

ARTERIES

Arteries carry blood from the heart. The pressure wave dilates the vascular wall and it is palpated as a pulse. Blood is ejected from the left ventricle during systole into the aorta, a tube about 2,5 cm diameter in the adult, with a wall thickness of about 1,5 mm.

Three zones have classically been described in the walls of all vessels except for capillaries and sinusoids:

Tunica intima - single layer of endothelial cells supported externally by fine subendothelial connective tissue of largely longitudinal arrangement. The fibromuscular tunica media extends from the internal elastic lamina to external elastic lamina and is circumferential. The outer tunica adventitia is again largely longitudinal or irregular in the orientation and blends at its outer limit with the connective tissue of the structures surrounding it. Adventitia contains nutrient blood vessels, **vasa vasorum**, lymphatics and nerve fibers.

The large elastic arteries - aorta and its main branches, pulmonary trunk and pulmonary arteries - concentric elastic lamellae in the middle tunic separated by fibrous tissue and non-striated myocytes (up to 40 layers in the normal aorta).

Medium and small muscular arteries - e.g. axillary, uterine, coronary aa. - non-striated myocytes with scattered elastic fibers and a small amount of collagen in the middle tunic.

Arterioles - a few circular layers of non-striated myocytes

Capillaries - 8 µm in diameter- capillary plexus

Sinusoids - wider caliber than capillaries (bone marrow, spleen, liver...)

In the systemic circulation arteries carry oxygenated blood and veins carry deoxygenated blood. In the pulmonary circulation deoxygenated blood flows through the arteries into lungs and oxygenated through the veins to the heart.

Collaterals - arterial branches accompanying the main trunk

Anastomoses - connections that allow overrunning of blood between adjacent regions

Terminal arteries - missing or functionally insufficient anastomoses (heart, retina, kidney)

TRUNCUS PULMONALIS

A. pulmonalis dx. and sin.

Lig. arteriosum (ductus arteriosus)

AORTA

1. **Aorta ascendens** - 3-5 cm long, from the 3rd right sternocostal junction to the 2nd right sternocostal junction, **bulbus aortae - a. coronaria cordis dx. et sin.**
2. **Arcus aortae** - from the 2nd right sternocostal junction to the left side of the 3rd thoracic vertebra - **truncus brachiocephalicus, a. carotis communis sin. and a. subclavia sin.**
3. **Aorta descendens - aorta thoracica** (T3 to T11-12), **aorta abdominalis** - to the L4 - **a. iliaca communis dx. et sin., a. sacralis mediana**

TRUNCUS BRACHIOCEPHALICUS - to the right sternoclavicular joint - **a. carotis communis dx. and a. subclavia dx.**

A. CAROTIS COMMUNIS

left is 4 cm longer than right, lateral to the trachea and larynx, posterior to m. sternocleidomastoideus and m. omohyoideus, cranially - to the lobe of the thyroid gland, medial to the v. jugularis int. and n. vagus - common connective tissue sheath, anterior to the transverse processes of the cervical vertebrae (tuberculum caroticum). Trigonum caroticum.

A. carotis int. et ext. - upper margin of the thyroid cartilage.

A. CAROTIS EXTERNA

supplies the upper half of the neck and the head except the brain, orbit and inner ear.
Medial to the m. stylohyoideus and venter post. m. digastrici, submandibular triangle, fossa retromandibularis - parotid gland, crossed by the v. facialis, v. lingualis, vv. thyroideae sup. and n. hypoglossus. Lateral to the pharynx, anterior to the styloid septum.

Ventral branches:

1. A. thyroidea sup.:

- a) r. infrahyoideus
- b) r. sternocleidomastoideus
- c) a. laryngea sup.
- d) r. cricothyroideus
- e) r. anterior et posterior

2. A. lingualis:

- a) r. suprahyoideus
- b) a. sublingualis
- c) rr. dorsales linguae
- d) a. profunda linguae

Angulus Béclardi – cornu majus ossis hyoidei + venter post. m. digastrici, deep to m. hyoglossus

Trigonum Pirogovi - m. mylohyoideus muscle + the tendon of the digastricus + n. hypoglossus, deep to the m. hyoglossus.

3. A. facialis:

- a) a. palatina ascendens
- b) r. tonsillaris – tonsilla palatina
- c) a. submentalis
- d) rr. glandulares - glandula submandibularis
- e) a. labialis inf. et sup. - arcus labialis sup. and inf. - circulus arteriosus oris
- f) a. alaris nasi
- g) a. angularis anastomoses with a. ophthalmica and a. infraorbitalis

(Truncus thyro-lingualis or tr. linguo-facialis or tr. thyro-linguo-facialis).

The lateral branch:

- 1. A. sternocleidomastoidea** - arcus n. hypoglossi runs below the artery

Dorsal branches:

1. A. occipitalis:

- a) rr. musculares (a. sternocleidomastoidea)
- b) r. mastoideus - foramen mastoideum - cranial cavity
- c) r. auricularis - medial surface of the auricle
- d) rr. occipitales - terminal branches

2. A. auricularis post.:

- a) rr. musculares
- b) rr. glandulares - parotid gland

- c) **r. auricularis** - auricle
- d) **a. stylomastoidea** - for. stylomastoideum - canalis facialis – **a. tympanica post.** to the tympanic cavity, **rr. mastoidei** - cellulae mastoideae, **r. stapedialis** m. stapedius
- e) **r. occipitalis**

The medial branch:

1. A. pharyngea ascendens:

- a) **rr pharyngeales**
- b) **a. tympanica inf.** - - canaliculus tympanicus - tympanic cavity
- c) **a. meningea post.** - - for. jugulare - posterior cranial fossa - dura mater

Terminal branches:

1. A. temporalis spf.:

- a) **rr. parotidei**
- b) **a. transversa faciei**
- c) **a. zygomaticoorbitalis**
- d) **rr. auriculares ant.** - mandibular joint, meatus acusticus ext., lateral side of the auricle
- e) **a. temporalis media** - m. temporalis.
- f) **r. frontalis et r. parietalis**

2. A. maxillaris - medial to the collum mandibulae (pars mandibularis), fossa infratemporalis (pars pterygoidea), fossa pterygopalatina (pars pterygopalatina)

Pars mandibularis:

- a) **a. auricularis prof.** - meatus acusticus ext.
- b) **a. tympanica ant.** - fissura petrotympanica - tympanic cavity
- c) **a. meningea media** - for. spinosum - middle cranial fossa - **r. frontalis, r. parietalis, r. orbitalis, a. tympanica sup.** - canalis facialis - tympanic cavity
- d) **a. alveolaris inf.** - **r. mylohyoideus**, canalis mandibulae - **rr. dentales** and **rr. gingivales**, for. mentale - **a. mentalis**

Pars pterygoidea (muscular):

- a) **a. masseterica**
- b) **aa. temporales prof.**
- c) **rr. pterygoidei**
- d) **a. bucalis**

Pars pterygopalatina

- a) **a. infraorbitalis** - - fissura orbit. inf., sulcus and canalis infraorbitalis, for. infraorbitale - **aa. alveolares sup. anteriores (rr. dentales and gingivales)** - upper premolars, canine, incisors
- b) **a. alveolaris sup. post.** - for. alveolaria (tuber maxillae) – **rr. dentales and gingivales** - upper molars.
- c) **a. palatina descendens** - **a. palatina major, aa. palatinae minores**
- d) **a. canalis pterygoidei** - nasal part of the pharynx
- e) **a. sphenopalatina** - for. sphenopalatinum - nasal cavity– **aa. nasales post. lat. et med. (septi)**

A. CAROTIS INTERNA

supplies most of the brain and the content of the orbit. The beginning - sinus caroticus - baroreceptors (register changes of the tension of the vascular wall). Parasympathetic paraganglion in the bifurcation of the common carotid artery - glomus caroticum - regulation of blood pressure, informs about the amount of oxygen in flowing blood (chemoreceptor). First dorsally and laterally from the a. carotis ext. then in the retrostyloid space to the skull base.

Apertura ext. canalis carotici - carotid canal - middle cranial fossa where - the cavernous sinus – carotid syphon (reduces hits of blood to minimize their negative effect to the brain), baroreceptors in the wall of the carotid syphon.

Aa. caroticotympanicae – in the carotid canal - tympanic cavity

Cavernous sinus – **rr. sinus cavernosi, r. meningeus, rr. tentorii, aa. hypophysiales**

A. ophthalmica

A. cerebri ant. et media - terminal

ARTERIES OF THE UPPER EXTREMITY

A. SUBCLAVIA

Cupula pleurae - impression on the apex of the lung, fissura scalenorum, below the clavicle.

1. **a. vertebralis**
2. **a. thoracica interna**
3. **truncus thyrocervicalis**
4. **truncus costocervicalis**
5. **a. transversa colli**

1. **A. vertebralis**

Foramen transversarium C6 - foramina transversaria of upper cervical vertebrae - base of the skull- sulcus a. subclaviae atlantis - membrana atlantooccipitalis post. - foramen magnum.

Through cervical vertebrae - **rr. spinales** for the spinal cord and meninges, **rr. musculares** for deep cervical muscles.

Its intracranial branches: **r. meningeus** - posterior cranial fossa.

a. spinalis post. - sulcus lat. post. of the spinal cord

a. spinalis ant. - fissura mediana ant. of the spinal cord.

Branches for the posterior part of the brain (CNS).

2. **A. thoracica interna**

1 cm from the border of the sternum to the level of the 6th and 7th costal cartilages - terminal branches, **a. musculophrenica** and **a. epigastrica sup.**

Branches:

1. Visceral - **rr. mediastinales, thymici, bronchiales**
2. **A. pericardiacophrenica**
3. **Rr. sternales**
4. **Rr. perforantes - rr. mammarii**
5. **Rr. intercostales anteriores** - 6 cranial intercostal spaces - anastomose with aa. intercostales posteriores
6. **A. musculophrenica** - at the circumference of the diaphragm - **rr. intercostales ant. for 5 caudal intercostal spaces.**
7. **A. epigastrica sup.** - posterior surface of the m. rectus abdominis - anastomoses with the a. epigastrica inf. (a. iliaca ext.)

3. Truncus thyrocervicalis

1. **A. thyroidea inf.** - toward the thyroid gland - **A. laryngea inf., rr. pharyngei, rr. oesophagei, rr. thymici, rr. tracheales**
2. **A. cervicalis ascendens** - along the anterior side of the m. scalenus ant.
3. **A. cervicalis spf.** - m. trapezius. (may be a branch of the a. transversa colli)
4. **A. suprascapularis** - margo superior scapulae - fossa supraspinata and infraspinata - anastomoses with the a. circumflexa scapulae (a. subscapularis)

4. Truncus costocervicalis

1. **A. cervicalis profunda** - nuchal muscles - between the m. semispinalis capitis and cervicis.
2. **A. intercostalis suprema** - **aa. intercostales post.** for the first two intercostal spaces.

5.A. transversa colli

It may be a branch of the tr. thyrocervicalis and then replaces the a. cervicalis spf.

r. ascendens - m. levator scapulae and nuchal muscles

r. descendens - mm. rhomboidei and m. trapezius.

A. AXILLARIS

Lower margin of the 1st rib - the lower border of the m. pectoralis major

1. **Rr. subscapulares** - m. subscapularis.
2. **A. thoracica suprema** - mm. pectorales.
3. **A. thoracoacromialis** - in the trigonum deltoideopectorale - **r. acromialis** - rete acromiale, r. deltoideus - m. deltoideus, rr. pectorales - pectoral muscles
4. **A. thoracica lateralis** - m. serratus ant.- rr. mammarii lat.
5. **A. subscapularis** - **A. circumflexa scapulae** - foramen omotricipitale - fossa infraspinata - anastomoses with the a. suprascapularis. **A. thoracodorsalis** - m. latissimus dorsi
6. **A. circumflexa humeri ant.** anterior to collum chirurgicum humeri - shoulder joint and m. deltoideus.
7. **A. circumflexa humeri post.** - foramen humerotricipitale - m. deltoideus.

A. BRACHIALIS

From the lower margin of the major pectoral muscle to the cubital fossa.

1. **A. profunda brachii** - between medial and lateral heads of triceps - sulcus nervi radialis
R. deltoideus – m. deltoideus, a. nutricia humeri, a. collateralis media - rete articulare cubiti, a. collateralis radialis - rete articulare cubiti.
2. **A. collateralis ulnaris sup.** - septum intermusculare mediale - rete articulare cubiti.
3. **A. collateralis ulnaris inf.** - proximal to the cubital fossa - rete articulare cubiti.
4. **A. radialis** - between m. pronator teres and m. brachioradialis proximally, between m. brachioradialis and m. flexor carpi radialis distally, foveola radialis (anatomical snuff box) - between the tendons of m. extensor pollicis brevis and longus - dorsum of the hand- 1st interosseus dorsalis muscle - **r. palmaris profundus** and **a. princeps pollicis**
Branches: **A. recurrens radialis** - rete articulare cubiti, rr. musculares, r. carpeus palmaris - rete carpi palmare, r. palmaris spf. - arcus palmaris spf., r. carpeus dorsalis - rete carpi dorsale- 3 aa. metacarpeae dorsales - **aa. digitales dorsales, a. metacarpea dorsalis prima, a. princeps pollicis, r. palmaris profundus** - arcus palmaris profundus - **3 aa. metacarpeae palmares.**

Developmental remark: During the embryonal development there are 2 brachial arteries in the upper limb: the typical a. brachialis and the superficial **a. brachialis spf.** This superficial artery sometimes persists to the adulthood and continues to the forearm as a. radialis that then lies superficial to the aponeurosis m. bicipitis brachii.

- 5. A. ulnaris** - proximally between the m. flexor digitorum profundus and superficialis, distally between tendons of the m. flexor carpi ulnaris and m. flexor digitorum superficialis, accompanies the ulnar nerve, over the retinaculum flexorum- terminal branches - **r. palmaris spf.** and **prof.**

Branches: **A. recurrens ulnaris** - rete articulare cubiti, **a. interossea communis** - **a. interossea ant. et post.** **A. interossea ant.** - m. flexor pollicis longus and m. flexor digitorum profundus, **aa. nutriciae** - dorsal side of the forearm - rete carpi dorsale. (**a. mediana** - n. medianus). **A. interossea post.** - extensors, - **a. recurrens interossea** - rete articulare cubiti.

Rr. musculares, **r. carpeus palmaris** - rete carpi palmare, **r. carpeus dorsalis** - rete carpi dorsale, **r. palmaris spf.**, - arcus palmaris spf. (it is its larger tributary) - **3 aa. digitales palmares communes** - 2 **aa. digitales palmares propriae**, **a. palmaris digiti quinti ulnaris**, **a. princeps pollicis**, **r. palmaris profundus** - arcus palmaris profundus-**aa. metacarpeae palmares** - **rr. perforantes** (to aa. metacarpeae dorsales).

Arterial anastomoses of the upper limb

Rete articulare cubiti - a. collateralis media et radialis (a. profunda brachii), a. collateralis ulnaris sup. et inf. (a. brachialis), a. recurrens radialis (a. radialis), a. recurrens ulnaris (a. ulnaris), a. recurrens interossea (a. interossea post.)

Rete carpi palmare - r. carpeus palmaris (a. radialis and ulnaris), a. interossea ant., branches from the arcus palmaris profundus.

Rete carpi dorsale - r. carpeus dorsalis (a. radialis and ulnaris), a. interossea ant. et post.