General Splanchnology - Viscera

Functional Anatomy of the Digestive System

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Plan

- Viscera
- Digestive System
• Locomotor apparatus – movement
• Internal organs - supply the locomotor apparatus
CLASSIFICATION OF THE INTERNAL ORGANS

According to functional point of view the viscera are divided into systems of organs and apparatuses.

- **Digestive system** (energy, nutrients for growing up) /the mouth, esophagus, gastrointestinal tract, liver and pancreas and salivary glands/;
- **Respiratory system** (exchange of gases O2 to support burning) /the nose, airways, larynx and lungs/;
- **Urogenital system** (excretion also skin) /the urinary and genital or reproductive organs) – (multiplication);
- **Controlling system** Endocrine and Nervous systems (the ductless glands and cells which produce hormones);
- **Circulatory system** (the heart and blood and lymph vessels);
- **Defense system** (the blood, lymphatics and bone marrow);
The organs are divided into **tubular** (hollow) and **parenchymatous** organs.

**Cavitary organs** have a common tubular structure;

*The wall of the cavitary organs consist of few layers:*

- **The mucous coat**  (tunica mucosa)
- **The submucous layer**  (tela submucosa)
- **The muscular coat**  (tunica muscularis)
- **The serous coat**  (tunica serosa), or the **adventitious coat**  (tunica adventitia)
The **parenchymatous organs** consist of **parenchyma** and **stroma**.

- The *parenchyma*, which is formed from specific elements, that assure the function of organs;
- The *stroma*, which has a connective tissue origin sustains the parenchyma and leads the vessels and nerves.
The Structure of the Digestive Tract
Classification of the viscera dependent on their development, topography, structure, and functions

a) According to the development organs are divided into:

I. Organs derived from endoderm
II. Organs derived from somatic mesoderm
III. Organs derived from ectoderm
b) According to the topographical principle organs are divided into:

I. Organs of the head
II. Organs of the neck
III. Organs of the thoracic cavity
IV. Organs of the abdominal cavity
V. Organs of the pelvis.
Viscera and constitutional types of the human body

- The size, shape and position of the organs and vessels depend on constitutional type.

- In asthenics the viscera are smaller and have a lower position as they were ptotic. The lungs are longer, because the thoracic cage is longer. The heart has a vertical position and the aorta is narrow. The stomach has almost a vertical position as well as the loops of the small intestine. The liver, spleen and the pancreas and the kidney are small.

- In hypersthenics the heart is relatively large and has almost a horizontal position and the aorta is large. The lungs are short. The stomach has a transverse position as well as the loops of the small intestine. The liver, spleen and the pancreas and the kidney are large.

- The normosthenenic type is an intermediate between the hypersthenec and asthenic type, and the organs have an intermediate position according to the characteristics accounted above.
Hypertonic stomach
Orthotonic stomach
Hypotonic stomach
Atonic stomach
Topography

- Syntopy
- Skeletotopy
- Holotopy
Key for planes:

Key for nine regions of the abdomen:
1. Right hypochondrium. 2. Epigastric. 3. Left hypochondrium. 4. Right lumbar.
9. Left iliac fossa.
Examination on alive person
the digestive system, or alimentary system (systema digestorium) is a complex of organs which provides mechanical and chemical treatment of food, absorption of the treated nutrients, and excretion of undigested remnants of the food.
The Components of the Digestive System

**SALIVARY GLANDS**
Secretion of lubricating fluid containing enzymes that break down carbohydrates

**PHARYNX**
Pharyngeal muscles propel materials into the esophagus

**ESOPHAGUS**
Transport of materials to the stomach

**LIVER**
Secretion of bile (important for lipid digestion), storage of nutrients, many other vital functions

**GALLBLADDER**
Storage and concentration of bile

**STOMACH**
Chemical breakdown of materials via acid and enzymes; mechanical processing through muscular contractions

**PANCREAS**
Exocrine cells secrete buffers and digestive enzymes; endocrine cells secrete hormones

**SMALL INTESTINE**
Enzymatic digestion and absorption of water, organic substrates, vitamins, and ions

**LARGE INTESTINE**
Dehydration and compaction of indigestible materials in preparation for elimination

**ORAL CAVITY, TEETH, TONGUE**
Mechanical processing, moistening, mixing with salivary secretions
- Tongue
- Parotid gland
- Sublingual gland
- Submandibular gland
- Mouth (oral cavity)
- Esophagus
- Pharynx
- Stomach
- Pancreas
- (Spleen)
- Liver
- Gallbladder
- Small intestine
  - Duodenum
  - Jejunum
  - Ileum
- Transverse colon
- Descending colon
- Ascending colon
- Cecum
- Sigmoid colon
- Rectum
- Vermiform appendix
- Anal canal
- Anus
Functions of the digestive system

- Ingestion
- Mechanical processing
- Digestion
- Secretion
- Absorption
- Excretion
Glands

exocrine

endocrine
Movement of digestive materials

- Visceral smooth muscle shows rhythmic cycles of activity
  - Pacemaker cells
- Peristalsis
  - Waves that move a bolus
- Segmentation
  - Churn and fragment a bolus
Peristalsis

Figure 24.4

**STEP 1:**
Contraction of circular muscles behind food mass

**STEP 2:**
Contraction of longitudinal muscles ahead of food mass

**STEP 3:**
Contraction of circular muscle layer forces food mass forward
- Lips (labia) – protect the anterior opening
- Cheeks – form the lateral walls
- Hard palate – forms the anterior roof
- Soft palate – forms the posterior roof
- Uvula – fleshy projection of the soft palate
The tongue

- primary functions include:
  - Mechanical processing
  - Assistance in chewing and swallowing
  - Sensory analysis by touch, temperature, and taste receptors
The pharynx

- Common passageway for food, liquids, and air
- Lined with stratified squamous epithelium
- Pharyngeal muscles assist in swallowing
  - Pharyngeal constrictor muscles
  - Palatal muscles
Histology of the esophagus

- Distinctive features of the esophageal wall include
  - Nonkeratinized, stratified squamous epithelium
  - Folded mucosa and submucosa
    - Mucous secretions by esophageal glands
  - A muscularis with both smooth and skeletal muscle portions
  - Lacks serosa
    - Anchored by an adventitia
The Esophagus
Functions of the stomach

• Bulk storage of undigested food
• Mechanical breakdown of food
• Disruption of chemical bonds via acids and enzymes
• Production of intrinsic factor
Digestion and absorption in the stomach

- Preliminary digestion of proteins
  - Pepsin
- Permits digestion of carbohydrates
- Very little absorption of nutrients
  - Some drugs, however, are absorbed
  - Mucous secretion containing several hormones
- Enteroendocrine cells
  - G cells secrete gastrin
  - D cells secrete somatostatin
The Stomach

- Esophagus
- Fundus
- Anterior surface
- Cardia
- Longitudinal muscle layer
- Circular muscle layer
- Pyloric sphincter
- Lesser curvature (medial surface)
- Left gastroepiploic vessels
- Oblique muscle layer overlying mucosa
- Greater curvature (lateral surface)
- Body
- Duodenum
- Pyloric canal
- Pylorus
- Rugae
- Pyloric antrum
- (b)
The Stomach Lining

- Mucous epithelial cells
- Entrance of gastric pit
- Lamina propria
- Mucous neck cells
- Parietal cells
- Chief cells
- Entrance to gastric pits
- Gastric glands
- Lumenal surface
- Muscularis mucosae
The Stomach Lining

- Gastric pit (opening to gastric gland)
- Mucous epithelium
- Lymphatic vessel
- Lamina propria
- Muscularis mucosae
- Submucosa
- Oblique muscle
- Circular muscle
- Longitudinal muscle
- Serosa
- Gastric pit
- Gastric gland
- Artery and vein
- Myenteric plexus
- Mucous cells
- Neck
- Parietal cells
- Chief cells
- Smooth muscle cell
- G cell

(c)

(d)
Histology of the stomach

- Gastric glands
  - Parietal cells
    - Intrinsic factor, and HCl
  - Chief cells
    - Pepsinogen
- Pyloric glands
Small intestine

• Important digestive and absorptive functions
  • Secretions and buffers provided by pancreas, liver, gall bladder
• Three subdivisions:
  • Duodenum
  • Jejunum
  • Ileum
• Ileocecal sphincter
  • Transition between small and large intestine
Regions of the Small Intestine
Histology of the small intestine

- Plicae
  - Transverse folds of the intestinal lining
- Villi
  - Fingerlike projections of the mucosa
- Lacteals
  - Terminal lymphatic in villus
- Intestinal glands
  - Lined by enteroendocrine, goblet and stem cells
The Intestinal Wall

- **Mucosa**
- **Submucosa**
- **Muscularis externa**
- **Serosa**
- **Plica**
- **Muscularis mucosae**
- **Circular muscle layer of muscularis externa**
- **Longitudinal muscle layer of muscularis externa**
The Intestinal Wall
The Intestinal Wall
Small Intestine

- Duodenal glands (Brunner’s glands)
  - produce mucus, buffers, urogastrone
- Ileum
  - aggregated lymphoid nodules (Peyer’s patches)
Intestinal movements

- Peristalsis
- Segmentation
- Gastroenteric reflexes
  - Initiated by stretch receptors in stomach
- Gastroileal reflex
  - Triggers relaxation of ileocecal valve
The pancreas

- Pancreatic duct penetrates duodenal wall
- Endocrine functions
  - Insulin and glucagon
- Exocrine functions
  - Majority of pancreatic secretions
  - Pancreatic juice secreted into small intestine
    - Carbohydrases
    - Lipases
    - Nucleases
    - Proteolytic enzymes
The Pancreas
The Liver

- Performs metabolic and hematological regulation and produces bile
- Histological organization
  - Lobules containing single-cell thick plates of hepatocytes
  - Lobules unite to form common hepatic duct
    - Duct meets cystic duct to form common bile duct
The Anatomy of the Liver
The Anatomy of the Liver

(b) Anterior surface

(c) Posterior surface
Liver Histology

- Kupffer cells
- Hepatocytes
- Sinusoid
- Bile canaliculi
- Hepatic artery proper
- Bile duct
- Hepatic portal vein
- Central vein
- Interlobular septum
- Bile duct
- Hepatic portal vein
- Portal area
- Bile ductules
The gallbladder

- Hollow, pear-shaped organ
- Stores, modifies and concentrates bile
The Gallbladder

- Right hepatic duct
- Left hepatic duct
- Cystic duct
- Fundus
- Body
- Neck
- Common bile duct
- Cut edge of lesser omentum
- Common hepatic duct
- Hepatic portal vein
- Common hepatic artery
- Right gastric artery
- Duodenal ampulla
- Duodenal papilla
- Hepatopancreatic sphincter
- Intestinal lumen
- Pancreatic duct

Liver
Duodenum
Stomach
Pancreas
Functions of the large intestine

- Reabsorb water and compact material into feces
- Absorb vitamins produced by bacteria
- Store fecal matter prior to defecation
The Large Intestine
The Large Intestine
The rectum

- Last portion of the digestive tract
- Terminates at the anal canal
- Internal and external anal sphincters
Histology of the large intestine

- Absence of villi
- Presence of goblet cells
- Deep intestinal glands
THE DEVELOPMENT OF THE DIGESTIVE SYSTEM

The digestive tube derives from the primitive gut. As a result of cephalocaudal and lateral folding of the embryo, a portion of the endoderm-lined yolk sac cavity is incorporated into the embryo to form the **primitive gut**. Two other portions of the endoderm-lined cavity, the yolk sac and the allantois, remain outside the embryo.

In the cephalic and caudal parts of the embryo, the primitive gut forms a blind-ending tube, the foregut and hindgut, respectively. The middle part, the midgut, remains temporary connected to the yolk sac by means of the viteline duct, or yolk stalk.

*Development of the primitive gut and its derivatives:*

- The **pharyngeal gut**, or pharynx, extends from the bucopharyngeal membrane to the tracheobronchial diverticulum;
- The **foregut** lies caudal to the pharyngeal tube and extends as far caudally as the liver outgrowth;
- The **midgut** begins caudal to the liver bud and extends to the junction of the right two-thirds and left third of the transverse colon in the adult;
- The **hindgut** extends from the left third of the transverse colon to the cloacal membrane.
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PENTRU ATENȚIE!