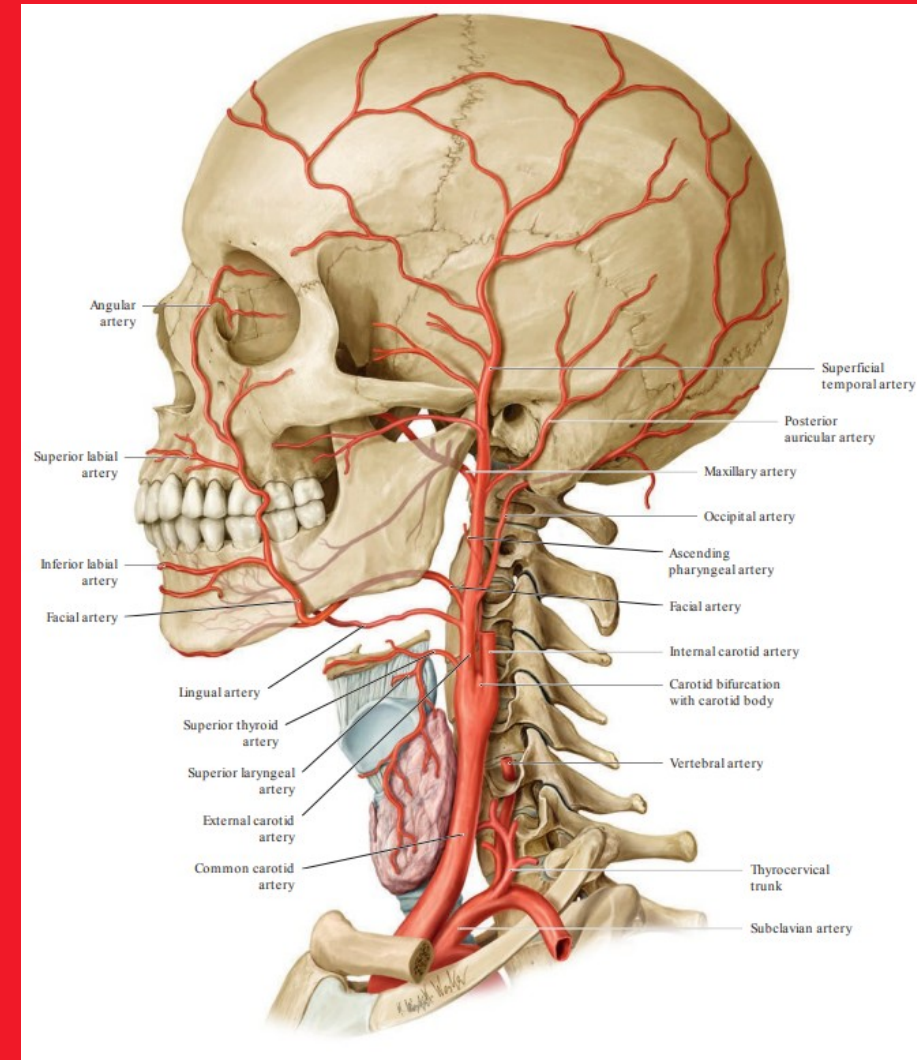
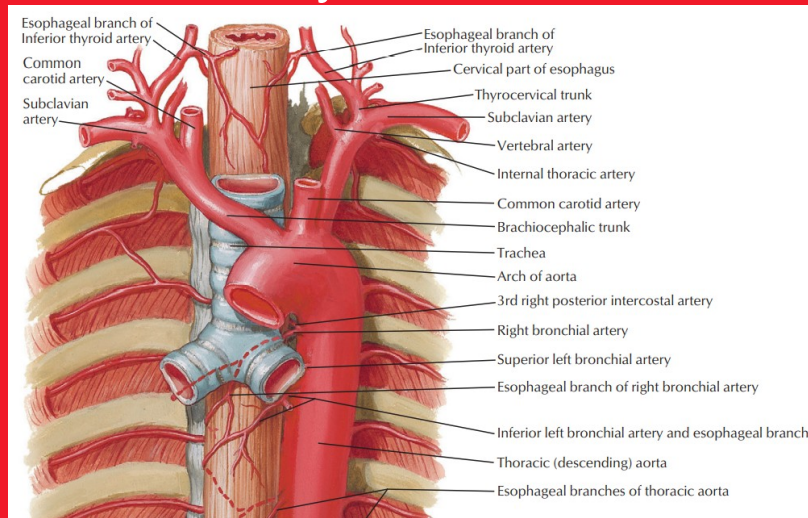


M U N I
M E D

**Clinical anatomy of head and neck
vessels.**
Lymphatic drainage

MUNI MED COMMON CAROTID ARTERY

- main artery of head
- supplies most of the head and neck
- most often branch of brachiocephalic trunk (right) and aortic arch (left)
- without branches usually

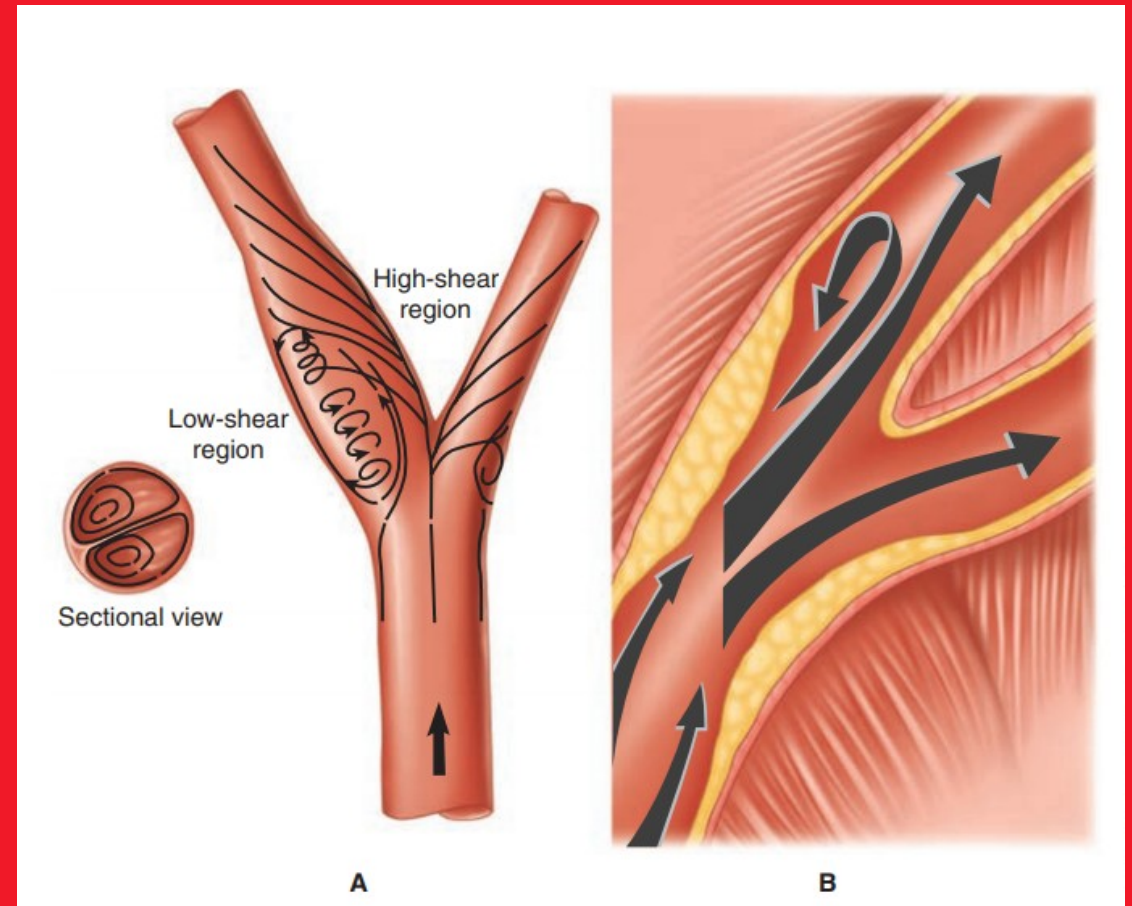


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The carotid bifurcation → side predilection of an atherosclerosis

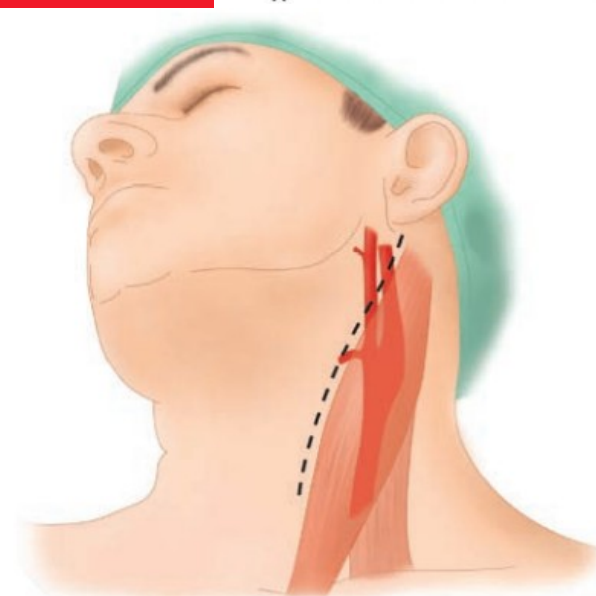
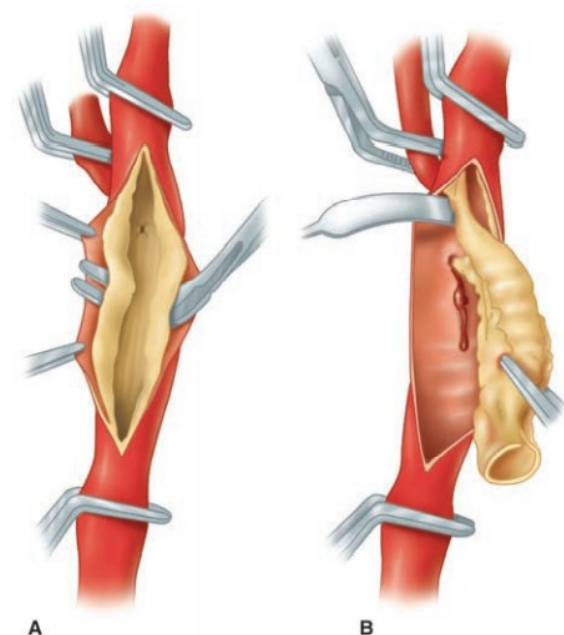
- hypertension and small injuries of the vessel wall lead to plaque formation
- plaque is made of fat, cholesterol, calcium, and other fibrous material
- plaque deposits inside the inner wall of the artery can form a large mass that narrows the lumen (inside diameter of the artery)
- plaque blocks blood flow to the brain and can lead to brain ischemia



CAROTIC ENDARTERECTOMY

Carotid endarterectomy

- surgical procedure atherosclerotic plaque is removed from the bifurcation of the common carotid artery
- plaque is removed from the artery from a longitudinal arteriotomy (longitudinal incision of the artery)
- 20-30% of ischemic strokes are caused by carotid stenosis - using endarterectomy we reduce the risk the ischemia



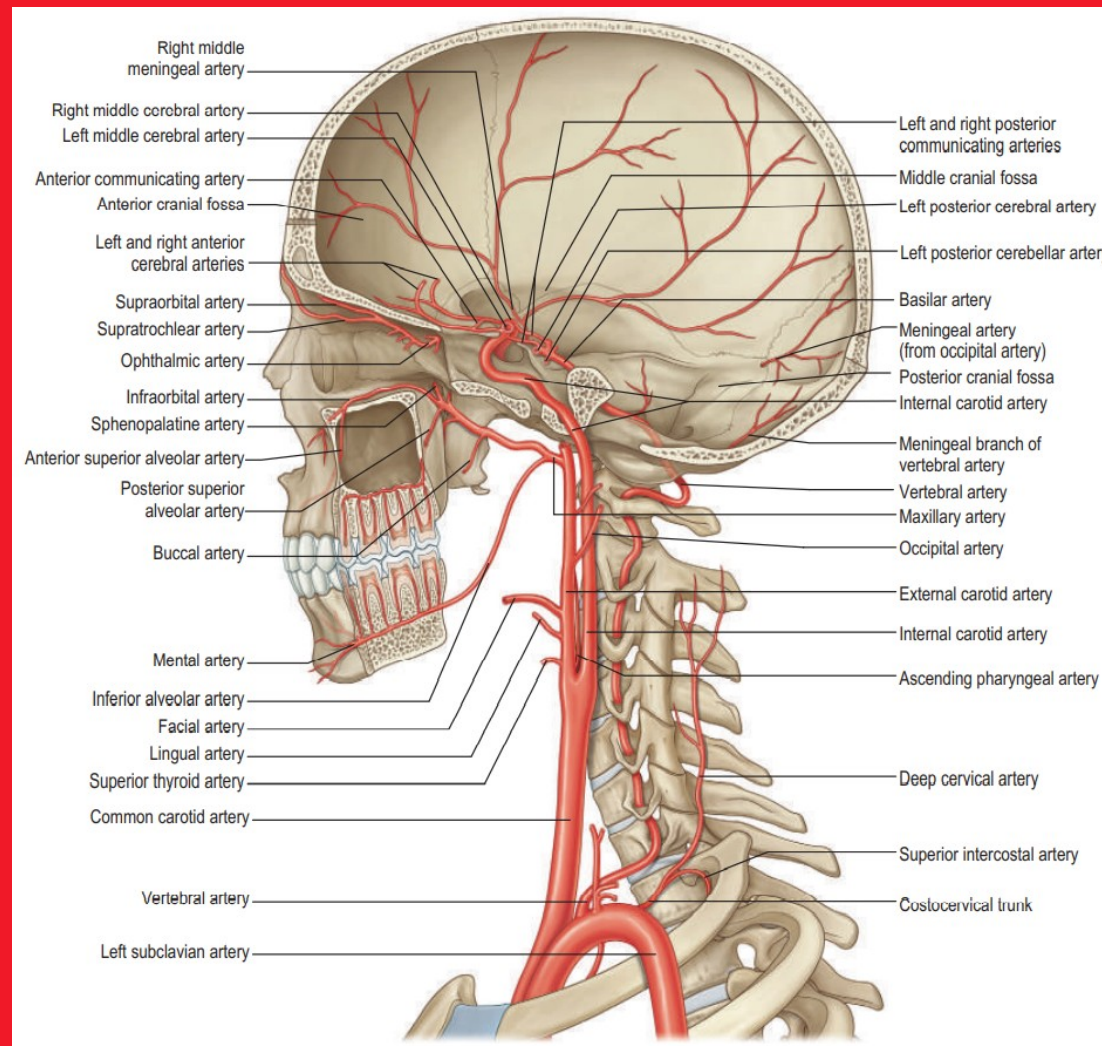
sclerotic clamps
, and internal
carotid lumen.
closed either

Figure 23-17. To perform carotid endarterectomy, the patient's neck is slightly hyperextended and turned to the contralateral side. An oblique incision is made along the anterior border of the sternocleidomastoid muscle centered on top of the carotid bifurcation.

INTERNAL CAROTID ARTERY

The **internal carotid artery (ICA)** is one of the two terminal branches of the common carotid artery which supplies the intracranial structures

In most cases, the carotid bifurcation occurs between the levels of the C3 and C5 vertebrae



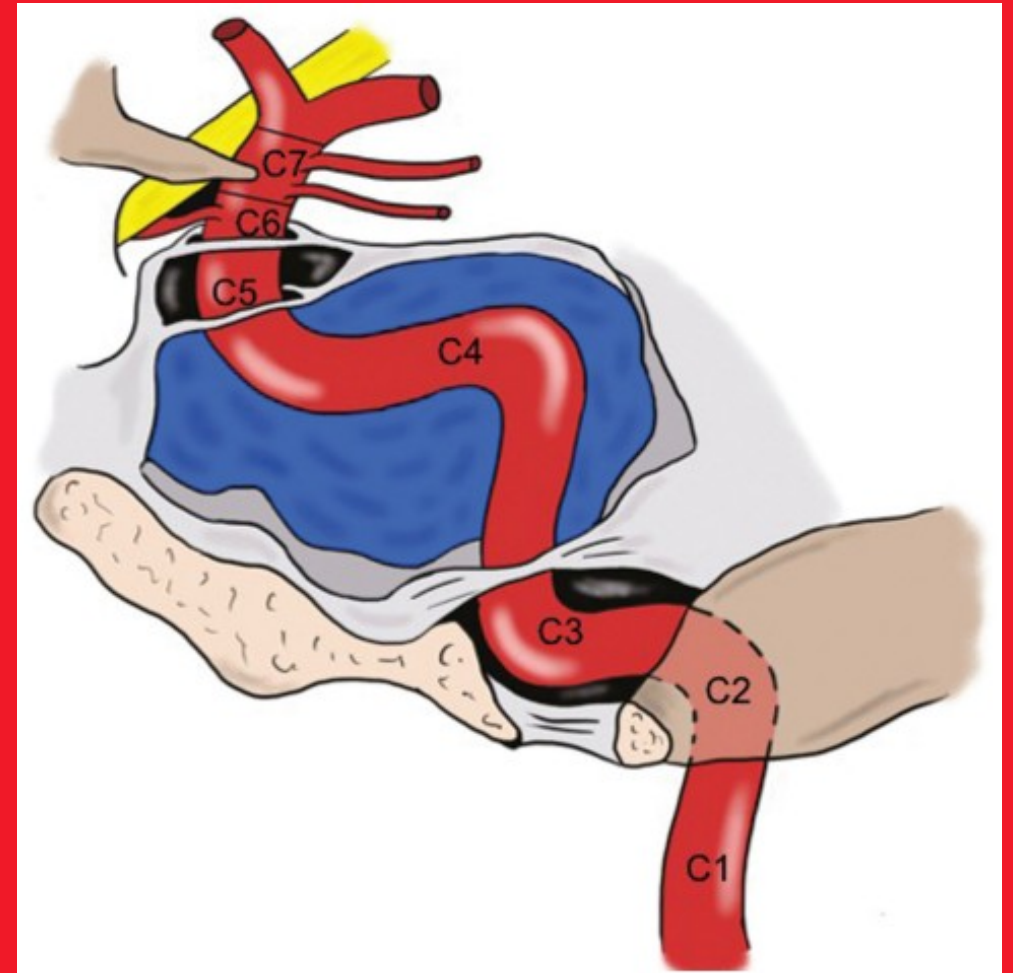
M U N I

M E D

Segments of the internal carotid artery

Several classification systems describing the internal carotid artery segments have been described

The most commonly used classification was described by Bouthillier



Bouthillier classification

There are seven segments in the Bouthillier classification:

C7 (communicating segment)

- Anterior choroidal artery
- Posterior communicating artery

C6 (ophthalmic segment)

- Ophthalmic artery
- Superior hypophyseal artery

C5 (clinoid segment)

- without branches

C4 (cavernous segment)

- Meningohypophyseal trunk (MHT)
- Inferolateral trunk (ILT)
- Capsular arteries

C3 (lacerum segment)

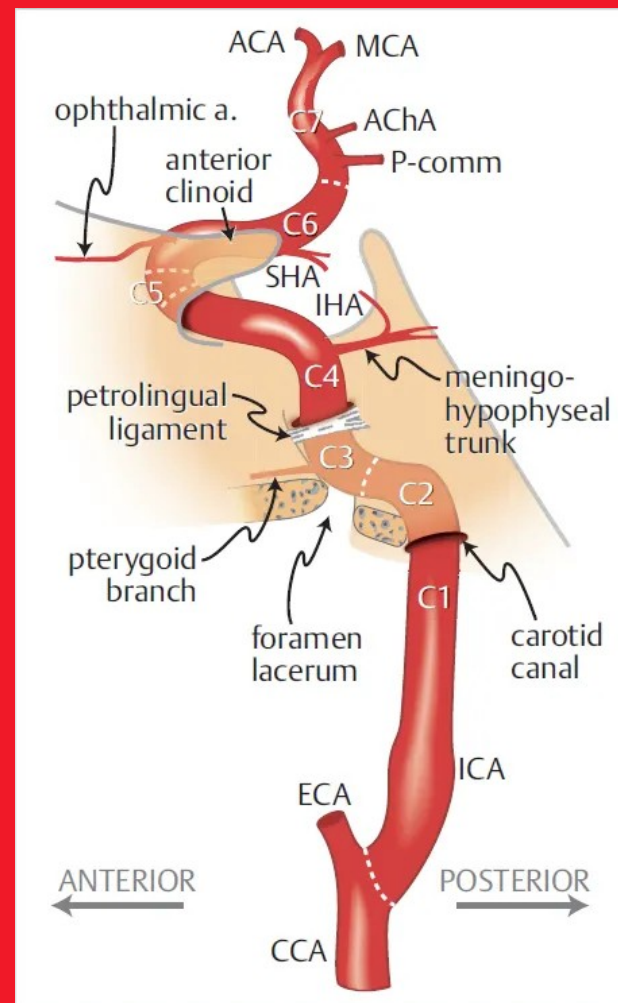
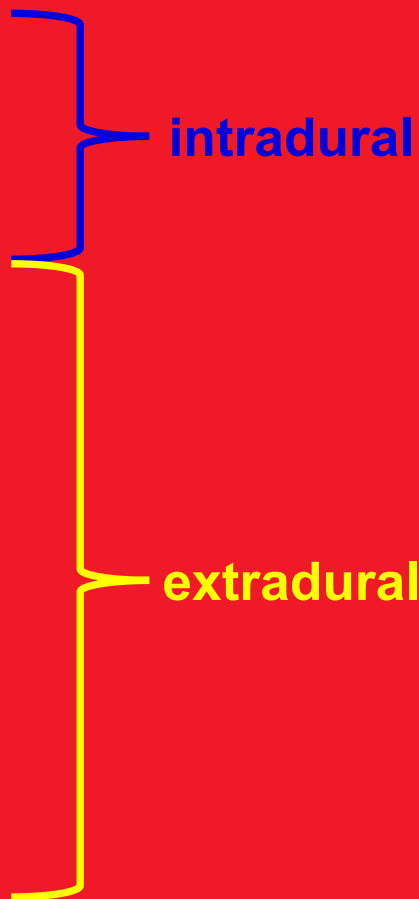
- without branches
- (or artery of pterygoid canal)

C2 (petrosus segment)

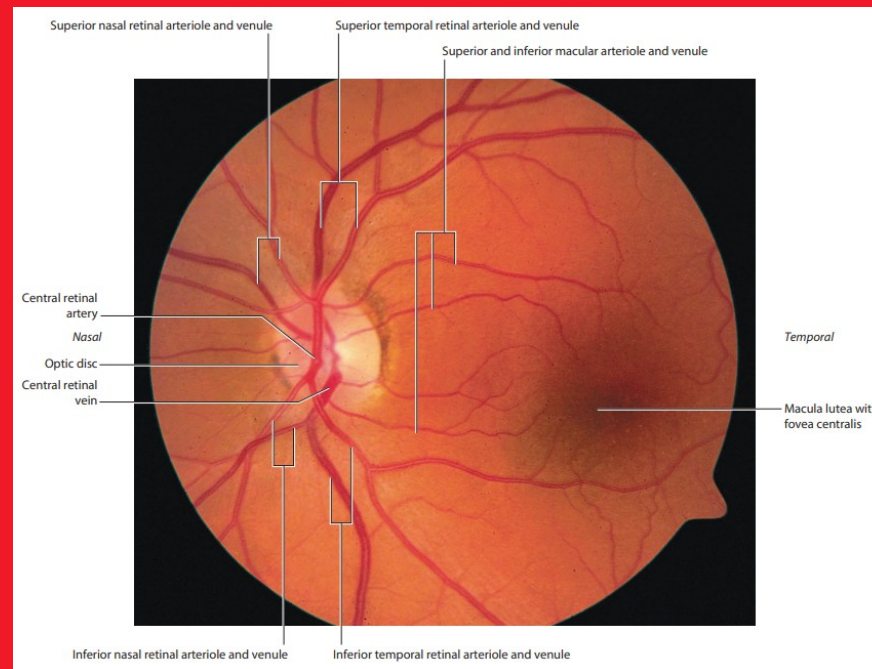
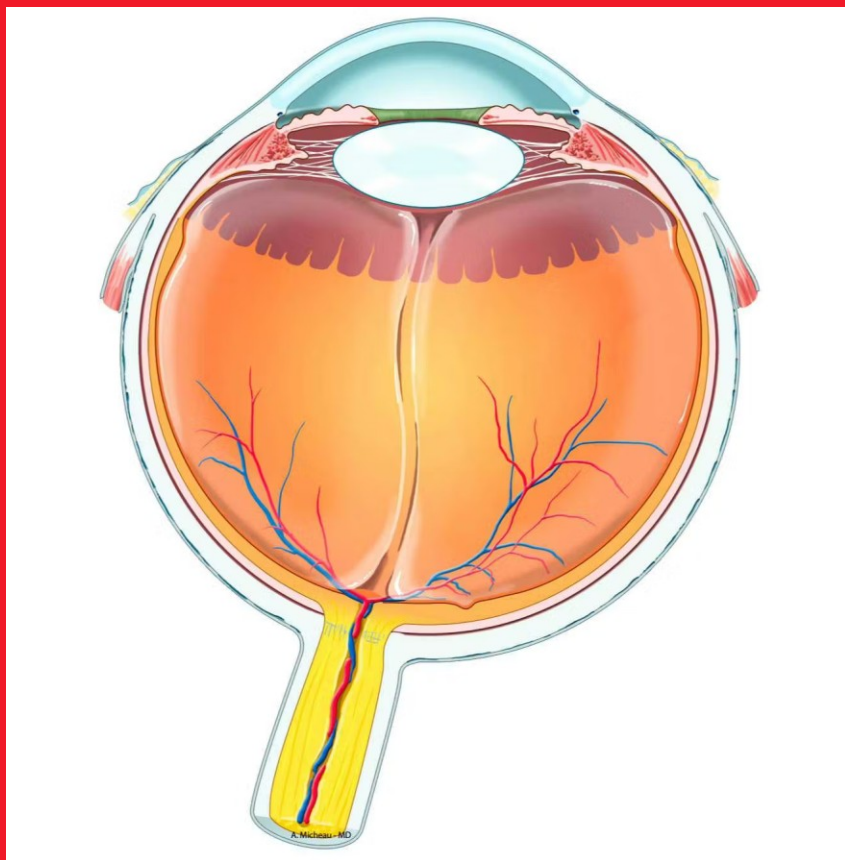
- Caroticotympanic arteries
- Artery of pterygoid canal

C1 (cervical segment)

- without branches

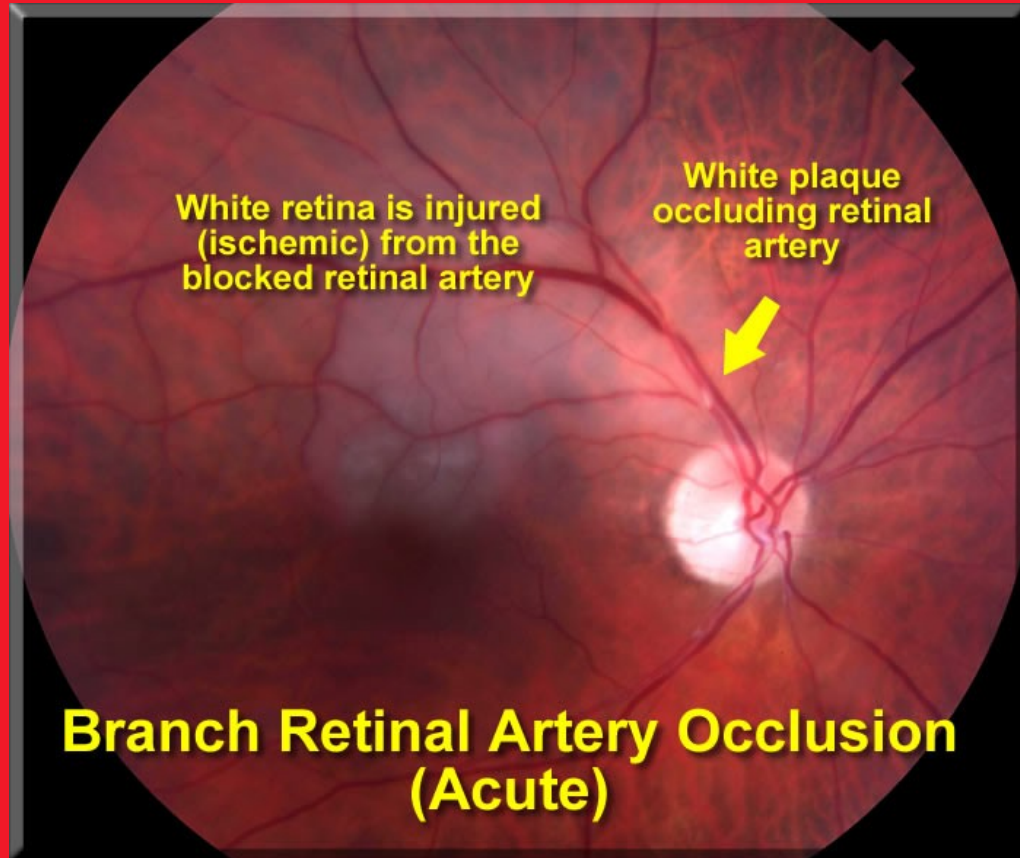


Central Retinal Artery

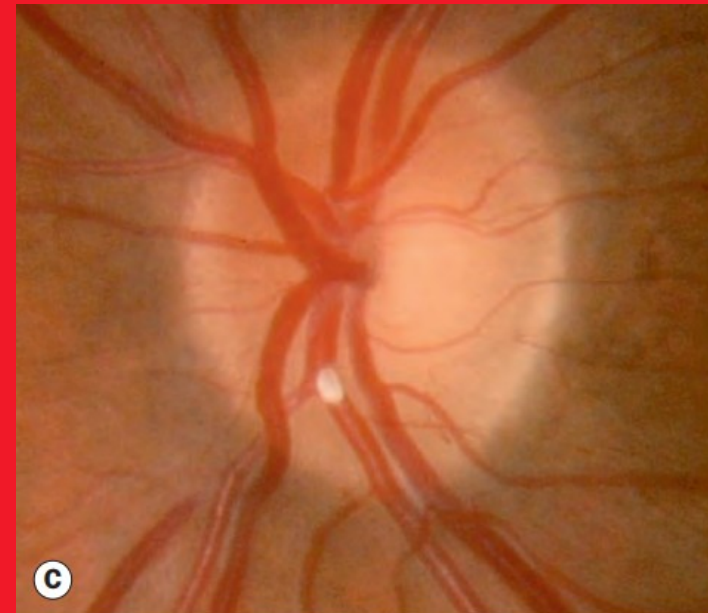


- branches off the ophthalmic artery
- runs in the center of the optic nerve with the central vein of the retina
- enters the globe and divides into four branches to supply each quadrant of the globe

MUNI RETINAL ARTERY OCCLUSION MED



Occlusion of the central retinal artery – leads to retinal ischemia
- an acute condition that often leads to severe visual impairment or blindness and can predict further cerebrovascular events



VERTEBRAL ARTERY

Cervical branches

Spinal branches

Muscular branches

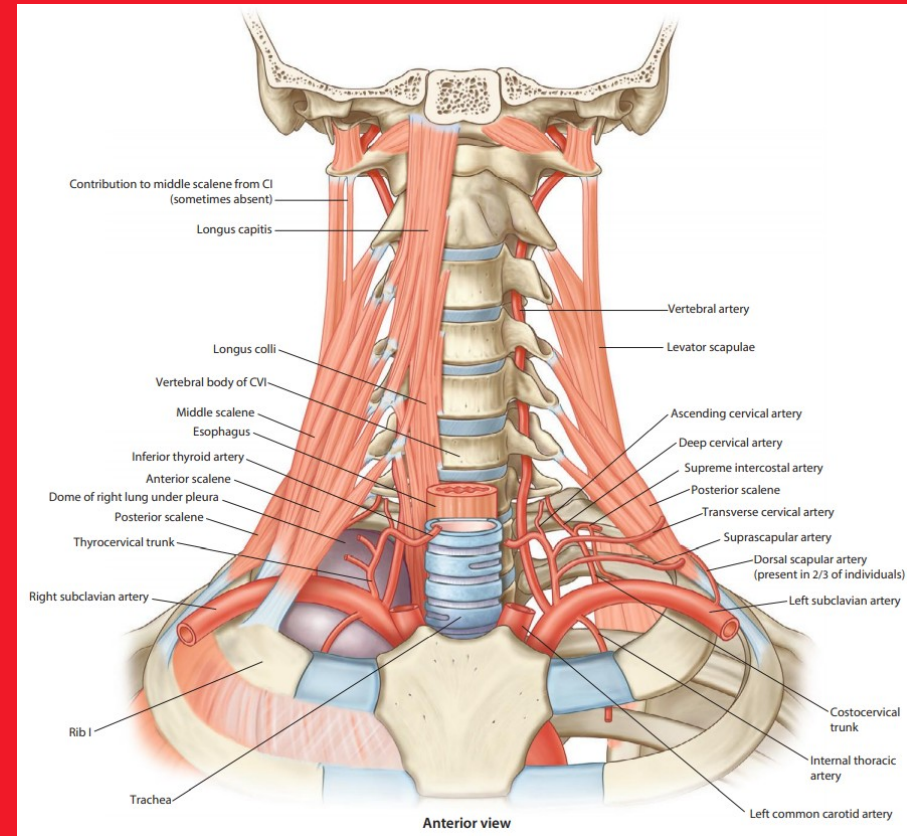
Meningeal branches

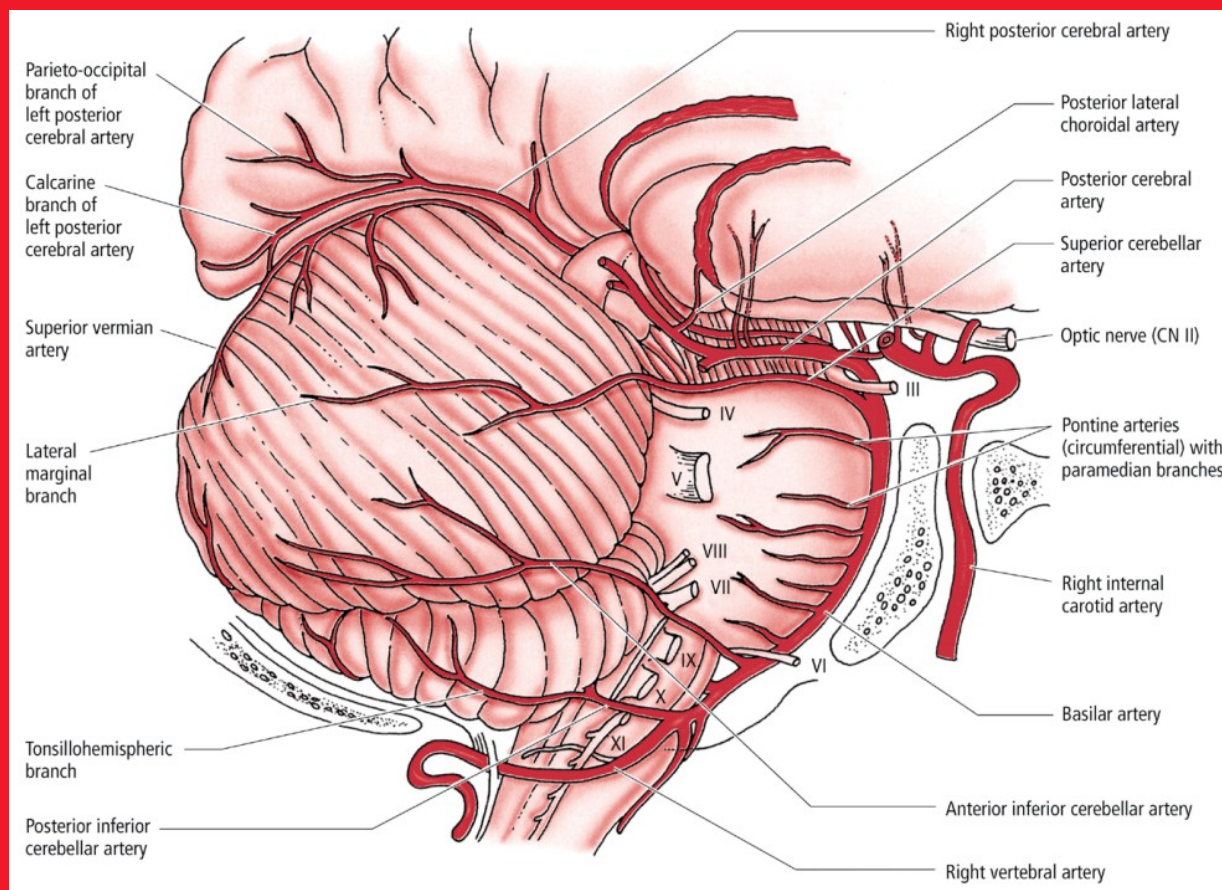
Cranial branches

Basilar artery

Posterior cerebral arteries

- arises from the subclavian artery
- ascends in the transverse foramina of the cervical vertebrae
- enters the transverse foramen of the sixth cervical vertebra
- the two vertebral arteries join to form the basilar artery at the base of the pons





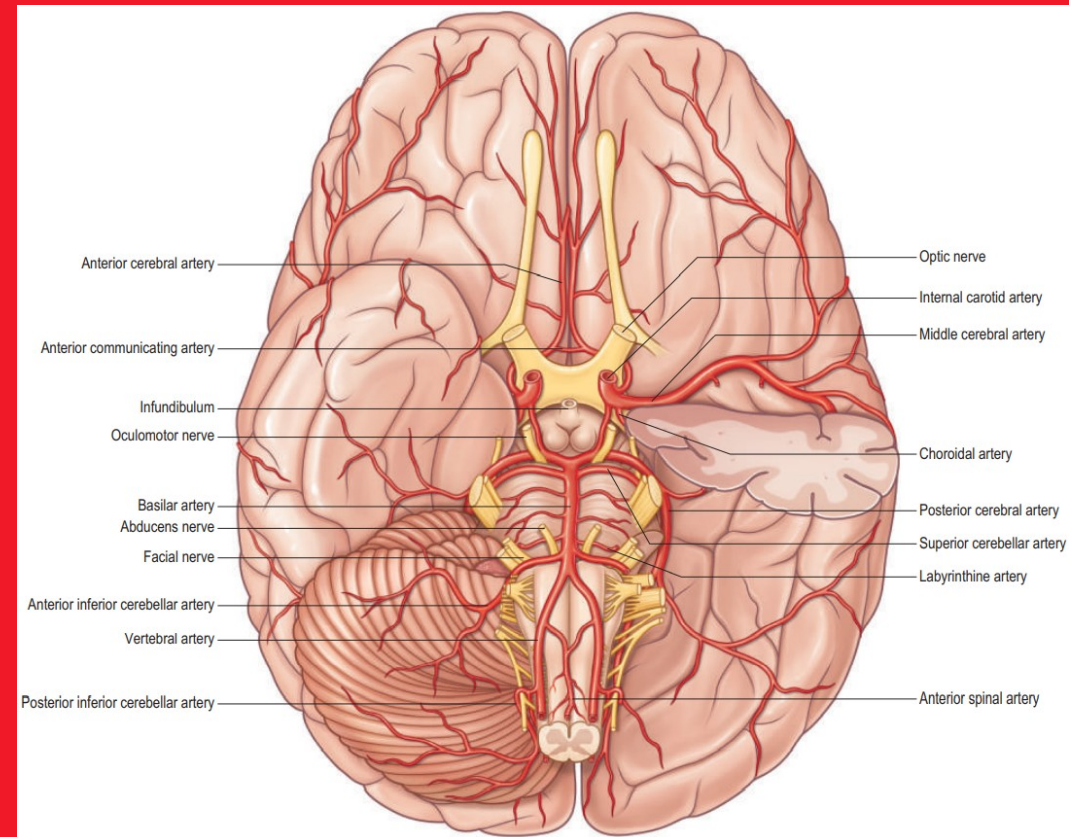
- posterior inferior cerebellar artery (PICA) originates from the vertebral artery
- supplies to the cerebellum
- AICA and SCA - branches from the basilar artery

M U N I

M E D

CIRCULUS ARTERIOSUS CEREBRI WILLISI (Circle of Willis)

The circle of Willis consists of an arterial network located at the skull base allowing arterial blood flow exchange between the anterior and the posterior circulation and between the right and left hemispheres



M U N I C I R C U L U S A R T E R I O S U S C E R E B R I M E D W I L L I S I (C i r c l e o f W i l l i s)

The circle of Willis is composed of the following arteries:

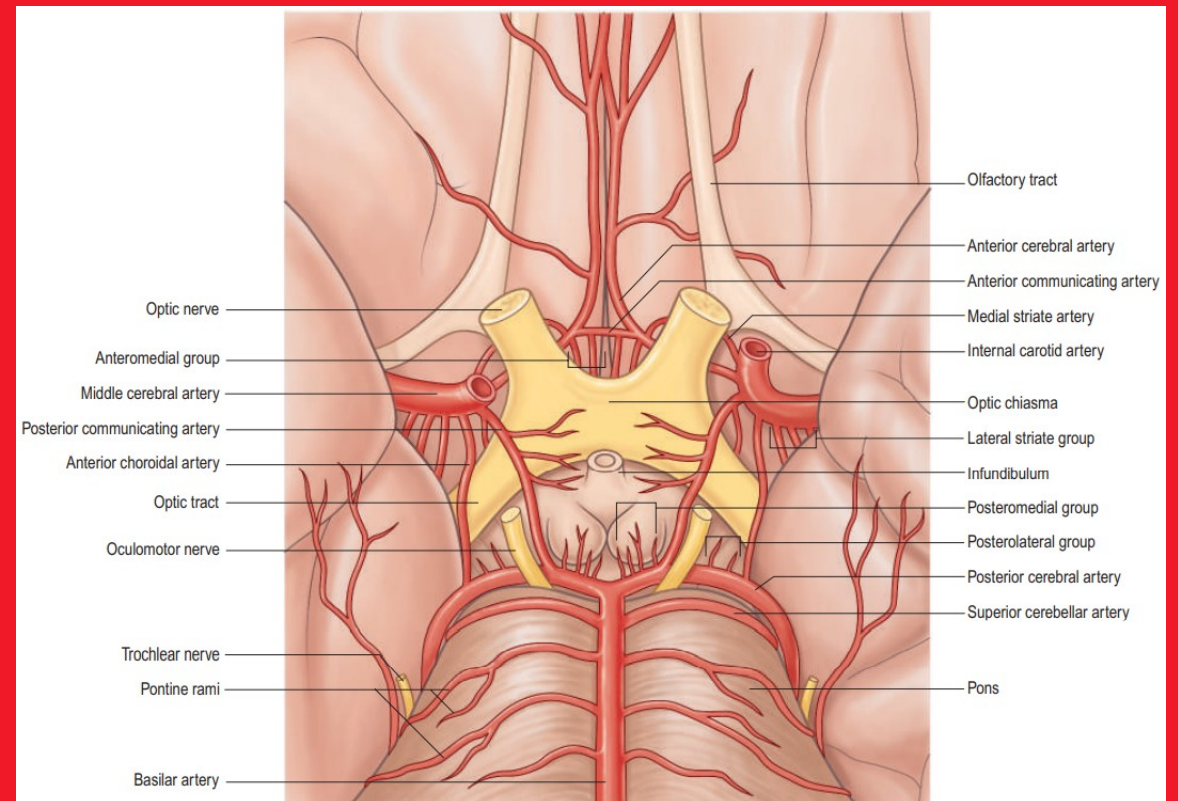
Anterior cerebral artery (left and right)

Anterior communicating artery

Internal carotid artery (left and right)

Middle cerebral arteries

Posterior communicating artery (left and right)



ARTERIAL SUPPLY OF THE BRAIN

Anterior 2/3 → *internal carotid artery*

Posterior 1/3 → *vertebral artery*

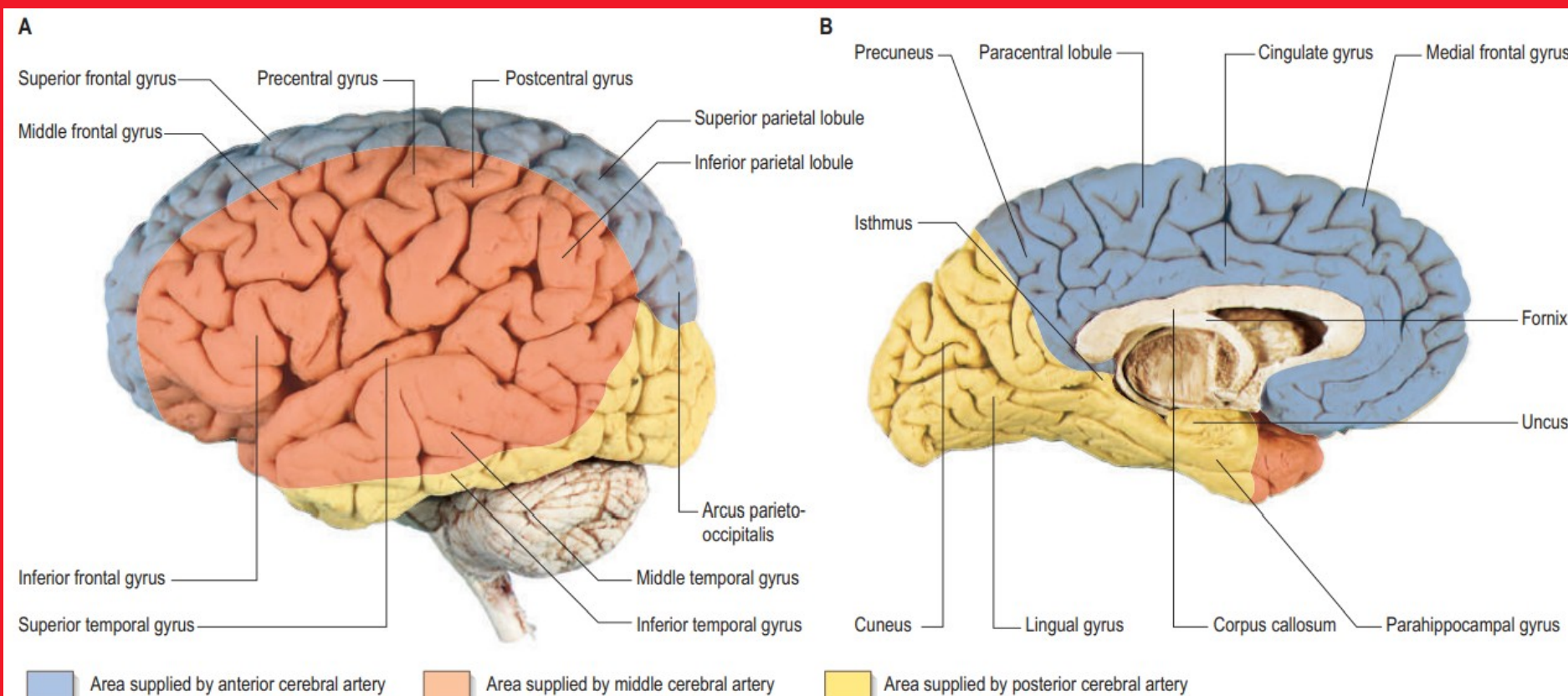
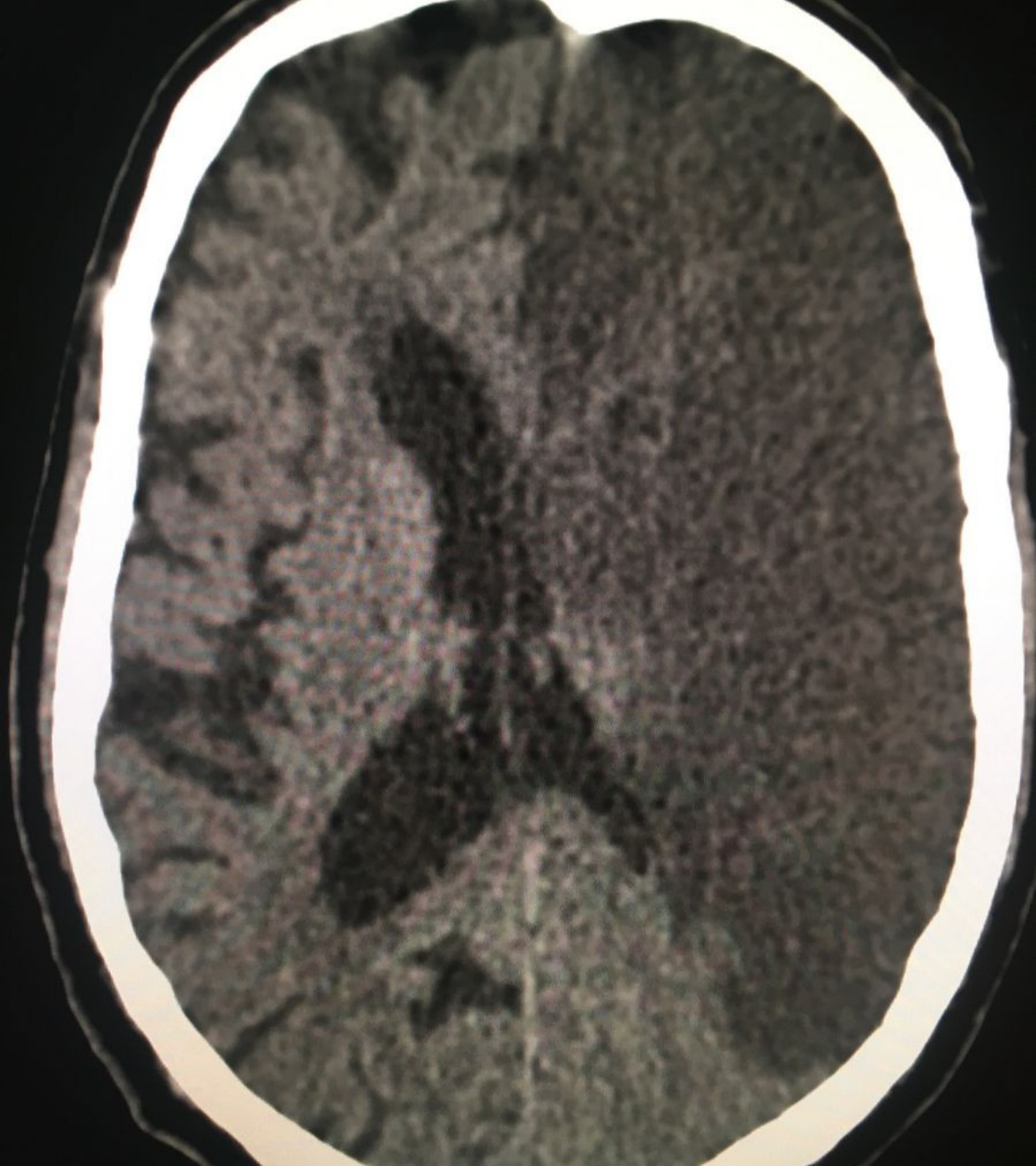


Fig. 19.5 The arteries supplying the left cerebral hemispheres. **A**, Lateral surface. **B**, Medial surface.

**CT of the brain from
a patient with
internal carotid
artery ischemia**

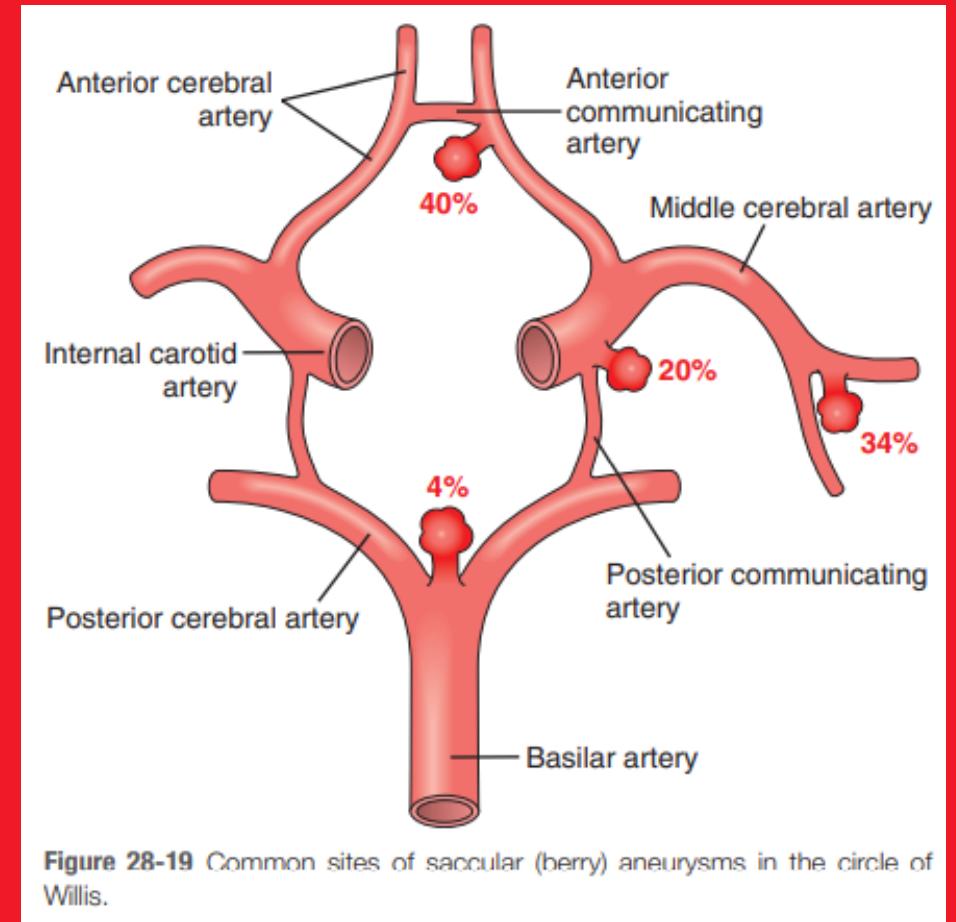


M U N I ANEURYSMS IN THE CIRCLE OF WILLIS

M E D

Intracranial aneurysms are weak pouches in the walls of brain arteries

- most often located on the arteries of the circle of Willis
- rupture of intracranial aneurysms causes subarachnoid haemorrhage, a type of stroke with a high mortality raty (around 50% of patients die)



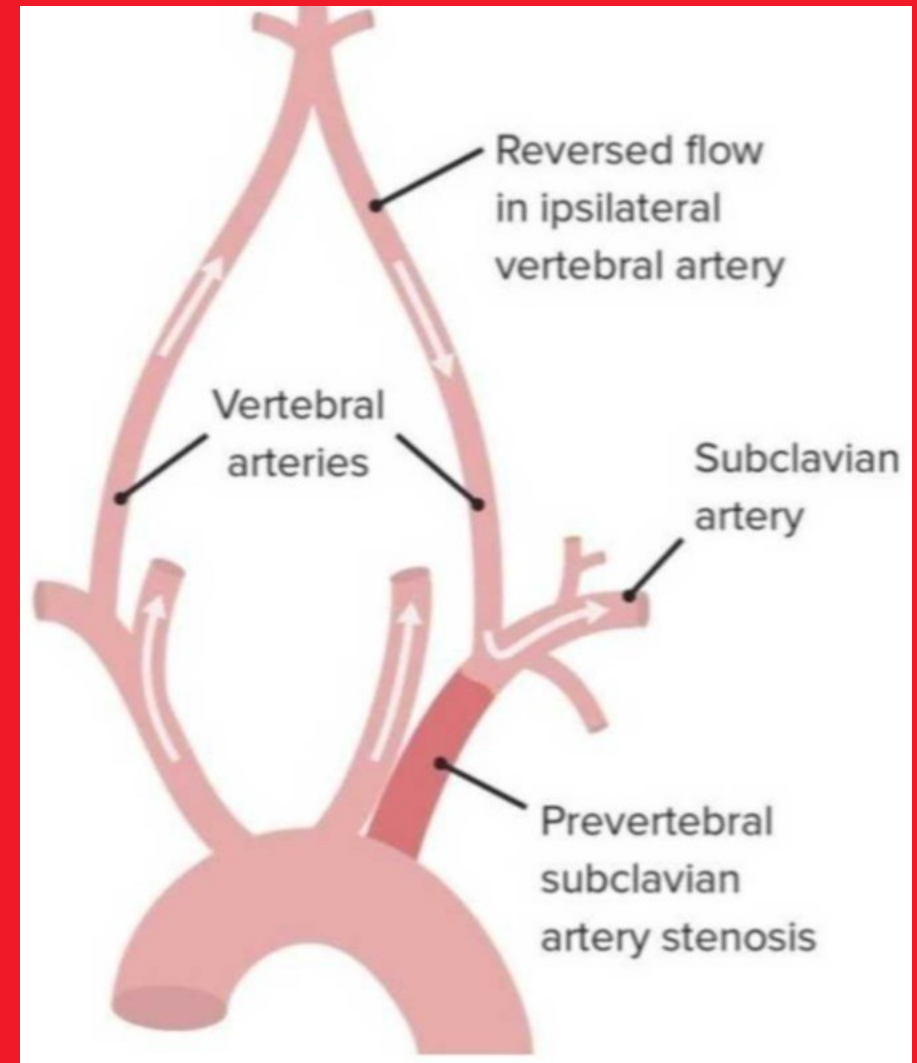
the most common localization of aneurysms is the branching of the arteries - in these places there is the greatest stress on the vessel wall

Subclavian steal syndrome

Subclavian steal syndrome result from severe proximal subclavian artery stenosis or occlusion resulting in retrograde flow in the ipsilateral vertebral artery

stenosis of the subclavian artery, proximal to the origin of the vertebral artery
altered flow on the side of the stenosis - leads to lower blood supply to the brainstem and cerebellum

- dizziness/vertigo/syncope
- ataxia
- visual changes
- dysarthria (difficulty speaking because the muscles you use for speech are weak)



M U N I

M E D

EXTERNAL CAROTID ARTERY

External carotid artery is one of the two terminal branches of the common carotid artery that has many branches that supplies the structures of the neck, face and head

Ventral branches

Superior thyroid artery

Lingual artery

Facial artery

Medial branches

Ascending pharyngeal artery

Dorsal branches

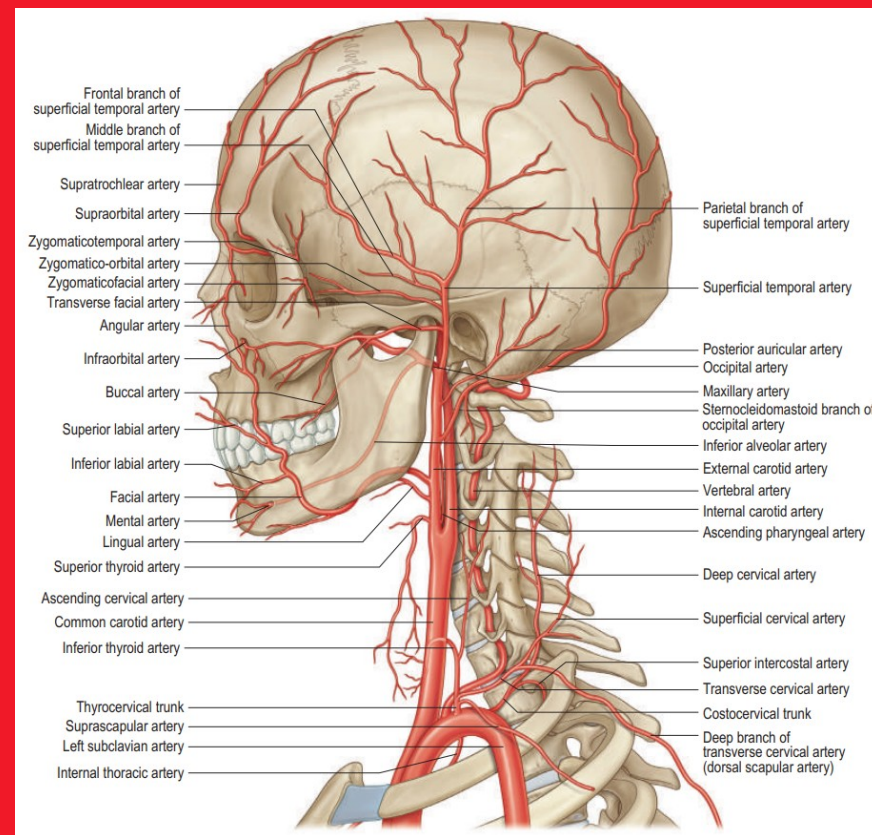
Occipital artery

Posterior auricular artery

Terminal branches

Maxillary artery

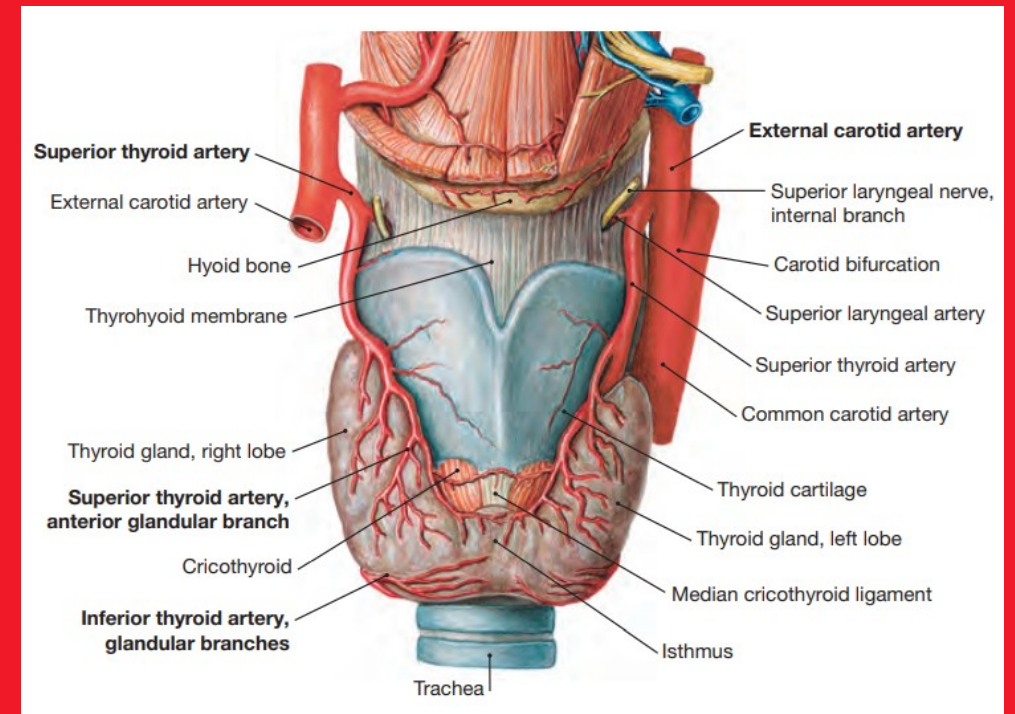
Superficial temporal artery



SUPERIOR THYROID ARTERY

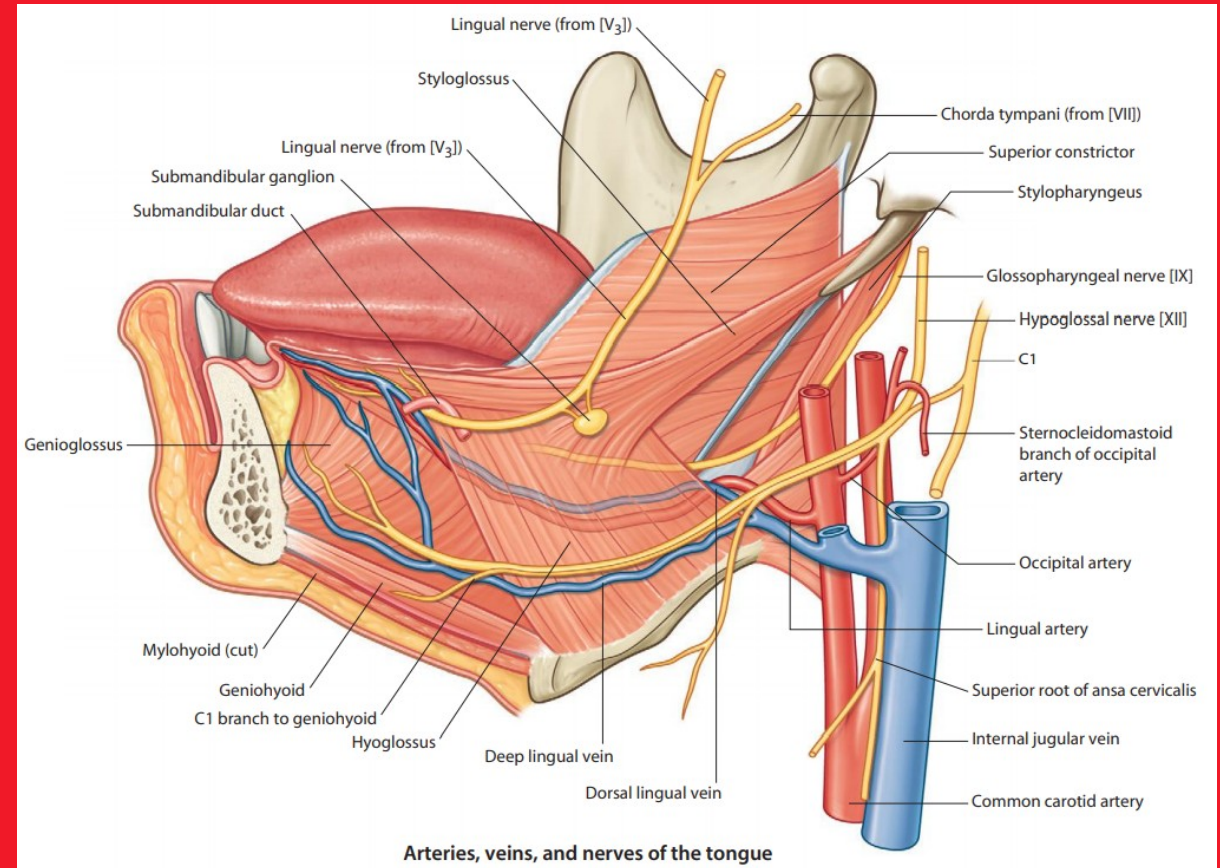
- Superior laryngeal artery
- Cricothyroid artery
- Infrahyoid branch
- Sternocleidomastoid branch
- Glandular branches (anterior, lateral and posterior)

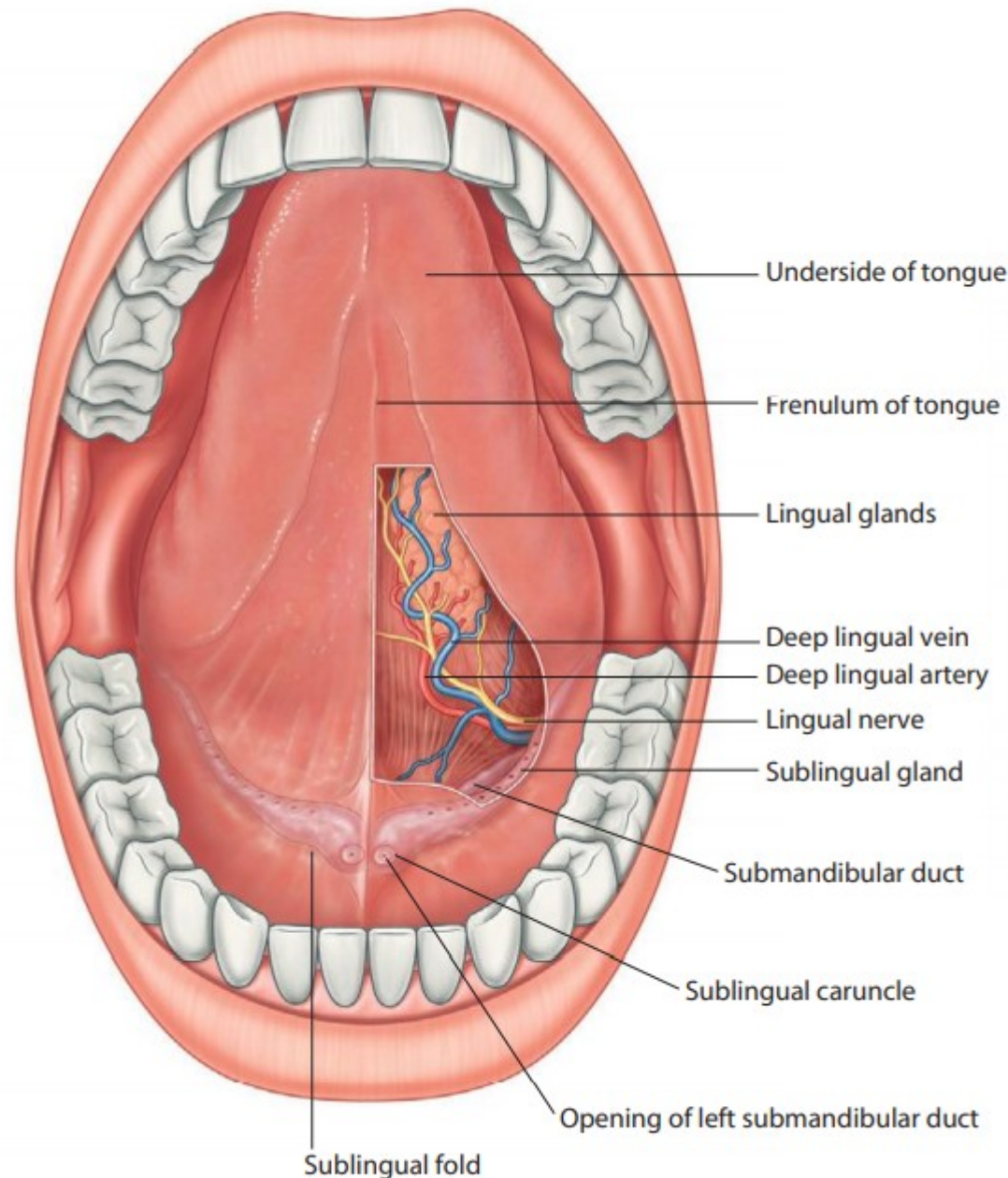
- the first of the branches of the external carotid artery
- leaves immediately after dividing of the common carotid artery to internal and external carotid arteries
- supplies the thyroid gland along with the muscles and mucous membrane of the larynx



LINGUAL ARTERY

- Suprahyoid branch
 - Sublingual artery
 - Dorsal lingual branches
 - Deep lingual artery
- arises cranially from the large corners of the hyoid bone (where it can be found in the so-called Beclard's angle or Pirogow's triangle)
- participates in the supply of the tongue and the lower part of the oral cavity





Inferior surface of tongue and floor of oral cavity

Deep lingual artery
Deep lingual vein
Lingual nerve

The lingual artery ligation

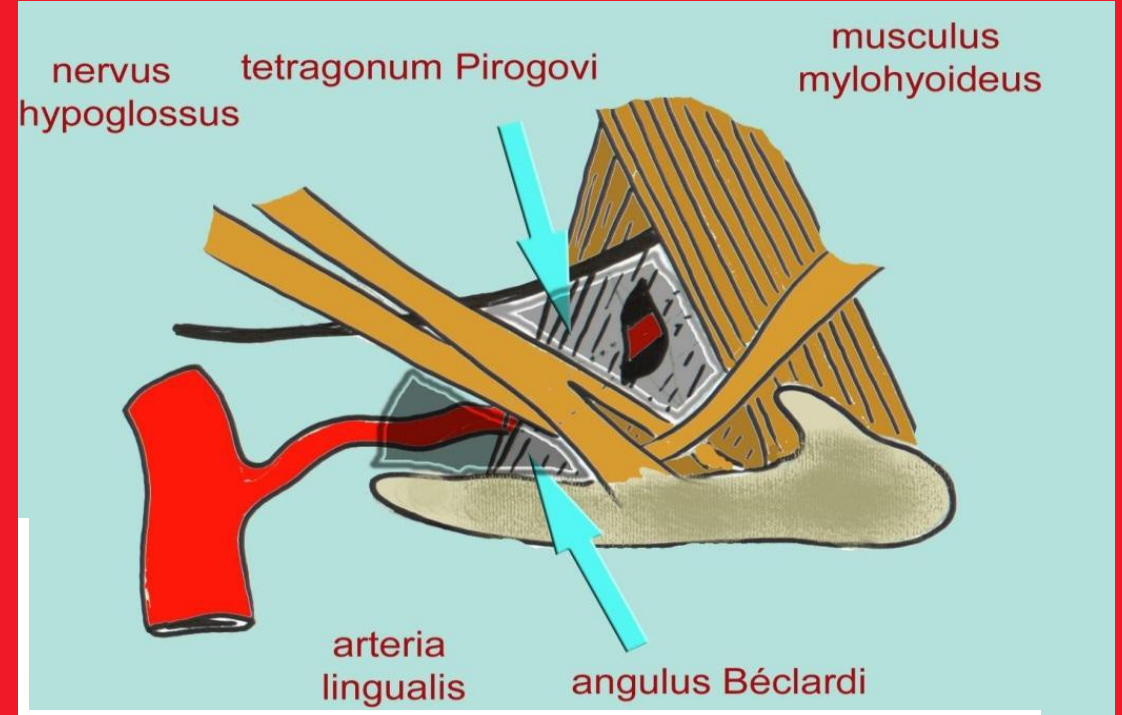
The lingual artery may be ligated extraorally in two of the large triangles of the anterior neck

1. The Béclard's angle

- caudal: the greater horn of the hyoid bone
- cranial: the posterior belly of the digastric muscle

2. The Pirogov triangle

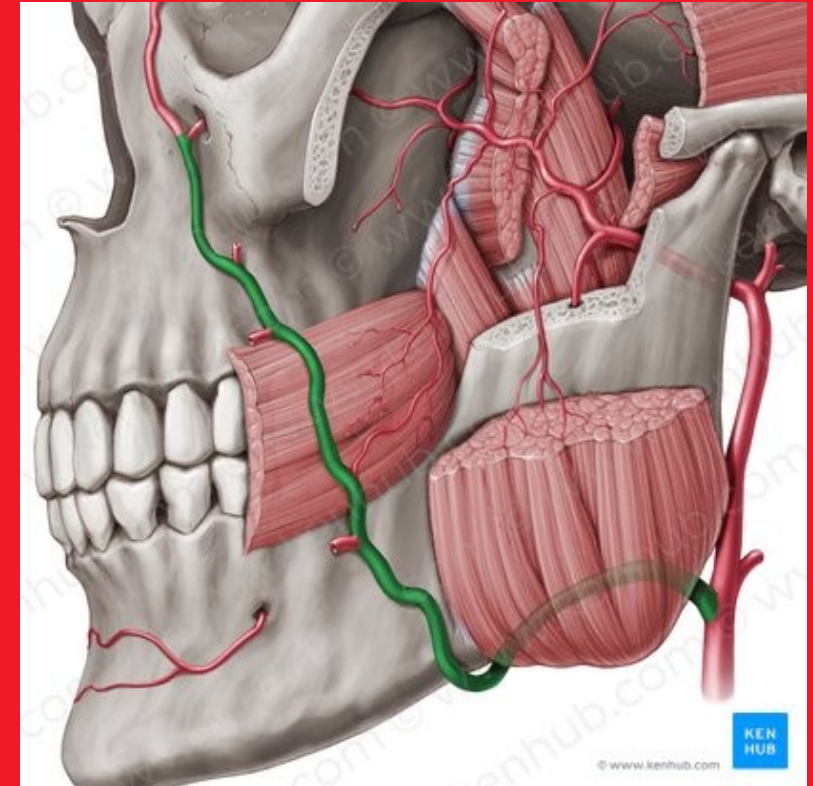
- the posterior border of the mylohyoid muscle
- the intermediate tendon of the digastric muscle
- hypoglossal nerve



M U N I F A C I A L A R T E R Y

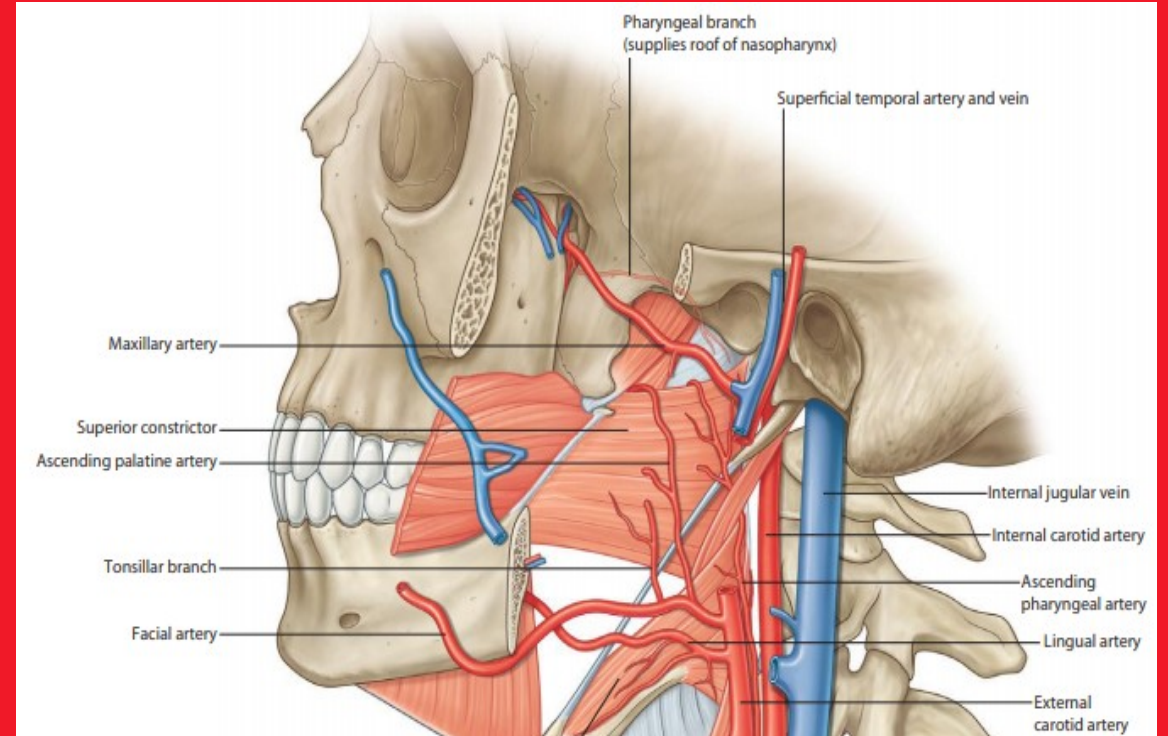
M E D

- branching from external carotid artery
- runs over the edge of the mandible in a winding course through the face around the corner of the mouth, nose to the corner of the eye
- facial artery is palpable against the bony surface of the mandible - can be compressed at this point



FACIAL ARTERY

- Ascending palatine artery
- Submental artery
- Tonsillar branch
- Glandular branches
- Superior and inferior labial artery
- Lateral nasal branch
- Angular artery

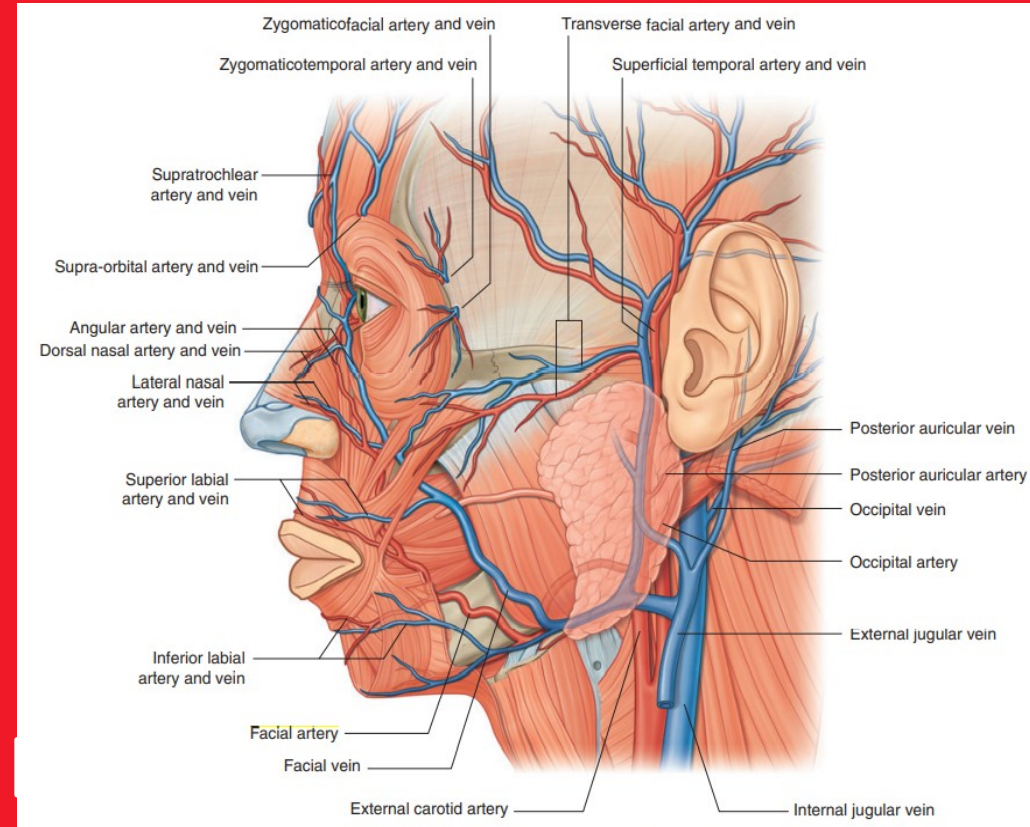


- ascending palatine artery supplies the palate with palatine tonsil and part of the pharynx, upper and lower lips

FACIAL ARTERY

Due to the abundant vascular supply of the face, injuries in the face usually bleed profusely even though the injury is not serious

compression of the facial artery against the bony surface of the mandible



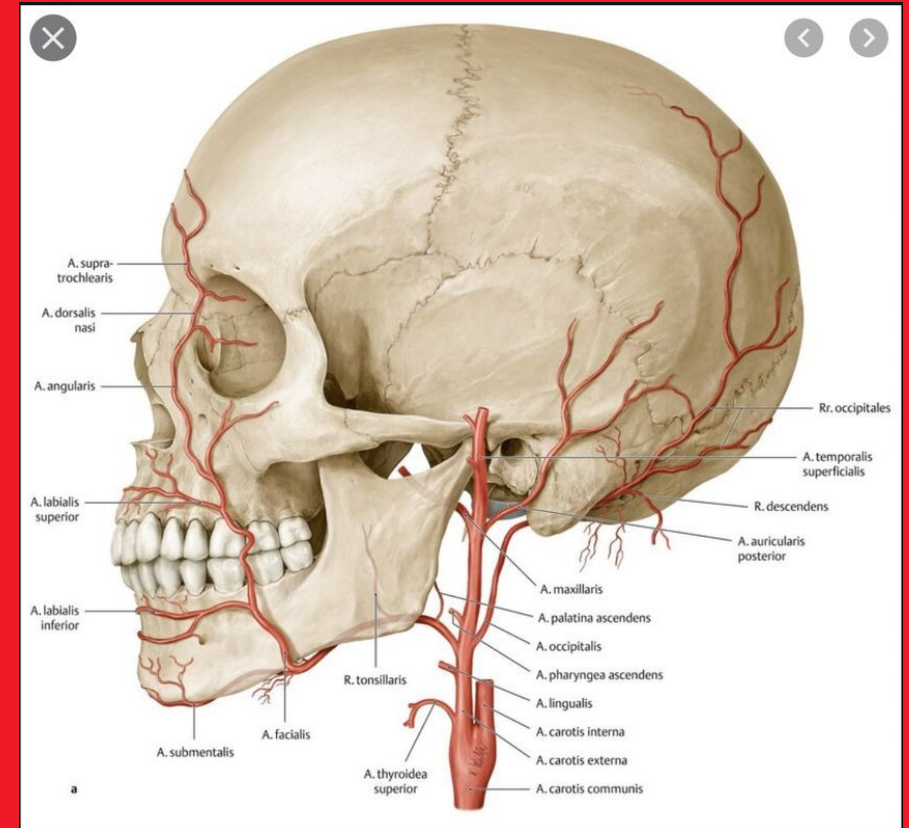
rich network of blood vessels

POSTERIOR AURICULAR ARTERY

- **Muscular branches**
- **Glandular branches**
- **Auricular branch**
- **Stylomastoid artery**
 - Posterior tympanic artery
 - Mastoid branches
 - Stapedial branch
- **Occipital branch**

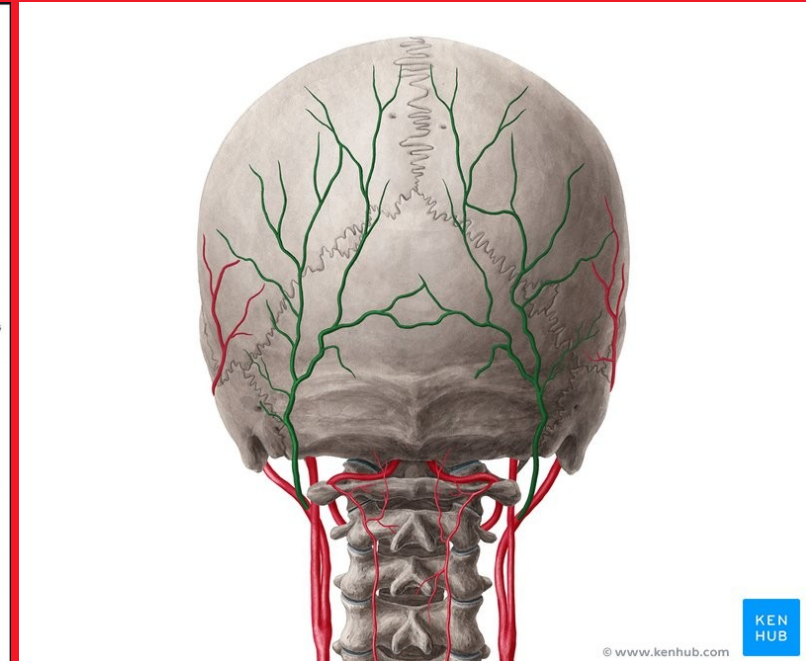
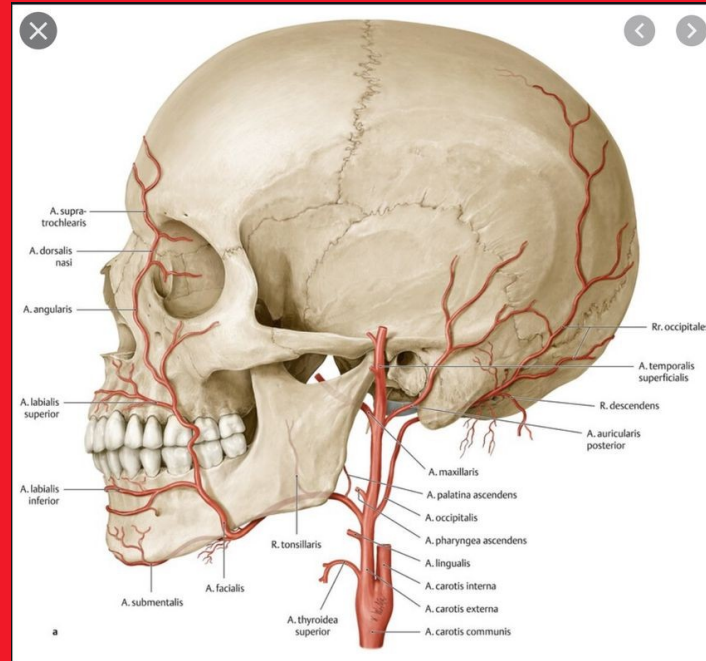
dorsal branch of the external carotid artery - travels to the region posterior to the ear.

- supplies the auricle, the adjacent part of the soft skull, cellulae mastoideae and part of the parotid gland



OCCIPITAL ARTERY

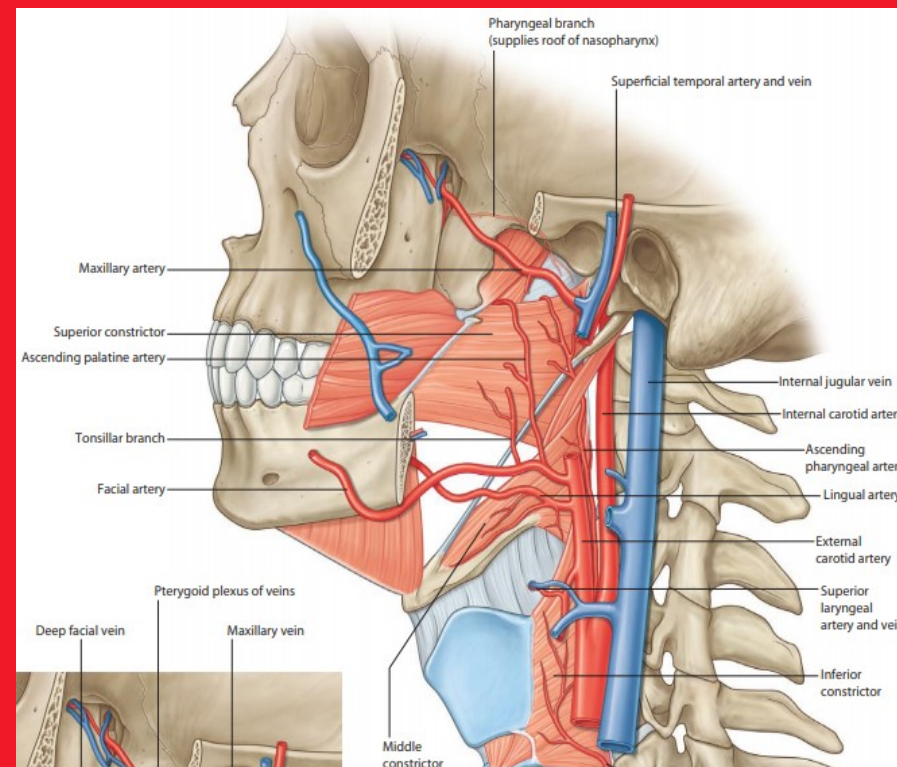
- **Sternocleidomastoid branch**
- **Auricular branch**
- **Mastoid (meningeal) branch**
- **Occipital branches**



- runs behind the posterior belly of the digastric muscle
- supplies the sternocleidomastoid, digastric and cervical muscles, skull in the occipital region, the auricle and the dura mater in the posterior cranial fossa.

ASCENDING PHARYNGEAL ARTERY

- Pharyngeal branches
- Posterior meningeal artery
- Inferior tympanic artery



- the only medial branch of the external carotid artery
- the smallest branch of the external carotid artery
- runs cranially along the pharynx to the base of the skull
- supplies the dura mater in the posterior fossa of the skull and inner ear

- theoretically, it is possible to injure the internal carotid artery and the ascending pharyngeal artery during tonsilectomy (removal of the palatine tonsils)

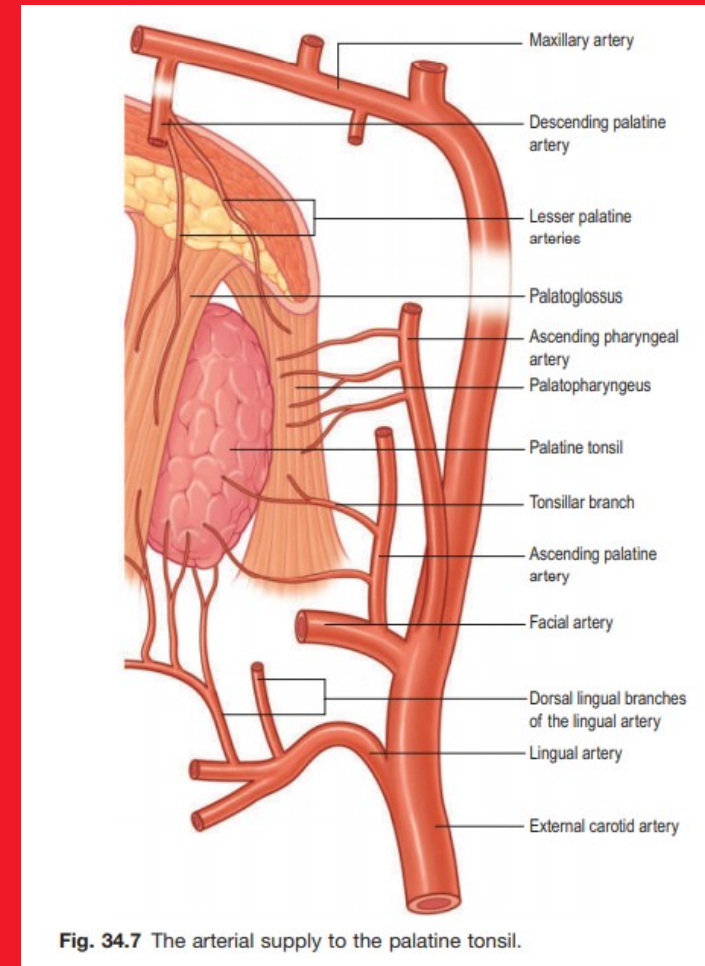
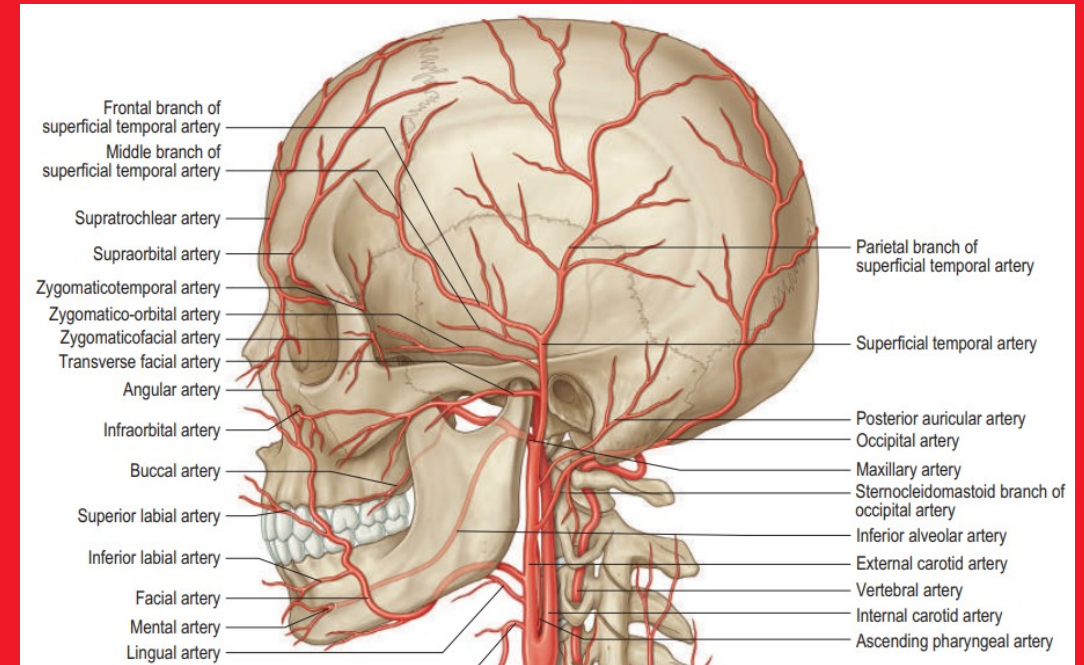


Fig. 34.7 The arterial supply to the palatine tonsil.

SUPERFICIAL TEMPORAL ARTERY

- Parotid branches
- Transverse facial artery
- Anterior auricular branches
- Zygomatico-orbital artery
- Middle temporal artery
- Frontal branch
- Parietal branch

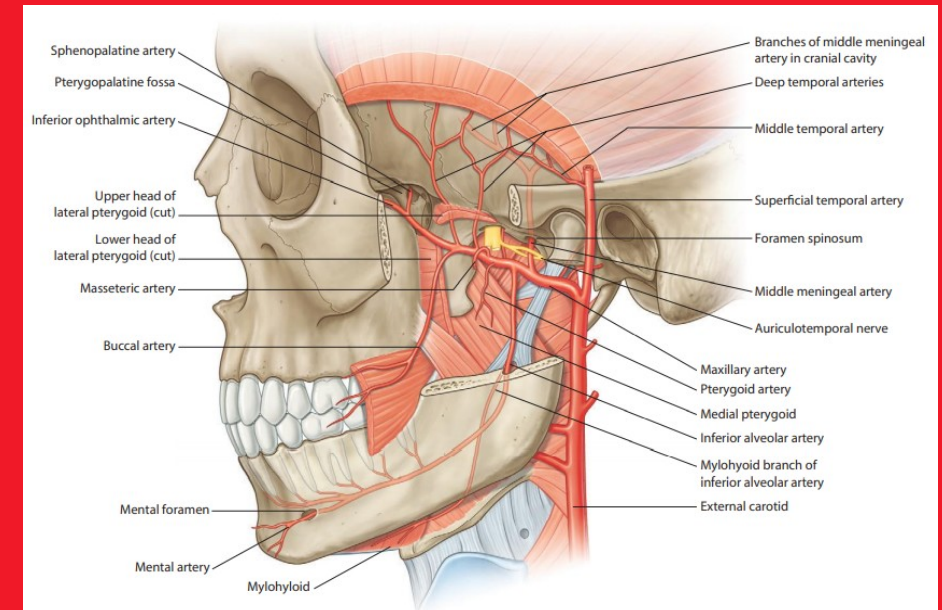
- represents the final branch of the external carotid artery
- rises in the cranial direction, covered by the parotid gland
- passes over the the zygomatic arch in front of the auricle
- branches in the temporal area and supplies the parotid gland, the anterior part of the auricle and temporalis muscle



MAXILLARY ARTERY

The largest branch of the external carotid artery

1. **MANDIBULAR PORTION** (the area behind the neck of the mandible)
2. **PTERYGOID PORTION** (between the medial and lateral pterygoid muscles in the infratemporal fossa)
3. **PTERYGOPALATINE PORTION** (in the pterygopalatine fossa)



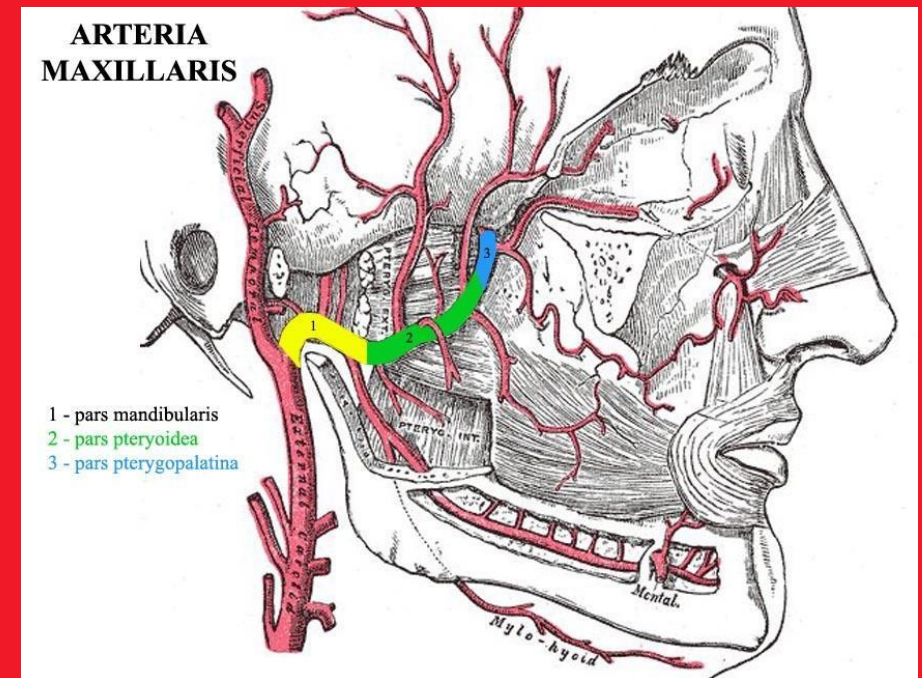
M U N I M E D

MAXILLARY ARTERY MANDIBULAR PORTION

The most important branches of this portion are:

middle meningeal artery - passing through the foramen spinosum, runs in the epidural space and supplies the dura mater of the middle cranial fossa

inferior alveolar artery - runs in the canalis mandibulae and gives off branches for the teeth of the lower jaw, skin and muscles in the chin area

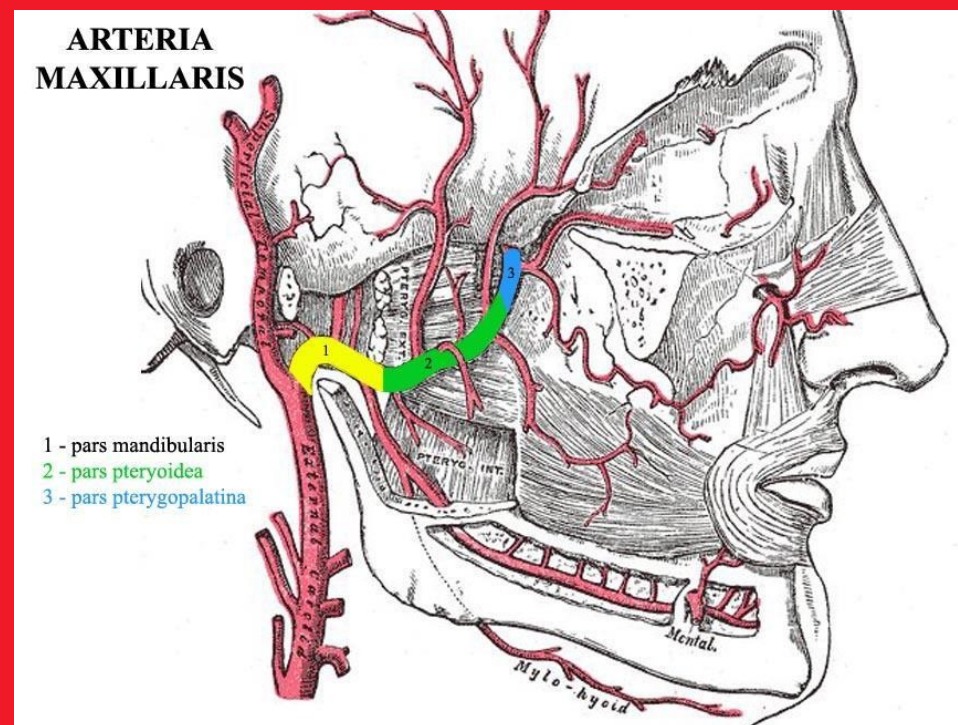
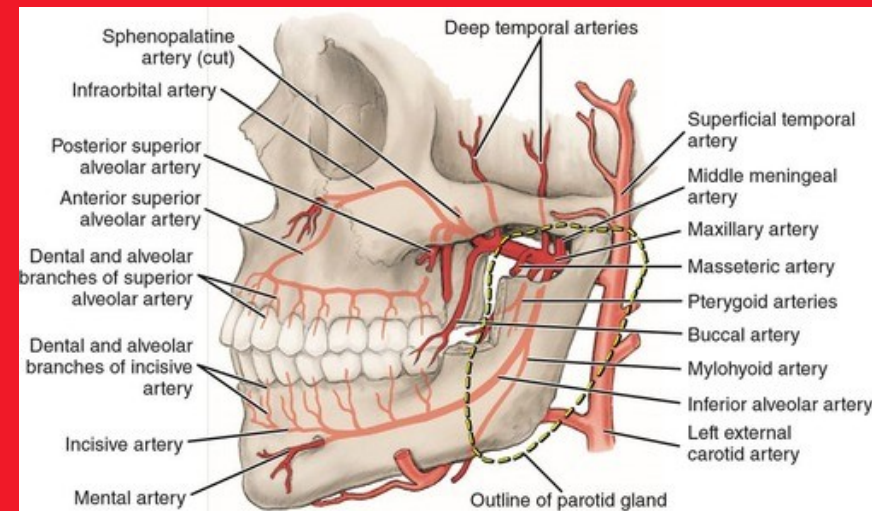


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MAXILLARY ARTERY MANDIBULAR PORTION

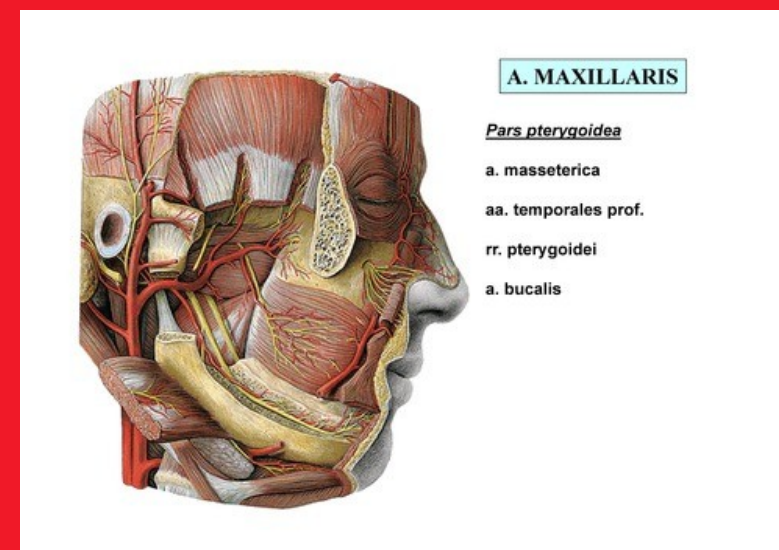
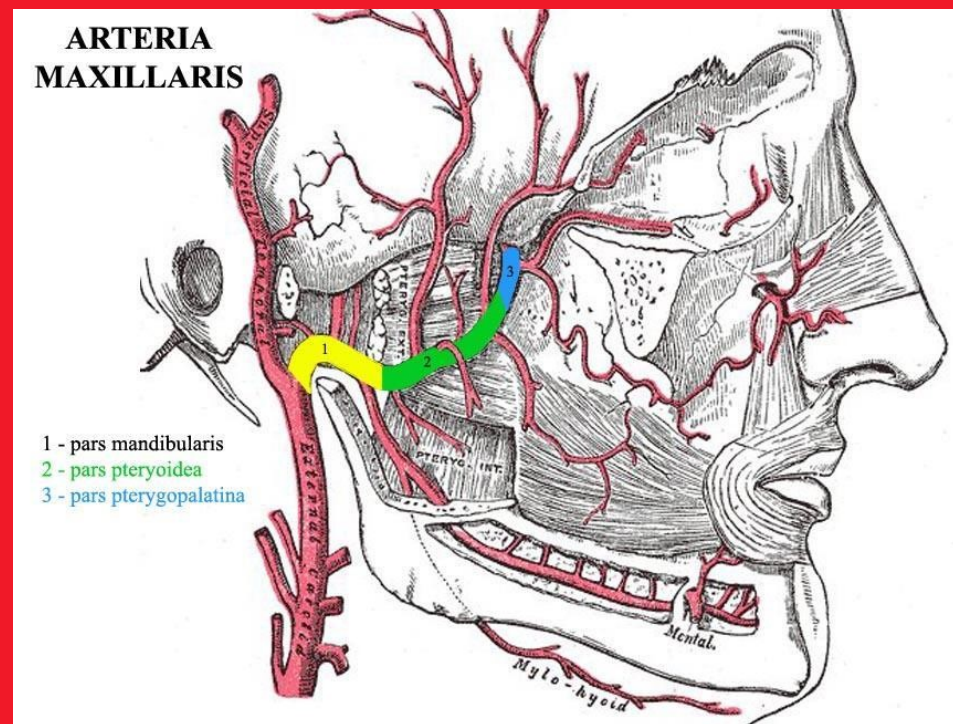
Inferior alveolar artery

- enters through the mandibular foramen into the mandibular canal of the lower jaw, which leaves through the mental foramen
- supplies the teeth, bone and gum of the lower jaw



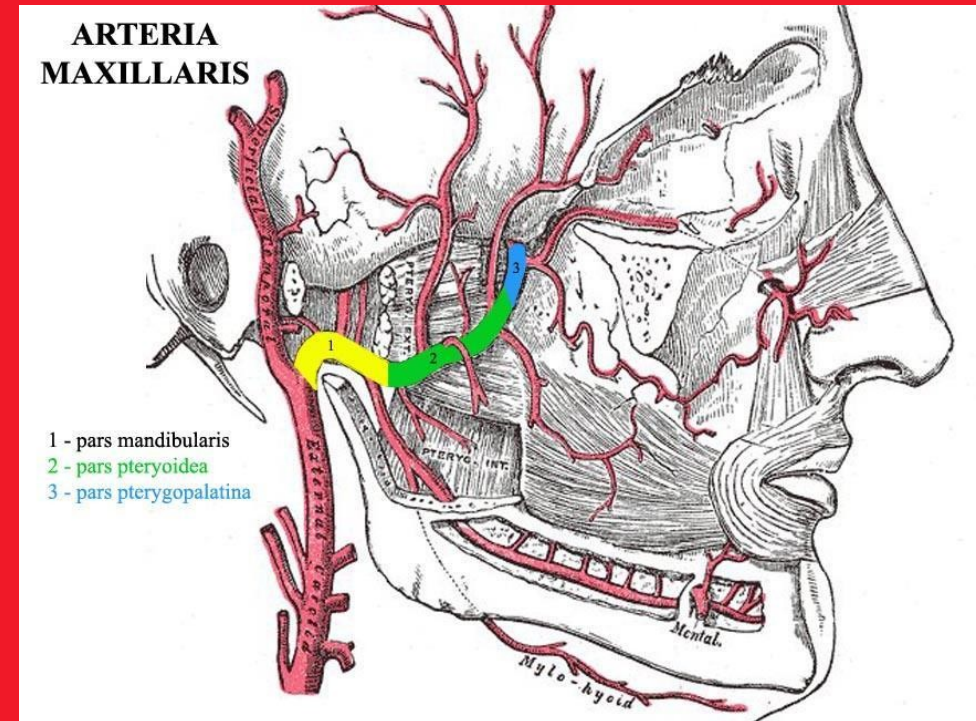
MAXILLARY ARTERY PTERYGOID PORTION

- gives off branches for the masticatory muscles – masseteric artery and buccal/buccinator artery (buccinator muscle), a branch for the temporomandibular joint and temporalis muscle – deep temporal arteries



MAXILLARY ARTERY PTERYGOPALATINE PORTION

- gives off posterior superior alveolar artery and infraorbital artery to supply the upper jaw, **descending palatine artery** with final branches of greater palatine artery, lesser palatine arteries, artery of the pterygoid canal (or Vidian artery) and sphenopalatine artery, supplying the mucous membrane of the nasal cavity

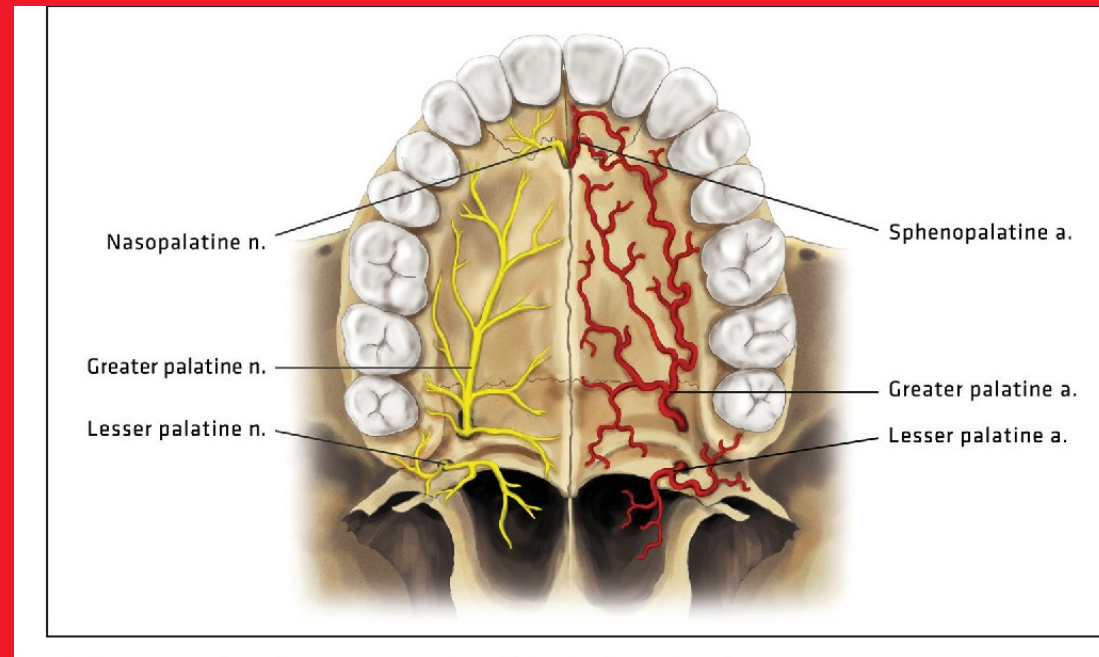


MUNI MED

descending palatine artery - the main artery of the hard and soft palate, branch from the maxillary artery

its branches: **greater palatine artery** (greater palatine foramen), **lesser palatine arteries** (lesser palatine foramina)

- branches from the pharyngeal ascending artery (external carotid artery) and from the ascending palatine artery (facial artery) also reach the edge of the soft palate



sphenopalatine artery - incisive foramen

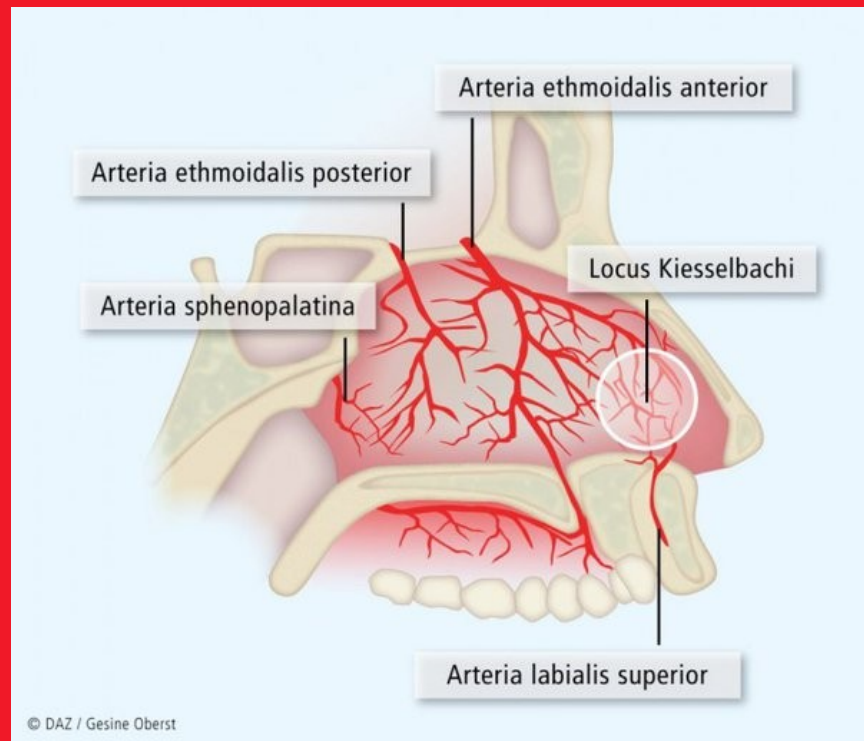
Bleeding from blood vessels in the area of

- □ the nasal mucosa (epistaxis)
- most often, bleeding from the Kiesselbachi locus – vascular plexus on the septum
- damage to these vessels occurs during strong blowing

Treatment: insertion of tampons into the nose and pressing on the wings of the nose

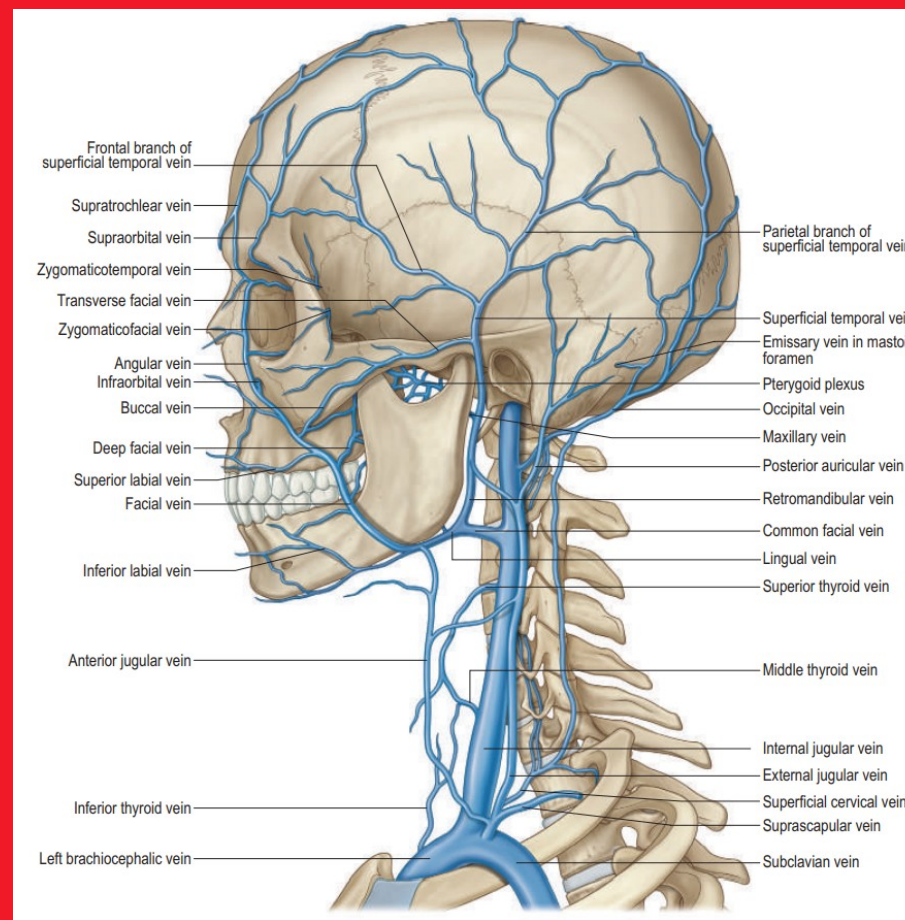
- the bleeding then slowly stops

do not tilt the head - the blood should not flow into the neck

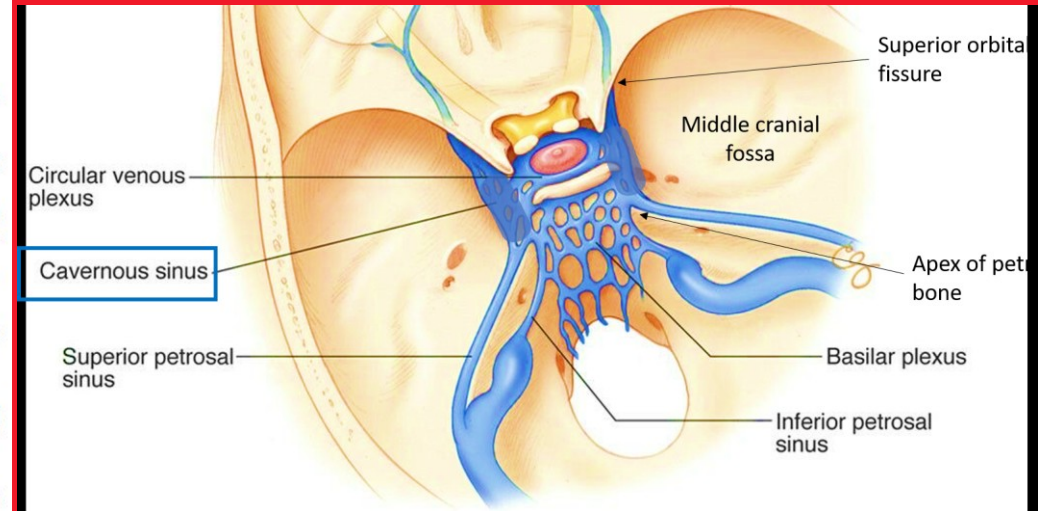
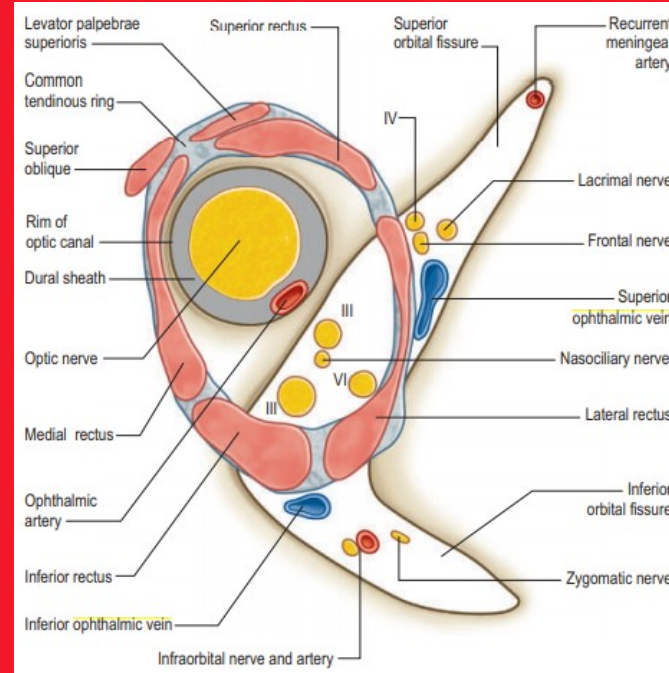
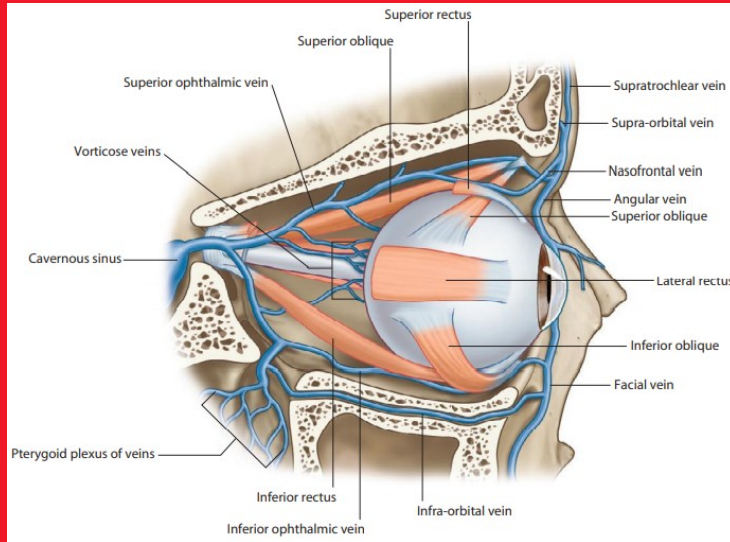


VENOUS DRAINAGE OF THE HEAD AND NECK

1. Cerebral veins
2. Meningeal veins
3. Dural venous sinuses
4. Diploic veins
5. Veins of labyrinth
6. **Emissary veins**
7. **Retromandibular vein**
 - **Superficial temporal vein**
 - **Middle temporal vein**
 - **Transvers facial vein**
 - **Maxillary veins**
8. **Ophthalmic veins**
9. **Pharyngeal veins**
10. **Facial vein**
11. **Lingual vein**
 - **Sublingual vein**
 - **Vena comitans nervi hypoglossi**
12. Superior thyroid vein
13. Middle thyroid vein
14. **External jugular vein**



venous drainage is abundant



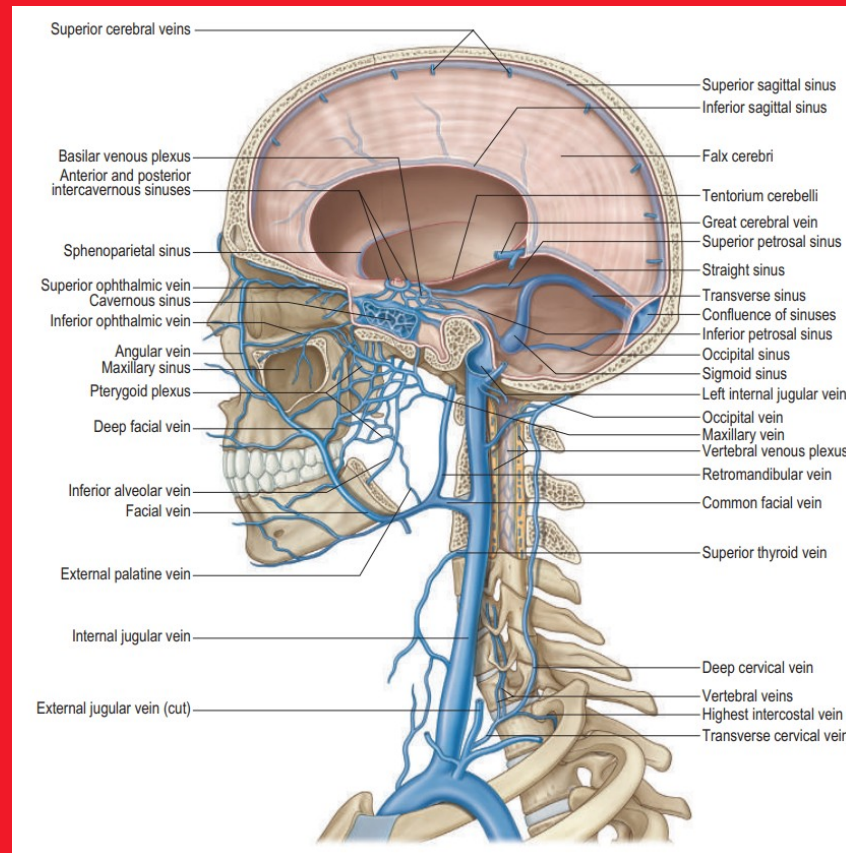
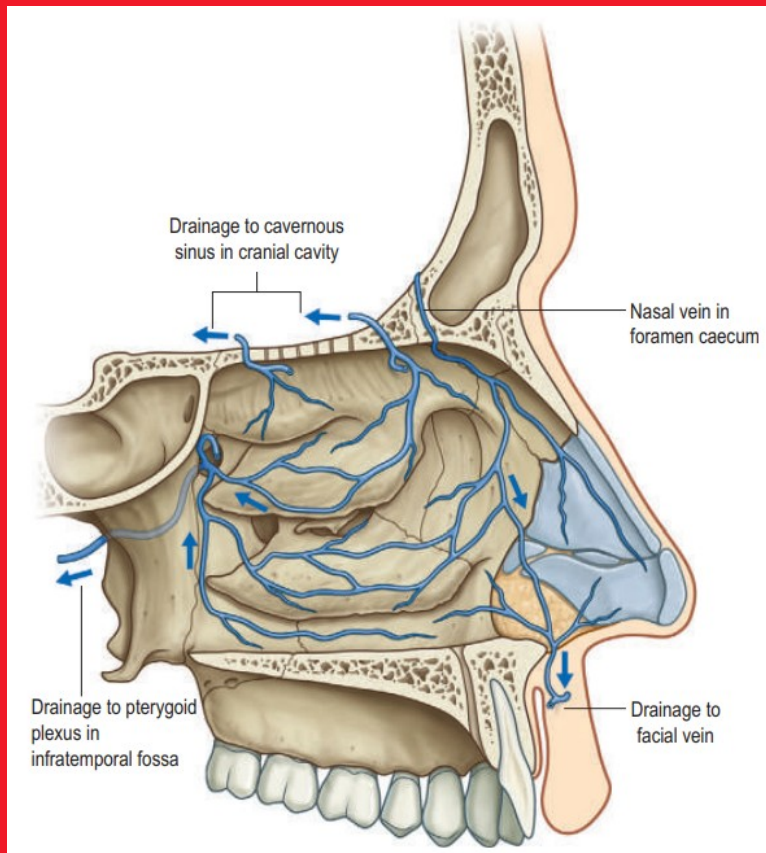
- superior ophthalmic vein flows into the cavernous sinus – drains venous blood from the brain
- through the eye vein, it also has a connection with the blood flowing from the facial area
- some purulent infections in the face (e.g. cheilitis - inflammatory changes in the lips area, furuncle - skin abscess) can spread through this connection to the cavernous sinuses and cause serious intracranial infections

Cavernous sinus thrombosis

-usually a late complication of an infection of the face or paranasal sinuses.



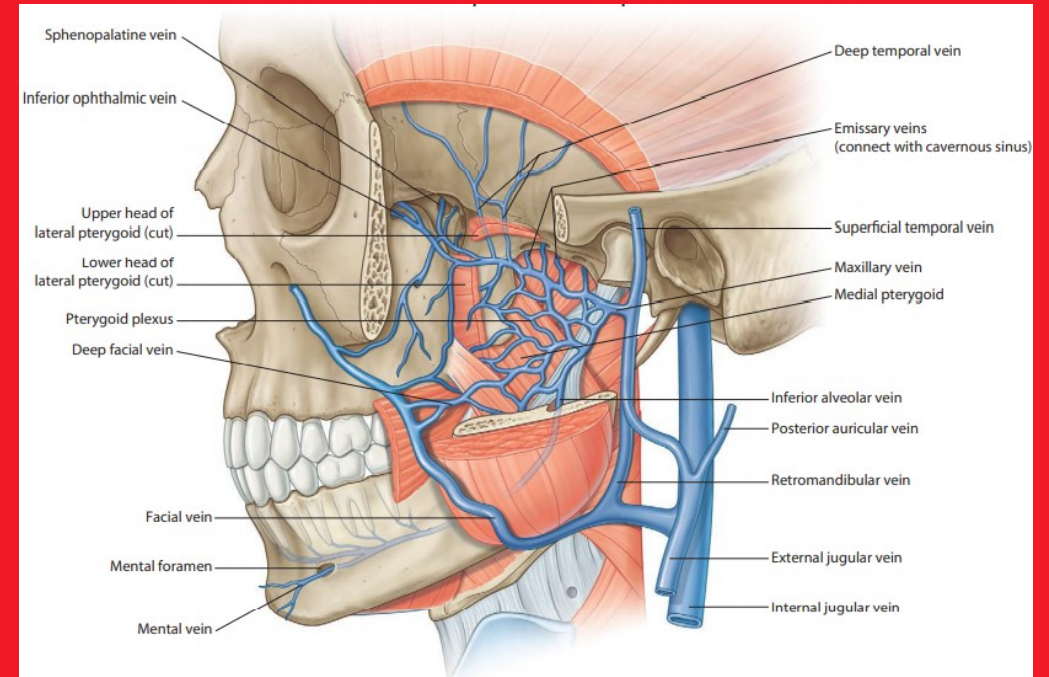
- thrombosis of the cavernous sinus — severe pain behind the eye and in the eye
- bleeding (hemorrhage) into the conjunctiva which may protrude the eye
- hemorrhage on the fundus of the eye - blindness
- loss of consciousness, intracranial hypertension, bleeding...



- connections between the intracranial venous system and the veins in the face
- bacterial infection in the area of the face or oral cavity can spread to the brain

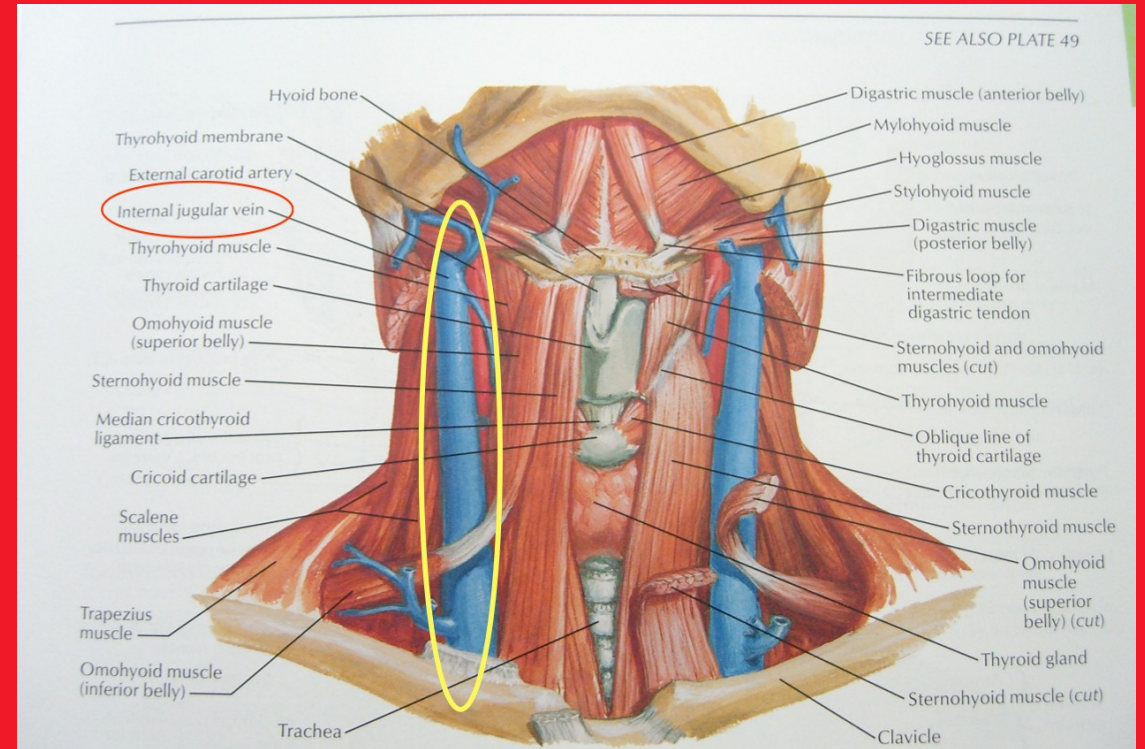
PTERYGOID PLEXUS

Venous plexus in the infratemporal fossa -
 between pterygoid muscles and temporalis
 muscle - collects blood from the deep areas
 of the face, masticatory muscles, alveoli of
 both jaws from the area supplied by the
 maxillary artery and the orbit
 - blood flows into retromandibular vein – facial
 vein – internal jugular vein



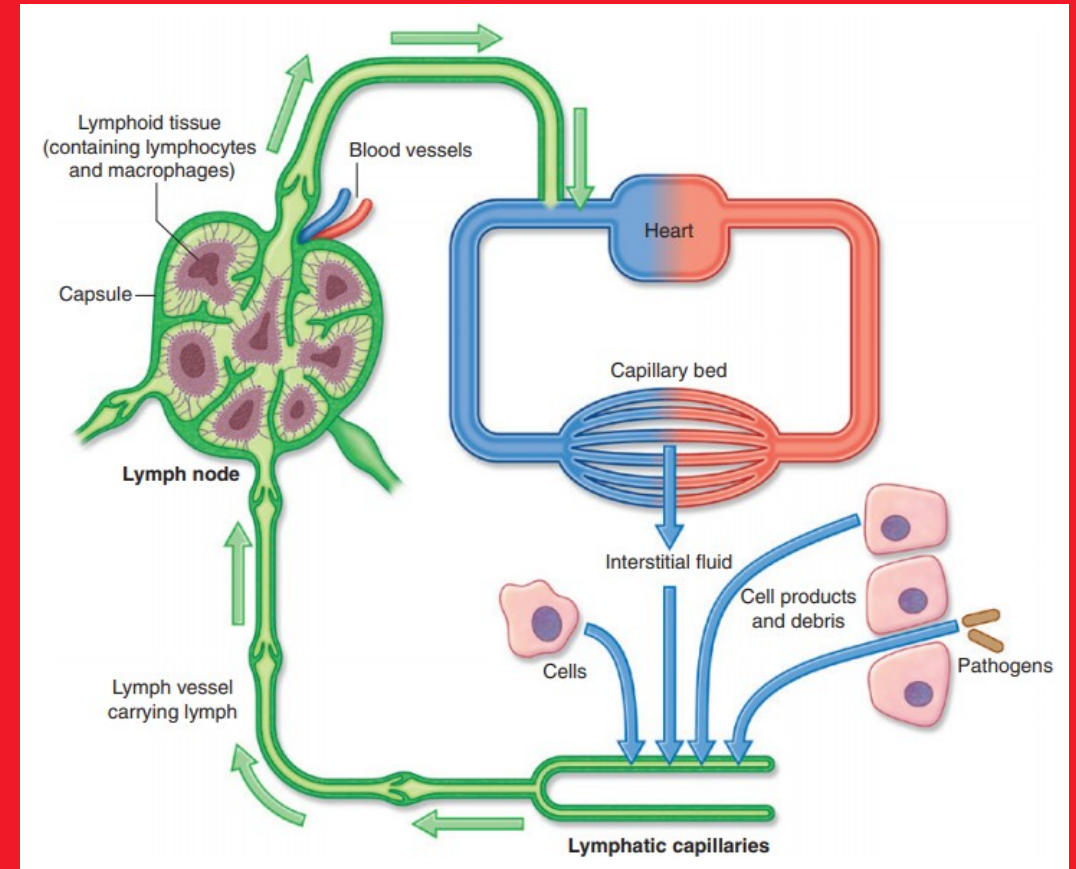
INTERNAL JUGULAR VEIN

- the main vein of the neck
- has an 8-16 mm wide trunk in the cervical neurovascular bundle
- runs under the sternocleidomastoid muscle laterally from the internal carotid artery and the common carotid artery
- opens into the brachiocephalic vein - collects blood from a large part of the head and neck, including the brain and meninges



LYMFATIC SYSTEM - OVERVIEW

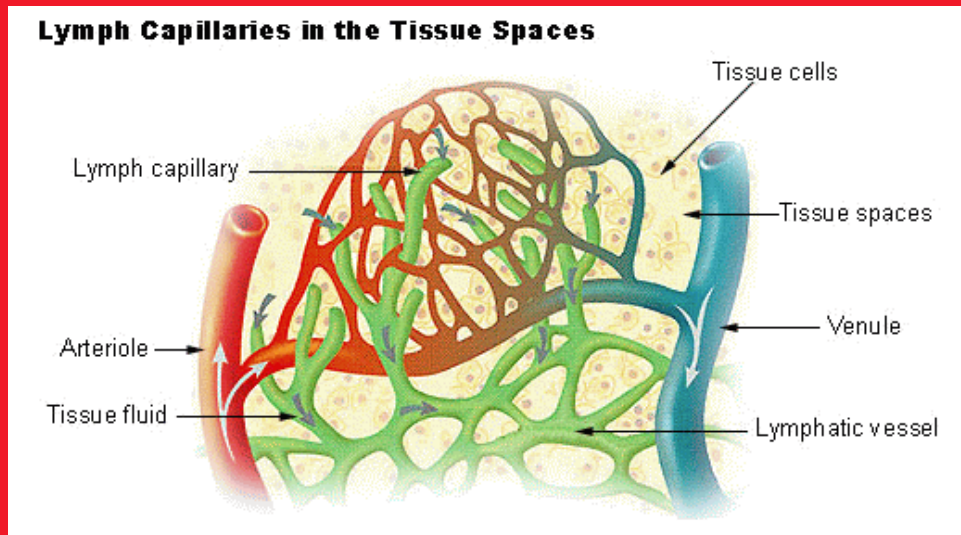
- the lymphatic system is a one-way system of the human body, leading from the intercellular spaces to the blood through lymphatic vessels
- the lymphatic system consists of lymphatic vessels and highly specialized lymphoid organs and tissues, primarily the thymus, spleen, and tonsils



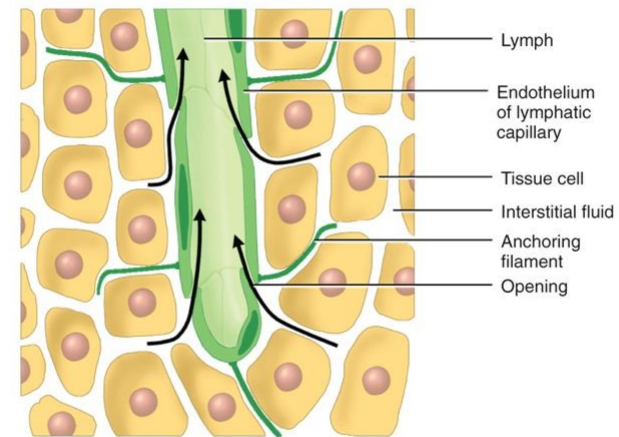
Lymphatic vessels

Lymphatic capillaries form anastomosing networks

- the walls of the lymphatic capillaries are very thin and highly permeable
- large molecules and particles including bacteria that cannot enter the blood capillaries are carried away by the lymph



Lymphatic Vessels and Fluid

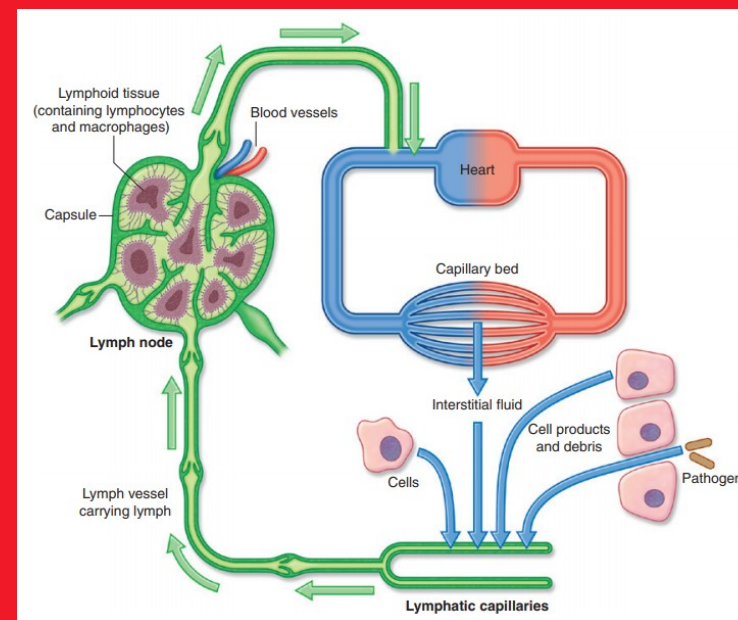
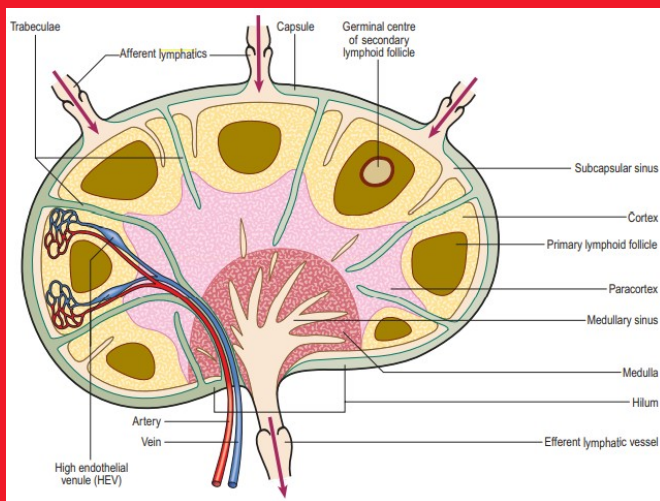


(b) Details of a lymphatic capillary

Lymphatic capillaries showing blind ends and one way flow

Lymph node

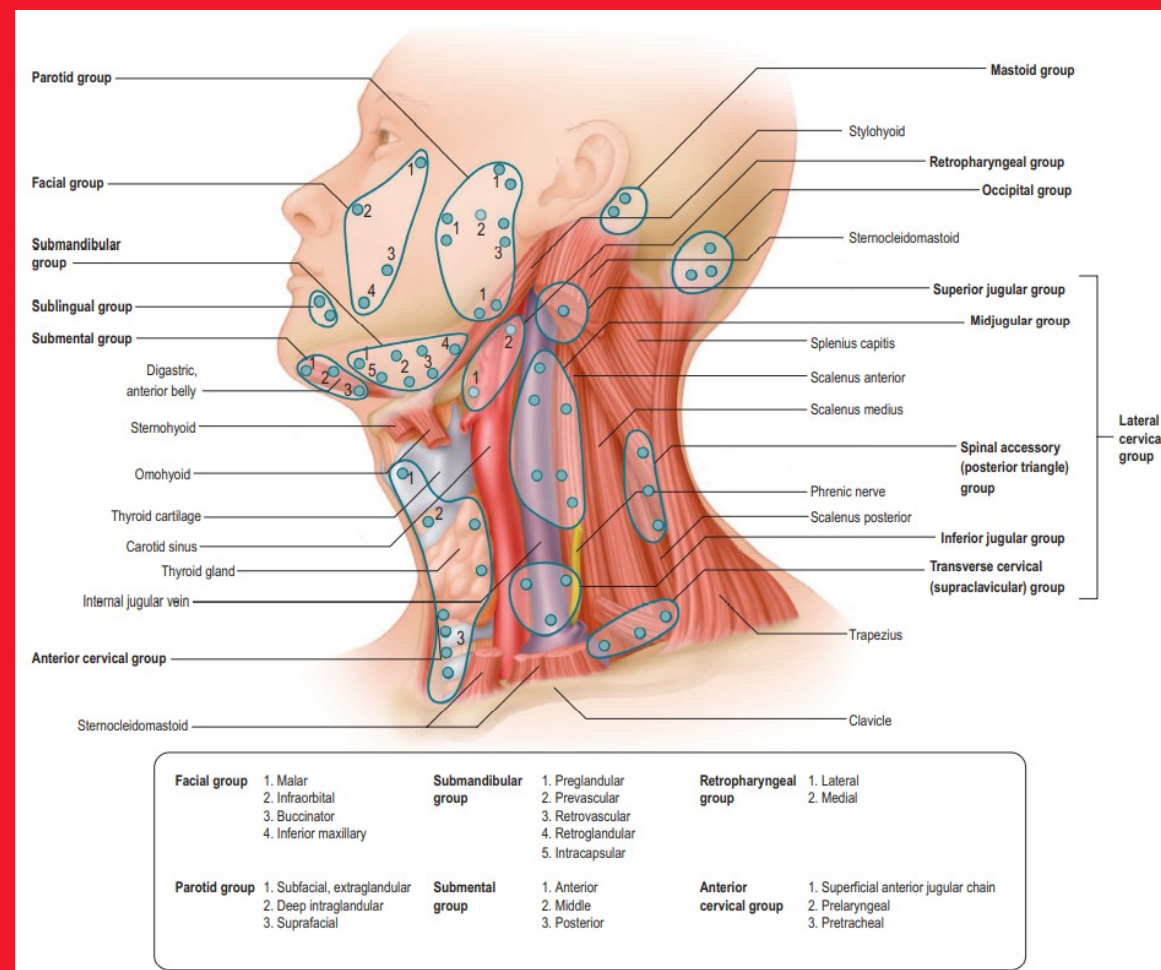
A **lymph node** is a spherical or oval-shaped organ - it is found in the circulation of lymphatic vessels and serves as a biological filter of lymph - they play an essential role in the body's defense against microbes and tumor cells (sentinel node - the first lymph node to which cancer spreads)



Lymph nodes of the head and neck

The **lymphatic system** of the head and neck is very rich, therefore the spread of inflammation or tumor occurs very quickly

- the lymphatic system of the head and neck is divided into superficial and deep



The lymphatic system of the head and neck

- drains lymph from the skin and subcutaneous tissue of the head and neck

Includes:

occipital nodes - in the occipital region, when enlarged, they can become very painful, as they are close to the occipital nerve

mastoid nodes - behind the auricle, posterior side of the auricle

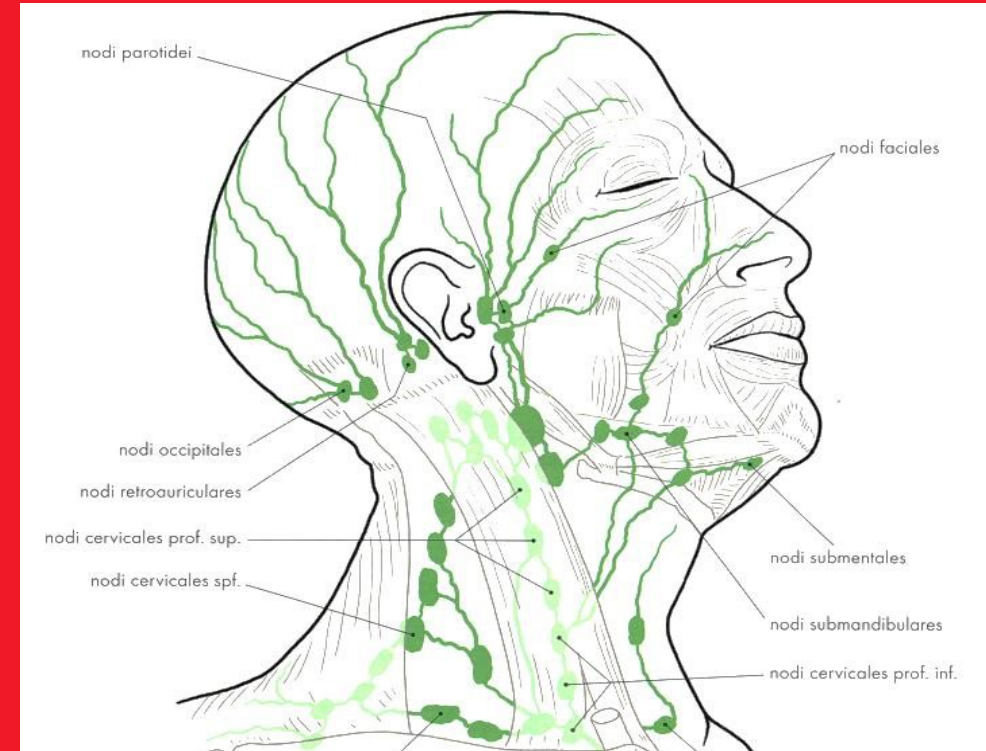
superficial and deep parotid nodes - lymph flows from the upper molar, parotid gland

nodi lymphatici submentales - lymph flows from the lower lip, tip of the tongue, stored under the chin, lymph travels to the submandibular nodes and deep neck nodes

submandibular nodes - lymph flows from the upper lip, lower lip, cheek, teeth, side of the tongue, palate, glandula submandibularis, external nose

superficial cervical nodes - lymph flows from the skin and subcutaneous tissue of the neck

deep cervical nodes - lymph flows from the teeth, tip of the tongue, root of the tongue, palatine tonsils, glandula sublingualis, glandula thyroidea, sinus maxillaris, larynx (between the muscles, blood vessels, esophagus, trachea and larynx in the neck)



Enlargement of lymph nodes

Enlarged lymph nodes can occur as a response to inflammation in the mouth and throat in young children they can also become enlarged during teething or in adults when wisdom teeth grow

If a foreign substance enters the body, white blood cells begin to multiply in the nearest lymph nodes, - the lymph nodes swell, cannot squeeze into their tight shell and become painful

Common sources of **cervical lymphadenitis** (enlargement of neck nodes) are **odontogenic processes** (dental caries, gingivitis - nflammation of the gums, pulpitis-inflammation of the dental pulp) and **infections** of the soft tissues of the head and face (herpes labialis, insect bites, piercings, acne), **angina** - acute tonsillitis, **nasopharyngitis** etc...



Locally, we find swollen nodes, sensitive to palpation, the skin above the nodes is sometimes inflamed and looks red

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