**cardiovascular system**

**Overview**

* Heart (cor)
* System of vessels: arteries (arteriae), veins (venae), capillaries

COR

Position, size, shape, function.

Axis of a heart, auscultation points of valves - A, B, C, D.

Parts: basis et apex cordis

Facies: sternocostalis, diaphragmatica

Margines: dexter (acutus) et sinister (obtusus)

Surface: sulcus interventricularis ant. et post., sulcus coronarius

Septum cordis (interatriale, interventriculare); septum atrioventriculare

Cavities of a heart:

**Atrium dextrum**:

shape, walls: *upper* (ostium venae cavae superioris), *lower* (ostium et valva venae cavae inf., ostium sinus coronarii, valvula sinus coronarii, venae cordis anteriores), *medial* (septum interatriale, fossa ovalis, limbus fossae ovalis), *lateral* (crista terminalis), *anterior* (ostium atrioventriculare dx., valva tricuspidalis: cuspis ant., post., septalis), *posterior* (torus intervenosus); auricula dextra

**Ventriculus dexter**:

shape, *inflow part* (pars trabecularis): ostium atrioventriculare dx., valva tricuspidalis, (cuspis ant., post., septalis), chordae tendineae, mm. papillares (ant., post., septalis), crista supraventricularis

*outflow part* (pars glabra): ostium trunci pulmonalis, valva trunci pulmonalis (valvulae seminlunaris ant., dx., sin.).

**Atrium sinistrum:** fossa ovalis, ostia venarum pulmonalium, auricula sinistra

**Ventriculus sinister***:* shape , *inflow part* (pars trabecularis): ostium atrioventriculare sin., valva bicuspidalis (cuspis ant. et post.), chordae tendinae, mm. papilares (ant. et post.) *outflow part* (pars glabra): ostium aortae valva semilunaris aortae (valvula semilunaris post., dx., sin.)

Structure of wall: endocardium, myocardium (working, conductive), epicardium.

Pericard (perikardium): fibrosum, serosum; porta arteriarum et venarum; sinus obliquus et transversus.

Skeleton of heart (anulus fibrosus dx. et sin., anulus aorticus, anulus trunci pulmonalis, trigonum fibrosum dx. et sin., konusová šlacha).

Inervation: **Conductive system of heart:** nodus sinuatrialis et atrioventricularis, fasciculus atrioventricularis, crus dx. et sin. (branches of Tawar), fibres of Purkynje. Accessory connections. Modulation of heart labor: plexus cardiacus superficialis et prof. (sympathetic fibres - nn. cardiaci; parasympathetic fibres- rr. cardiaci)

Nourishment:

**aa. coronariae cordis**:leaving from aorta, postion, region of blood supply. A. coronaria cordis sin.: r. interventricularis ant., r. circumflexus; a. coronaria cordis dx.: r. interventricularis post.

Branches from both aa. coronariae: r. coni arteriosi, rr. atriales, rr. ventriculares, rr. septales, rr. marginales, rr. nodi sinuatriales/atrioventriculares

**venae cordis**: localization, place of inflow, tributary regions. Sinus coronarius (vena cordis magna, media et parva); vv. cordis anateriores; vv. cordis minimae

Lymphatic vessels: lymphatic plexuses, truncus lymphaticus anterior dx. et sin.

X-ray:

* native X-ray of a thorax (posteroanterior projection, describe and shox right and left border of a heart shade)
* contrast examination of coronary arteries - coronarography - PTCA

ARTERIAE

Basic structure of wall: tunica intima, media, externa

In each artery briefly course and region of nourishment

**Aorta ascendens**

Borders, bulbus aortae, sinus aortae

* Aa. coronariae cordis

**Arcus aortae**

Borders

* Truncus brachiocephalicus (a. carotis communis dx, a. subclavia dx)
* A. carotis communis sin.
* A. subclavia sin.

**A. carotis communis**

Course on a neck

**A. carotis externa**

(detailed knowledge of passage!)

*Anterior branches:*

* A. thyroidea superior (a. laryngea sup.)
* A. lingualis (a. sublingualis, rr. dorsales linguae, a. profunda linguae)
* A. facialis (a. palatina ascendens, r. tonsillaris, a. submentalis, a. labialis sup. et inf., arcus labialis superior et inferior, a. alaris nasi, a. angularis)

## *Lateral branches*

* A. sternocleidomastoidea

## *Dorsal branches*

* A. occipitalis
* A. auricularis post. (rr. glandulares, r. auricularis, a. stylomastoidea, a. tympanica post.)

## *Medial branches*

* A. pharyngea ascendens (a. meningea post., a. tympanica inf.)

## *Terminal branches*

* A. temporalis superficialis (rr. parotidei, a. temporalis media, rr. auriculares ant., r. frontalis et parietalis
* A. maxillaris
  + pars mandibularis (a. meningea media, a. alveolaris inf.)
  + pars pterygoidea (a. masseterica, aa. temporales profundae, rr. pterygoidei, a. buccalis)
  + pars pterygopalatina (a. infraorbitalis, a. palatina descendens, a. sphenopalatina)

**A. carotis interna**

( 3. semester)

**A. subclavia**

Boundaries; fissura scalenorum

* A. vertebralis (CNS – 3. semester)
* A. thoracica interna
  + rr. mediastinales
  + a. pericardiacophrenica
  + rr. intercostales ant.
  + a. musculophrenica
  + a. epigastrica superior
* Truncus thyrocervicalis
  + a. thyroidea inf. (a. laryngea inf., rr. tracheales, rr. pharyngeales, rr.oesophageales)
  + a. cervicalis ascendens
  + a. cervicalis superficialis
* Truncus costocervicalis (a. cervicalis prof., a. intercostalis suprema)
* A. transversa colli
* A. suprascapularis

**A. axillaris**

Boundaries

* Rr. subscapulares
* A. thoracica suprema
* A. thoracoacromialis
* A. thoracica lateralis
* A. subscapularis (a. circumflexa scapulae, a. thoracodorsalis)
* A. circumflexa humeri ant. et post.

**A. brachialis**

Boundaries, sulcus bicipitalis medialis

* A. profunda brachii - průběh (a. collateralis media, a. collateralis radialis)
* A. collateralis ulnaris sup. et inf.

**A. radialis**

Relation to canalis carpi

* A. recurrens radialis
* R. carpeus dorsalis (rete carpi dorsale, aa. metacarpeae dorsales, aa. digitales dorsales)
* A. metacarpea dorsalis prima (aa. digitales dorsales)
* A. princeps pollicis (aa. digitales palmares)
* R. palmaris superficialis et profundus

**A. ulnaris**

Relation to canalis carpi

* A. recurrens ulnaris
* A. interossea communis (a.interossea ant. et post.)
* R. carpeus dorsalis (rete carpi dorsale, aa. metacarpeae dorsales, aa. digitales dorsales)
* R. palmaris superficialis et profundus

Rete articulare cubiti (a. brachialis, a. radialis, a. ulnaris)

Arcus palmaris superficialis et profundus (aa. metacarpeae palmares, aa. digitales palmares)

**Aorta thoracica**

Boundaries, position (posterior mediastinum)

*Parietal branches*

* Aa. intercostales post.
* Aa. phrenicae superiores

*Visceral branches*

* Rr. bronchiales, oesophagei, pericardiaci

**Aorta abdominalis**

Boundaries, position (retroperitoneal)

*Parietal branches*

* Aa. phrenicae inf. (a. suprarenalis sup.)
* Aa. lumbales

*Visceral branches - paired*

* Aa. suprarenales mediae
* Aa. renales (rr. ureterici, a. suprarenalis inf.)
* Aa. testiculares / aa. ovaricae

*Visceral branches - unpaired*

* Truncus coeliacus
  + a. gastrica sin.
  + a. hepatica communis: hepatica propria (a. cystica), a. gastroduodenalis (a. gastroepiploica dx. et a. pancreaticoduodenalis sup.)
  + a. lienalis (rr. pancreatici, a. gastroepiploica sin., aa. gastricae breves, rr. lienales)
* A. mesenterica sup.
  + a. pancreaticoduodenalis inf.
  + aa. jejunales et ilei
  + a. ileocolica
  + a. colica dextra
  + a. colica media
* A. mesenterica inf.
  + a. colica sin. (ramus ascendens et descendens)
  + aa. sigmoideae
  + a. rectalis sup.

**Arteria iliaca communis**

Boundaries, position (retroperitoneal)

* A. sacralis mediana

**A. iliaca interna**

*Parietal branches*

* A. iliolumbalis
* A. sacralis lateralis
* A. obturatoria
* A. glutea sup. et inf.
* A. pudenda interna (canalis pudendalis)
* a rectalis inf.
* a. perinealis
* a. penis (a. bulbi penis, a. urethralis, a. dorsalis penis, a. profunda penis) nebo a. clitoridis (a. bulbi vestibuli, a. dorsalis clitoridis, a. profunda clitoridis)

## *Visceral branches*

* A. umbilicalis (a. vesicalis sup.)
* A. vesicalis inf.
* A. rectalis media
* A. uterina - ♀ (r. uretericus, rr. uterini, r. tubarius, r. ovaricus, a. vaginalis) nebo a. ductus deferentis - ♂

**A. iliaca externa**

Boundaries; lacuna vasorum

* A. epigastrica inf.
* A. circumflexa ilium prof.

**A. femoralis**

Boundaries; fossa iliopectionea, canalis adductorius (lamina vastoadductoria), hiatus adductorius

* A. epigastrica superficialis
* A. circumflexa ilium superficialis
* Aa. pudendae externae
* A. profunda femoris
* a. circumflexa femoris medialis
* a. circumflexa femoris lateralis (r. ascendens et descendens)
* aa. perforantes
* A. genus descendens

**A. poplitea**

* Aa. surales
* Aa. genus sup., media et inf.

**A. tibialis anterior**

* Aa. recurrentes
* A. malleolaris anterior medialis et lateralis
* A. dorsalis pedis:
  + aa. tarseae mediales
  + a. tarsea lateralis (anastomosa s a. arcuata)
  + a. arcuata (aa. metatarseae dorsales, aa. digitales dorsales)
  + a. metatarsea dorsalis prima (aa. digitales dorsales)
  + r. plantaris profundus (napojení na arcus plantaris)

**A. tibialis posterior**

* R. circumflexus fibulae
* A. peronea (rr. malleolares laterales, rr. calcanei laterales)
* Rr. malleolares mediales
* Rr. calcanei mediales
* A. plantaris medialis (r. superficialis et prof.)
* A. plantaris lateralis (arcus plantaris, aa. metatarseae plantares, aa.digitales plantares)

Rete articulare genus (a. femoralis, a. poplitea, aa. tibiales)

VENAE

Basic structure of wall (tunica intima, media, externa). In each vein tributary region, in large veins briefly course.

X-ray of vessels:angiography (arteries– arteriography, veins– phlebography)

***remark: by Origin is meant, from which vessels is formerly mentioned vein actually constituted***

**V. cava superior**

Origin, position, tributary region

* v. azygos

**Vv. brachiocephalicae**

Origin, position, tributery region, difference between left and right vein

* vv. thyroideae inf.
* v. vertebralis
* v. thoracica interna (v. epigastrica sup. a v. musculophrenica)
* mediastinal organs (vv. thymicae, tracheales, bronchiales, esophageales, pericardiacae)

**V. jugularis interna**

Origin, position, bulbus sup. et inf., tributary regions

* *Intracranial inflows*:
  + sinus durae matris
  + vv. cerebri
  + vv. diploicae
  + vv. meningeae
  + vv. emissariae
  + vv. ophtalmicae
* *Extracranial inflows:* 
  + v. retromandibularis (v. temporalis superf., v. maxillaris, plexus pterygoideus)
  + v. facialis (v. profunda faciei)
  + v. lingualis
  + vv. thyroideae sup.
  + vv. pharyngeae
  + (v. transversa colli, v. suprascapularis)

**V. jugularis externa**

Origin, position, tributary region

* v. auricularis post.
* v. occipitalis
* vv. jugulares ant. (arcus venosus juguli)

**V. subclavia**

Origin, position, tributary region

* (v. transversa colli, v. suprascapularis)

**V. axillaris**

Origin, position, tributary region

* v. thoracoepigastrica
* v. thoracica lateralis
* v. cephalica

**Veins of upper extremity**

Profound and superficial system, differences

**Profound veins:** vv. digitales, radiales, ulnares, interosseae antebrachii, brachiales

**Superficial veins:** rete venosus dorsale manus, rete venosus palmare manus, vv. intercapitulares, v. basilica, v. cephalica (v. mediana cubiti, v. mediana antebrachii)

**V. cava inferior**

Origin, position, tributary region

* *Parietal inflows:* 
  + vv. iliacae communes
  + vv. lumbales
  + vv. phrenicae inf.
* *Visceral inflows:*
* vv. testiculares / vv. ovaricae
* vv. renales
* vv. suprarenales
* vv. hepaticae

**Vv. iliacae communes**

Origin, position, tributary region

* v. sacralis mediana

**V. iliaca interna**

Origin, position, tributary region

* *Parietal inflows*:
* vv. iliolumbales
* sacrales lat.
* gluteae sup. et inf.
* obturatoriae
* pudendae int.
* *Visceral inflows*:
* plexus venosus vesicalis
* plexus venosus prostaticus
* plexus venosus uterinus, vaginalis
* plexus venosus rectalis (vv. rectales sup. mediae et inf.)

**V. iliaca externa**

Origin, position, tributary region

* v. epigastrica inf.
* v. circumflexa ilium prof.

**Veins of lower extremity**

Profound and superficial system, differences, perforators

Profound veins of LE*:* vv. digitales, metatarsales, vv. tibiales ant. et post., vv. peroneae, v. poplitea, v. femoralis (v. profunda femoris, vv. perforantes, v. circumflexa femoris medialis et lateralis)

Superficial veins of LE:rete venosum dorsale pedis, rete venosum plantare pedis, vv. intercapitulares, v. saphena parva (v. femoropoplitea), v. saphena magna (v. saphena accessoria, epigastrica superficialis, circumflexa ilium superficialis, vv. pudendae externae)

**Outflow of blood from vertebrae**

* plexus venosi vertebrales int.
* plexus venosi vertebrales ext.

Position, course of blood flow

**V. portae**

Origin, position, tributary region

* v. mesenterica sup.: head of pancreas, duodenum, stomach, small intestine, oral part od large intestine
* v. lienalis: body and tail of pancreas, stomach, spleen
  + - v. mesenterica inf. (aboral part of large intestine)
* vv. cysticae

**Portocaval anastomoses and their importance**

* 1. connections between vv. oesophageae (inflow to v. cava sup.) and vv. gastricae (inflow to v. portae)
  2. cpnnections around umbilicus: vv. paraumbilicales in lig. teres hepatis directs blood to umbilicus („caput Medusae“). Outflow to v. cava sup.: through v. thoracoepigastrica and v. epigastrica sup. Outflow to v. cava inf.: through v. epigastrica superficialis a v. epigastrica inf.
  3. connections around rectum: v. rectalis sup. (inflow to v. portae); v. rectalis media a inf. (inflow to v. cava inf.)

**Cavocaval anastomoses**

V. azygos, position, tributary region

* vv. lumbales
* vv. intercostales post.
* v. hemiazygos (v. hemiazygos accessoria)
* vv. phrenicae sup.
* veins for organs of mediastinum (vv. esophageae, bronchiales, pericardiacae)

**Fetal blood circulation**

Oxygenated blood from placenta*:* umbilical cord, v. umbilicalis, v. cava inf. (through ductus venosus or v. portae), atrium dx., foramen ovale, atrium sin., ventriculus sin., branches of arcus aortae

Deoxygenated blood from featus:

* **v. cava sup**., atrium dx., ventriculus dx., truncus pulmonalis, ductus arteriosus, aorta descendes
* **aa. iliacae internae**:
  + v. cava inf., atrium dx....
  + pupeční provazec, placenta

Condition after birth and interruption of umbilical cord:

V. umbilicalis = lig.teres hepatis, ductus venosus = lig. venosum, aa. umbilicales = ligg.umbilicalia medialia ( + non-obliterated aa.vesicales sup.), foramen ovale = septum secundum (fossa ovalis), ductus arteriosus = lig. arteriosum.

**Lymphatic system**

**Overview**

* Lymph (lympha)
* lymphatic vessels (vasa lymphatica), lymphatic stems (truncus lymphaticus dx., ductus thoracicus),
* Lymphatic folicles, lymphatic nodes (nodi lymphatici), tonsiles (tonsilae), spleen (lien), thymus (thymus)

Function of lymphatic system

X-ray exam.: lymphography

**Lymph**

Formation, amount, qualities, daily production, circulation

**Lymphatic vessels**

profound and superficial; structure; valves; tissues without lymphatic vessels

**Trunci lymphatici**

* **Ductus thoracicus:** drained region, lenght, place of formation, parts(truncus lumbalis dx. et sin., truncus intestinalis; cisterna chyli). Pars: abdominalis, thoracica, cervicalis. Inflows: truncus jugularis sin., truncus subclavius sin., truncus bronchomediastinalis sin.
* **Ductus lymphaticus dexter:** drained region, place of formation, parts (truncus jugularis dx., truncus subclavius dx., truncus bronchomediastinalis dx.)

**Lymphatic folicles**

Localization, function

**Tonsillae**

Localization, function. Tonsilla: palatina, tubaria, lingualis, pharyngea, abdominalis

**Nodi lymphatici**

Shape, size, color, function (filtration, imunobiological), regional lymph nodes.

Structure: capsula, trabeculae, cortex, medulla, sinusy, vasa afferentia, vas efferens, hilus

**In each group of lymph nodes is necessary to know: tributery region (drained region) and outflow to more distant lymph nodes!**

**Lymph nodes of head.**

Nodi lymphatici: occipitales, retroauriculares, parotidei, submandibulares, submentales, retropharyngei. More forwarded lymph nodes (nll. faciales).

**Lymph nodes of neck**

Nodi lymphatici cervicales superficiales: localization, concomitant veins

Nodi lymphatici cervicales profundi: localization, concomitant structures. Nodus jugulodigastricus, juguloomohyoideus, tonsillaris (lymph node of Wood)

**Lymph nodes and vessels of upper extremity**

Superficial lymph vessels: lateral, medial and anterior collectors

Profound vessels

Nodi lymphatici:

* cubitales: superficiales et profundi
* axillares: laterales, subscapulares, pectorales, interpectorales, centrales, apicales (infraclaviculares)

**Lymph nodes of thorax**

Visceral – nodi lymphatici: pulmonales, bronchopulmonales, bronchiales, tracheobronchiales, paratracheales, mediastinales ant. et post.

Parietal – nodi lymphatici: phrenici sup., parasternales, intercostales

**Lymph nodes of abdomen and pelvis**

* Nodi lymphatici coeliaci (stomach, liver, pancreas, duodenum, spleen,small and large intestine) → **truncus instestinalis**
* Nodi lymphatici:
* iliaci externi
* iliaci interni (paravesicales, paravaginales, parauterini, pararectales)
* iliaci communes
* lumbales
* sacrales → **trunci lumbales**

**Lymph nodes and vessels of lower extremity**

Superficial vessels (lateral, medial and posterior collectors)

Profound vessels

Nodi lymphatici:

* poplitei superficialis et profundi
* inguinales superficiales et profundi

**Lien**

Position, shape, size, function

Margo: superius et inferius

Facies: diaphragmatica et visceralis

Extremitas: ant. et post.

Hilus lienis

Structure: tunica fibrosa, trabeculae lienis, pulpa lienis alba et rubra.

Blood supply: a. et v. lienalis

**Thymus**

Size, color, position, function, involution

Lobus: dexter et sinister

Structure: capsula thymi, septa, lobuli, cortex, medulla thymi, reticulum thymi

Blood supply: branches of a. subclavia, inflow to vv. brachiocephalicae