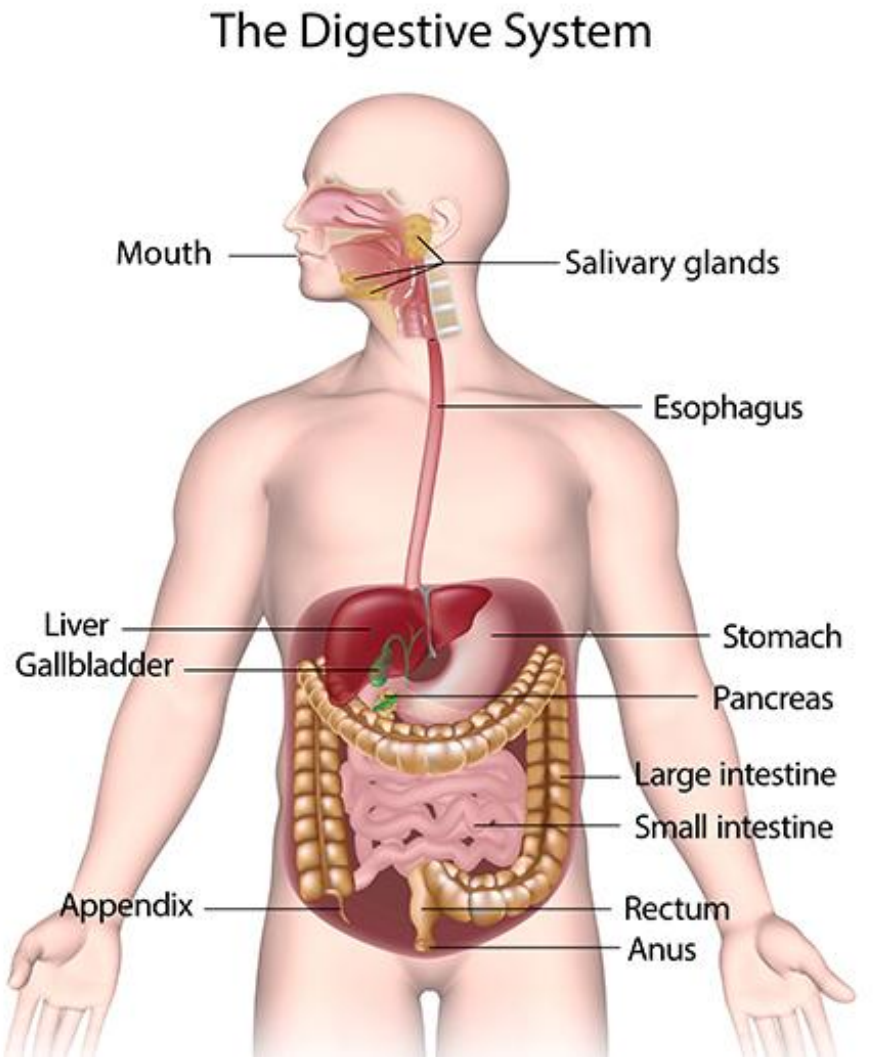
Inside the Digestive System: Anatomy, Common Diseases, and Medications in Pakistan



Introduction :

The digestive system is a complex network of organs responsible for the breakdown of food into simpler substances that can be absorbed and utilized by the body. It enables the intake of nutrients, including carbohydrates, proteins, fats, vitamins, and minerals, which are essential for energy, growth, and repair. The process of digestion involves both mechanical and chemical actions, beginning in the mouth and continuing through the esophagus, stomach, small intestine, and large intestine. Additionally, accessory organs

such as the liver, pancreas, and gallbladder play a vital role by producing enzymes and secretions that aid in digestion. Overall, the digestive system ensures the efficient conversion of food into usable energy while eliminating waste products from the body.

Digestive Organs :

- The digestive system is composed of the alimentary canal and accessory organs that work together to process food efficiently.
- The main digestive organs—mouth, esophagus, stomach, and intestines—are responsible for the breakdown and absorption of nutrients.
- Accessory organs, including the liver, pancreas, gallbladder, and salivary glands, support digestion by producing enzymes and secretions.
- Together, these components ensure effective nutrient utilization and the elimination of waste products.

In the following sections, we will discuss the organs of the digestive system in detail, including their anatomy, functions, and role in the process of digestion.

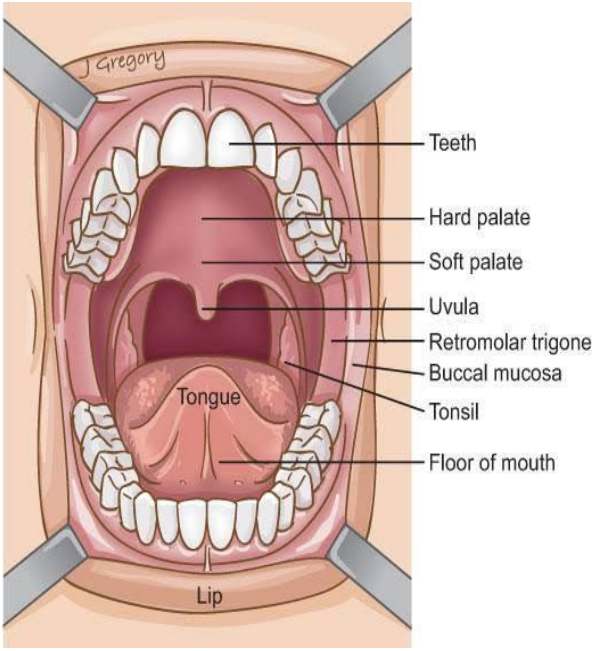
Descriptive Anatomy of the Mouth

1. Definition

The **mouth or oral cavity** is a cavity situated below the nasal cavity and above the pharynx. It serves as the **entrance to the digestive system** and plays roles in **mastication, taste, speech, and swallowing**.

2. Parts of the Oral Cavity

The mouth is divided into two parts:



1. Oral Vestibule

The **oral vestibule** is the slit-like space between the **lips and cheeks externally** and the **teeth and gums internally**.

Boundaries

- Anterior: Lips
- Posterior: Teeth and gums
- Lateral: Cheeks

Important feature

- Opening of the **parotid duct** opposite the upper second molar tooth.

2. Oral Cavity Proper

The **oral cavity proper** lies **within the dental arches** (inside the teeth).

Boundaries

- Anterior & lateral: Teeth and gums
- Roof: Palate
- Floor: Tongue and floor of mouth
- Posterior: Opens into the **oropharynx** through the **oropharyngeal isthmus**

3. Internal Structures of the Mouth

1. Lips

The **lips** form the anterior boundary of the mouth.

Structure of lips

1. Skin
2. Superficial fascia
3. Orbicularis oris muscle
4. Submucous tissue containing

   labial glands

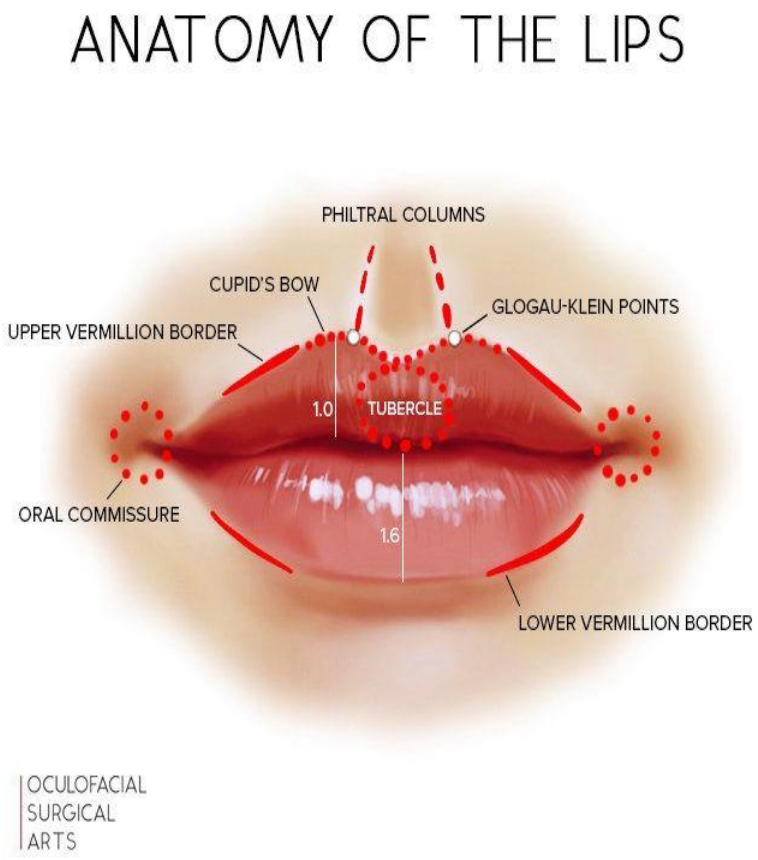
   5. Mucous membrane

Features

- Labial frenulum connects lips to gums.
- Highly vascular and sensitive.

Functions

- Food intake
- Speech articulation
- Facial expression

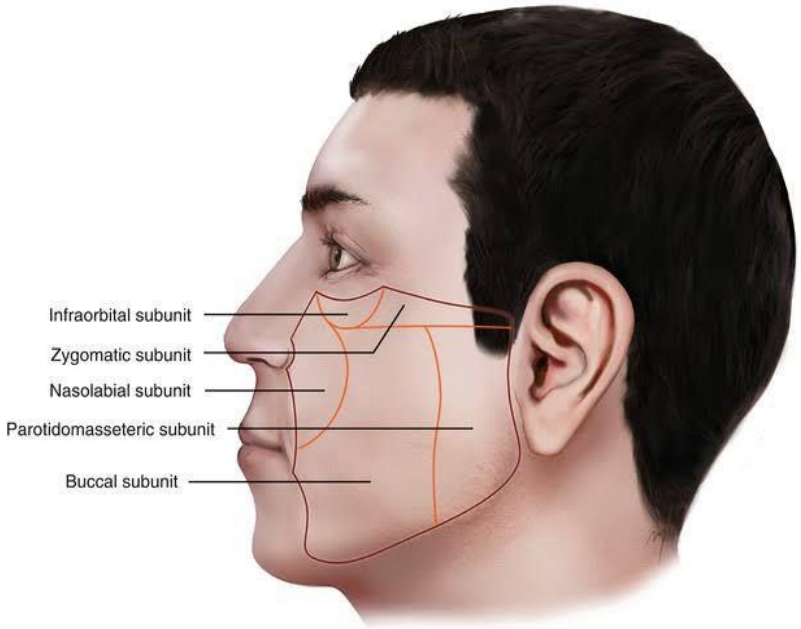


2. Cheeks

The **cheeks** form the lateral walls of the oral cavity.

Layers of the cheek

1. Skin
2. Superficial fascia
3. Buccinator muscle
4. Buccal glands
5. Mucous membrane



Important feature

- Opening of the **parotid duct** on the buccal mucosa.

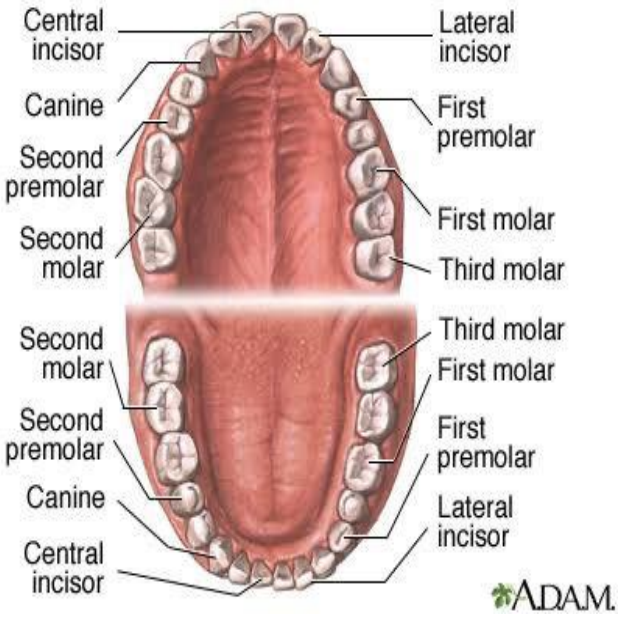
Function

- Keeps food between the teeth during chewing.

3. Teeth

The teeth are hard structures embedded in the alveolar sockets of the maxilla and mandible.

Types of Teeth (Adult Dentition – 32 teeth)



Incisors – cutting food

Canines – tearing food

Premolars – crushing

Molars – grinding

Structure of a Tooth

Crown

Neck

Root

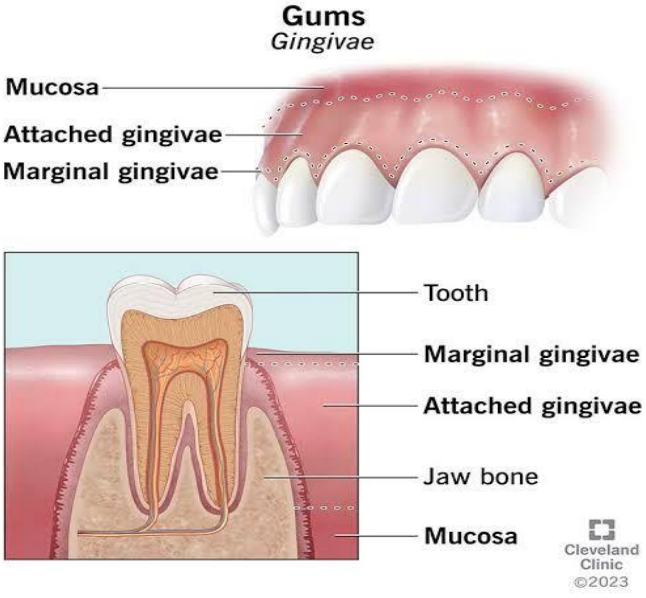
Tissues of Tooth

Enamel

- Dentin
- Cementum
- Pulp

4. Gums (Gingiva)

The **gingiva** is the mucous membrane covering the **alveolar processes of the jaws** and surrounding the necks of the teeth.



Functions

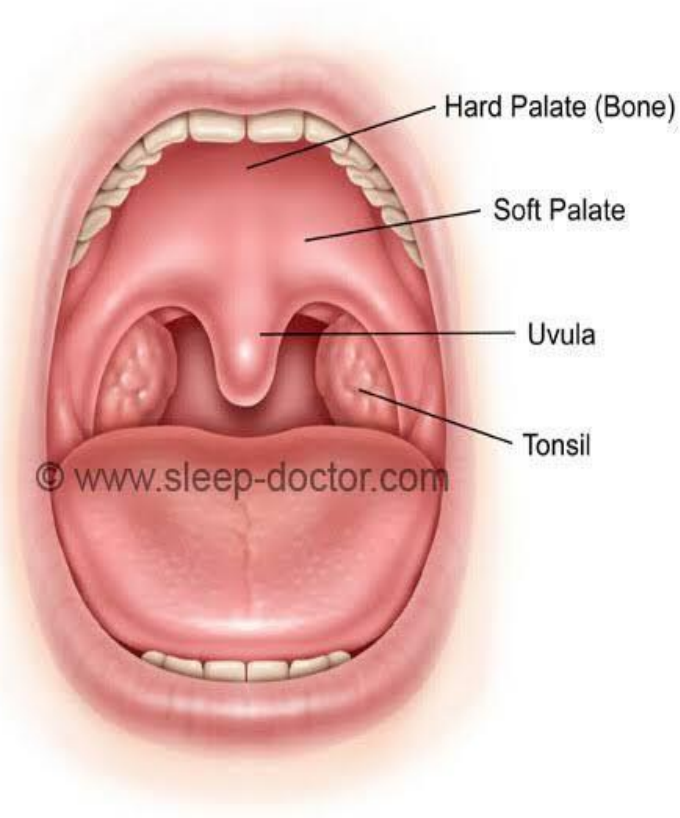
- Protects tooth roots
- Supports teeth in sockets

5. Palate (Roof of Mouth)

The **palate** separates the **oral cavity from the nasal cavity**.

Hard Palate

- Anterior two-thirds
- Bony structure
- Formed by:
  - Palatine process of maxilla
  - Horizontal plate of palatine bone



Features

- Palatine rugae
- Incisive papilla

Soft Palate

- Posterior one-third
- Muscular and movable

Components

- Uvula
- Palatoglossal arch
- Palatopharyngeal arch

Function

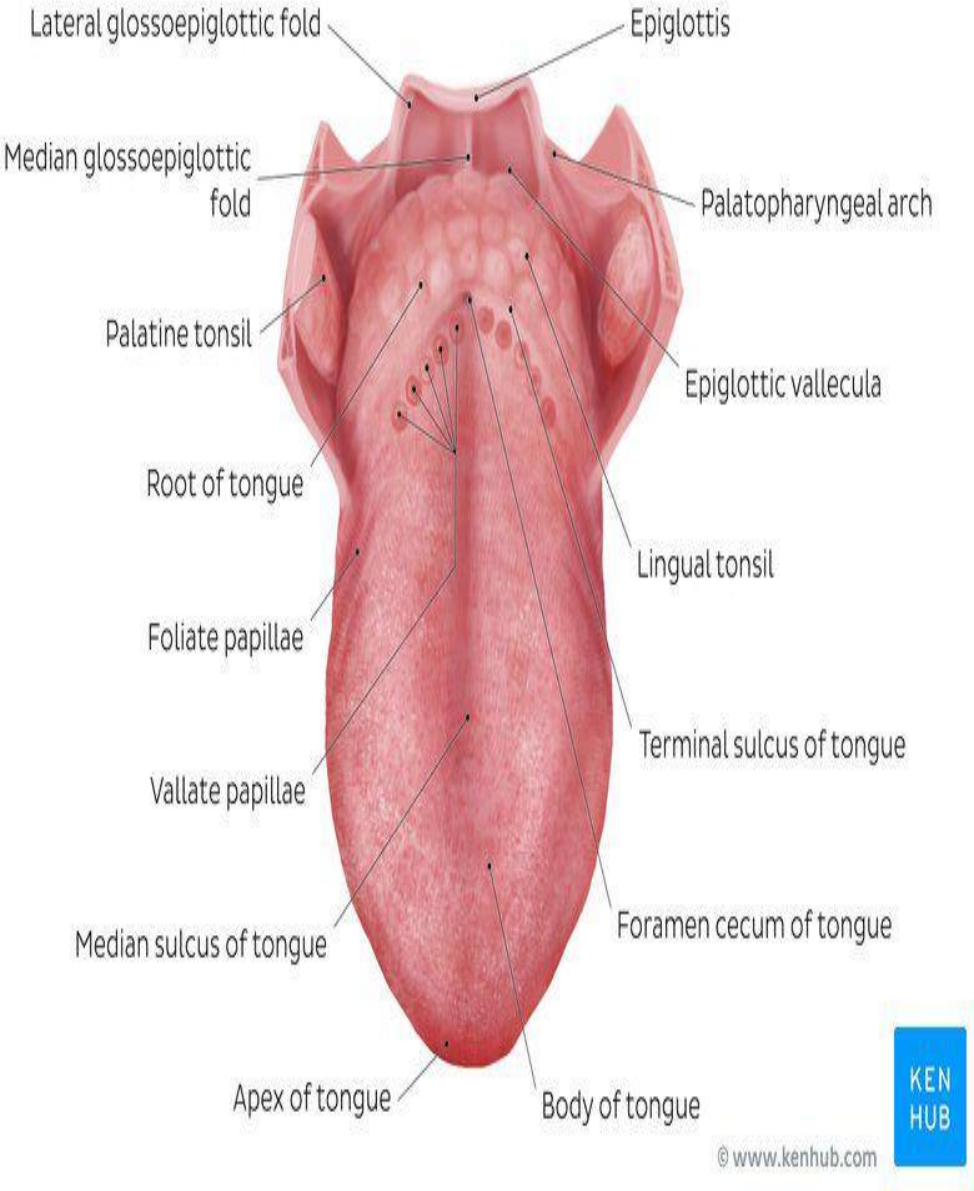
- Closes the nasopharynx during swallowing.

6.Tongue

The **tongue** is a muscular organ located on the **floor of the mouth**.

Parts of Tongue

1. Tip (apex)
2. Body (anterior 2/3)
3. Root (posterior 1/3)



Surface Features

- Median sulcus
- Sulcus terminalis
- Foramen cecum

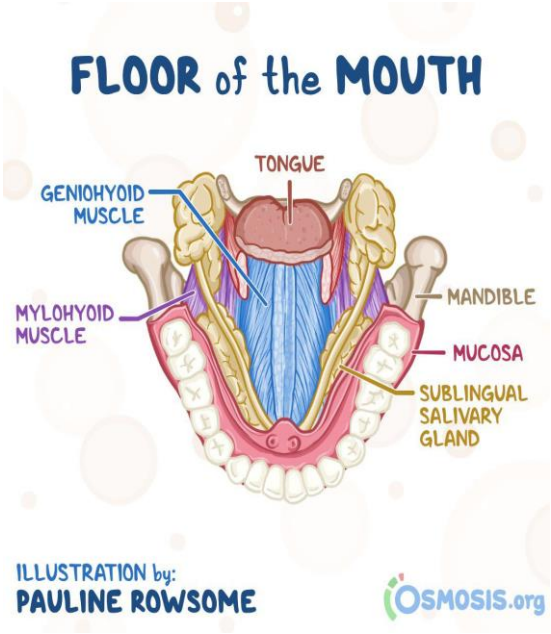
Papillae of Tongue

1. Filiform papillae
2. Fungiform papillae
3. Circumvallate papillae
4. Foliate papillae

Functions

- Taste
- Speech
- Mastication
- Swallowing

7. Floor of the Mouth



The floor of the mouth is located beneath the tongue.

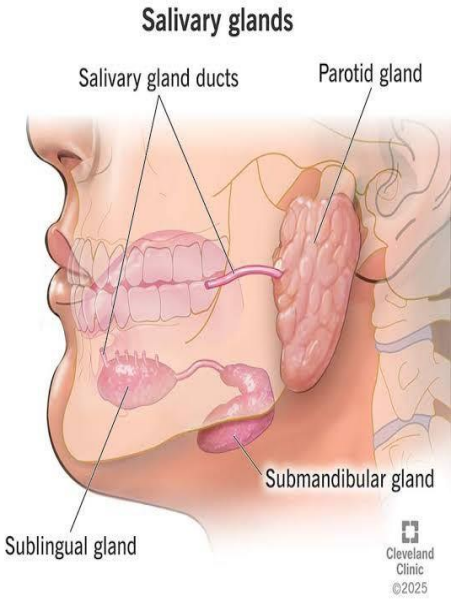
Formed by

- Mylohyoid muscle
- Covered by mucous membrane

Structures present

- Sublingual fold
- Sublingual glands
- Opening of **submandibular duct** on the **sublingual papilla**

8. Salivary Gland Openings



Saliva enters the mouth through ducts of major glands.

Major Salivary Glands

1. **Parotid gland**
   - Opens opposite upper second molar tooth.
2. **Submandibular gland**
   - Opens on the **sublingual papilla**.
3. **Sublingual gland**
   - Multiple openings along the **sublingual fold**.

Function

- Lubricates food
- Begins digestion (amylase)
- Maintains oral hygiene

Functions of the Mouth

1. Mastication (chewing)
2. Taste perception
3. Speech production
4. Swallowing

Diseases of mouth with their symptoms, causes and proper medication:

1. Stomatitis (Mouth Ulcers)

- Symptoms: Painful ulcers inside the mouth, usually on cheeks, tongue, or lips.

- **Causes:** Stress, poor nutrition, vitamin B12 deficiency, hormonal changes.

- **Medication**: Analgesic gels (e.g., Enziclor Dental Gel), medicated mouthwashes (e.g., Enziclor Mouth Wash).

2. Oral Thrush (Candidiasis)

- **Symptoms:** White patches in mouth, sore throat, difficulty swallowing.

- **Causes:** Weakened immune system, antibiotics, steroids.

- **Medication:** Antifungal lozenges or mouthwashes (consult a dentist).

3. Gum Disease (Periodontitis)

-**Symptoms:** Bleeding gums, bad breath, loose teeth.

- Causes: Poor oral hygiene, smoking.

- **Medication**: Scaling and root planing, antibiotics (consult a dentist).

4. Tooth Abscess

- **Symptoms:** Severe toothache, fever, swollen lymph nodes.

- **Causes:** Bacterial infection.

- **Medication:** Antibiotics, drainage or root canal (consult a dentist).

5. Cold Sores (Herpes Simplex)

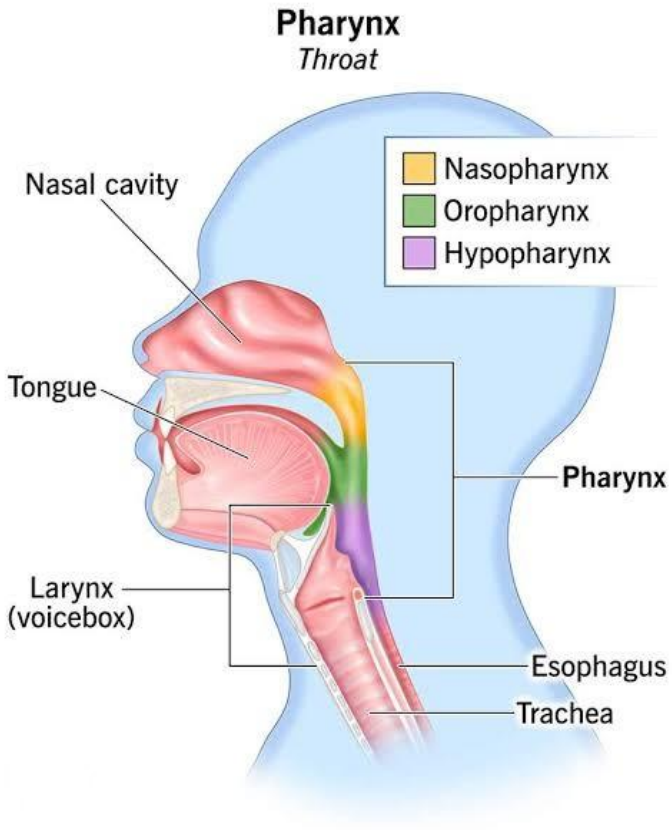
- Symptoms: Fluid-filled blisters around lips.

- **Causes:** Viral infection, stress.

- Medication: Antiviral creams (e.g., Blistex, Campho-Phenique).

Pharynx

Location of the Pharynx



• Introduction

The Pharynx, commonly called the throat, is a muscular tube that connects the nasal cavity and mouth to the esophagus and larynx. It plays an important role in both the respiratory system and

digestive system. It allows air to pass to the lungs and food to move to the stomach.

• Structure (Anatomy) of Pharynx

The pharynx is about 12–14 cm long and lies behind the nose and mouth in the neck region.

It is divided into three main parts:

1. Nasopharynx

Upper part of the pharynx

Located behind the nose na

Connects nasal cavity with the throat

Contains adenoids and openings of the Eustachian tubes

2. Oropharynx

Middle part

Located behind the mouth

Contains tonsils and the base of the tongue

Passage for air, food, and liquids

3. Laryngopharynx (Hypopharynx)

Lower part of the pharynx

Connects with the esophagus and larynx

Directs food to the esophagus and air to the lungs

These three parts together form a muscular passage for breathing and swallowing.

• Functions of Pharynx

The pharynx performs several important functions:

1. Respiration

Conducts air from the nose and mouth to the lungs.

2. Digestion

Helps move food from the mouth to the esophagus during swallowing.

Speech

Helps in voice production and resonance.

Immune Defense.

Equalizing Ear Pressure.

• Diseases of the Pharynx

Some common diseases affecting the pharynx include:

1. Pharyngitis

Inflammation of the throat

Symptoms: sore throat, fever, difficulty swallowing

Usually caused by viral or bacterial infection.

2. Tonsillitis

Infection and inflammation of the tonsils

Causes throat pain, fever, and difficulty swallowing.

3. Throat Cancer

Abnormal growth of cells in the pharynx

Symptoms: persistent sore throat, difficulty swallowing.

4. Epiglottitis

Severe inflammation of the epiglottis that can block the airway.

• Medicines Used for Treatment

Common medicines used for pharynx infections in Pakistan include:

1. Antibiotics (for bacterial infection)

Amoxicillin

Azithromycin

Cefixime

2. Pain Relievers

Paracetamol

Ibuprofen

3. Antiseptic Throat Lozenges

Strepsils

Septran lozenges

4. Syrups

Cough syrups for throat irritation

These medicines are commonly available in pharmacies across Pakistan but should be used according to a doctor's advice.

• Prevention

To keep the pharynx healthy:

Maintain good oral hygiene

Avoid smoking and polluted air

Drink warm fluids

• Conclusion

The pharynx is an essential part of the human body that connects the respiratory and digestive systems. Its proper functioning is necessary for breathing, swallowing, and speech.

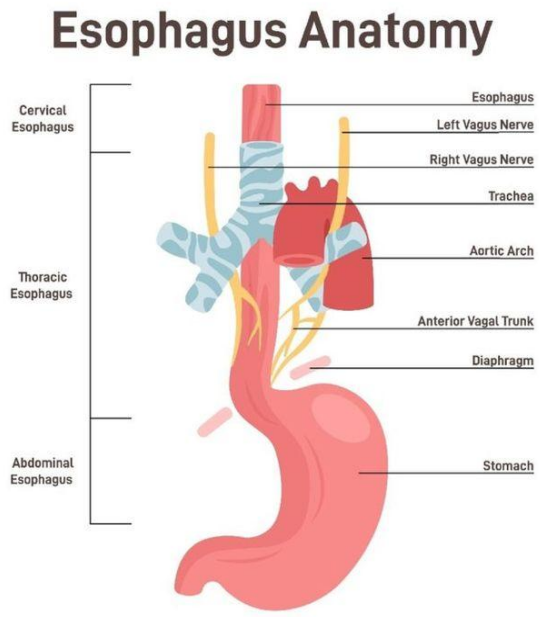
• Reference

1. Gray's Anatomy –

Henry Gray

2. BD Chaurasia's Human Anatomy –

B. D. Chaurasia



OESOPHAGUS INTRODUCTION

The oesophagus (or esophagus) is a 25–30 cm long, muscular tube that transports food and liquids from the pharynx to the stomach via involuntary contractions called peristalsis. Located in the chest behind the trachea and heart, this "food pipe" acts as a vital digestive conduit that passes through the diaphragm to connect to the stomach, functioning primarily through muscular movement rather than gravity

• location: Begins at the neck (level C6) behind the larynx, descends through the mediastinum (thorax), and enters the abdominal cavity through the diaphragm at the level of T10.

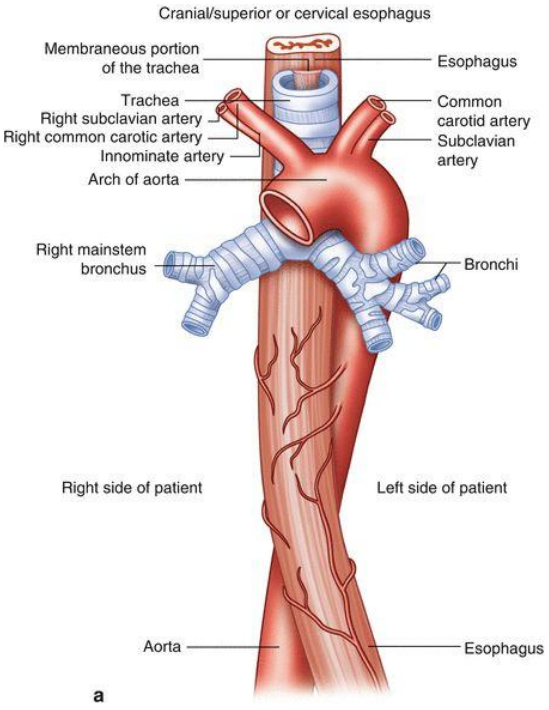
•layers: From inside out, it consists of mucosa, submucosa, muscularis propria, and adventitia (no serosa).

•sphincters: The upper esophageal sphincter (UES) prevents air from entering, while the lower esophageal sphincter (LES) prevents stomach acid reflux.

•Transport: It actively moves food from the mouth to the stomach within seconds using peristaltic waves.

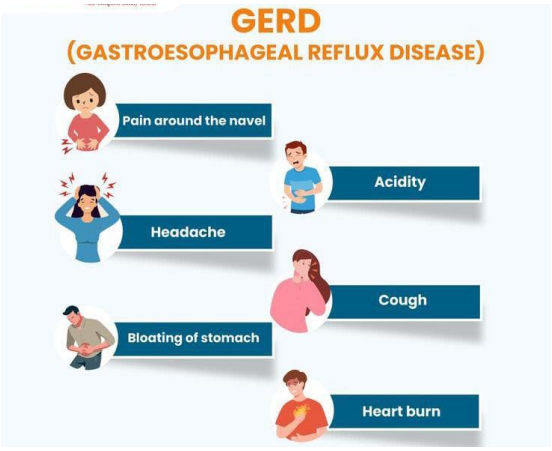
•Profection: The LES keeps stomach acid out of the esophagus.

•Lubrication: Glands in the submucosa secrete mucus to aid in the smooth



passage of food.

COMMON DISEASES RELATED TO OESOPHAGUS:



Gastroesophageal Reflux Disease (GERD): Acid flowing back from the stomach, causing heartburn.

Dysphagia: Difficulty or pain when swallowing, sometimes due to blockages.Oesophageal Varices: Dilated veins that can cause severe bleeding, often linked to liver disease.

Esophageal Cancer: Malignancy often linked to chronic damage.

Symptoms of Esophageal Disorders

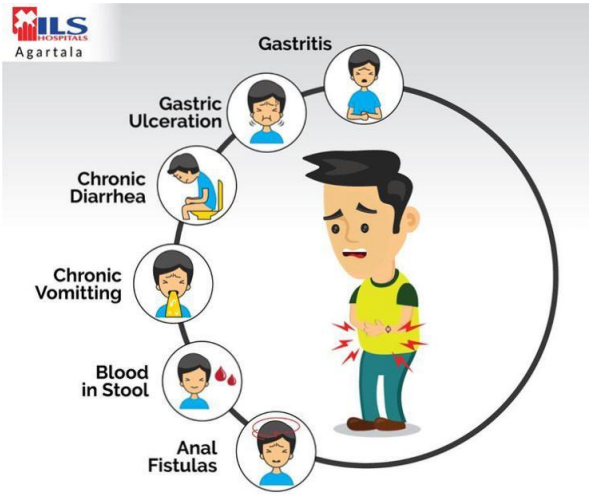
Heartburn: Burning sensation in the chest.

Dysphagia: Difficulty swallowing or feeling of food stuck in the chest/throat.

Odynofagia: Painful swallowing.

Regurgitation: Bitter food/acid returning to the mouth.

Chronic cough or hoarseness.



Unexplained weight loss.

Causes and Risk Factors

Reflux: Weakening of the lower sphincter.

Lifestyle: Smoking, alcohol consumption, obesity.

Allergic reactions: Eosinophilic esophagitis (EoE) caused by food allergens.

Infections: Infections damaging the esophagus.

Medications: Certain medications that irritate the lining.

Medical and Lifestyle Management

Acid Suppression: PPIs (e.g., omeprazole, lansoprazole) are the most effective for healing esophageal damage. H2 blockers (e.g., famotidine) are also used for mild symptoms.

Lifestyle Changes: Weight loss is the most effective change for GERD. Other changes include avoiding late-night meals, smoking cessation, and reducing fat, caffeine, alcohol, and mint intake.

Medication-Induced (Pill) Esophagitis: Switching to liquid medication, drinking a full glass of water, and staying upright for 30 minutes after taking pills

Esophageal Dilation: A procedure to stretch the esophagus, typically used for strictures (narrowing) or achalasia.

POEM (Peroral Endoscopic Myotomy): A minimally invasive, endoscopic procedure to treat achalasia by cutting the tight muscle

COMMONLY PRESCRIBED MEDICINE IN PAKISTAN

Treatment for esophageal diseases in Pakistan, particularly Gastroesophageal Reflux Disease (GERD) and esophagitis, focuses on reducing stomach acid. Key medications include Proton Pump Inhibitors (PPIs) such as Esomeprazole (e.g., Esophag), Omeprazole, and Rabeprazole, alongside H2 blockers (famotidine), antacids (Risek Insta), and prokinetics (domperidone).

Proton Pump Inhibitors (PPIs) – Acid Reduction:

Risek (Omeprazole) – Getz Pharma

Esoprime (Esomeprazole) – Pearl Pharmaceuticals

Novoteph/Teph (Esomeprazole/Omeprazole) – Sami Pharmaceuticals

Zopent (Pantoprazole) – Hilton Pharma

Vonolia/Vocinti (Vonoprazan) – Sami Pharmaceuticals/Searle

Redexa (Dexlansoprazole) – PharmEvo

Antacids/Alginates – Immediate Relief:

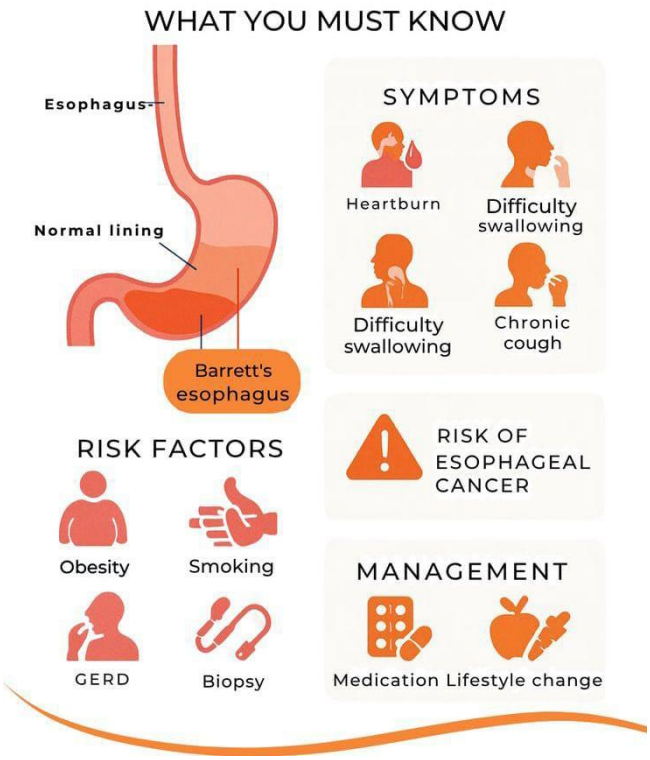
Gaviscon (Sodium Alginate + Antacids) – Reckitt Benckiser

Ventacid (Calcium Carbonate + Magnesium Hydroxide) – Nutrifactor

Prokinetics – Motility Improvement:

ITP/Itoguard (Itopride) – Sami Pharma/CCL Pharmaceuticals

PRECAUTIONS FOR OESOPHEAGEL DISEASES

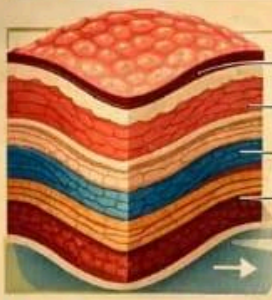


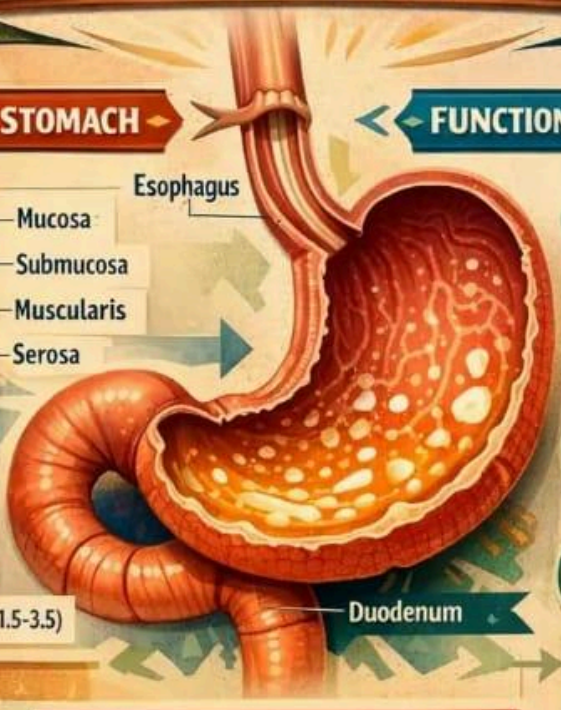
To prevent or manage esophageal diseases like GERD, esophagitis, or esophageal cancer, it is essential to adopt a lifestyle that minimizes acid reflux and damage to the esophagus. Key precautions include maintaining a healthy weight, quitting smoking, limiting alcohol, and avoiding eating 3 hours before lying down. Dietary changes are crucial, involving smaller, frequent meals and reducing intake of spicy, fatty, acidic, and caffeinated items. Other protective measures involve elevating the head of the bed (4–

11 inches) while sleeping, avoiding tight clothing, and ensuring pills are taken with ample water while sitting upright

THE HUMAN STOMACH

STRUCTURE OF THE STOMACH





- J-Shaped Organ
- Holds 1-2 Liters
- Gastric Folds (Rugae)
- Acidic Environment (pH 1.5-3.5)

FUNCTIONS OF THE STOMACH

- Food Breakdown
- Secretes Gastric Juices
- Nutrient Absorption
- Mixing & Churning

- Digestive Enzymes
- Hydrochloric Acid
- Intrinsic Factor

DISEASES OF THE STOMACH

Gastritis
- Inflammation of the Stomach Lining

Ulcers
- Peptic Ulcers & Erosion

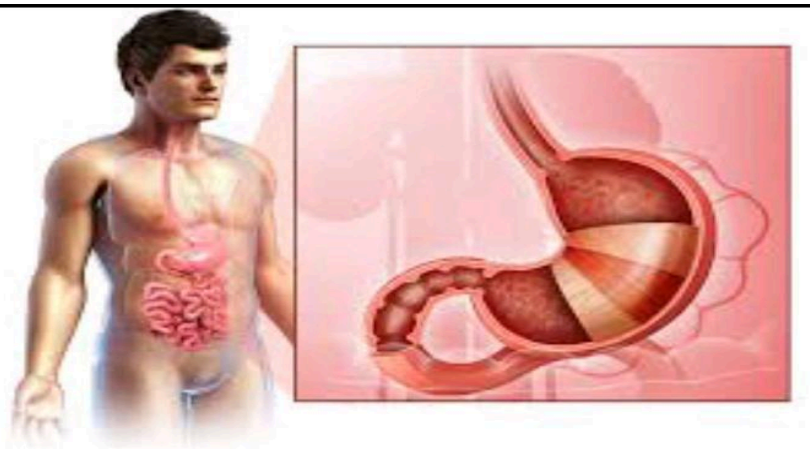
GERD
- Acid Reflux & Heartburn

- Digesting Food Takes 2-4 Hours
- Stomach Produces 1.5 Liters of Gastric Juice Daily
- Absorbs B12 & Important Nutrients

Stomach

Introduction of stomach:

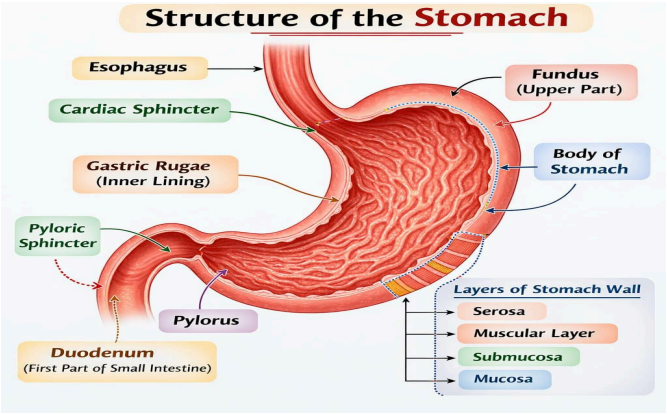
Introduction The stomach is a muscular, hest hollow organ in the digestive system. It stores and digests food, it mixing it with digestive juices and sends partially digested food to the small intestine. It is located in the upper left part of the abdomen, under the diaphragm.



Structure:

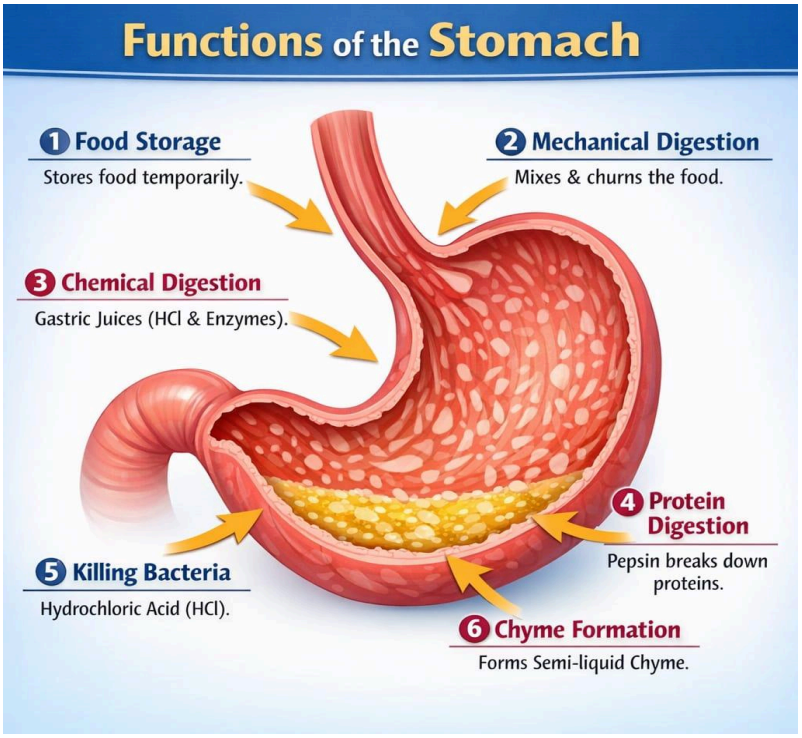
The stomach is divided into four main parts:

- **Cardia**: Entry point of food from the esophagus
- **Fundus**: Upper curved part. Body Main and largest part where food is digested.
- **Pylorus**:Lower part that connects to st intestine.



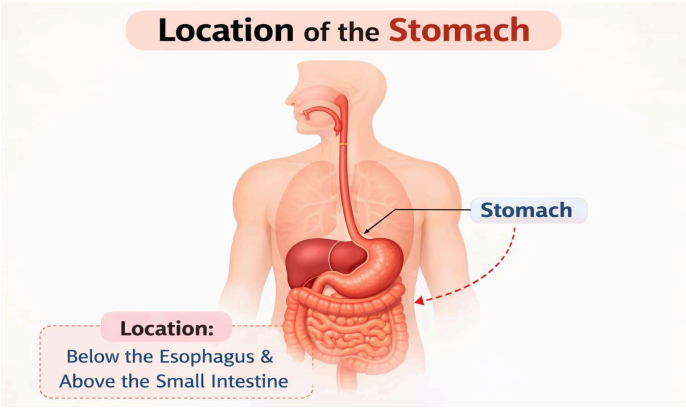
Function:

- Temporarily stores food. Mixes food with gastric juices to form **chyme**.
- Begins protein digestion with **pepsin**:
- Absorbs small amounts of water, alcohol, and drugs.
- Protects the body from harmful bacteria with acid.



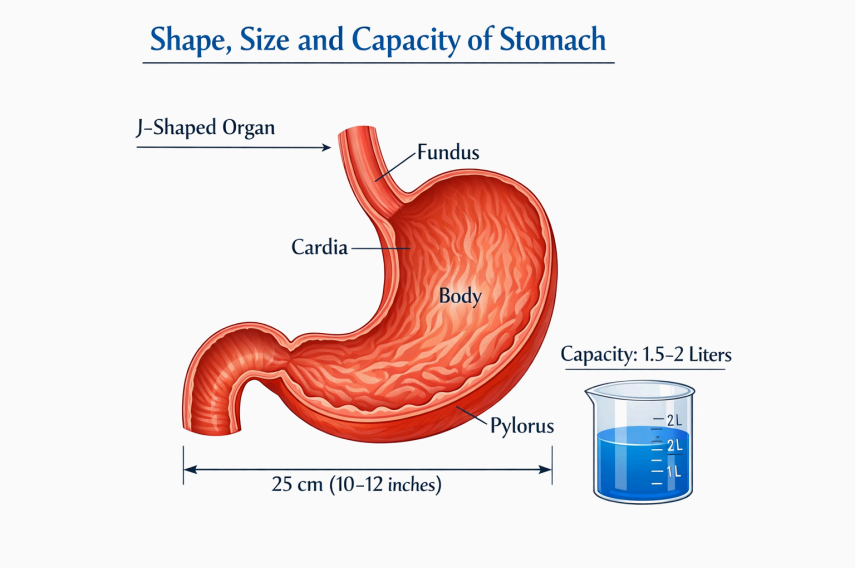
Location:

The stomach is located in the upper left abdomen, below the diaphragm and above the pancreas. Connected to the esophagus at the top and small intestine (duodenum) at the bottom.



Shape, size and capacity:

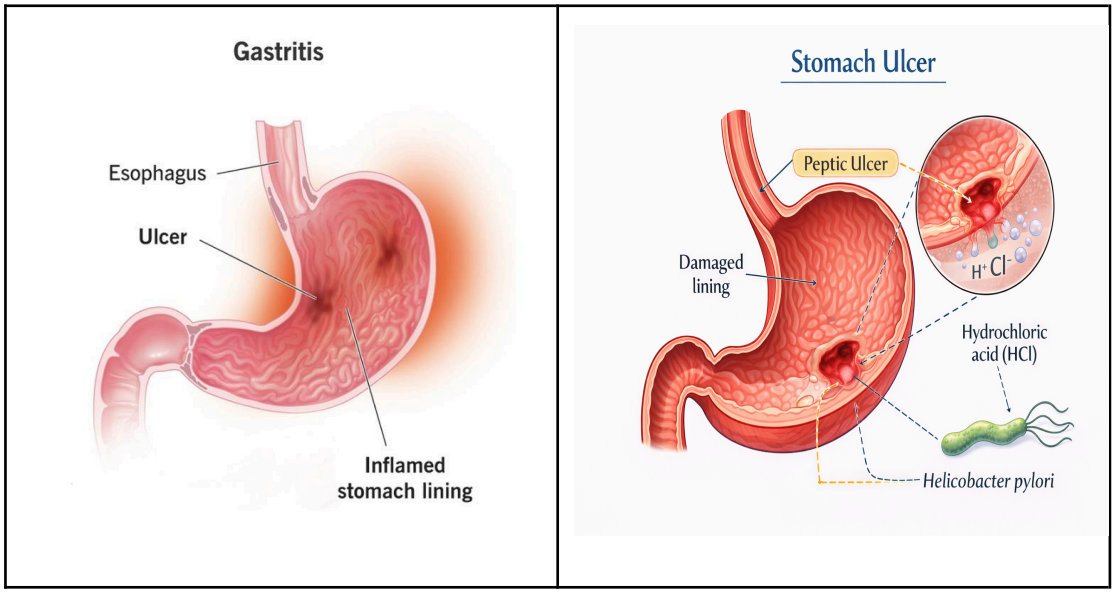
- The shape of stomach depends upon the degree of tone of its muscles and tone of muscles of the body.
- In normal active persons(sthenic), its shape is somewhat J-shaped.
- In thin, tall persons (hyposthenic), its shape is J-shaped, while in broad, strong and very active persons, its shape is horizontal.
- The stomach is a very distensible organ.
- It is about 25 cms long, and the mean capacity is one ounce (30 ml) at birth, one litre (1000 ml), at puberty, and 1.5 to 2 litres or more in adults. Esophagus Cardia Lower esophageal sphincter Duodenum Diaphragm Fundus Stomach Antram Pyons.



Diseases:

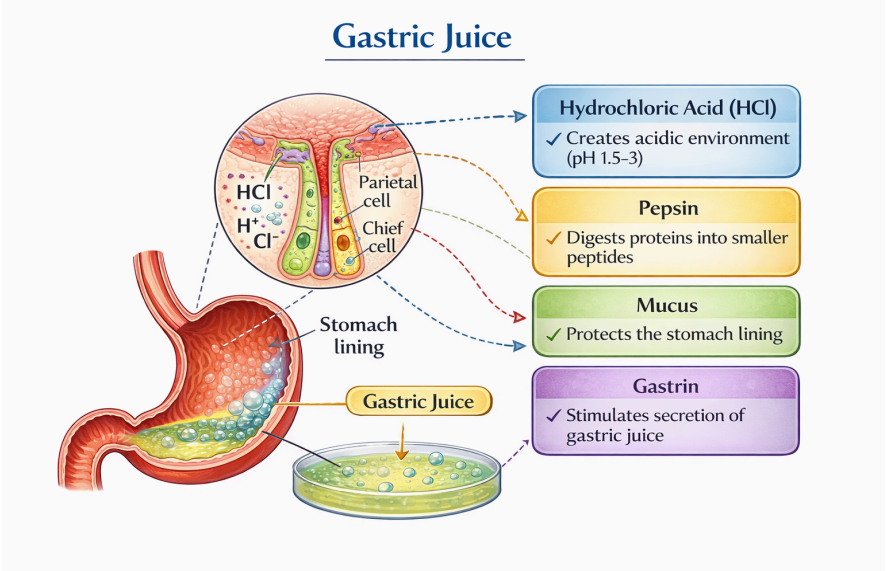
- **Gastritis:** Inflammation of stomach lining.
- **Peptic Ulcer:** sores due acid damage .
- **Stomach cancer:** Malignant-tumor.

- **GERD (Gastroesphageal Reflux):** Acid reflux into esophagus.



Gastric juice:

- **Hydrochloric Acid (HCI):** Kills bacteria and activates pepsin.
- **Pepsin:** Protein-digesting enzyme.
- **Mucus:** Protects stomach lining from acid.
- **Intrinsic Factor:** Helps absorb Vitamin B12.



Clinical:

- **Symptoms:** Pain, nausea, vomiting, in- digestion.
- **Diagnosis:** Endoscopy, biopsy, imaging (X-ray, CT scan).
- **Treatment:** Lifesyle changes, medication (antacids, antibiotics) surgery if severe.

Conclusion:

The stornach: is essential for digestion and protection from pathogens. A healthg diet, avoiding exces spicy or acid food, and regular cheebups prevent most stomach problem.

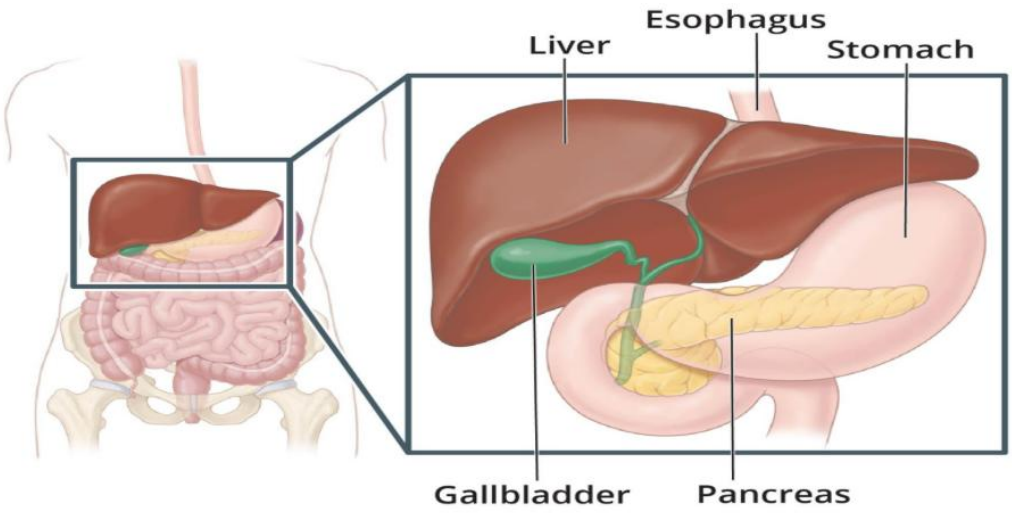
Reference:

- **Guyion** and Hall Textbook of Medical Physiology
- **Human** Anatomy & Physiology, Elaine N. Maireb

Liver – Structure, Function and Clinical Importance

Introduction :

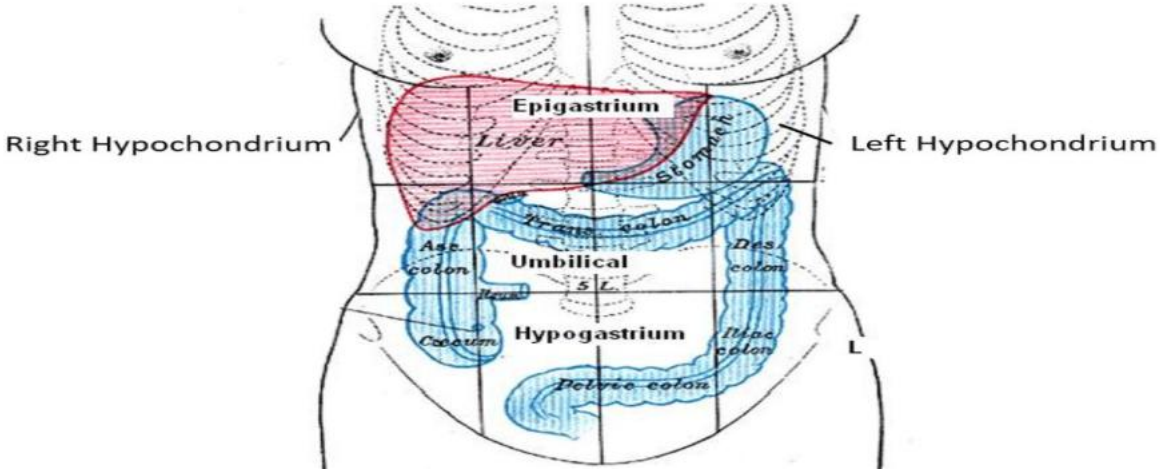
The liver is the largest internal organ of the human body and one of the most important organs of the digestive system. It performs numerous metabolic, detoxification, and synthetic functions that are essential for maintaining normal physiology. The liver processes nutrients absorbed from the intestine, produces bile for digestion, and plays a major role in metabolism of carbohydrates, proteins, and lipids.



References: Hall JE. Guyton and Hall Textbook of Medical Physiology; Encyclopaedia Britannica – Liver.

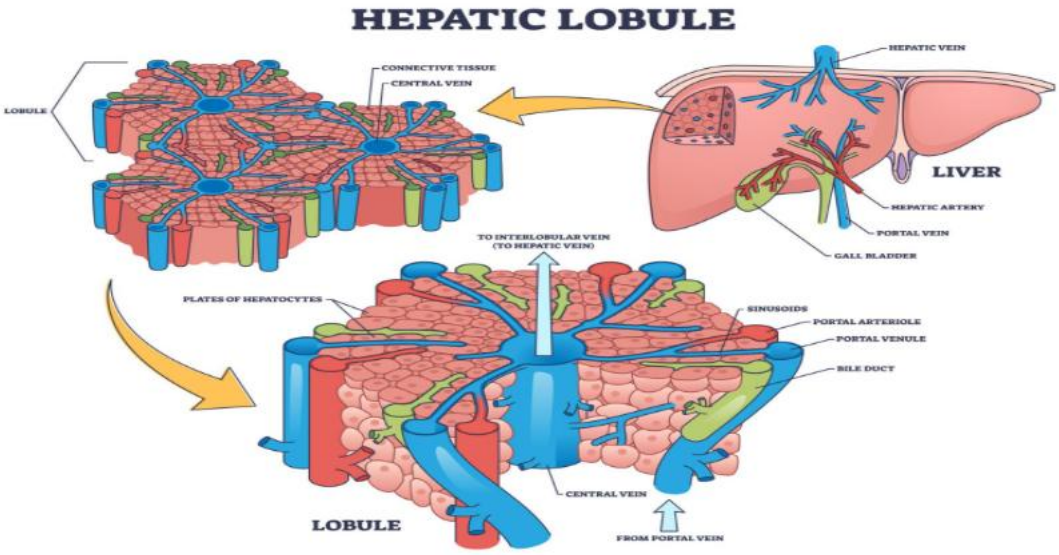
Location :

The liver is located in the upper right quadrant of the abdominal cavity, just below the diaphragm and above the stomach. It occupies most of the right hypochondriac region and extends partially into the epigastric region and left hypochondrium. The liver is protected by the lower ribs and is connected to surrounding organs through ligaments.



References: Moore KL. Clinically Oriented Anatomy; Kenhub – Liver Anatomy.

Structure and Anatomy :

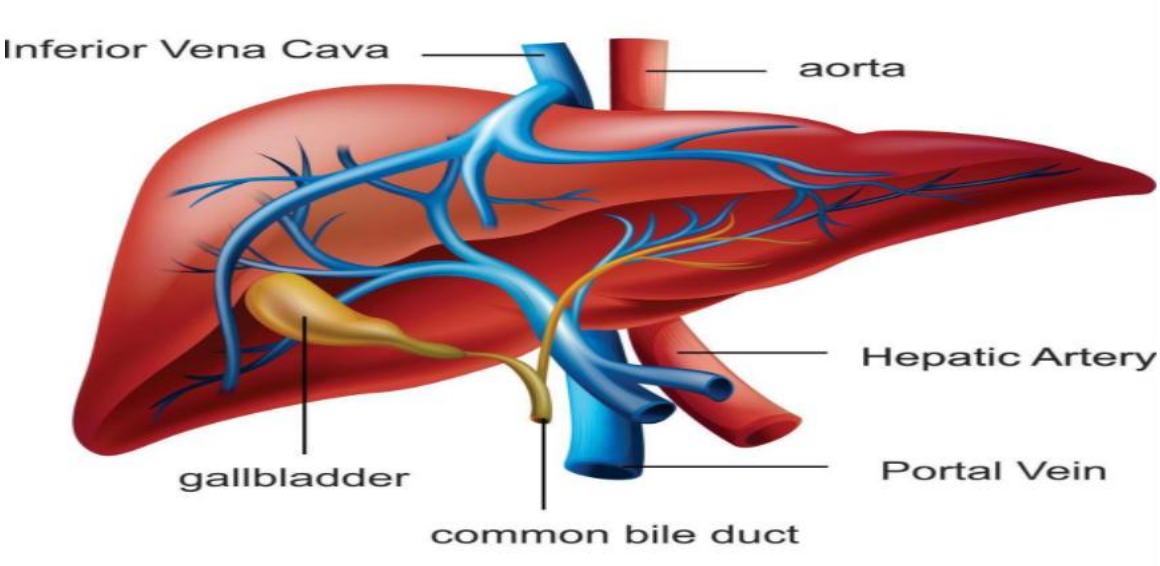


The liver is a large reddish- brown organ that weighs approximately 1.2–1.5 kg in adults. It is divided into two main anatomical lobes, the right lobe and the left lobe, and further subdivided into functional segments. The liver is composed of microscopic units called hepatic lobules which contain hepatocytes arranged around a central vein.

References: Ross MH & Pawlina W. Histology: A Text and Atlas; Kenhub – Liver Structure.

Blood Supply :

The liver has a unique dual blood supply. It receives oxygenated blood from the hepatic artery and nutrient- rich blood from the hepatic portal vein. Blood flows through liver sinusoids where hepatocytes process nutrients, detoxify harmful substances, and perform metabolic functions before draining into the hepatic veins.



References: Moore KL. Clinically Oriented Anatomy; Gray's Anatomy.

Functions :

The liver is a vital organ of the digestive system that performs many important functions. Its main role is the production of bile, a fluid that helps in the digestion and emulsification of fats and supports the absorption of fat-soluble vitamins such as A, D, E, and K. The liver also regulates blood sugar levels by converting excess glucose into glycogen for storage and breaking it back into glucose when the body needs energy. In protein metabolism, it converts harmful ammonia into urea and produces essential blood proteins like albumin and clotting factors. It is also responsible for fat metabolism by producing cholesterol, breaking down fatty acids, and regulating fat storage. In addition, the liver detoxifies harmful substances such as drugs, alcohol, and toxins, stores important nutrients like vitamins and glycogen, and helps protect the body through immune cells that destroy bacteria coming from the digestive tract.

References: Guyton and Hall Textbook of Medical Physiology; Britannica – Liver Function.

Common Diseases and Disorders :

Common digestive system disorders include **GERD (acid reflux)**, which causes heartburn when stomach acid flows back into the esophagus, and **gastritis**, which is inflammation of the stomach lining. **Peptic ulcers** are painful sores in the stomach or intestine, while **diarrhea** and **constipation** affect normal bowel movements. **Irritable bowel syndrome (IBS)** causes abdominal pain and irregular bowel habits. **Hepatitis** affects the liver and its digestive functions, and **gallstones** can block bile flow, affecting fat digestion. In more serious cases, **colorectal cancer** can develop in the large intestine.

Hepatitis: Inflammation of the liver caused by viral infection, alcohol, or toxins. Cirrhosis: Chronic liver damage leading to scarring and impaired liver function.Fatty Liver Disease: Accumulation of excess fat in liver cells.Liver Cancer: Malignant growth of liver cells, often associated with chronic liver disease.

References: Kumar, Abbas & Aster. Robbins and Cotran Pathologic Basis of Disease; WHO Liver Disease Reports.

Medications Used in Pakistan :

1. For Acid Reflux / GERD / Heartburn / Ulcers

Proton pump inhibitors (PPIs) such as *Risek (omeprazole)* and *Nexum* — reduce stomach acid and help heal ulcers/GERD.

Antacids and acid reducers like *Gaviscon* syrup — neutralize acid and relieve heartburn quickly.

Ruling capsules — reduce excess stomach acid for GERD and reflux symptoms.

2. For Irritable Bowel Syndrome (IBS) and Cramping

Antispasmodics such as *Colofac* (mebeverine) help relax gut muscles and reduce cramps.

Medicines like *Buscopan* can also help relieve abdominal cramps.

3. For General Stomach Pain, Indigestion & Discomfort

Motilium tablets (domperidone) may be used for nausea and stomach discomfort.

Enterogermina (probiotic suspension) can help balance gut bacteria and improve digestion.

4. For Peptic Ulcers

In addition to PPIs, doctors may prescribe protective agents like **sucralfate**, which coats and helps heal ulcers.

5. For Liver-related Digestive Issues (e.g., hepatitis)

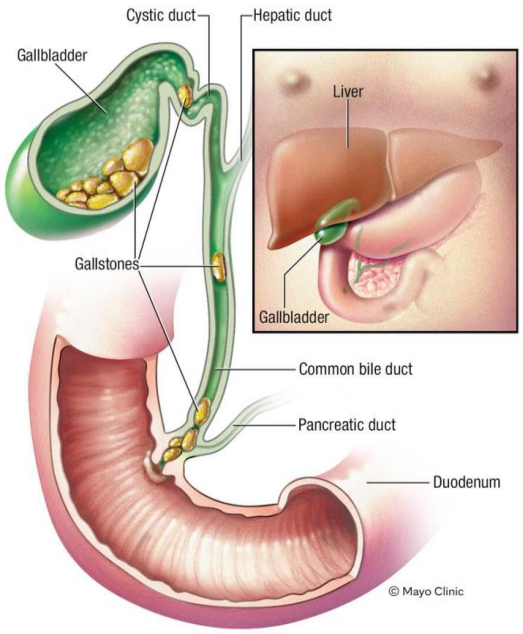
Treatment for hepatitis (liver inflammation) often involves **antiviral medicines** prescribed by a doctor, especially for viral hepatitis B or C (specific drugs vary and must be prescribed by a specialist).

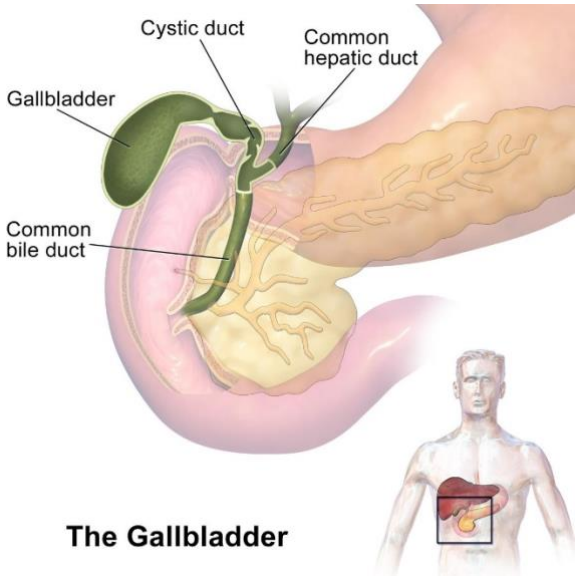
References: Pakistan Pharmacopoeia; Local clinical treatment guidelines.

Introduction

The gall bladder is a small, pear-shaped organ located beneath the liver in the right upper quadrant of the abdomen. It is part of the biliary system and its main function is to store and concentrate bile produced by the liver. Bile helps in the digestion and absorption of fats in the small intestine. When fatty food enters the duodenum, the gall bladder contracts and releases bile through the bile ducts into the duodenum.

The gall bladder is divided into three parts: fundus, body, and neck, and it connects to the bile duct via the cystic duct. Although it aids digestion, it is not an essential organ, and people can live normally after gall bladder removal (cholecystectomy).





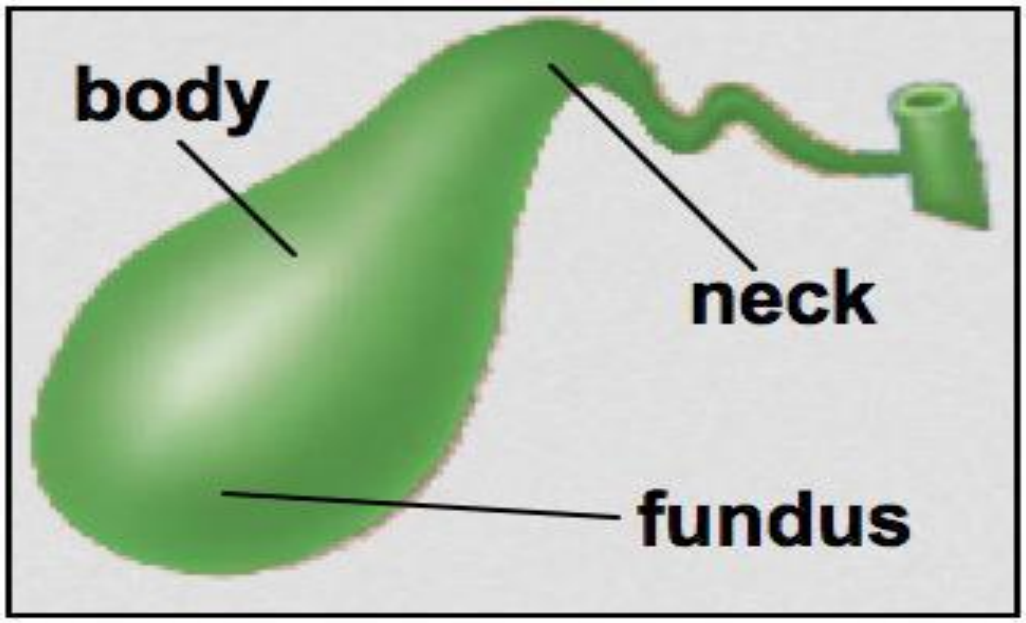
Basic Introduction

- The gallbladder's main job is to store and concentrate bile, a digestive fluid produced by the liver.
- Bile helps break down fats in the food you eat so they can be absorbed in the intestine.

Structure

The gallbladder is divided into three main anatomical regions:

1. Fundus
   - The rounded, wide end of the gallbladder.
   - It projects slightly beyond the lower border of the liver.
2. Body
   - The largest middle portion.
   - It lies in a shallow depression on the liver called the gallbladder fossa.
3. Neck
   - The narrow end that connects to the cystic duct.
   - The cystic duct joins the hepatic duct to form the common bile duct.



Size and Shape of the Gallbladder

The gallbladder is a small hollow organ located beneath the liver on the right side of the abdomen.

Size

- Length: about 7–10 cm

- Width: about 3–4 cm
- Capacity: approximately 30–60 mL of bile

Shape

- The gallbladder is pear-shaped (or sometimes described as a small sac).
- It has a rounded end (fundus), a central body, and a narrow neck that connects to the bile duct system leading to the small intestine.

Function

Main Functions of the Gallbladder

1. **Storage of Bile**

The gallbladder stores bile that is continuously produced by the liver. Between meals, bile flows from the liver into the gallbladder for temporary storage.

2. **Concentration of Bile**

Inside the gallbladder, water and electrolytes are absorbed, which makes the bile 5–10 times more concentrated. This stronger bile is more effective in digestion.

3. **Release of Bile During Digestion**

When fatty food enters the small intestine (especially the duodenum), a hormone called Cholecystokinin is released.

This hormone causes the gallbladder to contract and release bile through the bile ducts.

4. **Helps in Fat Digestion**

Bile released into the intestine emulsifies fats, breaking them into small droplets so digestive enzymes can act on them more easily.

5. **Helps Absorption of Fat-Soluble Vitamins**

By aiding fat digestion, bile indirectly helps absorb vitamins such as:

- Vitamin A

- Vitamin D
- Vitamin E
- Vitamin K

Common Gallbladder Diseases

1. **Gallstones**
   - The most common gallbladder disease.
   - Hardened deposits made from cholesterol or bile pigments form inside the gallbladder.
   - They may block the bile duct and cause pain, nausea, and vomiting.

   Causes:
- Cholesterol super saturation of bile, obesity, female gender, pregnancy, diabetes, rapid weight loss, liver disease.

  Treatment:
- Analgesics for pain, ursodeoxycholic acid for small cholesterol stones, and laparoscopic cholecystectomy (definitive treatment).

2. **Cholestasis**
   - Inflammation of the gallbladder, often caused by gallstones blocking the cystic duct.
   - Symptoms may include severe abdominal pain, fever, and tenderness in the upper right abdomen.

   Causes:
- Gallstones (most common), bacterial infection (E. Coli), bile stasis, trauma, severe illness.

  Treatment:
- Hospitalization, IV fluids, antibiotics, analgesics, and cholecystectomy.

3. **Choledocholithiasis**
   - A condition where gallstones move into and block the common bile duct.
   - This can prevent bile from reaching the small intestine.

   Causes:

- Migration of gallstones from gallbladder, bile duct infection, biliary obstruction.
  Treatment:
- ERCP for stone removal, antibiotics if infection present, followed by cholecystectomy.
-

4. **Gallbladder Cancer**

- A rare but serious disease where malignant cells develop in the gallbladder.
- Often detected late because early symptoms are minimal.

Causes:

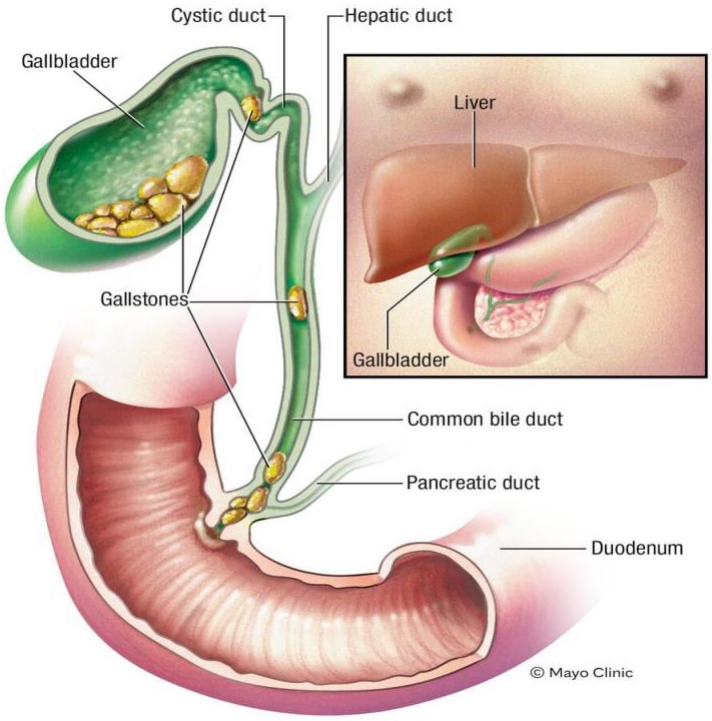
- Chronic gallstones, chronic cholecystitis, porcelain gallbladder, gallbladder polyps, smoking.

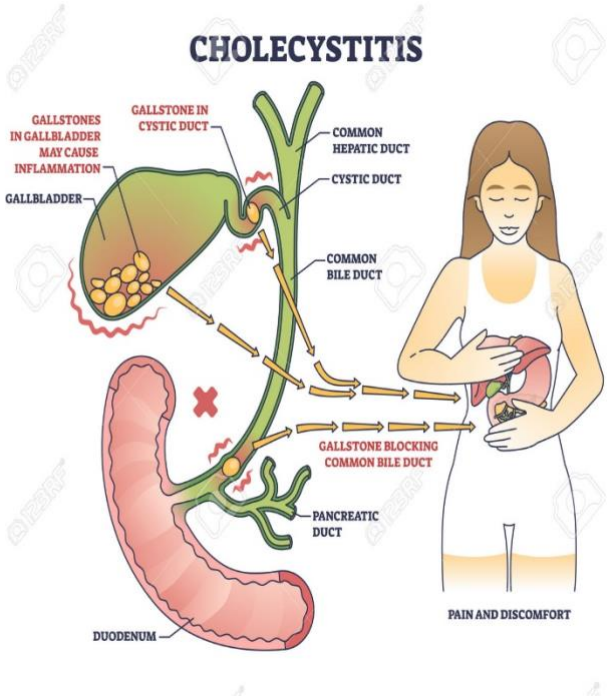
Treatment:

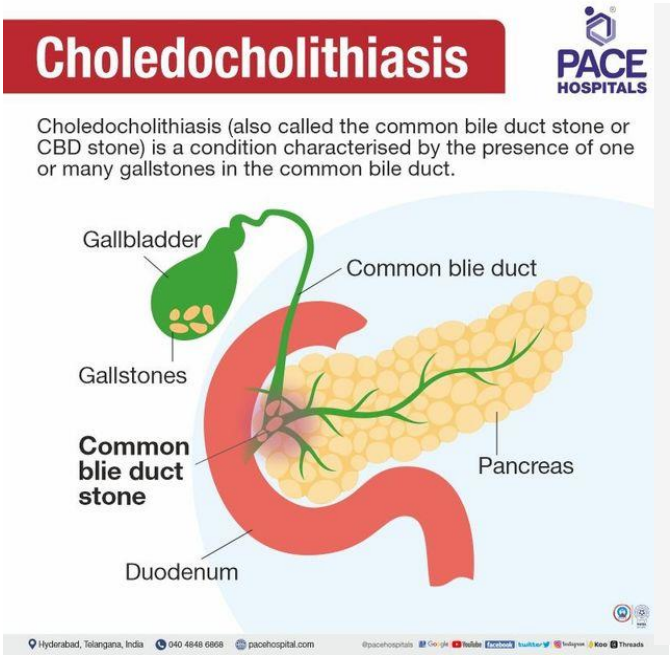
- Surgical removal (cholecystectomy with liver resection), chemotherapy, and radiotherapy depending on stage.

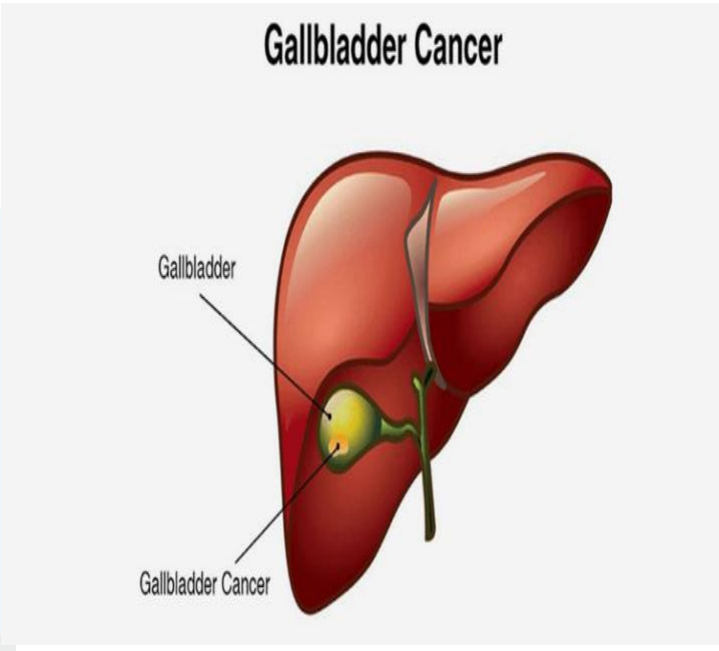
5. **Biliary Dyskinesia**

- A disorder where the gallbladder does not empty bile properly, even without stones
  Causes:
- Gallbladder motility disorder, sphincter of Oddi dysfunction, hormonal factors, functional biliary disorder.
  Treatment:
- Low-fat diet, prokinetic drugs, and cholecystectomy in severe symptomatic cases.


Cystic duct
Hepatic duct
Gallbladder
Liver
Gallstones
Gallbladder
Common bile duct
Pancreatic duct
Duodenum
© Mayo Clinic

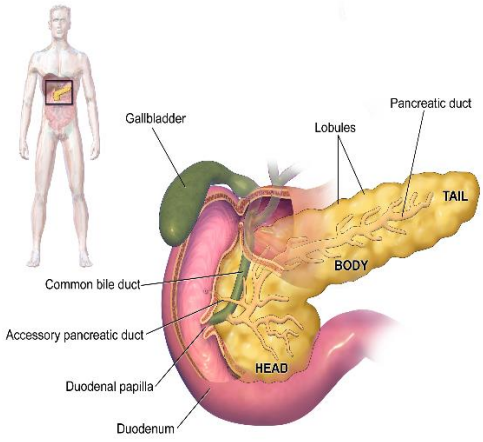

CHOLECYSTITIS
GALLSTONES IN GALLBLADDER MAY CAUSE INFLAMMATION
GALLSTONE IN CYSTIC DUCT
COMMON HEPATIC DUCT
CYSTIC DUCT
GALLBLADDER
COMMON BILE DUCT
GALLSTONE BLOCKING COMMON BILE DUCT
PANCREATIC DUCT
DUODENUM
PAIN AND DISCOMFORT

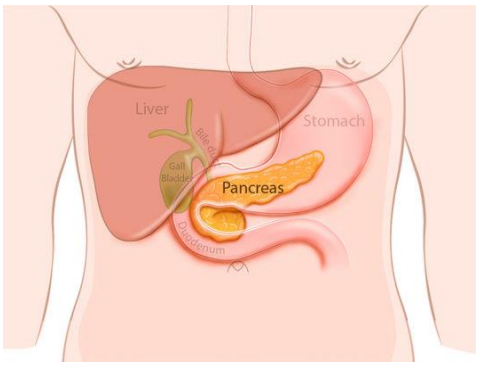

Choledocholithiasis
PACE HOSPITALS
Choledocholithiasis (also called the common bile duct stone or CBD stone) is a condition characterised by the presence of one or many gallstones in the common bile duct.
Gallbladder
Common blie duct
Gallstones
Common blie duct stone
Pancreas
Duodenum
Hyderabad, Telangana, India
040 4848 6868
pacehospital.com

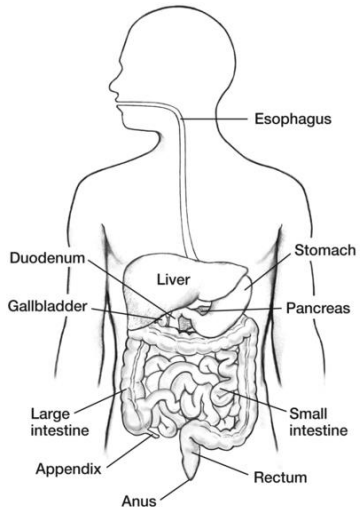

Gallbladder Cancer
Gallbladder
Gallbladder Cancer

Pancreas

Location of the Pancreas







The **pancreas** is an elongated gland located in the **upper abdomen**.

Exact position:

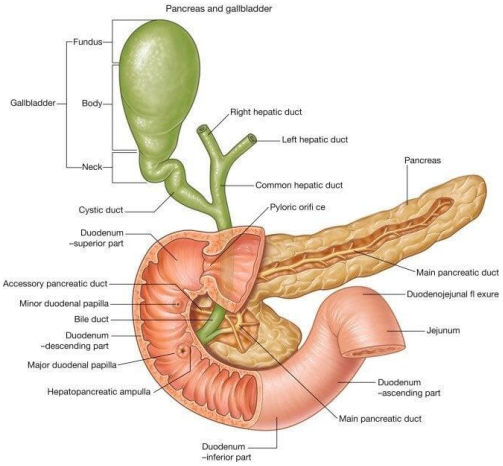
- It lies **behind the stomach**
- It is placed **between the duodenum (first part of the small intestine) and the spleen**
- It sits roughly at the level of the **first and second lumbar vertebrae (L1–L2)**

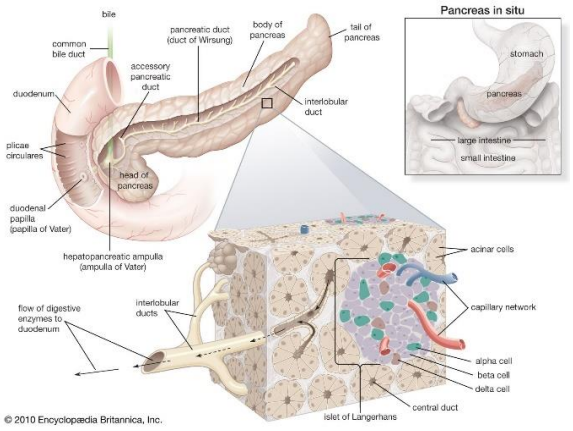
Parts of the pancreas:

1. **Head** – widest part, located in the curve of the duodenum
2. **Neck** – short section connecting head and body
3. **Body** – central elongated portion
4. **Tail** – narrow end that touches the spleen

It is about **12–15 cm long** and weighs roughly **70–100 grams** in adults.

Anatomy of the Pancreas





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The pancreas has **two main anatomical components based on function**:

1. Exocrine Portion (Digestive part)

- Makes up about **95% of the pancreas**
- Consists of **acinar cells**
- These cells produce **digestive enzymes**

The enzymes travel through:

- **Pancreatic duct**
- Join the **common bile duct**
- Empty into the **duodenum**

2. Endocrine Portion (Hormonal part)

Contains clusters of cells called **Islets of Langerhans**.

These release hormones directly into the blood.

Main cells and hormones:

Cell Type	Hormone	Function
Alpha cells	Glucagon	Raises blood sugar
Beta cells	Insulin	Lowers blood sugar
Delta cells	Somatostatin	Regulates hormone secretion
PP cells	Pancreatic polypeptide	Controls pancreatic secretion

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Functions of the Pancreas

The pancreas has **two major functions**:

1. Digestive Function (Exocrine Function)

The pancreas produces **pancreatic juice** which contains digestive enzymes.

Main enzymes:

Enzyme	Digests
Amylase	Carbohydrates
Lipase	Fats
Trypsin & Chymotrypsin	Proteins
Nucleases	DNA & RNA

These enzymes help break down food into **small absorbable molecules**.

Pancreatic juice also contains **bicarbonate ions** which:

- Neutralize the **acidic chyme from the stomach**
- Protect the intestine lining.

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2. Hormonal Function (Endocrine Function)

The pancreas controls **blood sugar levels**.

Main hormones:

Insulin

- Produced by **beta cells**
- Decreases blood glucose
- Helps cells absorb glucose for energy.

Glucagon

- Produced by **alpha cells**
- Increases blood glucose
- Stimulates the liver to release stored glucose.

This balance keeps blood sugar stable.

Link Between Pancreas and the Digestive System

The pancreas is a **major accessory organ of digestion**.

How it works in digestion:

1. **Food enters stomach**
2. Stomach releases **acidic chyme**
3. Chyme enters the **duodenum**
4. The pancreas releases **pancreatic juice**
5. Enzymes break down food molecules
6. Nutrients are absorbed in the **small intestine**

The pancreas works closely with:

- **Liver**
- **Gallbladder**
- **Small intestine**

Together they ensure **proper digestion and nutrient absorption**.

Common Pancreas Diseases

1. Pancreatitis

Types:

- **Acute** (sudden)
- **Chronic** (long-term)

Symptoms:

- Severe upper abdominal pain (radiates to back)
- Nausea & vomiting
- Fever
- Rapid pulse
- Oily or foul-smelling stools (chronic)

Causes:

- Gallstones
- Alcohol use
- High triglycerides
- Certain medications
- Infections

Treatment:

- Hospital care (fluids, fasting)
- Pain relief: Ibuprofen, Morphine
- Enzyme supplements (chronic)
- Stop alcohol & treat underlying cause

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2. Pancreatic Cancer

Symptoms (often late):

- Jaundice (yellow skin/eyes)
- Weight loss
- Loss of appetite
- Abdominal/back pain
- Dark urine

Causes / Risk Factors:

- Smoking
- Diabetes
- Chronic pancreatitis
- Family history

Treatment:

- Surgery (if early)
- Chemotherapy: Gemcitabine
- Radiation therapy
- Pain management

3.Pancreatic Cysts

Symptoms:

- Often none
- Abdominal discomfort
- Nausea

Causes:

- Inflammation
- Genetic conditions

Treatment:

- Monitoring
- Drainage or surgery (if large or suspicious)

4. ⚙ Exocrine Pancreatic Insufficiency

Symptoms:

- Weight loss
- Fatty stools
- Malnutrition

Causes:

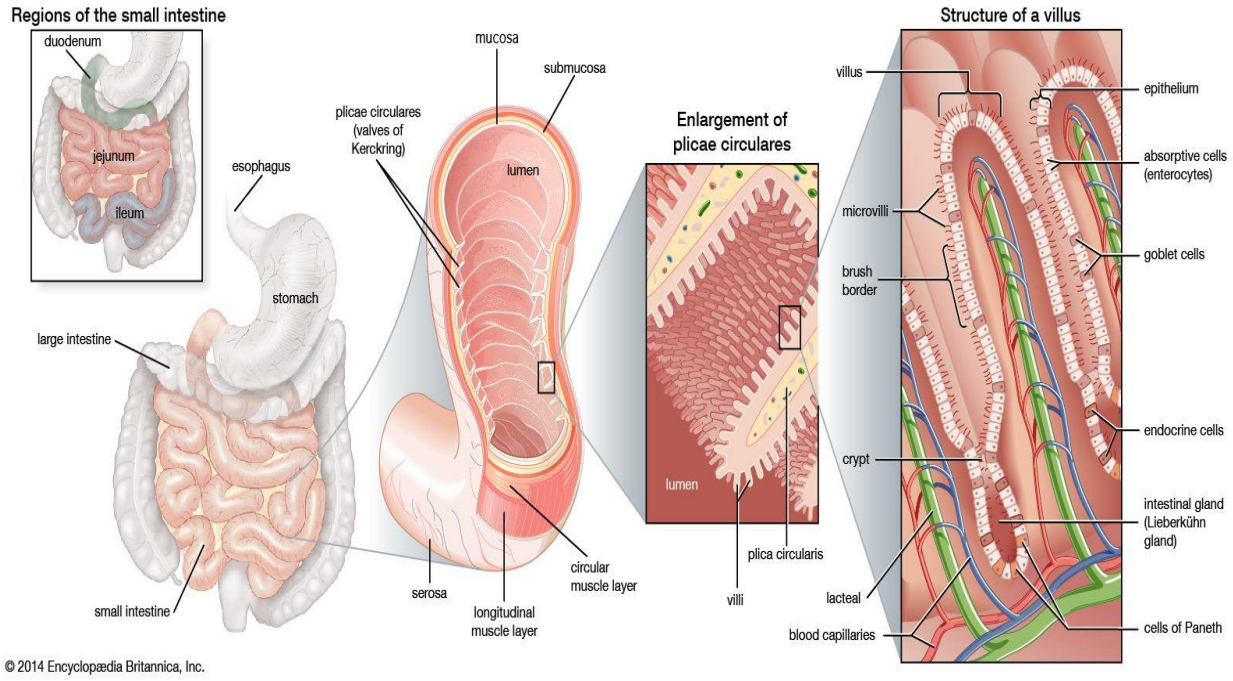
- Chronic pancreatitis
- Cystic fibrosis

Treatment:

- Enzyme replacement: Pancrelipase

Descriptive Anatomy of Small Intestine:

Small Intestine:

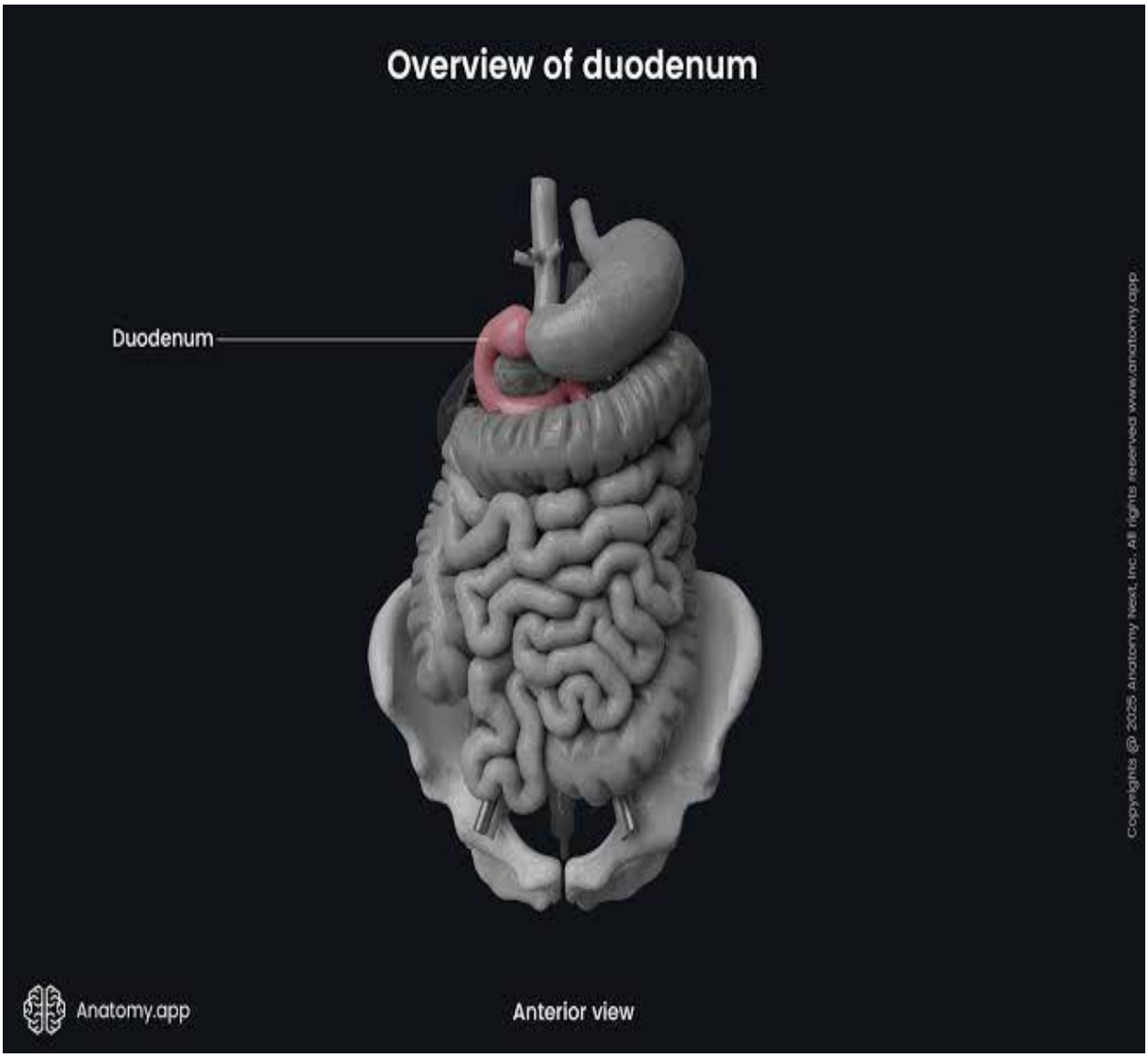


Introduction:

The small intestine is the longest portion of the alimentary canal and is the principal site for digestion and absorption of nutrients. It extends from the pyloric end of the stomach to the ileocecal junction where it joins the large intestine. In adults it measures about six to seven meters in length and occupies the central region of the abdominal cavity. The structure of the small intestine is specially adapted to facilitate digestion and absorption of food materials

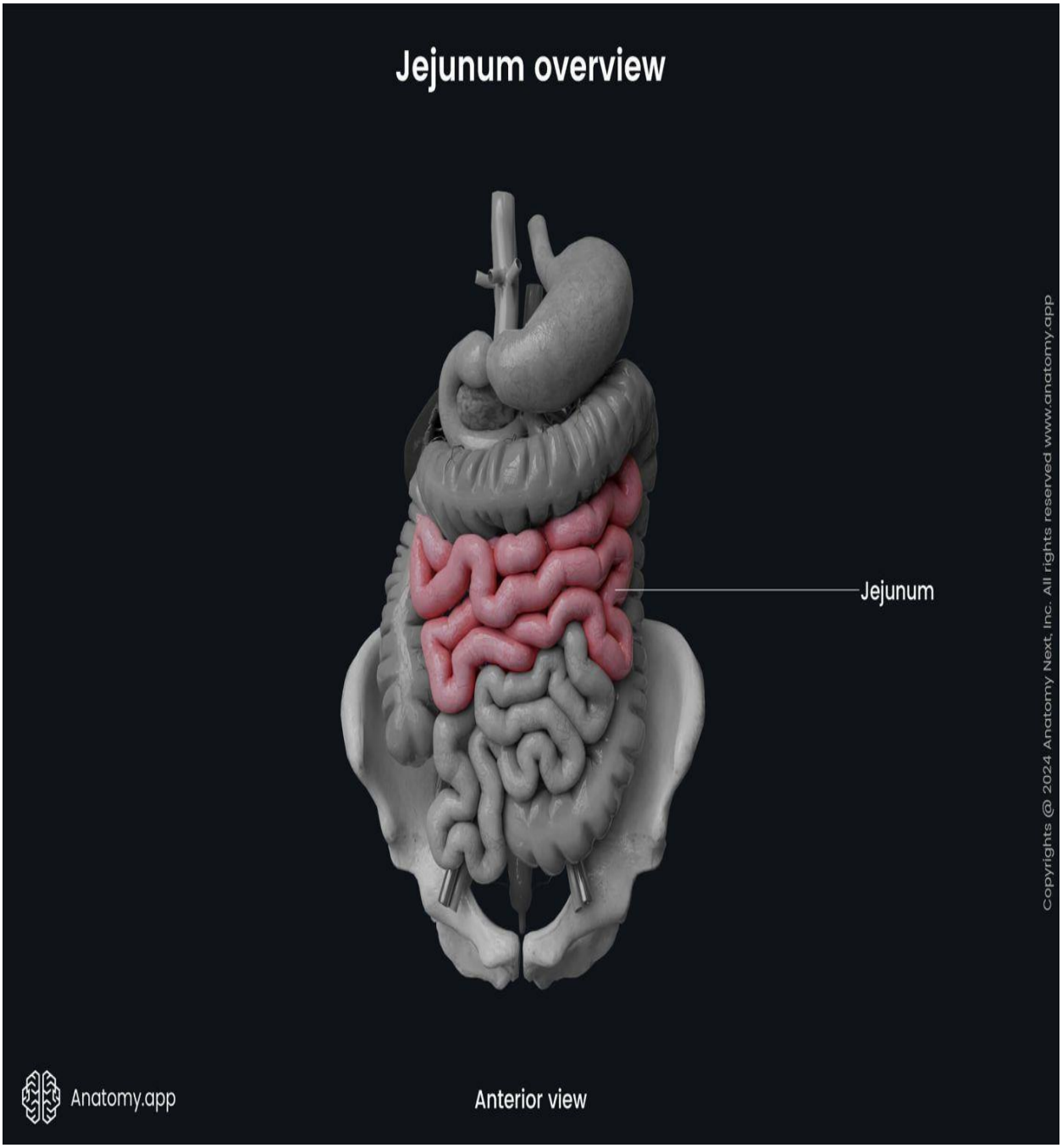
Duodenum:

The duodenum is the first and shortest part of the small intestine, measuring about 25 centimeters in length. It is C-shaped and curves around the head of the pancreas. This segment receives partially digested food called chyme from the stomach. It also receives bile from the liver and digestive enzymes from the pancreas through the bile duct and pancreatic duct. These secretions play an essential role in the chemical digestion of carbohydrates, proteins, and fats.



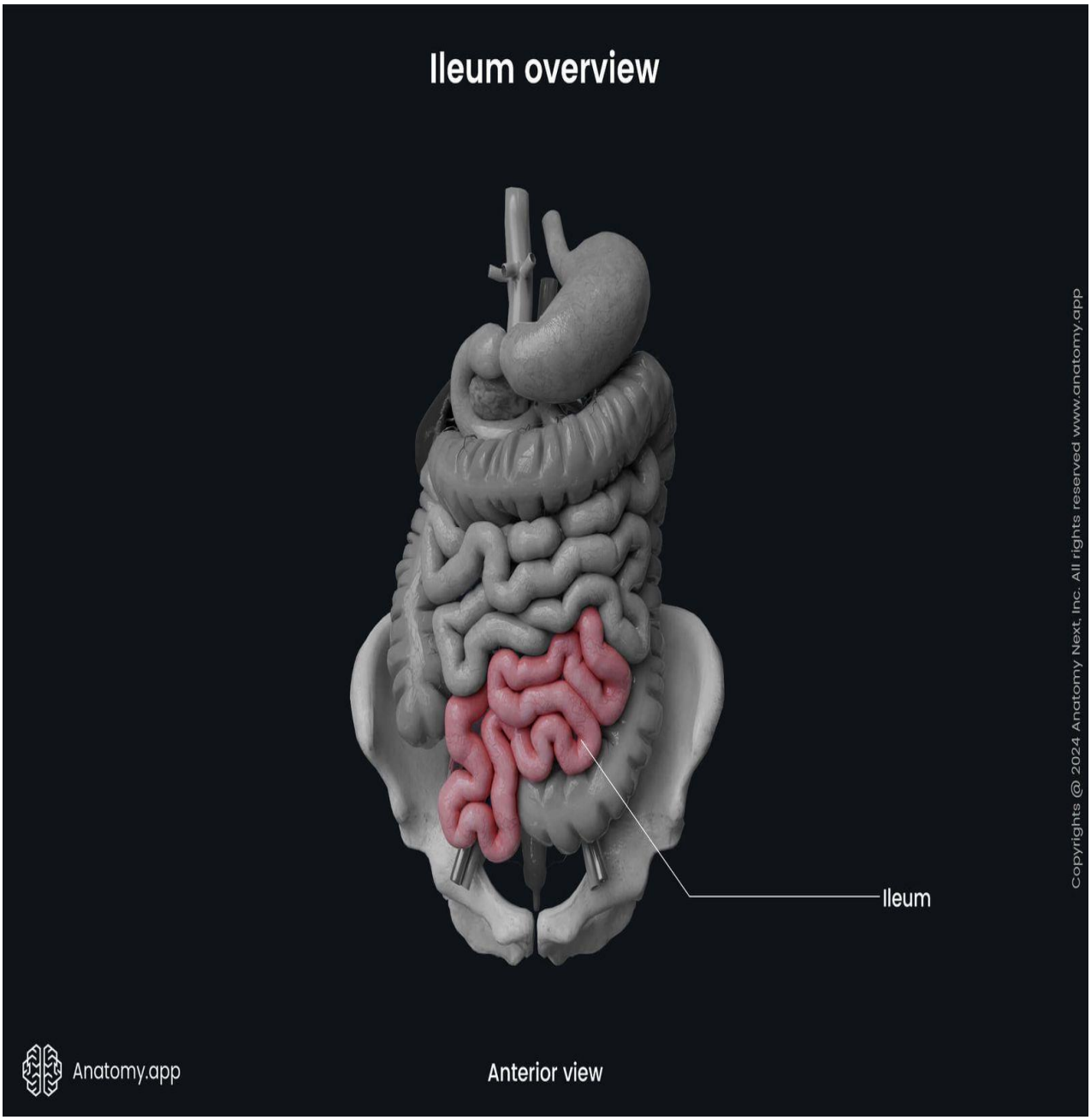
Jejunum:

The jejunum is the middle portion of the small intestine and is approximately 2.5 meters long. It lies mainly in the upper left region of the abdominal cavity. The walls of the jejunum are thick and highly vascular, which supports efficient absorption. Most of the absorption of digested nutrients such as glucose, amino acids, fatty acids, vitamins, and minerals occurs in this region.



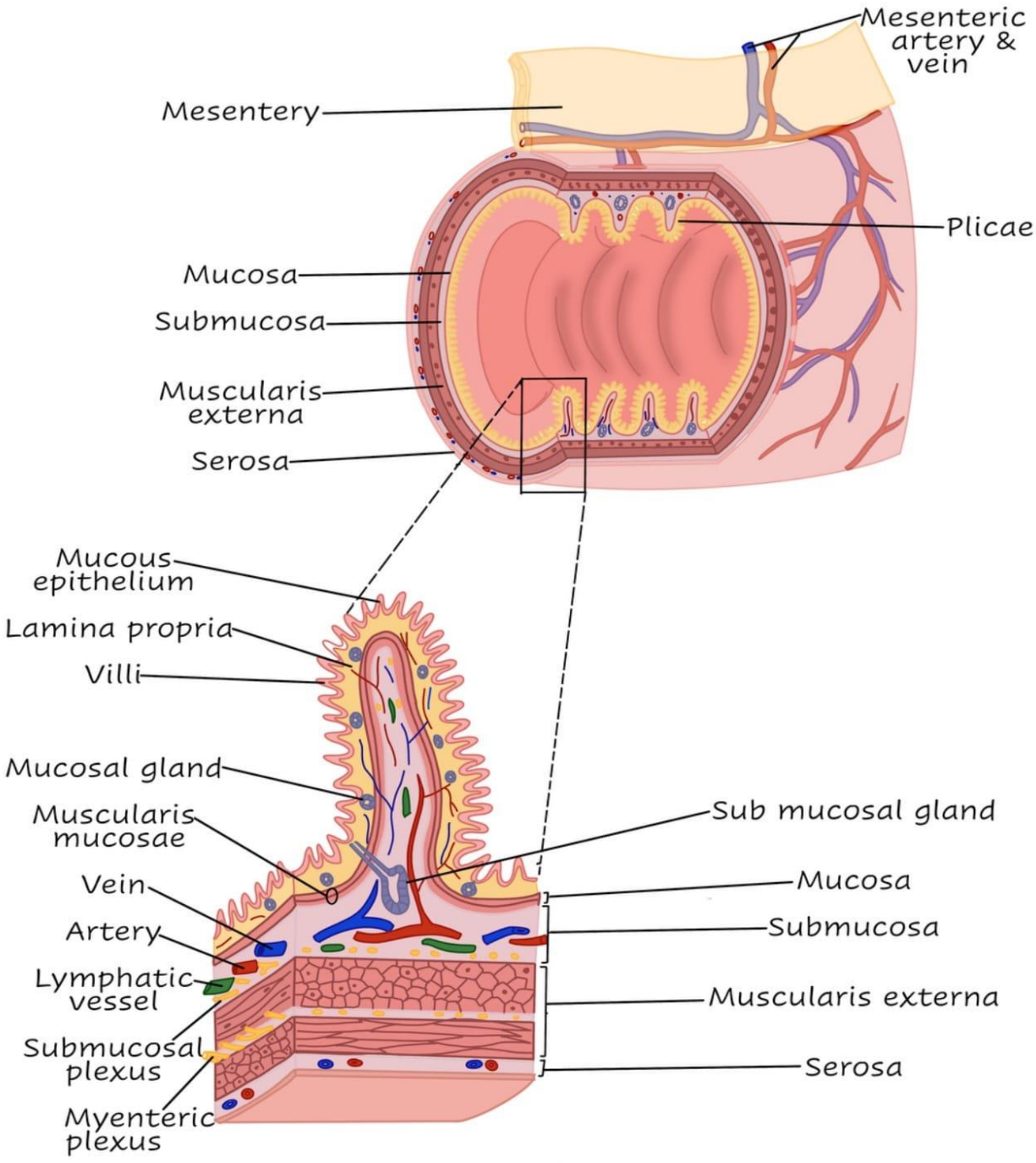
Ileum:

The ileum is the final and longest portion of the small intestine, measuring about 3 to 3.5 meters in length. It occupies the lower part of the abdominal cavity and opens into the large intestine through the ileocecal valve. The ileum continues the absorption of nutrients and is particularly important for the absorption of vitamin B12 and bile salts. It also contains lymphoid structures called Peyer’s patches that contribute to immune protection.



Internal Structure:

The inner lining of the small intestine is highly specialized to increase the surface area for absorption. The mucosa forms circular folds known as plicae circulares. These folds bear numerous finger-like projections called villi, which greatly enhance the absorptive capacity. Each villus is lined with epithelial cells that possess microscopic projections called microvilli, collectively forming the brush border. These structures ensure efficient digestion and absorption of nutrients.

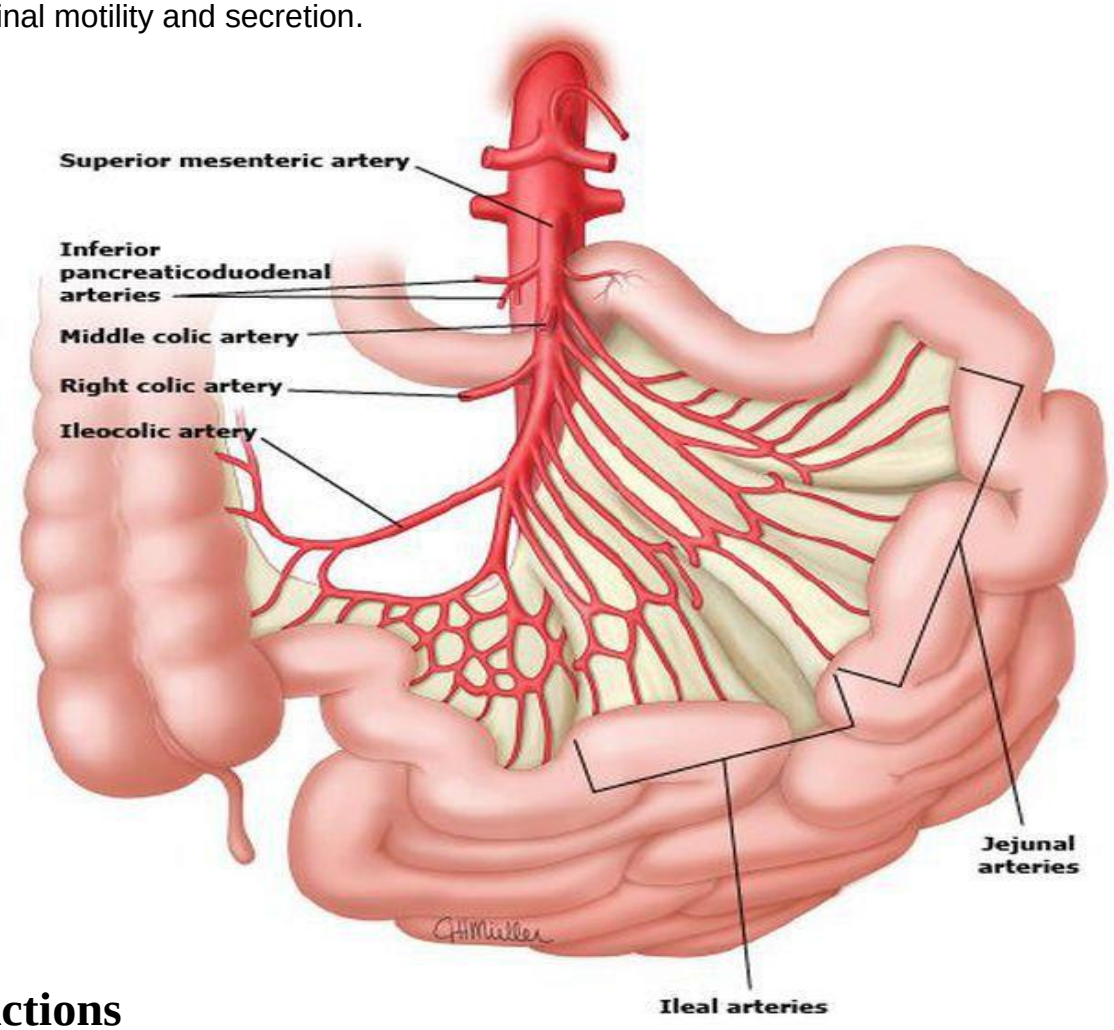


The Structure of the Intestine

Blood Supply and Nerve Supply

The small intestine receives its blood supply mainly from the **superior mesenteric artery**, which branches into several intestinal arteries that supply the jejunum and ileum. Venous blood is drained through the **superior mesenteric vein**, which eventually joins the portal vein and carries blood to the liver.

The nerve supply of the small intestine is derived from the **autonomic nervous system**, including sympathetic and parasympathetic nerves. These nerves regulate intestinal motility and secretion.



Functions

The small intestine is responsible for the completion of digestion and the absorption of most nutrients from food. Digestive enzymes break down carbohydrates, proteins, and fats into simpler substances that can be absorbed into the bloodstream or lymphatic system. The muscular layers of the intestine produce rhythmic contractions known as peristalsis, which help mix the intestinal contents and move them forward through thedigestive tract.

DISEASES OF SMALL INTESTINE WITH THEIR SYMPTOMS, CAUSES AND MEDICATION:

1. Celiac Disease

- Symptoms: Diarrhea, bloating, abdominal pain, fatigue

- Causes: Autoimmune response to gluten

- Medication: Gluten-free diet, medications like analgesic gels (e.g., Enziclor Dental Gel) for symptom relief

2. Irritable Bowel Syndrome (IBS)

- Symptoms: Abdominal discomfort, bloating, changes in bowel habits

- Causes: Stress, dietary factors, hormonal changes

- Medication: Dietary changes, stress management, fiber supplements, medications like antispasmodics

3. Short Bowel Syndrome

- Symptoms: Diarrhea, malnutrition, weight loss, fatigue

- Causes: Surgical removal of intestine, congenital defects

- Medication: Nutritional supplements, antidiarrheals (e.g., loperamide), antibiotics for bacterial overgrowth

4. Enteritis (Inflammation of Small Intestine)

- Symptoms: Fever, abdominal pain, diarrhea, nausea

- Causes: Viral or bacterial infections, radiation

- Medication: Antibiotics, antidiarrheals, hydration therapy

5. Bile Acid Malabsorption

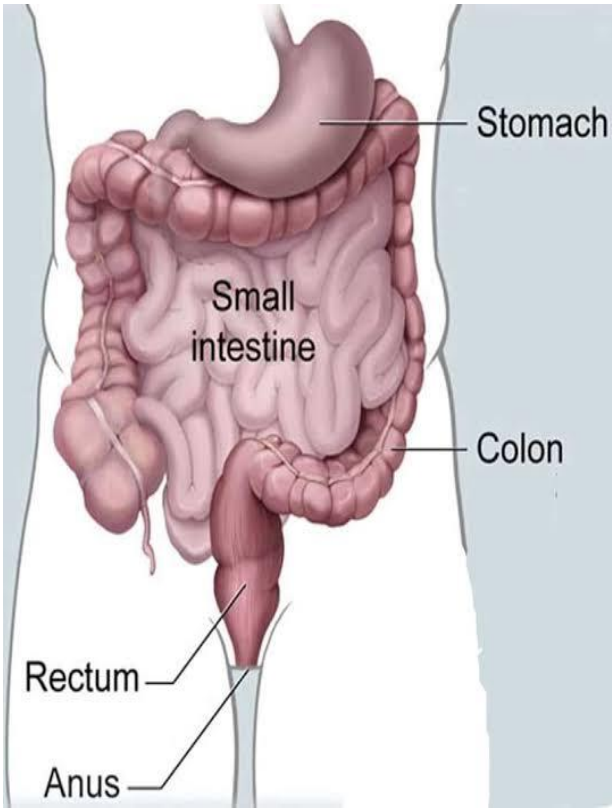
- Symptoms: Watery diarrhea, abdominal pain, bloating

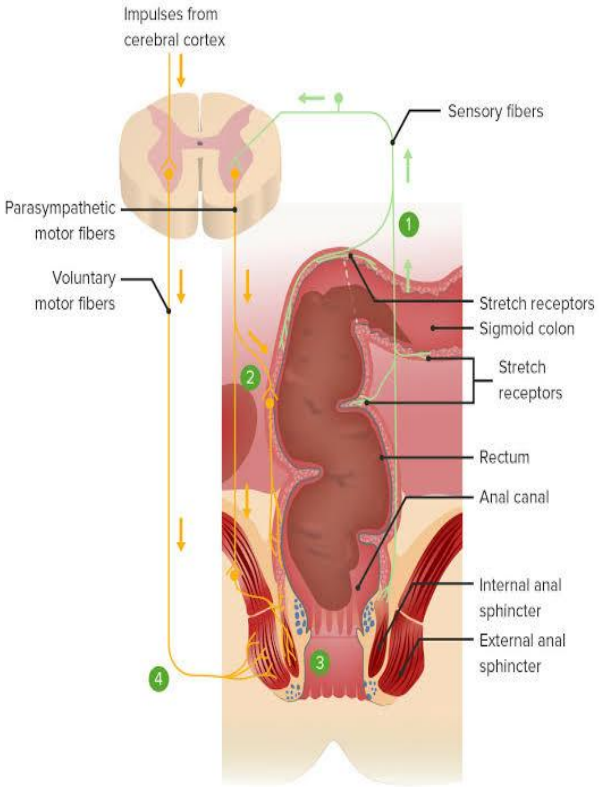
- Causes: Ileal disease, gallbladder removal

- Medication: Bile acid sequestrants (e.g., cholestyramine), dietary changes

Rectum

Postion of Rectum





Introduction

The rectum is the last part of the large intestine. It connects the colon to the anus and temporarily stores feces before elimination. The rectum expands when filled and sends signals to the brain, creating the urge for defecation. It plays an important role in maintaining bowel control.

Functions of Rectum

Storage of feces before elimination

Helps in the defecation process

Maintains continence (control of bowel movement)

Passageway between colon and anus

Sends signals for bowel movement

Diseases of Rectum

Common diseases of rectum include:

Hemorrhoids (piles)

Proctitis

Rectal Prolapse

Anal Fissure

Rectal Cancer

Symptoms

Pain during bowel movement

Rectal bleeding

Constipation

Diarrhea

Itching in anal region

Swelling near anus

Mucus discharge

Feeling of incomplete evacuation

Medication & Treatment

Treatment depends on the condition:

High-fiber diet and adequate fluids

Warm sitz bath

Stool softeners

Anti-inflammatory medicines

Antibiotics (if infection present)

Surgical treatment (for severe cases)

Medicines Available in Pakistan

Daflon – used for hemorrhoids

Proctosedyl – reduces pain and inflammation

Anusol – relief from piles

Duphalac – for constipation

Flagyl – for infection

Buscopan – relieves cramps

Movicol – stool softener

Conclusion

The rectum plays an important role in storing and eliminating waste. Several diseases can affect it, such as hemorrhoids and fissures. These conditions can be managed with proper treatment, diet, and medicines that are available in Pakistan.

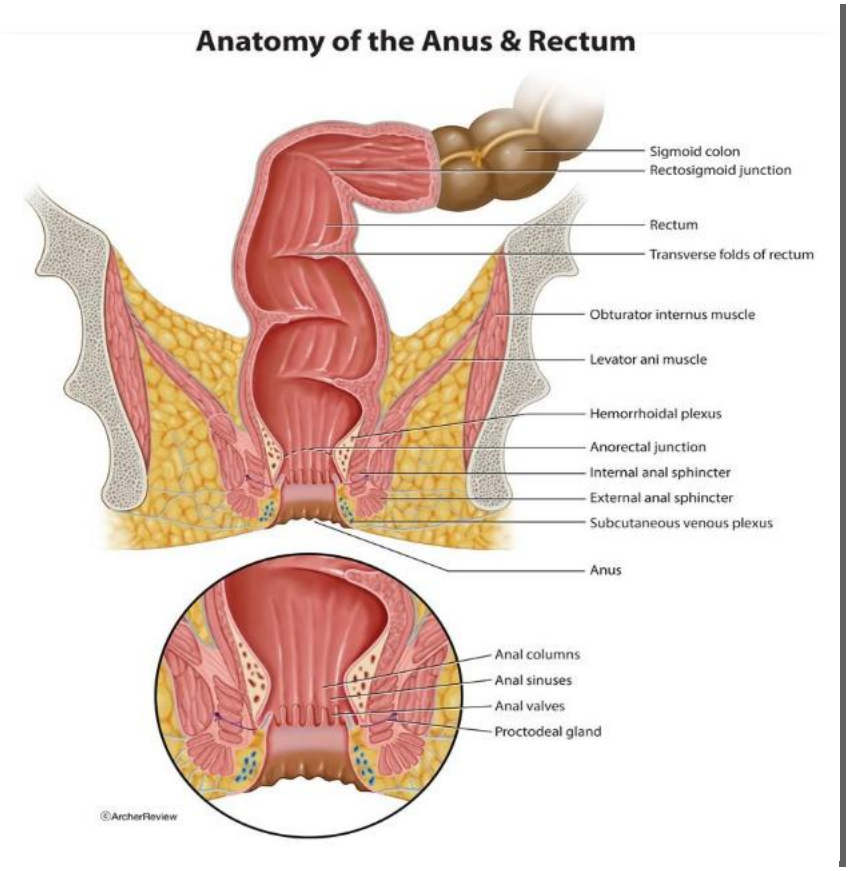
References

- **Gray's Anatomy**
- **Guyton and Hall Textbook of Medical Physiology**
- **World Health Organization**

ANUS – STRUCTURE, FUNCTION AND CLINICAL IMPORTANCE

Introduction:

The anus is the terminal opening of the digestive system and represents the final exit point of the gastrointestinal tract.
It plays an essential role in the process of defecation, allowing the body to eliminate solid waste. The anus is connected to the rectum through the anal canal and is supported by muscles and nerves that regulate bowel movements and maintain fecal continence.
These specialized structures ensure both voluntary and involuntary control of stool passage.

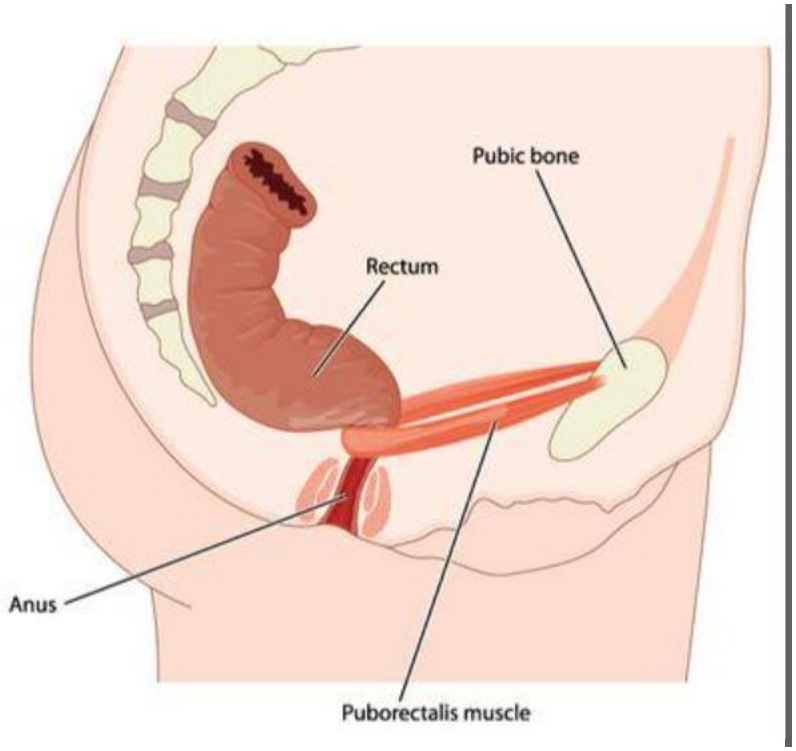


References: Hoagland TM. Anal Canal Anatomy. Medscape (2025); Encyclopaedia Britannica Anal Canal.

Location:

The anus is located at the distal end of the digestive tract in the perineal region, positioned between the buttocks and below the rectum. It marks the external opening of the anal canal and serves as the

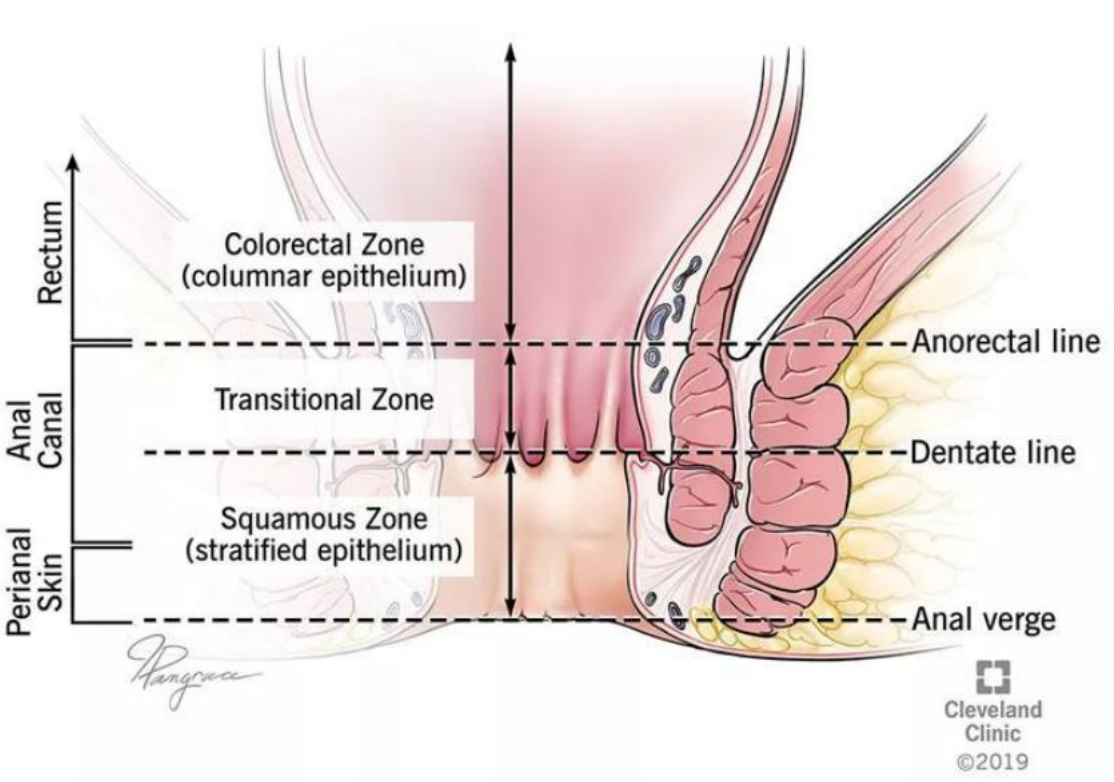
endpoint of the large intestine.
The anal canal extends from the pelvic diaphragm to the anal opening and forms the transition between the rectum
and the outside of the body.



References: Hoagland TM. Anal Canal Anatomy. Medscape; Karunaharamoorthy A. Anal Canal Anatomy. Kenhub (2023).

Structure and Anatomy :

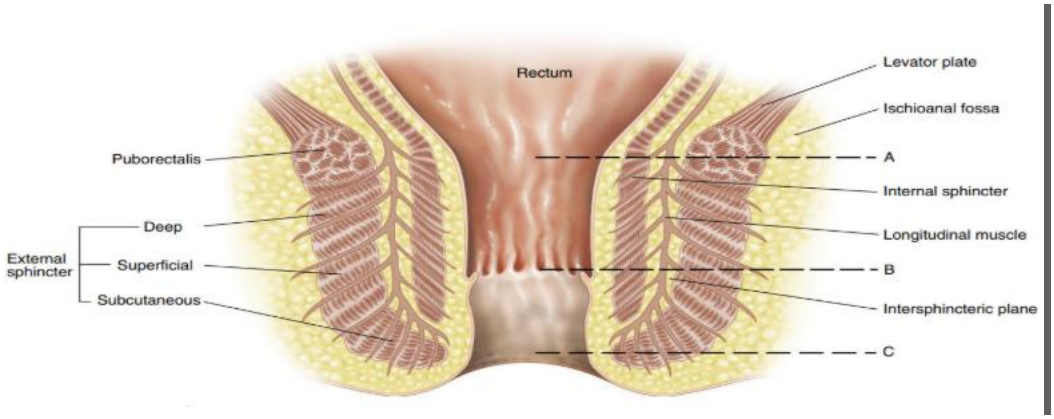
The anus forms part of the anal canal, which is approximately 3–4 cm long and is divided into different
anatomical zones. The canal contains longitudinal folds known as anal columns and is lined with different types of epithelial
tissue along its length. These structural features allow flexibility and
help maintain continence while also facilitating
the passage of stool.



References: Karunaharamoorthy A. Anal Canal
Anatomy. Kenhub; Encyclopaedia Britannica – Anal Canal.

Anal Sphincters

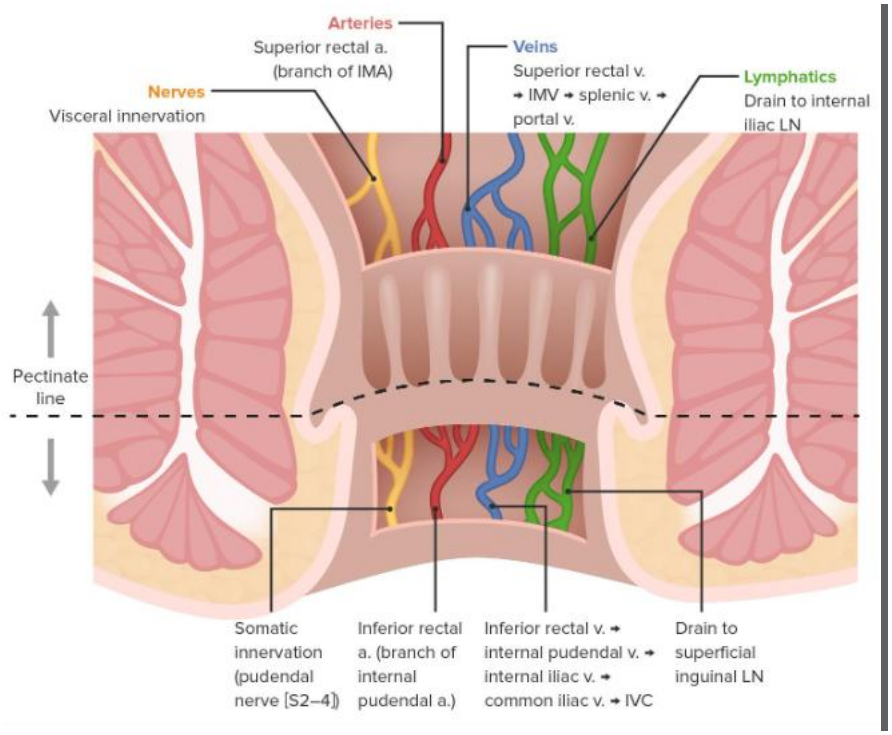
The anal canal contains two important muscles known as anal sphincters, which regulate the passage of feces.
The internal anal sphincter consists of smooth muscle and operates involuntarily under autonomic nervous system control.
The external anal sphincter is composed of skeletal muscle and is under voluntary control, allowing individuals to consciously
delay or initiate defecation.



References: Kenhub Anatomy Library; Britannica Editors – Anal Canal Muscles.

Blood Supply and Nerve Supply :

The anal canal receives blood from the superior, middle, and inferior rectal arteries which
ensure proper oxygen and nutrient supply to the tissues. Venous drainage occurs through rectal veins. The nerve supply differs
above and below the pectinate line, with autonomic innervation in the upper part and somatic innervation through the pudendal
nerve in the lower part.



References: Kenhub – Anal Canal Anatomy; El- Haddad J. Revisiting the Anatomy of the Rectum and Anal Canal. IntechOpen (2025).

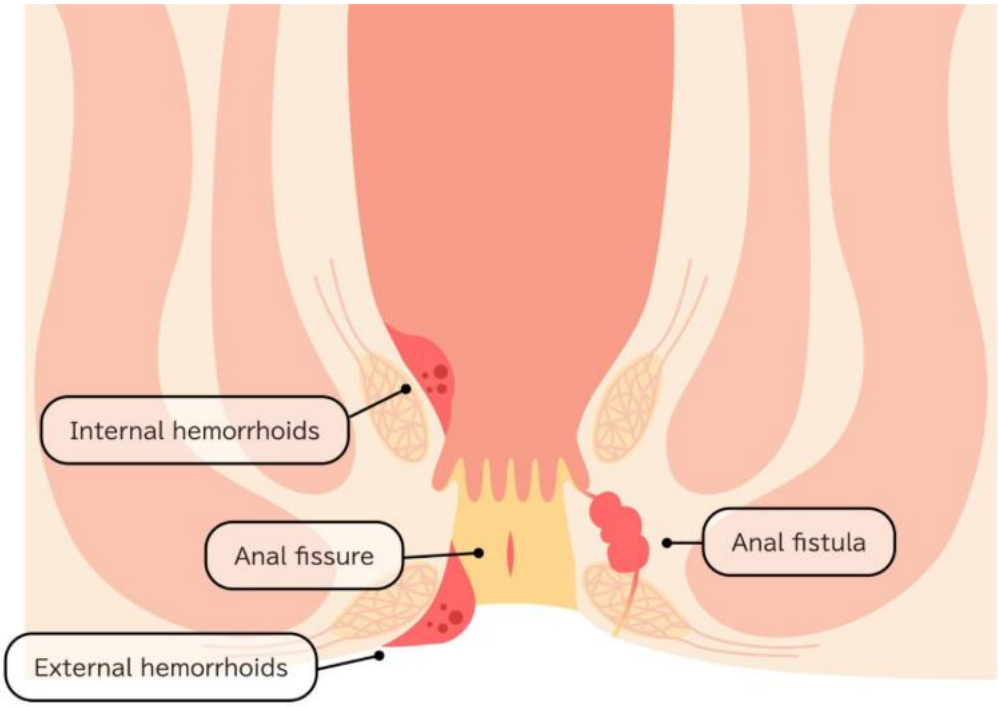
Functions

The anus performs several physiological functions in the digestive system. Its primary role is the elimination
of solid waste from the body. It also contributes to fecal continence
by maintaining closure of the anal canal through
the sphincter muscles. Sensory nerves in the anal canal detect the presence of stool and initiate the defecation reflex.

References: Britannica Editors – Anal Canal Function; Kenhub – Anal Canal Anatomy.

Common Diseases and Disorders

Hemorrhoids: Swollen veins in the anal region causing pain, itching, and bleeding.
Anal Fissure: A small tear in the lining of the anal canal causing severe pain during bowel movements.
Anal Fistula: An abnormal tunnel between the anal canal and surrounding skin usually following infection.
Anal Cancer: A rare malignant condition affecting the tissues of the anus.



References: Vannelli A. Diseases of the Rectum and
Anus. IntechOpen (2025); Encyclopaedia Britannica – Anal Canal Diseases.

Medications Used in Pakistan

Glyceryl Trinitrate (GTN) Ointment – used for anal fissures to relax sphincter muscles.
Anusol Cream – commonly used for hemorrhoids to reduce swelling and irritation.
Pilex Forte Ointment – herbal formulation used for piles and fissures.
Lidocaine Cream – provides local pain relief in hemorrhoids and fissures.

References: Pakistan Pharmacopoeia; Local pharmacy formularies and medical practice guidelines.