

VENAE

The wall of the veins

- **reduced muscle layer**

VENA CAVA SUPERIOR

- *vena brachiocephalica dextra + vena brachiocephalica sinistra (art. sternocostalis I. dextra)*
- behind art. sternocostalis III. opens out into the right atrium

Vena brachiocephalica: *vena jugularis interna + vena subclavia (behind art. sternoclavicularis - angulus venosus)*

- *ductus thoracicus, ductus lymphaticus dexter*

Vena brachiocephalica

1) The collateral branches

- ***From the thyroid gland, the larynx, the trachea***
- ***vena vertebralis***
- ***vena thoracica interna***
- ***From the mediastinal organs***

2) The truncal tributaries

- ***vena jugularis interna***
- ***vena subclavia***

VENA JUGULARIS INTERNA

- The cranial cavity, the facial areas of the head, the neck
- It starts as *bulbus superior venae jugularis internae*, behind the sternoclavicular joint it is extended as *bulbus inferior venae jugularis internae*

intracranial and extracranial tributaries:

1) The intracranial tributaries

- *sinus durae matris*

**(without the smooth muscle
and valves)**

2) The extracranial tributaries

- *v. facialis*
- *v. lingualis*
- *from the thyroid gland, the pharynx, larynx and the trachea*
- *v. retromandibularis* is created by the confluence of *v. temporalis superficialis* and *v. maxillaris*
- *v. jugularis externa* – the subcutaneous vein

The ways of the spread of infection from the facial areas into the cranial cavity:

v. facialis – v. profunda faciei - plexus pterygoideus

v. facialis – v. ophthalmica – sinus cavernosus

VENA SUBCLAVIA

- It is the continuation of *vena axillaris*, the border line is the first rib

The tributaries (small):

- *vena transversa colli*
- *vena suprascapularis*

VENA AXILLARIS

- It starts at the level of the attachment of *musculus pectoralis major* (at the level of *collum chirurgicum humeri*), it is created by the confluence of *venae brachiales*

The tributaries:

- **venae brachiales** (*the truncal tributaries*)
- **venae thoracoepigastricae**: from the subcutaneous areas of the lateral and anterior thoracic wall, they are attached to the subcutaneous veins of the abdomen (*venae subcutaneae abdominis*)
- **vena cephalica**: the superficial subcutaneous vein of the upper extremity, it runs on the lateral side of the forearm and arm (within *sulcus bicipitalis lateralis*) and within *trigonum deltoideopectorale*
- **venae costoaxillares** – join to the intercostal veins
- **vena thoracica lateralis** – *m. serratus anterior*

VENAE MEMBRI SUPERIORIS

- Two venous systems:

1) The deep veins:

- They are usually double and accompany the homonymic arteries

2) The superficial subcutaneous veins:

- They create the subcutaneous nets (*rete venosum dorsale et palmare manus*)

On the dorsal side of the hand:

- **vena basilica** – originates from the dorsal venous net as **vena salvatella**, continues on the ulnar side and opens out into **vena brachialis** (*sulcus bicipitalis medialis*)
- **vena cephalica** – is formed on the radial side of **rete venosum dorsale manus** as **vena cephalica pollicis**, it continues on the lateral side and opens out into **vena axillaris** (*sulcus bicipitalis lateralis*)
- These two veins are interconnected through **vena mediana cubiti**, in the region of the cubital fossa

Facies dorsalis

Facies ventralis

VENA CAVA INFERIOR

- It begins on the right side of the lumbar vertebral column at the level of L4 as a connection of *vena iliaca communis dextra et sinistra*, it opens out into the right cardiac atrium
It has the parietal and visceral tributaries:

a) The parietal tributaries

- *venae iliacaes communes*
- from the abdominal wall
- from the diaphragm

b) The visceral tributaries

- from the testicles (ovaries)
- from the renal and suprarenal glands
- *venae hepaticae*
- *vena umbilicalis*

Venae iliacae communes

- ***vena iliaca communis sinistra et dextra*** begin in front of the right and left ***art. sacroiliaca*** as the connection of ***v. iliaca interna*** and ***v. iliaca externa***

Vena iliaca interna

- It originates from the venous plexuses of the small pelvis above ***foramen ischiadicum majus***
- a) **The parietal tributaries**
 - ***the branches from the pelvic wall***
- b) **The visceral tributaries**
 - the venous plexuses around the pelvic organs (***plexus uterinus, vaginalis, prostaticus, rectalis***)

Vena iliaca externa

- It is a continuation of ***v. femoralis***
- It begins below the medial part of ***ligamentum inguinale*** within ***lacuna vasorum***

VENAE MEMBRI INFERIORIS

- The deep and superficial venous system
 - The both systems are interconnected through numerous connections (*vv. perforantes*)
- a) The deep veins of the lower extremity
- They are usually double and accompany the homonymic arteries
 - The largest of the deep veins is *vena femoralis*, which continues into the pelvis as *vena iliaca externa*
- b) The superficial (subcutaneous) veins of the lower extremity
- *rete venosum plantare et dorsale pedis*
 - from the dorsal venous net starts *vena saphena parva et vena saphena magna*
 - *v. saphena parva* runs behind the lateral ankle and is the tributary of *v. poplitea*
 - *v. saphena magna* begins on the medial side of the foot and opens out into *v. femoralis*

vv.perforantes

The varices

VENA PORTAE

- It forms the functional circulation of the liver, it drains the blood away from the unpaired abdominal organs into the liver
- It is formed by confluence of *vena mesenterica superior* and *vena lienalis* behind *caput pancreatis* at the level of L2

Přítoky:

a) Kmenové přítoky

- *vena mesenterica superior*
- *vena lienalis*, na rozdíl od tepen bývá většinou přítokem i *vena mesenterica inferior*

b) Další přítoky

- ze žaludku a jícnu
- *venae paraumbilicales*

The portocaval anastomoses

- Connections between ***vena portae*** and ***v. cava superior et inferior***, under the pathological conditions when the pressure within the stream bed of the portal vein is increased, they widen and enable the outflow of the blood into the caval veins
- Connections within the inferior part of the esophagus and the gastric wall
- Connections around the umbilicus, which are during extension stellate shaped and are called „*caput Medusae*“
- Connections around the rectum
- Burow´s around the urinary bladder
- Retzius veins between intra and retroperitoneally veins

The cavocaval anastomoses

- The superior and inferior caval vein are interconnected through the use of the special venous system which are distributed on the sides of the vertebral column, these veins collect the blood from the retroperitoneal area, the posterior abdominal wall, the intercostal spaces, the vertebral column and the posterior mediastinum
- The incompletely valves, blood flow in the both directions
 - 1) *Plexus venosi vertebrales*
 - 2) *Vena azygos*
- It begins below the diaphragm and caudally connects to *vena iliaca communis dextra*, it opens out from behind into *vena cava superior*

The tributaries:

- from caudal 8 till 10 intercostal spaces
- *vena hemiazygos* passes on the right side of the vertebral column, cranially it reaches up to the level of Th7–9
- they drain the blood away from the organs of the mediastinum and the diaphragm

The fetal circulation

**The blood of the mother and the foetus
doesn't mix!**

The lymphatic system

The lymphatic system

- it begins in the peripheral parts of the body, leads only centripetally and the terminal sections open out into the veins
- it provides the return transport of the water and the metabolites from the interstitial fluid into the blood
- **System-** superficial
 - deep
- **Function-** drainage and transport
 - immunology

The lymph

- It results from the interstitial fluid
- Colourless or milky coloured liquid
- Daily: 1,5 till 2 liters of the lymph

- The stopping of the drain of the
- lymph → lymph edema

The lymphatic vessels

- They begin blindly
- The wall is thin
- Numerous valves
- Within their course, there are the lymphonodes inserted
- lymphatic capillars → lymphatic capillary plexuses → lymphatic vessels → lymphatic plexuses → lymph ducts

The tissues without the lymphatic vessels:

hair, nails, epidermis, the sclera, the cornea, the lens, the cartilages, the nervous tissue, the bones

The lymph nodes (*nodi lymphatici*)

- capsule + trabeculae
- hilus
- Cortex – more lymphocytes
- medulla – less lymphocytes
- convex part - „afferent“ – vasa afferentia (more)
- concave hilus - „efferent“ – vas efferens
- They filtrate the lymph

2 main lymph ducts (irregular division of the body)

- **ductus thoracicus**
 - **pars abdominalis**
 - **pars thoracica**
 - **pars cervicalis**
- **ductus lymphaticus dx.**

ductus thoracicus (3/4 of the body)

- cisterna chyli (below the diaphragm (L1-L2), tr. intestinalis, tr. lumbalis dexter et sinister)
 - pars abdominalis (retroperitoneally)
 - pars thoracica (mediastinum posterius, aorta and the esophagus)
 - pars cervicalis (angulus venosus sinister C7) takes tr. jugularis sin. and tr. subclavius sin., tr. bronchomediastinalis sin.

ductus lymphaticus dx. (1/4 of the body)

- tr. jugularis dex. and tr. subclavius dex.
tr. bronchomediastinalis dx.

The lymphatic drainage of the head

- *n.l. parotidei*
- *n.l. retroauriculares*
- *n.l. occipitales*
- *n.l. submandibulares*
- *n.l. submentales*



N.l. cervicales profundi

The lymphatic drainage of the tongue

- **3 directions**
- + over the midline of the tongue**

The lymphatic drainage of the neck

1. N.I. cervicales superficiales

- ***along v. jugularis externa***
- ***vassa efferentia into n.I. cervicales profundi***

2. N.I. cervicales profundi—> truncus jugularis

- ***15-30, Wood's lymphonode,***
along v. jugularis int., n. accesorius, nodi supraclaviculares

The lymphatic drainage of the thorax

1. The thoracic walls

- Superficial layer → nodi axillares
- Inner side of wall → nodi parasternales et intercostales

2. The thoracic organs:

- Organs of the mediastinum → nodi tracheobronchiales sup. et. inf. → truncus bronchomediastinalis

The lymphatic drainage of the lungs

- **Everything into truncus lymphaticus dexter**
- **Only two superior segments of the right lung – into the thoracic duct !!!**

Axilla 40 lymph nodes 6 groups

noduli lymphatici:

- pectorales (Sorgius)
- subscapulares
- interpectoriales
- laterales (humerales)
- centrales



- apicales (infraclaviculares)



plexus lymphaticus axillaris



Truncus subclavius



ductus thoracicus
ductus lymphaticus dexter

The lymphatic drainage of Mamma

plexus areolaris

plexus subareolaris

plexus circumareolaris

- **nodi lymphatici axillares**
- **nodi lymphatici parasternales**
- **nodi supraclaviculares**
- **intercostální cesta (n. intercostales)**

The lymphatic drainage of the abdomen

1. The superficial system– *nodi axillares*

- *nodi inguinales*

- The border line is at the level of the umbilicus

2. The deep system

- parietal – along the large vessels
- visceral – unpaired and **paired** abdominal organs (around the unpaired branches of the aorta)

**The lymph nodes along the
large vessels
(retroperitoneally):**

Nodi lumbales—>tr. lumbalis



Nodi iliaci communnes



Nodi iliaci externi

Nodi iliaci interni

***Nodi parauterini (Bayer)/
nodi retroprostatici***

Truncus intestinalis



Nodi coeliaci (in front of the aorta)



Nodi gastrici

Nodi pylorici

Nodi pancreaticolienales

Nodi pancreaticoduodenales

Nodi hepatici

Nodi mesenterici

Nodi colici et paracolici

Nodi rectales et pararectales

The lymph from the pelvic organs – *nodi iliaci interni* – *nodi iliaci communes* – *nodi lumbales* – *truncus lumbalis* – *ductus thoracicus*

The lymph from the lower limb – *nodi inguinales profundi* – *nodi iliaci externi*

Nodi lumbales

Nodi lumbales

Nodi iliaci communes

Nodi iliaci communes

Nodi iliaci interni

Nodi iliaci externi

*Nodi inguinales
profundi*

The lymphatic drainage of the upper extremity

The superficial system

- The medial collectors
- The lateral collectors
- The anterior collectors

The deep system

- podél velkých cév

truncus subclavius



pl. lymphaticus axillaris



nodi axillares



nodi brachiales

n. l. cubitales profundi

**The medial collectors– 10-15, along v. basilica,
into axilla – nn. l. axillares centrales et laterales**

**The lateral collectors– 6-7, along v. cephalica
into axilla**

**The frontal collectors– from the palm, 4-5,
within the cubital fossa they connect to the
previous two systems**

The lymphatic drainage of the lower limb

The superficial system

- The lateral collectors
 - The medial collectors
 - The posterior collectors
- } N. inguinales superficiales

The deep system

- Along the large vessels

nodi lumbales



nodi iliaci communes



nodi iliaci externi



**nodi lymf. inguinales profundi
(lymphonodus Cloqueti)**

The lateral collectors- from dorsum pedis toward the knee, connect to the medial ones

The medial collectors- from planta pedis, along v. saphena magna onto thigh, they enter nodi lymph. ing. sup.

The posterior collectors- from heel, along v. saphena parva, inside fossa poplitea they enter nodi lymph. poplitei and then added to the deep lymphatic vessels

The lymphography of the pelvis

Lymph edema

THE THYMUS

- The lymphatic organ
- 30-40 g
- corpus adiposum thymi
- T-lymfocyty-diferentiantion and maturation

Tonsils (Tonsillae)

- aggregation of the lymphatic tissue below the epithelium
- production of lymphocytes

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