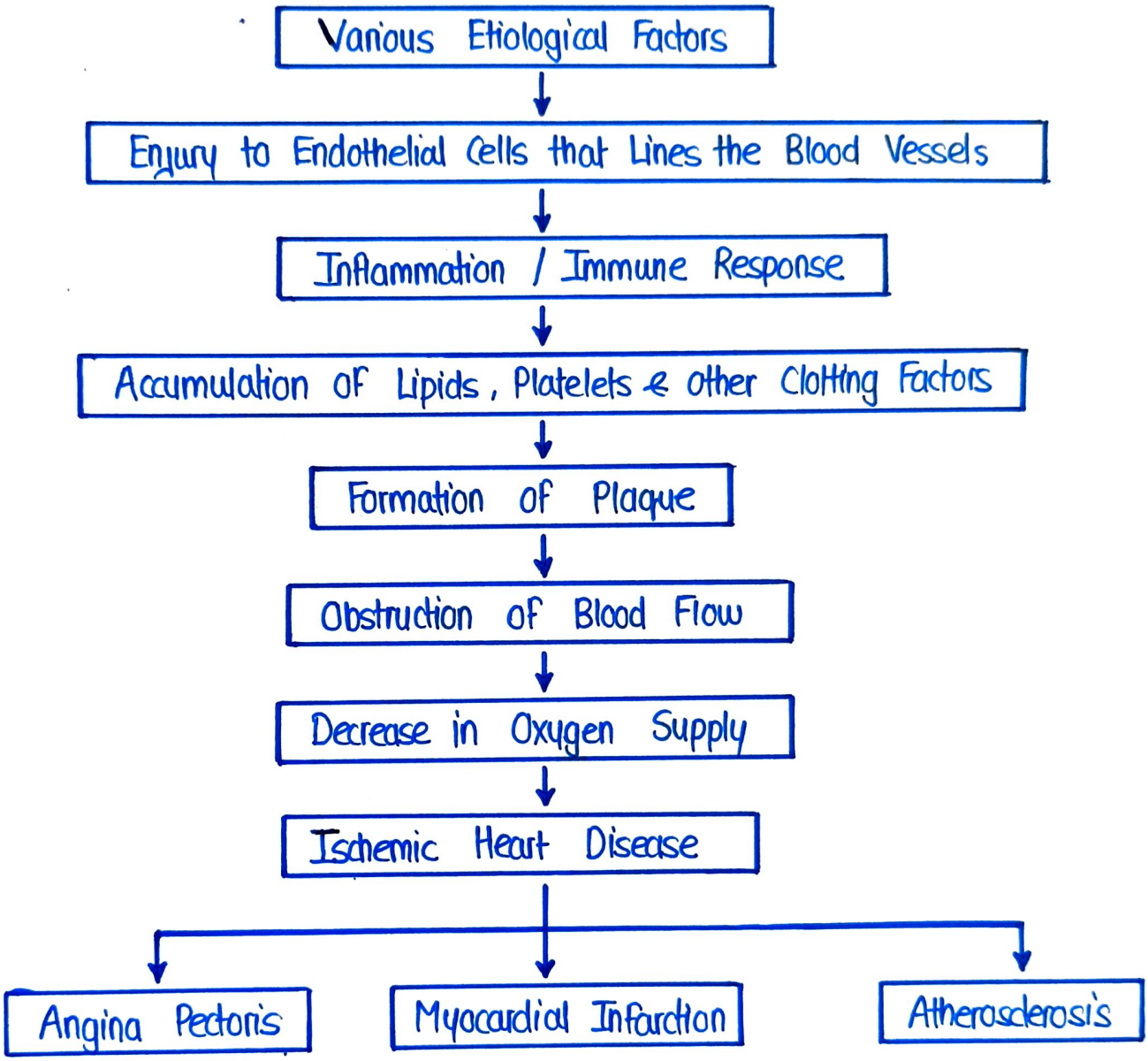
CAUSES

The various causes for Ischemic Heart Disease including Angina Pectoris, Myocardial Infarction & Atherosclerosis are as follows:

- Hypertension
- High Cholesterol
- Smoking
- Alcohol
- Obesity
- Diabetes
- Age
- Stress
- Genetics

PATHOGENESIS

The most common mechanism / pathogenesis behind all the Ischemic Heart Diseases are as follows :



Sign & Symptoms

- Chest Pain
- Fatigue
- Anxiety
- Headaches
- Shortness of Breath
- Irregular Heartbeat
- Blurred Vision

Complications

- Heart Attack
- Heart Failure
- kidney Failure
- Eye Problems
- Various Metabolic Disorders.

Treatment / Management

① Non Pharmacological

- Exercise
- Healthy Diet
- No Tabacco / Alcohol
- Healthy Lifestyle

② Pharmacological :

- Anticoagulants
- Beta Blockers
- ACE Inhibitors / Vasodilators

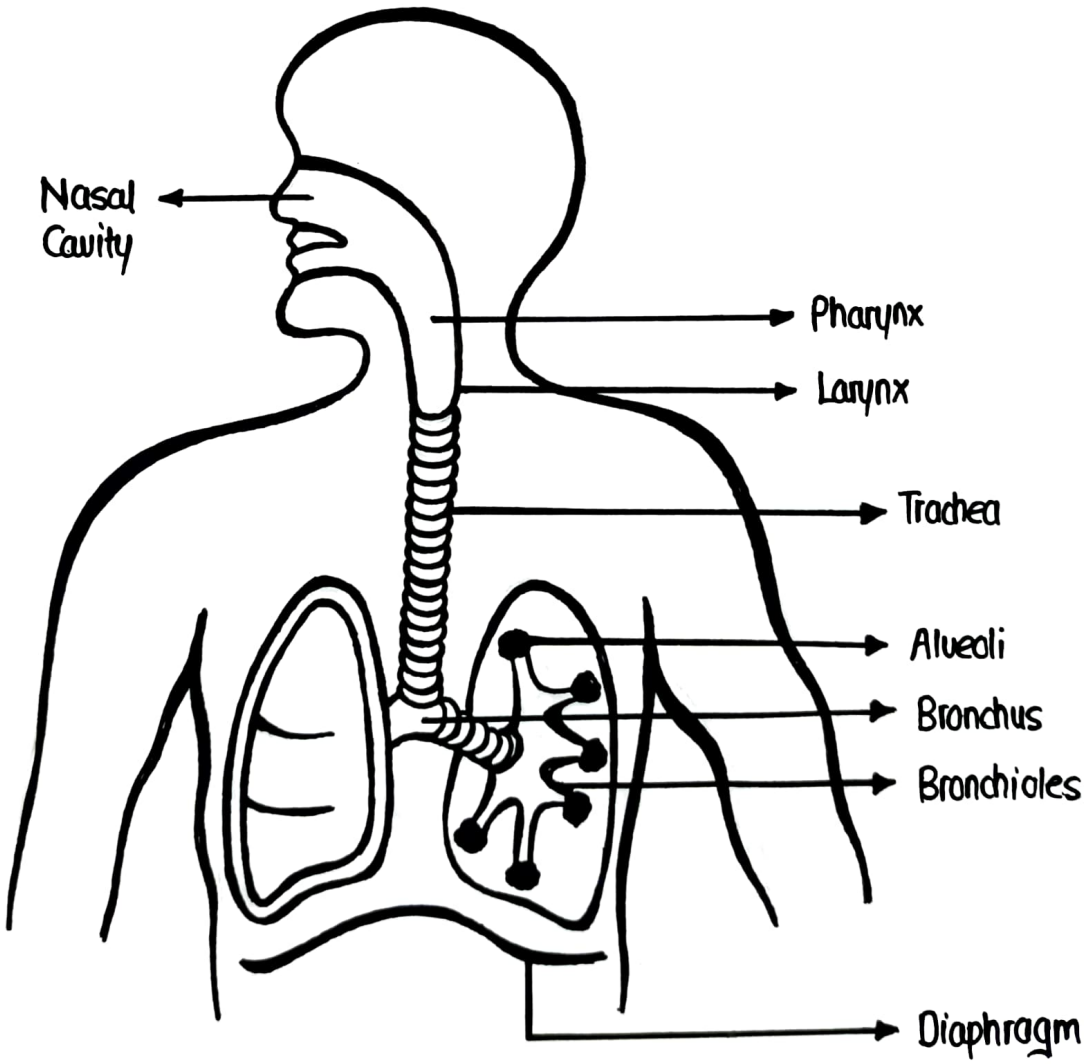
Respiratory System

- The supply of O_2 & excretion of CO_2 occurs through the process of Respiration & the system that performs the process of respiration is known as Respiratory System.
- There are 3 major parts of Respiratory System

① The Airway : Nose, Mouth, Pharynx, Larynx, Trachea, Bronchi, Bronchioles

② The Lungs : Functional Unit of Respiration

③ Muscles of Respiration : Diaphragm, Intercostal Muscles.



Stages Of Respiration

There are mainly 3 stages of respiration :

① Breathing
② Internal Respiration
③ Cellular Respiration

Mechanism Of Breathing

It can be further divided into two types :

- Inspiration
- Expiration

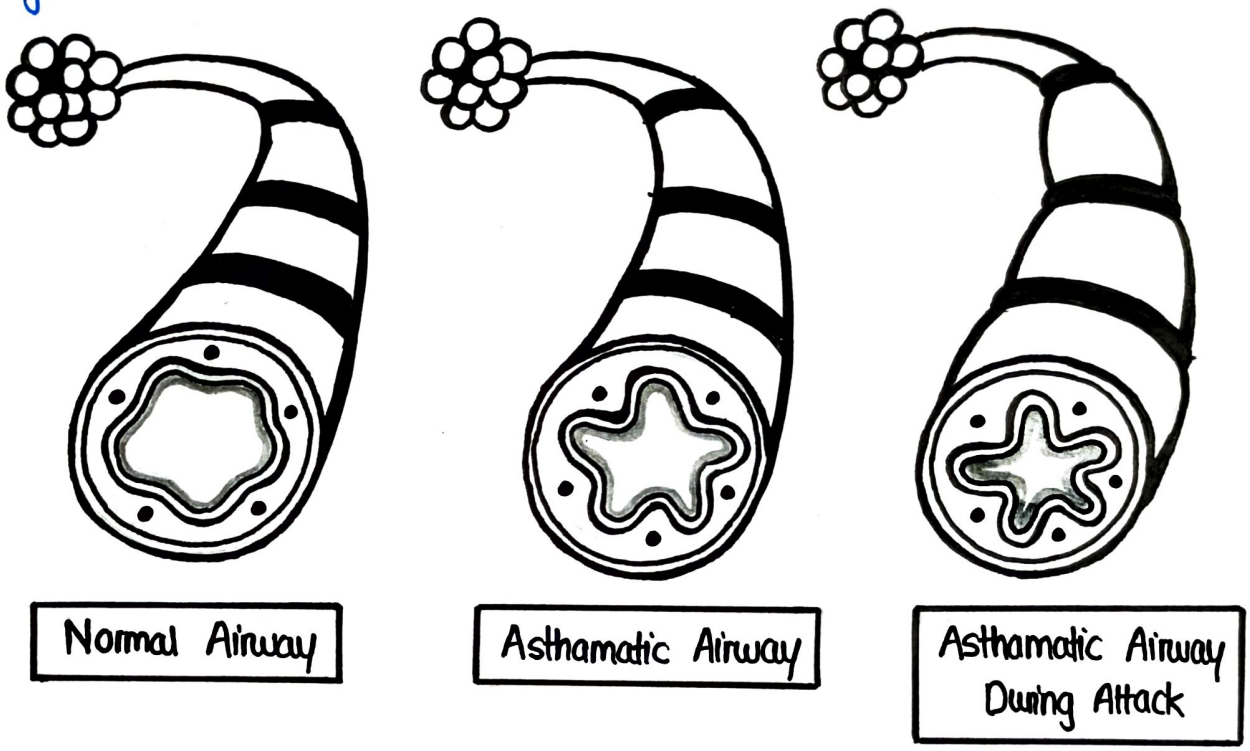
Respiratory Diseases

- The diseases / disorders related to respiratory system / tract are known as Respiratory Diseases.
- The are various respiratory diseases , some of them are as follows :

① Asthama
② Chronic Obstructive Pulmonary Disease (COPD)

ASTHAMA

- Asthama is a chronic, inflammatory & reversible airway disease in which a person's airway become inflamed, narrow & swell and produce extra mucus, which makes it difficult to breath.
- Asthama is a long term condition that requires ongoing management
- It affects the respiratory system, particularly the airways in the lungs.



ETIOLOGY

- Smoking
- Cold / Dry Air
- Air Pollutants
- Food Chemicals
- Certain Medications
- Family History
- Obesity
- Lung Infections

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Types Of Asthama

Asthama can be categorized into 4 major types :

① Extrinsic Asthama
② Intrinsic Asthama
③ Drug Induced Asthama
④ Occupational Asthama

Extrinsic Asthama

- It is also known as Atopic / Allergic Asthama.
- It is most common type of asthama & occurs due to allergens.
- It usually begins in childhood or in early adult life.

Intrinsic Asthama

- It is also known as Non- Atopic / Non- Allergic Asthama.
- It generally occurs due to any type of lung infection.
- It mostly developed ~~adulater~~ later in adult life.

Drug Induced Asthama

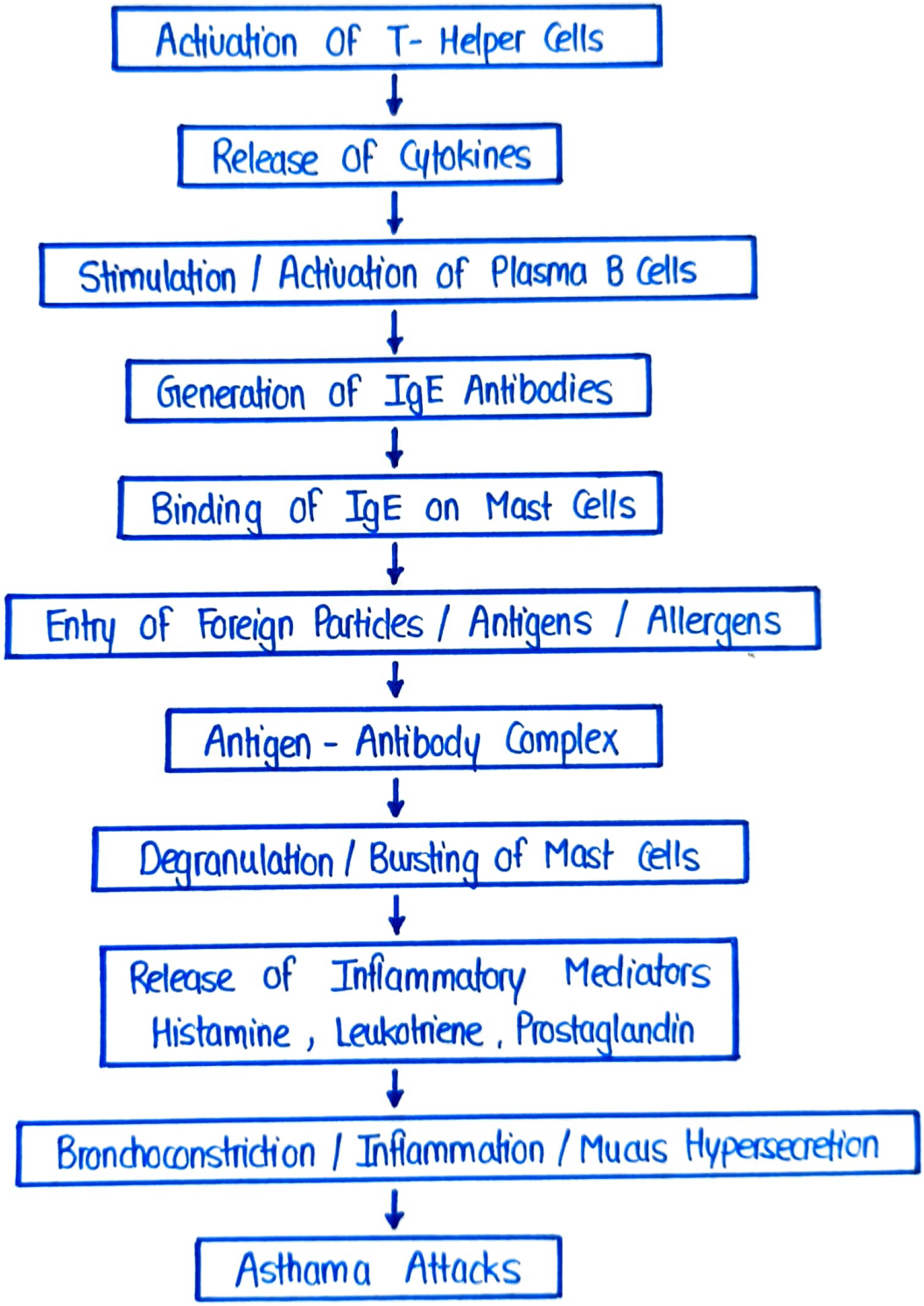
- It is a type of Asthama triggered by use of certain medications.
- These medications include Aspirin, NSAIDs, Beta- Blockers etc.

Occupational Asthama

- Occupational Asthama mainly caused by exposure to specific substances in workplace.
- These substances can include chemicals, dust, gases etc.

PATHOGENESIS

The pathogenesis of Asthama or we can say Asthamatic Attack can be explained as follows :



Symptoms

- Coughing
- Chest Tightness
- Wheezing
- Fatigue
- Shortness of Breath
- Anxiety / Discomfort while Breathing

Treatment

① Non Pharmacological :

- Avoid Tobacco / Smoking
- Avoid Medication such as Aspirin / Beta Blockers etc.
- Avoid Alcohol
- Intake of Fresh Air

② Pharmacological :

- Mast Cell Stabilizers
- Bronchodilators
- Leukotriene Receptor Antagonist
- Corticosteroids

COPD

- The word 'COPD' stands for 'Chronic Obstructive Pulmonary Disease'. Chronic Obstructive Pulmonary Disease refers to a group of lung disease that causes obstruction in the airflow from the lungs.
- It is a progressive and irreversible disease.
- COPD mainly includes :

① Chronic Bronchitis
② Emphysema

CHRONIC BRONCHITIS

- Chonic Bronchitis is defined as long term inflammation of bronchial tubes.
- It is a condition clinically defined as persistent cough with sputum on most days for at least 3 months.
- Cough is mainly caused by oversecretion of mucus.
- People with bronchitis breath less air & oxygen into the lungs.
- Smoking is most common cause of Chronic Bronchitis.

EMPHYSEMA

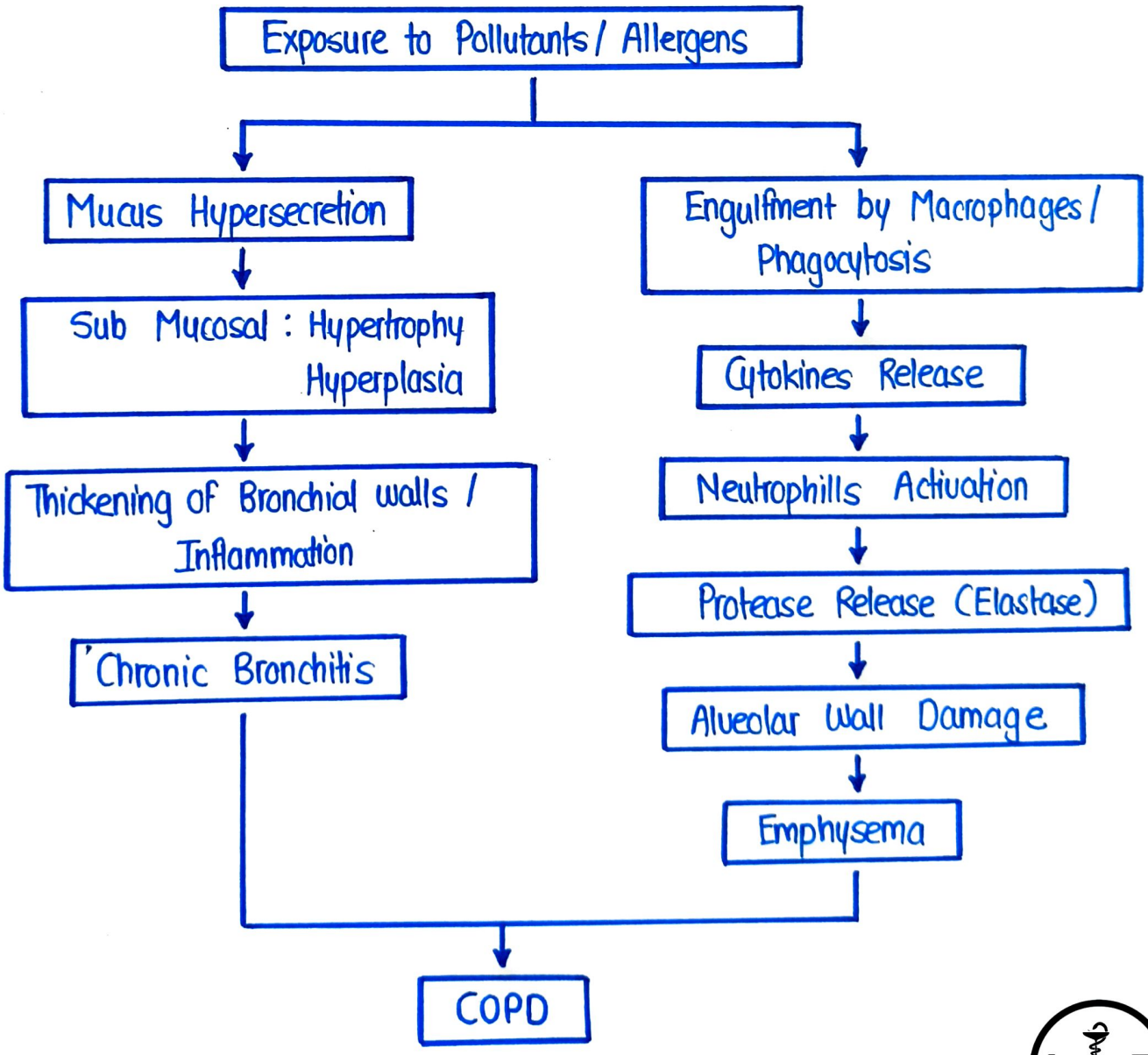
- Emphysema is a long term progressive lung disease where the air sacs (Alveoli) in the lungs become damaged, leading to difficulty in breathing.
- This damage causes the air sacs to lose their elasticity making it harder for them to expand & contract properly.
- The main cause behind it long term exposure to airborne irritants.

Causes

- Smoking
- Air Pollutants
- Chronic Bronchitis
- Emphysema
- Chronic Asthama

Pathogenesis

Pathogenesis of COPD can be explained as follows :



Symptoms

- Chronic coughing
- Wheezing
- Chest Tightness
- Shortness of Breath
- Fatigue

Treatment

① Non Pharmacological :

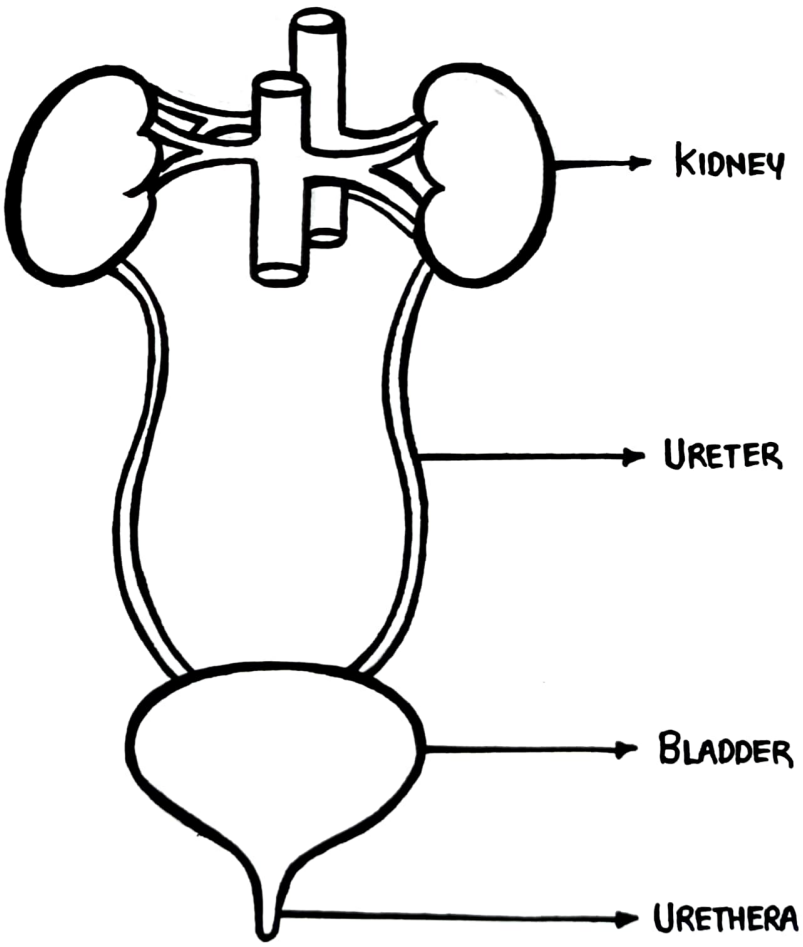
- No Smoke
- Regular Exercise
- Intake of Fresh Air

② Pharmacological :

- Bronchodilators
- Corticosteroids
- Surgery

RENAL SYSTEM

- Renal System is a system of organs that primarily includes kidneys, Ureters, Bladder & Urethra.
- The primary function of Renal System is to filter waste products from the blood, regulate electrolyte balance & maintain fluid balance in the body by producing, storing & eliminating urine.
- It is known as major excretory system of human body.
- Renal System is also known as Urinary System.



KIDNEY

- kidney is the major functional organ of Renal System.
- They are present in a pair in our kidney.
- Nephron is the basic structural & functional unit of kidney that performs major excretion process & urine formation.

Functions

- It helps in the excretion of waste products.
- It maintains water - electrolyte balance.
- It maintains Acid - Base balance.
- It secretes harmones like Renin, Erythropoeitin. etc.
- It also helps in regulation of Blood Pressure.

RENAL DISEASES

- The diseases / disorders related to Renal / Urinary system are known as Renal Diseases.
- We have to mainly study about

① Acute Renal Failure

② Chronic Renal Failure

Renal Failure

- Renal Failure also known as kidney failure, occurs when kidneys lost their ability to effectively filter waste products & excess fluids from the blood.
- This condition can lead to buildup of toxins & fluids in the body, causing various complications & potentially become life threatening if not managed appropriately
- Based on severity it can be divided into types:

① Acute Renal Failure
② Chronic Renal Failure

Acute Renal Failure

- Acute Renal Failure is also known as Acute kidney Injury (AKI)
- AKF occurs when there is a sudden loss of kidney functions & it becomes unable to filter waste products from blood
- It develops rapidly over a few ~~years~~ hours or days.
- It is a reversible disease but if not treated can be turned into Chronic Renal Failure.

Types

It can be categorized into 3 types

① Pre-Renal Failure
② Intra-Renal failure
③ Post-Renal Failure

Pre- Renal Failure

Pre-renal failure is a type of acute kidney injury that occurs when there is a sudden decrease in blood flow to the kidneys.

Intra- Renal Failure

Intra renal failure occurs when there is a direct damage to the kidney itself due to any type of injury, inflammation, infection etc.

Post- Renal Failure

Post renal failure occurs when there is a sudden obstruction in the urine flow from kidney to bladder & out of the body.

ETIOLOGY / CAUSES

① Prerenal Causes :

- Low Blood Pressure
- Hypovolemia
- Cardiac Failure

② Intrarenal Causes :

- Acute Tubular Necrosis
- Glomerulonephritis
- Interstitial Nephritis

③ Postrenal Causes :

- kidney Stones
- Bladder Tumour
- Blood Clotting

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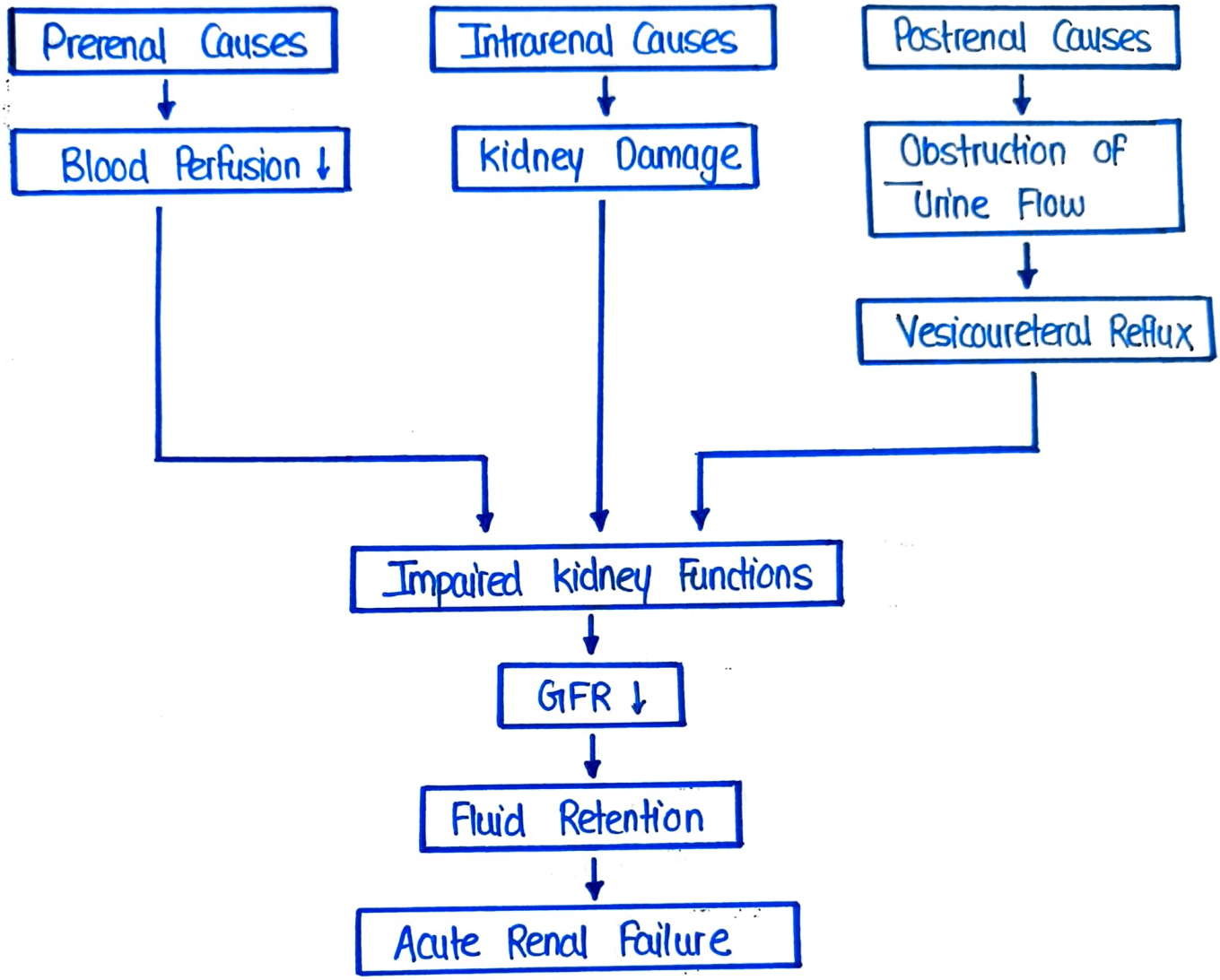
PATHOGENESIS

The pathogenesis of Acute Renal Failure can be explained as follows :



Sign & Symptoms

- Decrease Urine Output
- Fatigue
- Nausea
- Chest Pain
- Dehydration
- Fluid Retention
- Loss of apetite

Complications

- Heart Failure
- Hyperkalemia
- Chronic Renal Failure
- Death

Management

① Non-Pharmacological :

- Restriction of Potassium rich diet
- Water restriction
- Sodium restriction

② Pharmacological :

- Diuretics
- Calcium Gluconate
- Dialysis
- kidney Transplant

Chronic Renal Failure

- It is also known as Chronic kidney Disease (CKD)
- Chronic Renal Failure is defined as gradual loss of kidney function over time.
- It is generally progressive & irreversible
- It eventually leads to End Stage Renal Disease, when sufficient no. of nephrons have been damaged where kidney fails completely.

Stages Of CRF

There are mainly 5 stages of Chronic Renal Failure.

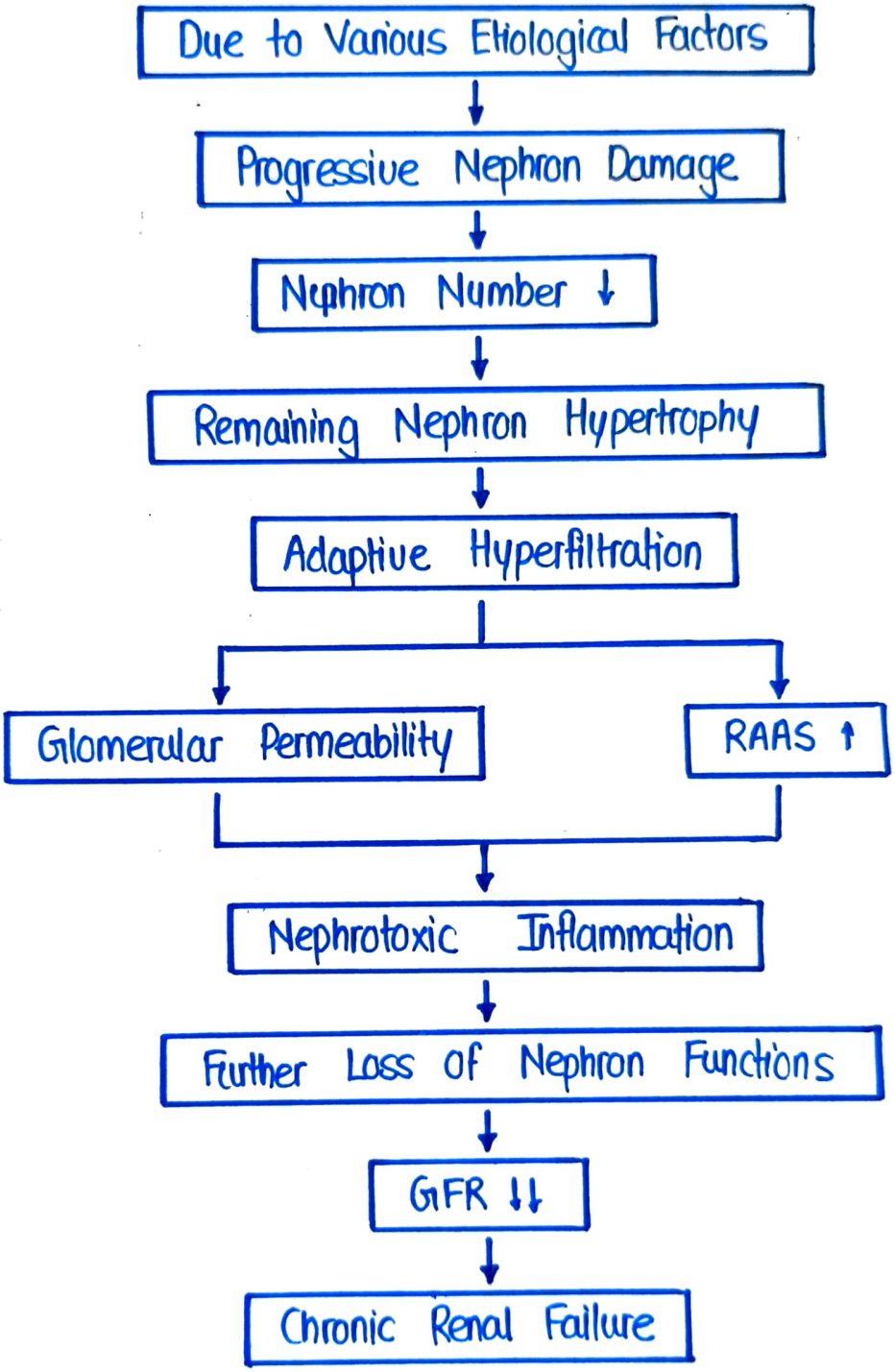
① Stage 1 : GFR $\geq$ 90
② Stage 2 : GFR = 60-89
③ Stage 3 : GFR = 45-59
④ Stage 4 : GFR = 15-29
⑤ Stage 5 : GFR < 15

Causes / Etiology

- Diabetes
- Hypertension
- Pyelonephritis
- UTI
- Glomeluronephritis
- Interstitial Nephritis
- Polycystic kidney Disease

PATHOGENESIS

Pathogenesis of Chronic Renal Failure can be explained as follows :



Sign & Symptoms

- Nausea & Vomiting
- Apetite Loss
- Fatigue
- Chest Pain
- Low Urine Output
- Swelling

Complications

- End Stage Renal Disease
- Heart Failure
- Erectile Dysfunction
- Pericarditis

Treatment

- Renal Dialysis
- Renal Transplantation

THANK YOU

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