

GENERAL STRUCTURE OF THE GASTROINTESTINAL TUBE

Mucous membrane (tunica mucosa):

Folds (**plicae**), smaller processes (**papillae**), **villi (villi intestinales)**. **Lamina epithelialis, lamina propria mucosae, lamina muscularis mucosae**. **Folliculi lymphatici solitarii** or **folliculi lymph. aggregati – Peyer’s patches**.

Submucous tissue (tunica submucosa)

The nervous plexus is called **plexus submucosus Meissneri**.

Muscular tissue (tunica muscularis)

Striated or smooth musculature. Internal **circular** and external **longitudinal**. The nervous **plexus myentericus Auerbachi**.

Outer layer

Tunica adventitia or **tunica serosa (visceral peritoneum)**.

Glands of the GIT

Intramural (e.g. goblet cells) or extramural glands.

ORAL CAVITY (CAVUM ORIS)

Rima oris

Vestibulum oris

Cavum oris proprium

Vestibule of the mouth (vestibulum oris)

Labia oris - labium superius – sulcus nasolabialis, philtrum - tuberculum labii superioris

cheiloschisis (cleft lip)

gnathoschisis (cleft jaw)

palatoschisis (cleft palate)

- labium inferius - sulcus mentolabialis

pars intermedia

fornix vestibuli superior et inferior - frenulum

anguli oris

glandulae labiales

m. orbicularis oris.

Buccae - glandulae buccales, m. buccinator, papilla parotidea - ductus parotideus.

Raphe pterygomandibularis – mandibular anesthesia

Gingiva - gingiva proper (attached gingiva) - pars fixa gingivae

- pars libera gingivae

Alveolar mucosa – separated from the gingiva by the mucogingival border

The oral cavity proper (cavum oris proprium)

diaphragma oris - mylohyoid muscles, geniohyoid muscles, anterior belly of the digastric muscle

glandula submandibularis

glandula sublingualis

Salivary glands

Glandulae salivariae minores - labiales, buccales, molares, palatinae, linguales

Glandulae salivariae majores - sublingualis, submandibularis and parotis

Glandula submandibularis – ductus submandibularis – caruncula sublingualis

Glandula sublingualis– plica sublingualis, ductus sublingualis major, ductus sublinguales minores

Glandula parotis - fossa retromandibularis, fascia parotideomasseterica. Tractus angularis separates the gland from the trigonum submandibulare. Parotid plexus - CN VII – nervus facialis.

Ductus parotideus - papilla parotidea

Glandula parotis accessoria

Palate (palatum)

Hard palate (palatum durum) - palatine processes of the maxillae and horizontal plates of the palatine bones

Raphe palati

Papilla incisiva

Plicae palatinae transversae

Glandulae palatinae

Soft palate (palatum molle, velum palatinum)

Aponeurosis palatina

Uvula palatina

Arcus palatoglossus et arcus palatopharyngeus

Tonsilla palatina – fossa (sinus) tonsillaris, plica triangularis, fossa supratonsillaris– plica semilunaris, 12 – 15 cryptae tonsillares– tonsillitis – tonsillar pegs, paratonsillar vein - tonsillectomy.

Muscles of the soft palate:

Musculus tensor veli palatini – CN V.

M. levator veli palatini

M. uvulae

M. palatoglossus

M. palatopharyngeus

plexus pharyngeus (CN IX., X.).

Tongue (lingua)

Corpus linguae

Radix linguae - tonsilla lingualis

Dorsum linguae - sulcus terminalis (ductus thyroglossus), sulcus medianus

Papillae filiformes, fungiformes, foliatae, valatae, (calliculi gustatorii)

Apex linguae

Margines linguae

Facies inferior linguae - frenulum linguae, plicae fimbriatae, plica sublingualis -caruncula sublingualis

Plica glossoepiglottica mediana and two plicae glossoepiglotticae laterales - valleculae epiglotticae

DENTITION

Dentes permanentes

32 teeth: 2 incisors, 1 canine, 2 premolars and 3 molars in one quadrant of the complete permanent dentition.

Description of the tooth:

Crown (corona dentis)

Masticatory surface (**facies oclusalis**) - **tubercula dentalia**

Contact ss. (**facies approximales**) - **facies mesialis, facies distalis**

Vestibular s. (**facies vestibularis**) - **f. labialis, f. buccalis**

Oral s. (**facies oralis**) - **f. palatina, f. lingualis**

Neck (collum dentis) - **gingivodental cap**

Root (radix dentis)

Pulp cavity (**cavitas dentis**) - **canalis radialis - foramen apicis dentis**

Structure of the tooth

Dentin (**dentinum**) formed by odontoblasts, 70% of inorganic substances.

Enamel (**enamelum**) 97% of inorganic substances.

Cement (**cementum**) formed by the fibrous bone.

Pulp (**pulpa dentis**) - areolar connective tissue, vessels and nerves.

Fixation of the tooth

Periodontium - collagen **Sharpey's fibers**

Parodontium - gum, periosteum, alveolus, periodontium, cement

Morphology of individual teeth

Dens incisivus -1 root, crown - occlusal edge. The largest incisor is upper medial one. The root is long, conical and flat from sides.

Dens caninus are long teeth with one root, the crown projects in the acute spike with cutting edges at its sides. The root is long and flat from sides. The upper canine is bigger than lower.

Dens premolaris has 2 tubercles on its occlusal surface (one vestibular, the other lingual).

Upper premolars have both tubercles of the same size, the lower have the bigger vestibular tubercle. Premolars have one root except the upper first premolar that has two roots – palatal and buccal.

Dens molaris - the occlusal surface of upper molars has 4 tubercles separated by a deep groove. The size of molars decreases distally. The crown has 2 buccal and 2 palatal tubercles. The groove has the shape of the letter H. Upper 1st molar is the strongest and biggest tooth of the upper arch. The additional tubercle may be on its palatine side

(**tuberculum anomale Carabelli**). Upper 2nd and 3rd molars have often only 2 tubercles.

The occlusal surface of the lower molars has the quadrangular shape. The groove has the shape of the cross. The 1st molar has often 5 tubercles the 5th lies distally.

Third molars have variable crowns and may be impacted. Upper molars have 3 roots (2 vestibular and 1 palatal), lower have 2 roots (1 mesial and 1 distal)

Dentes decidui

Crowns of milk teeth are lower and wide. They are of white colour with a blue shade. Roots are narrower and sharper and are more distant because they surround crowns of permanent teeth.

Dental formula

i1, i2, c, m1, m2 (I, II, III, IV, V) – deciduous teeth

I1, I2, C, P1, P2, M1, M2, M3 (1, 2, 3, 4, 5, 6, 7, 8) – permanent teeth

Dentition is divided into 4 quadrants:

$\frac{1 2}{4 3}$	$\frac{5 6}{8 7}$
permanent	deciduous

23 = upper left permanent canine

85 = lower right milk second molar

Occlusion

Upper dental arch has a shape of the half of an oval, lower arch of an parabola. Therefore the teeth do not meet each other exactly. Normally the crowns of the upper teeth direct slightly forward and those of the lower teeth backward. Thus the cutting edges of the upper front teeth lie anterior to that of lower front teeth like a pair of scissors. In the premolars and molars the vestibular tubercles of upper teeth overhangs those of lower teeth. Each tooth is in contact with two opposing teeth, with the principal antagonist (over a large contact area) and with an adjacent secondary antagonist. Only the 1st lower incisor and the third upper molar have a single antagonist. In rare cases the cutting edges are opposite each other like a forceps. In prognathism – the upper jaw is displaced anteriorly; in progenesis – the lower jaw is anterior to the upper one.

Eruption

The primordia of the deciduous teeth are already in a newborn child. The growing root pushes the crown to the gum, which atrophies and the tooth erupts.

I 6th-8th month

II 8th-12th month

III 16th-20th month

IV 12th-16th month

V 20th-36th month

Exchange of the teeth

Crowns of the permanent teeth grow orally and elicit resorption of alveoli of milk teeth and their roots. Roots of milk teeth shorten and disappear, the rest of the crown releases from the gum.

1 7th-8th year

2 8th-9th year

3 11th-13th year

4 9th-11th year

5 11th-13th year

6 6th-7th year

7 12th-14th year

8 17th-40th year

PHARYNX

fornix pharyngis
pharyngeal recess
cavum pharyngis
fascia pharyngobasilaris

Pars nasalis pharyngis (nasopharynx)

choanae
ostium pharyngeum tubae auditivae - torus tubarius - plica salpingopharyngea, plica salpingopalatina, torus levatorius
tonsilla pharyngea - fornix pharyngis
tonsilla tubaria
Waldeyer's lymphoepithelial ring

Pars oralis pharyngis (oropharynx)

a. isthmus faucium

Pars laryngea pharyngis (laryngopharynx)

2. aditus laryngis - epiglottis, aryepiglottic folds
3. recessus piriformis
4. plica n. laryngei

Muscles of the pharynx

Constrictors - raphe pharyngis

M. constrictor pharyngis superior:

1. Pars pterygopharyngea –lamina medialis proc. pterygoidei
2. Pars buccopharyngea –raphe pterygomandibularis
3. Pars mylopharyngea –linea mylohyoidea mandibulae
4. Pars glossopharyngea – transverse muscle of the tongue

M. constrictor pharyngis medius:

1. Pars chondropharyngea –cornu minus ossis hyoidei
2. Pars ceratopharyngea - cornu majus ossis hyoidei

M. constrictor pharyngis inferior:

1. Pars thyropharyngea –linea obliqua of the thyroid cartilage
2. Pars cricopharyngea – cricoid cartilage

Levators:

M. stylopharyngeus – from the processus styloideus caudally and medially - the fissure between the superior and middle constrictors.

M. palatopharyngeus

M. salpingopharyngeus – from the cartilaginous part of the auditory tube

The pharynx actively participates in swallowing, respiration and phonation. During swallowing the muscles of the soft palate open the auditory tube to ventilate the tympanic cavity.

Mechanism of the deglutition

The first stage of the swallowing is voluntary: the anterior part of the tongue is raised and pressed against the hard palate. A bolus is pushed dorsally. The hyoid bone is moved up and forwards by the suprahyoid muscles. The root of the tongue is drawn up and back and palatoglossal arches are approximated, pushing the bolus through the isthmus of the fauces into the oropharynx.

The second stage is involuntary. The soft palate is elevated, tightened and firmly approximated to the posterior pharyngeal wall (by the upper pharyngeal constrictor). Then the larynx and pharynx is drawn up (stylopharyngeus, palatopharyngeus, thyrohyoid muscles). Simultaneously, the aryepiglottic folds are approximated and epiglottis bends back onto the laryngeal inlet excluding the bolus from the larynx. The bolus slips into the lowest part of the pharynx.

The last stage is the expulsion of the bolus into the oesophagus, by the inferior constrictors.

OESOPHAGUS

1) **Pars cervicalis**

2) **Pars thoracica**

pars retrotrachealis

pars retropericardiaca

3) **Pars abdominalis** - cardia - gastrooesophageal junction

3 physiological narrowings

hiatus oesophageus

adventitia, serosa

oesophagoscopy, oesophagography

STOMACH (GASTER, VENTRICULUS)

regio hypochondriaca sinistra

J-shaped stomach, steer horn (transverse type)

cardia

pars cardiaca

fundus (fornix) ventriculi - stomach bubble

incisura cardiaca

corpus ventriculi - canalis gastricus

pars pylorica - antrum pyloricum, canalis pyloricus

pylorus - ostium pyloricum

paries anterior

paries posterior

curvatura minor - incisura angularis

curvatura major

Functionally:

Pars digestoria (digestive segment) - fundus and canalis gastricus.

Pars egestoria (evacuating segment) - gastric sinus (antrum) and canalis pyloricus

Plicae gastricae – sulcus salivarius

Mucinous glands – mucus

Tubulous glands - succus gastricus

Areae gastricae - foveolae gastricae

Musculature – fibrae obliquae

- stratum circulare - m. sphincter pylori
- stratum longitudinale

After the stomach is filled the musculature contracts and is in the rest (peristole), the mucosa adheres to the content (20 min). Then rhythmical contractions (peristalsis) begin. Peristaltic waves start in the cardia each 15 -30 seconds and get to the pylorus in 60 seconds. Four waves may be seen together at the X-ray picture. Peristalsis serves for the mixing of the content to the pulpy chyme that in small portions is emptied to the duodenum.

Omentum minus – lig. phrenicogastricum, hepatogastricum, hepatoduodenale

Omentum majus - lig. gastrocolicum, lig. gastrolienale

INTESTINUM

Intestinum tenue

ansae intestinales

Duodenum

pars superior - bulbus duodeni

flexura duodeni sup.

pars descendens duodeni

flexura duodeni inf.

pars horizontalis

pars ascendens

flexura duodenojejunalis

plicae circulares Kerkringi

villi intestinales

crypts of Lieberkuhn – glandulae intestinales

glandulae duodenales Brunneri

plica longitudinalis duodeni - papilla duodeni major Vateri

- papilla duodeni minor

Jejunum and ileum - jejunoileum

JEJUNUM	ILEUM
upper left part of the inframesocolic space	lower right part of the inframesocolic space
wider (3-4 cm)	narrower (2-3 cm)
more plicae circulares	fewer plicae circulares
1-2 arcades	2-3 arcades
folliculi lymph. solitarii	folliculi lymph. aggregati

mesenterium

ostium ileocaecale - valva ileocaecalis

INTESTINUM CRASSUM

intestinum caecum

appendix vermiformis

colon ascendens

flexura coli dextra – hepatica

colon transversum

flexura coli sinistra – lienalis

colon descendens

colon sigmoideum

rectum

mucosa - unilayered columnar epithelium, intestinal glands, lymphatic follicles

submucosa - vascular and nerve plexuses

circular musculature – plicae semilunares, haustra coli

longitudinal musculature - taenia mesocolica

12 taenia omentalis

13 taenia libera

visceral peritoneum - appendices epiploicae

Intestinum caecum

recessus retrocaecalis

caecum liberum – mesocaecum

ostium ileocaecale

valva ileocaecalis (Bauhini) - labium sup. et inf.

Appendix vermiformis (tonsilla abdominalis)

ostium appendicis vermiformis – valva appendicis vermiformis

mesoappendix

positio pelvina (32%) - ligamentum appendiculoovaricum

positio retrocaecalis (64%)

positio ileocaecalis

positio laterocaecalis

positio subcaecalis

positio praecaecalis

Projection of the appendix:

McBurney's point - linea spinoumbilicalis dextra - Monro's line

Lanz's point

Rectum

crena ani- anus

Ampulla recti - flexura sacralis

- plicae transversae recti - Kohlrausch's fold

- flexura perinealis

linea anorectalis

Canalis analis – zona hemorrhoidalis - columnae anales

- sinus anales

- valvulae anales

- pecten analis

linea anocutanea

plexus venosus rectalis

m. sphincter ani internus - m. sphincter ani externus – voluntary control of defecation.

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circular musculature – plicae semilunares, haustra coli

longitudinal musculature - taenia mesocolica

5. taenia omentalis

6. taenia libera

visceral peritoneum - appendices epiploicae

Intestinum caecum

recessus retrocaecalis

caecum liberum – mesocaecum

ostium ileocaecale

valva ileocaecalis (Bauhini) - labium sup. et inf.

Appendix vermiformis (tonsilla abdominalis)

ostium appendicis vermiformis – valva appendicis vermiformis

mesoappendix

positio pelvina (40%) - ligamentum appendiculoovaricum

positio retrocaecalis (15-30%)

positio ileocaecalis

positio laterocaecalis

positio subcaecalis

positio praecaecalis

Projection of the appendix:

McBurney`s point - linea spinoumbilicalis dextra - **Monro`s line**

Lanz`s point

Rectum

crena ani- anus

Ampulla recti - flexura sacralis

- plicae transversae recti - **Kohlrausch`s fold**

- flexura perinealis

linea anorectalis

Canalis analis – zona hemorrhoidalis - columnae anales

- sinus anales

- valvulae anales

- pecten analis

linea anocutanea

plexus venosus rectalis

m. sphincter ani internus
m. sphincter ani externus – voluntary control of defecation.

LIVER (HEPAR)

Facies diaphragmatica - pars superior (area nuda – bare area)
- pars anterior (covered by peritoneum)

lig. coronarium - lig. triangulare dextrum
- lig. triangulare sinistrum - appendix fibrosa hepatis

lig. falciforme hepatis - lobus dexter hepatis
- lobus sinister hepatis

lig. teres hepatis (v. umbilicalis)

Facies visceralis - fissura sagittalis dextra - sulcus v. cavae inf. (lig. venae cavae), fossa vesicae biliaris
- fissura sagittalis sinistra – lig. teres hepatis, lig. venosum (ductus venosus)
- porta hepatis- vena portae, a. hepatica propria, ductus hepaticus communis

lobus caudatus - processus caudatus

lobus quadratus

lobus dexter - impressio renalis, suprarenalis, duodeni, colica

lobus sinister – tuber omentale, impressio oesophagea, gastrica

Hepatic segments (Couinaud)

lobus caudatus – 1st segment

lobus sinister - 2nd to 4th segments

lobus dexter - 5th to 8th segments

Cantlie`s line

Structure of the liver

capsula fibrosa- capsula fibrosa perivascularis

lobulus venae centralis (hepaticus)

Glisson`s triad – a., v., ductus interlobularis

sinusoids

trabeculae

v. centralis

v. sublobularis

v. hepatica

Blood flow in the liver

functional circulation – v. portae

nutritive circulation – a. hepatica propria

Intrahepatic bile ducts:

canaliculus bilifer

ductus bilifer intralobularis

ductulus bilifer

ductus bilifer interlobularis

Extrahepatic bile ducts:

ductus hepaticus dexter et sinister

ductus hepaticus communis

ductus cysticus

ductus choledochus - m. sphincter ductus choledochi

Vater`s papilla (papilla duodeni major)- m. sphincter ampullae hepatopancreaticae (Oddi)

The liver fills the whole right diaphragmatic dome and reaches over the midline to the left diaphragmatic dome where it reaches the left midclavicular line. The lower border of the liver follows the right costal arch to the right midclavicular line (9th costal cartilage) where it ascends obliquely toward the end of the left 8th costal cartilage. This part of the liver between costal arches is in contact with the anterior abdominal wall. The superior part neighbors through the diaphragm with the right lung and the heart in the pericardium.

Vesica biliaris (fellea)

fundus

corpus

infundibulum

collum

ductus cysticus- plica spiralis

The fundus of the gallbladder is in contact with the anterior abdominal wall in the crossing of the right midclavicular line and the 9th costal cartilage.

PANCREAS

caput - incisura pancreatis - processus uncinatus

corpus - tuber omentale

cauda

capsula pancreatis

facies anterior

facies posterior

margo superior

margo inferior

ductus pancreaticus major - m. sphincter ductus pancreatici - papilla duodeni major (Vateri)

ductus pancreaticus accessorius (minor) - papilla duodeni minor

succus pancreaticus

islets of Langerhans - insulin, glucagon

The head of the pancreas lies in front of the L2.

SPLEEN (LIEN, SPLEN)

extremitas anterior

extremitas posterior

margo superior - crenae lienis

margo inferior

facies diaphragmatica

facies visceralis - hilum lienis - facies gastrica, facies renalis, facies colica

capsula fibrosa

red pulp

white pulp

segments

The spleen reaches from the 9th to the 11th ribs, the anterior pole does not reach over the **costoarticular line** – the connection between the end of the 11th costal cartilage and left sternoclavicular joint. In healthy man the spleen is not palpable. The posterior pole is about 4 cm from the 10th vertebra.

PERITONEUM

peritoneum parietale

peritoneum viscerale

cavitas peritonealis - pars supramesocolica
- pars inframesocolica

spatium retroperitoneale

spatium subperitoneale

spatium preperitoneale

Intraperitoneal organs: stomach, bulbus duodeni, jejunioileum, appendix vermiformis, colon transversum, colon sigmoideum, liver and spleen

The supramesocolic part - stomach, superior part of the duodenum, liver with bile ducts, spleen - truncus coeliacus

The inframesocolic part - coils of the small intestine, large intestine - a. mesenterica sup. et inf.

Secondarily retroperitoneal organs: most of the duodenum, caecum, colon ascendens, descendens, pancreas

PERITONEAL FOLDS

omentum minus – lig. hepatogastricum
- lig. hepatoduodenale

omentum majus - lig. gastrocolicum

mesenterium - radix mesenterii

mesocolon transversum

mesoappendix vermiformis

mesocolon sigmoideum

lig. gastrosplenicum (-lienale)

lig. phrenicosplenicum (-lienale)

lig. splenorenale

lig. phrenicocolicum

RECESSUS PERITONEI

herniae internae

bursa omentalis - foramen epiploicum – vestibulum, recessus superior, splenicus, inferior

recessus duodenales: recessus duodenalis inferior - plica duodenalis inf.

recessus duodenalis superior - plica duodenalis sup.

recessus duodenalis sinister - plica duodenalis lat. - v. mesenterica inf.

recessus retroduodenalis

recessus ileocaecalis sup. - plica ileocaecalis sup.

recessus ileocaecalis inf. - plica ileocaecalis inf.

recessus retrocaecalis

recessus paracolici

recessus intersigmoideus