Gastrointestinal System

Oleh:

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GASTROINTESTINAL SYSTEM:

- ORAL CAVITY
- SALIVARY GLAND
- OESOPHAGUS
- PHARYNX
- STOMACH
- SMAL INTESTINE
- LARGE INTESTINA
- HEPAR
- PANCREAS
Embriologi

Stage of intrauterin:
1. Embryonal phase → 0 to 8 / 12 weeks → cells proliferation & differentiation → organ
2. Foetus phase → 8 / 12 weeks until 40 weeks → growth & development of organ

• stage intrauterin termed in 3 trimester
1<sup>TH</sup> TRIMESTER

- **1<sup>st</sup> week:** zygote → proliferation cell: morula → blastula → implantation

- **2<sup>nd</sup> week:** embryo cells differentiation → two layers → bilaminar stadium → epiblast → ectoderm
  - hypoblast → endoderm
  - finished at → primitive streak.
• 3\textsuperscript{rd} weeks: created three embryogenic layer $\rightarrow$ ectoderm, mesoderm and endoderm layer with the invagination of the mesoderm layer between ectoderm and endoderm layer, and initially with primitive streak area $\rightarrow$ three layer stage (trilaminar stage).

primitive streak $\rightarrow$ neural plate & neural fold in cranial region $\rightarrow$ neural groove $\rightarrow$ neural tube.
• 4th Weeks: created somit
• GIS is origin from endoderm layer → anterior gut, mid gut & posterior gut
• Anterior gut → mouth, oesophagus, stomach, liver, pancreas
• Mid gut → duodenum, small intestine, colon transversum 2/3 proximal
• Posterior gut → colon transversum 1/3 distal to rectum
ORAL CAVITY (CAVUM ORIS)

Oral cavity is the beginning of the digestive tube

- In front it is bounded by the mucous membrane of the lips
- Lateral: the cheeks
- Above: palate
- Below: tongue and mucous membrane
Roof of the mouth cavity is formed by the palate (palatum)
The substratum of the palate is bony infront (palatum durum)
In the posterior part it is muscular (palatum molle)
Inspection of Oral Cavity
Dorsum of Tongue and Palate

- Philtrum of lip
- Soft palate
- Palatoglossal arch
- Palatine tonsil
- Palatopharyngeal arch
- Uvula
- Posterior wall of pharynx
THE TEETH (DENTES)

The teeth appear in two successive series called dentition:
1. First dentition: 20 milk teeth
2. Second dentition: 32 permanent teeth

PERMANENT TEETH:
Permanent teeth are present in the upper and lower jaws, eight on each side:
- 2 incisor teeth
- 1 canine tooth
- 2 premolar teeth
- 3 molar teeth
Teeth are firmly implanted in the jaw and are surrounded by the gingival mucosa.

Each tooth consists of:

- **Dentine (substantia eburnea)**
  forms the main mass and give the tooth its form

- **Enamel (substantia adamantina)**
  covers the free part of the tooth superficially

- **Cement (substantia ossea)**
  The parts hidden in the bone and gum
Teeth - Upper and Lower Permanent

Teeth - Left Upper and Left Lower Permanent
Labiobuccal View
According to form of the tooth are distinguished:

- Crown (corona dentis)
  - thickest part projecting free into the mouth cavity
- Neck (collum dentis)
- Root (radix dentis)
  - longest portion of the tooth
Anatomy of a Tooth

- Interproximal spaces
- Papilla
- Dentin and dentinal tubules (substantia eburnea)
- Enamel (substantia adamantina)
- Interglobular spaces
- Odontoblast layer
- Pulp containing vessels and nerves
- Gingival (gum) epithelium (stratified)
- Epithelial attachment
- Lamina propria of gingiva (gum) (mandibular or maxillary periosteum)
- Periodontium (alveolar periosteum)
- Cementum (substantia ossea)
- Root (central) canals containing vessels and nerves
- Bone
- Apical foramina
Within the dentine lies cavity which resembles the external form of the tooth:
- pulp cavity (cavum dentis)
  rich in blood vessels and nerve
- root canal (canalis radicis dentis)
- apex radicis dentis
- foramen apicis dentis
THE TONGUE (LINGUA)

The tongue is a flat, oblong body consisting mainly of muscle and is fastened below to the floor of the mouth.

Part of tongue:
1. Radix
2. Corpus
3. Apex
Mucous membran of the tongue is covered by papillae linguales:

- Papillae filiformes
- Papillae fungiformes
- Papillae vallatae
- Papillae foliatae
Afferent Innervation of Mouth and Pharynx

Anterior View

- Trigeminal nerve (V)
- Glosopharyngeal nerve (IX)
- Vagus nerve (X)
- Facial nerve (VII)

- Via superior alveolar nerves
- Via pterygopalatine ganglion and greater and lesser palatine nerves
- Facial (VII) (nervus intermedius)
- Via greater palatine nerve, pterygopalatine ganglion and greater and lesser palatine nerves

Dorsum of Tongue

- Glosopharyngeal (IX)
- Via pharyngeal plexus
- Via lingual branches
- Taste plus general sensation via lingual branches

- Via internal branch of superior laryngeal nerve
- Vagus (X)
- Taste via chorda tympani and lingual nerve

- Trigeminal (V) (mandibular)
- Via lingual nerve

- Facial (VII) (nervus intermedius)
Muscles Involved in Mastication [Deep]
Lateral View

- Pterygomandibular raphé
- Lateral pterygoid muscle
- Articular tubercle
- Articular disc of temporomandibular joint
- Parotid duct
- Sphenomandibular ligament
- Medial pterygoid muscle
- Buccinator muscle
- Superior pharyngeal constrictor muscle
Muscles of Pharynx
Partially Opened Posterior View

- Basilar part of occipital bone
- Pharyngobasilar fascia
- Pharyngeal tubercle
- Pharyngeal tonsil
- Cartilaginous auditory (Eustachian) tube
- Choana
- Pharyngobasilar fascia
- Superior pharyngeal constrictor muscle
- Salpingopharyngeus muscle
- Levator veli palatini muscle
- Uvula
- Palatopharyngeus muscle
- Middle pharyngeal constrictor muscle
- Stylopharyngeus muscle
- Pharyngoepiglottic fold
- Longitudinal pharyngeal muscles
- Superior horn of thyroid cartilage
- Thyrohyoid membrane
- Pharyngeal aponeurosis
- Posterior border of thyroid cartilage lamina
- Cricoid attachment of longitudinal esophageal muscle
- Circular esophageal muscle
- Longitudinal esophageal muscle

- Accessory muscle bundle from petrous part of temporal
- Styloid process
- Digastric muscle (posterior belly)
- Salpingopharyngeus muscle
- Stylohyoid muscle
- Medial pterygoid muscle
- Hyoid bone (tip of greater horn)
- Epiglottis
- Aryepiglottic fold
- Cuneiform tubercle
- Inferior pharyngeal constrictor muscle
- Comiculate tubercle
- Internal branch of superior laryngeal nerve
- Transverse and oblique arytenoid muscles
- Posterior cricoarytenoid muscle
- Cricopharyngeus muscle (part of inferior pharyngeal constrictor)
A muscular tube, length averages 25 cm

Begins as the continuation of the pharynx behind the cartilage cricoidea

Run downward through the spatium mediastinale posterior passes through the hiatus oesophagus diaphragmatis into abdominal cavity

Consist: pars thoracalis and pars abdominalis
MUSCLES OF THE ABDOMEN

• M. Obliquus externus abdominis
• M. Pyramidalis
• M. Obliquus internus abdominis
• M. Transversus abdominis
• M. Rectus abdominis
  - vagina m. rectus abdominis
  - inscriptiones tendineae

**Linea alba**: is a connective tissue strip which extends in the median plane between the m. rectus abdominis from the proc. xyphoideus to the symphysis pubis
Linea semilunaris: parallel fiber, run transversely forward and go over into a tendon plate along a line which is concave medianward.

In the lower third of m.obliquus abdominis internus, all the fiber run in front of m.rectus abdominis, the lower margin is curved and concave.
LIGAMENTUM INGUINAL (POUPARTI)

Is a powerful, flatly rounded tendon, which extends from the spina iliaca anterior superior to the tuberculum pubicum, and can be palpated through the skin as a hard cord.

CANALIS INGUINALIS

Is a cylindrical space filled up completely by the ductus deferens (male) / ligamentum teres uteri (female) with the accompanying vessels. The canal has two openings:
- annulus inguinalis abdominalis
- annulus inguinalis subcutaneus
INNERVASION MOTORIK ABDOMINAL MUSCLES

• M. Obliquus abdominis externus: - Nn. Intercostalis 5 – 12
  - Nn. Ilio Hypogastricus
  - Nn. Ilio Inguinalis

• M. Obliquus abdominis internus: - Nn. Intercostalis 5 – 12
  - Nn. Ilio Hypogastricus
  - Nn. Ilio Inguinalis

• M. Transversus abdominis: - Nn. Intercostalis 10 – 12
  - Nn. Ilio Hypogastricus
  - Nn. Ilio Inguinalis
INNERVATION SENSORIS SKIN AND ABDOMINAL WALL

• Innervation anterior, lateral and posterior-lateral abdominal wall → ramus cutaneous Nn.Intercostalis 7 – 11

• Innervation postero – medial abdominal wall → Ramus posterior Nervus Spinalis Th 10 – 11

Vascularisation Abdominal Wall

• Arteri-vena Epigastrica superior
• Arteri – vena Epigastrica inferior
• Arteri – vena Circumflexia Iliaca superficialis
• Arteri – vena Circumflexia Iliaca profundus
The smooth glistening serous membrane Which covers the walls and the viscera of abdominal and pelvic cavities
**Peritoneum Paritale**

Part of peritoneum which covers the walls cavities, the large vascular and the nerve trunk attached to them as well as some parts of the urinary and sexual apparatus.

**Peritoneum Viscerale**

The part of peritoneum which is firmly attached to the surface of the freely movable portion of digestive tube, the pancreas, liver and spleen.
INTRAPERITONEAL ORGANS:
• Hepar
• Lien
• Gaster
• Part of gut

RETROPERITONEAL ORGANS:
• Kidney (Ren)
• Pancreas
• Aorta abdominalis
• Vena cava inferior
MESENTERIUM:
Large fold of peritoneum, arises from posterior wall of the abdomen at flexura duodenojejunalis. *The starting point is radix mesentery*

OMENTUM MAJUS
Part of peritoneum viscerale which is hanging downward from curvatura major of the stomach like an apron in front of the colon transversum and small intestine.
Contain large accumulations of fat
BURSA OMENTALIS

A slit-like cavity surrounded on all sides by peritoneum, which is connected with the general cavum peritonei at one spot only.

FORAMEN EPIPLOICUM (WINSLOWI)

Bounded in front by the lig. hepatodudenale, above by processus caudatus of the liver, behind by the v. cava inferior and below by flexura duodeni superior.
REGION OF ANTERIOR ABDOMINAL WALL

1. Hypochondrium dekster
2. Epigastrium
3. Hypochondrium sinister
4. Lumbalis dekster
5. Umbilikalis
6. Lumbalis sinister
7. Iliaca dekster
8. Hypogastrium
9. Iliaca sinister
PROYEKSION OF INTRA ABDOMINAL ORGANS

- **Lien** : on latero-posterior of costae 9 – 10
- **Hepar** : on anterior right body wall, from right costae 6th to the last arch costae
- **Gaster (Stomach)** : from epigastrium regio to umbilikalis regio
STOMACH (VENTRICULUS, GASTER)

- A saccular dilatation of the alimentary canal connecting above with oesophagus below with the duodenum.
- The form of stomach depends particularly on the volume of its contents and on the position of the body.
  - When empty ➞ contracted
  - When filled ➞ fundus and corpus distend
- Position: the main portion of the stomach lies on the left side of the body.
PARTS OF STOMACH

- Curvatura ventriculi minor
- Cardia,
- Fundus ventriculi
- Corpus ventriculi
- Curvatura ventriculi major
- Curvatura ventriculi minor
- Pars pyloricum

Muscularis of the stomach:
- Outer layer: longitudinal muscle fibres
- Second layer: circular muscle fibers
- Deepest layer: oblique muscle fibre with numerous fold
  → Plica mucosae
Position stomach:

At the upper end of the curvatura minor, oesophagus enter the wall of stomach by the spincter cardia

At the end ventriculi continued into pars pylorica, approximately cylindrical in shape separated from duodenum by a ring-formed constriction (spincter pylori)

The fundus is bounded directly above by the cupola diaphragm, to the left and behind by the fascies gastrica of the spleen
Musculature of Stomach

- Longitudinal muscle of esophagus
- Outer longitudinal muscle layer of stomach (concentrated chiefly at lesser and greater curvatures and at pyloric area)
- Middle circular muscle layer of stomach
- Longitudinal muscle of duodenum
- Circular muscle of duodenum
- Circular muscle of duodenum (cut away)
- Windows cut in middle circular muscle layer
- Outer longitudinal muscle layer (cut away)
- Collar of Helvetius (middle circular and innermost oblique fibers blend here)
- Innermost oblique muscle
- Middle circular muscle layer
INTESTINUM

SMALL INTESTINE
INTESTINUM TENUE

LARGE INTESTINE
INTESTINUM CRASSUM
INTESTINUM TENUE

- DUODENUM
- JEJENUM
- ILEUM
DUODENUM

- The first portion of the small intestine which is directly and firmly attached to the posterior abdominal wall
- It forms a spirally curved ring, open to the left and above
- In the concavity of which the pancreas is inserted
- Consist:  - pars superior (shortest portion)
  - pars descendens
  - pars inferior
- It lies to the right and in front of the pars lumbalis of diaphragm, of the v.portae, a.hepatica and ductus choledocus, behind and below the lobus quadratus of the liver
- Bends around markedly to the right and forward to go over into the intestinum jejenum → flexura duodenojejunalis
The flexuraduodenojejunalis is firmly attached to the diaphragm by the m.suspensorium duodeni

In the mucosa present a longitudinal fold (\textit{plica longitudinalis duodeni}) and small projection upon which open the ductus choledocus and ductus pancreaticus (papilla Vateri)
Mucosa and Musculature of Jejunum

- Loop from superior mesenteric artery (intestinal branches)
- Mesentery
- Straight arteries (arteriae rectae)
- Serosa (visceral peritoneum)
- Longitudinal muscle layer
- Circular muscle layer
- Submucosa
- Mucosa
- Solitary lymph follicle (nodule)
- Circular folds (of Kerokring)

Barium radiograph of jejunum
JEJENUM AND ILEUM

Infront and lateralward jejenum and ileum is covered by the great omentum (omentum majus)

The mucous membrane presents the special structur :

- Plica circularis (Kerckring) :
  - the constant fold
  - In jejenum, they are longer and higher than in ileum

- Lymph node
  - in jejenum, they are usually single (noduli lymphatici i solitary)
  - in ileum, they are numerous and higher and in part are crowded together, Peyer Patcher (noduli lymphatici aggregati)
LARGE INTESTINE (INTESTINUM CRASSUM)

Following upon the small intestine, it begins as the intestinum caecum in the fossa iliaca dextra

Part of intestinum crassum:
- Caecum
- Colon ascendens
- Colon transversum
- Colon descendens
- Colon sigmoideum

The portion from the caecum to the rectum is called the colon.
The large intestine is characterized, its surface is not smoothly cylindrical, but presents a nodular appearance due to the three rows of irregular, flask-like projection → haustra

These rows of haustra are separated from one another by three bands-like strips of the longitudinal muscle taenia coli (taenia libera, taenia omentalis and taenia mesocolica)

Along the whole large intestine developed lobe-like fatty appendices epipolica

The mucosa have a large sickle-shaped fold plica semilunares
CAECUM

The blind-sac-like portion of the large intestine situated below the opening of the ileum into the large intestine.

At the upper limit of the caecum, in the posterior part of the left wall lies the opening of the small intestine within the valvula coli.

There arise two high folds formed by the wall of the small and large intestine:
- Labium superius of the valvula coli
- Labium inferius of the valvula coli

In the formation of this the terminal portion of the small intestine is invaginated into the large intestine cavity.
APPENDIX VERMIFORMIS

- A narrow, generally cylindrical, hollow, blind ending of the caecum.
- Length average 8.5 cm

COLON ASCENDENS

- Begins at the frenula valvulae coli as the direct continuation of caecum

COLON TRANSVERSUM

Runs out to the left and somewhat upward from the flexura coli dextra over the median plane in a curve convex forward and at the same time downward and goes over into the colon descendens
COLON DESCENDENS
A descending limb of colon

COLON SIGMOIDEUM
Terminal portion of colon, hangs as a loop generally down into the cavity of small pelvis and goes over in front of the sacrum into the rectum

RECTUM
Terminal portion of the digestive tube which extends from the colon sigmoideum through the inferior wall of the small pelvis to the inferior opening (anus)
Ileocecal Region

Labial Form of Ileocecal Sphincter

- Free tenia (tenia libera)
- Labial form of ileocecal sphincter (as seen commonly post mortem and occasionally in vivo)
- Terminal part of ileum
- Opening of vermiform appendix
- Frenulum
- Vermiform appendix

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Mesenteric Relations of Intestines

Sigmoid Colon Reflected

- Sigmoid colon (reflected)
- Ureter
- Parietal peritoneum
- Common and external iliac vessels
- Sigmoid mesocolon
- Intersigmoid recess (fossa)
LIVER

- A large, reddish brown gland, almost 2 kg in weight, which is situated for the most part to right of median plane in the regio hypochondrica dextra and regio epigastrica.
- A small part in regio hypochondrica sinistra
- Have four lobus:
  - lobis hepatis dexter
  - lobus hepatis sinister
  - lobus quadratus
  - lobus caudatus
- Ductus hepaticus: the excretory duct of the liver, begins in the porta hepatis by the union of the right and a left branch
- Porta hepatis consist:
  - v porta
  - a. hepatica
  - ductus choledocus
VESICA FELLEA (GALL BLADER)

Is an oblong, pear-shaped sac, which is fastened by loose connective tissue in the fossa vesica fellea of the liver.

The ductus cysticus leaves the blader and then join with ductus hepaticus.
Surfaces and Bed of Liver

Visceral Surface

- Caudate process
- Coronary ligament
- Left triangular
- Appendix fibrosa
- Esophageal impression
- Gastric impression
- Fissure for ligamentum venosum
- Caudate lobe
- Papillary process
- Proper hepatic artery
- Portal vein
- Fissure for ligamentum teres
- Falciform ligament
- Ligamentum teres
- Quadrate lobe
- Porta hepatis
- Hepatic veins
- Inferior vena cava
- Suprarenal impression
- Bare area
- Coronary ligament
- Right triangular ligament
- Common bile duct
- Common hepatic duct
- Cystic duct
- Renal impression
- Duodenal impression
- Colic impression
- Gallbladder
PANCREAS

• Lies transversely in front of the posterior wall of the abdominal cavity
• It presents for examination: caput, corpus and cauda
• The caput pancreatis fills up the concavity of the pars descendens and pars inferior duodenum
• The anterior and inferior surfaces are covered by peritoneum and the posterior surface is free from it
• The ductus of pancreas (ductus pancreaticus wirsungi and ductus pancreaticus santorini) is opening in the duodenum
VASCULARISATION

• Vascularisation in abdominal viscera is from branch of aorta abdominalis

• A. coeliaca, divides at three branches:
  - A. gastrica sinistra
  - A. Hepatica
  - A. Lienalis

• A. mesenterica superior: - A. intestinales
  - A. ileocolica
  - A. colica dextra & media

• A. mesenterica inferior: - A. colica sinistra
  - A. sigmoidea
  - A. haemorrhoidales superior
• A. Iliaca communis
• A. Hypogastrica

Vena
Vena portae: collects the blood from the digestive tube