

A microscopic image of a plant stem cross-section, showing a central vascular cylinder with several vascular bundles arranged in a ring. Each bundle contains xylem on the inner side and phloem on the outer side, separated by a vascular cambium. The surrounding cortex is composed of various types of parenchyma cells.

Clinical anatomy of head and neck vessels, Lymphatic drainage

MUDr. Erik Kročka

EXTERNAL CAROTID ARTERY

Ventral branches

Superior thyroid artery

Lingual artery

Facial artery

Medial branches

Ascending pharyngeal artery

Dorsal branches

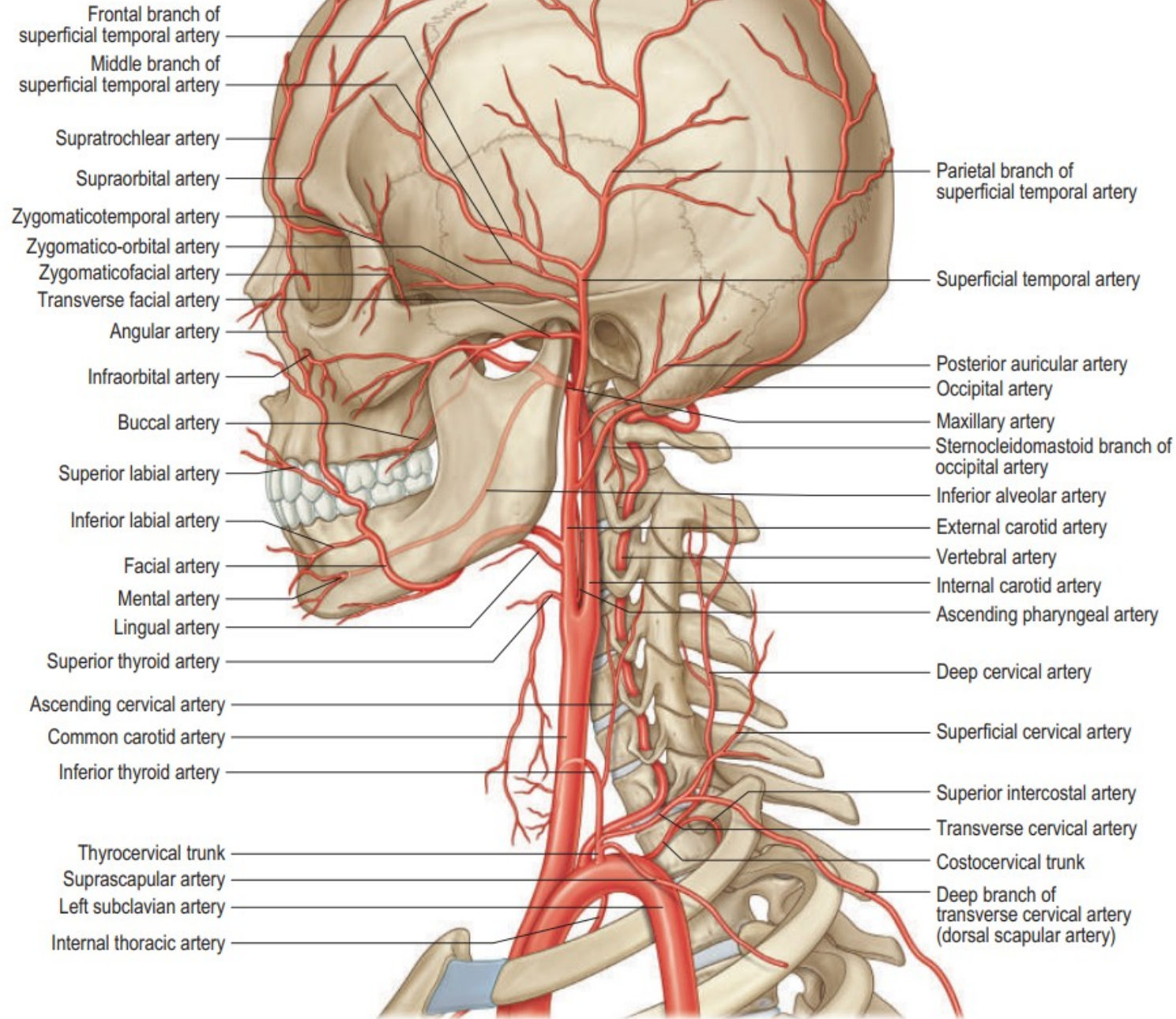
Occipital artery

Posterior auricular artery

Terminal branches

Maxillary artery

Superficial temporal artery



INTERNAL CAROTID ARTERY

Petrous segment

Caroticotympanic arteries

Cavernous segment

Tentorial basal branch

Tentorial marginal branch

Meningeal branch

Branches to nerves

Branches to trigeminal ganglion

Capsular branches (cavernous sinus)

Inferior hypophyseal artery

Cerebral segment

Superior hypophyseal artery

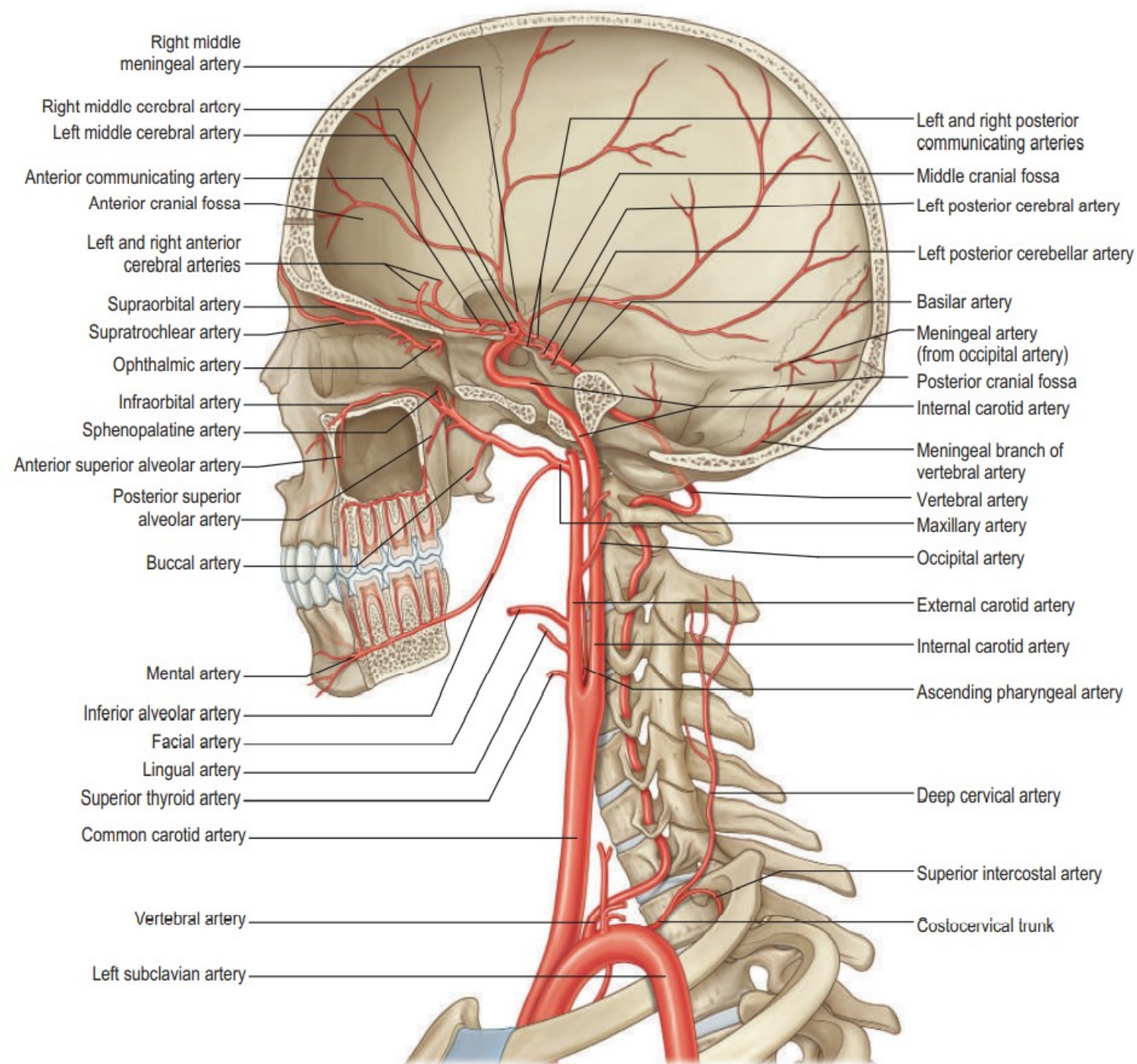
Ophthalmic artery

Anterior choroidal artery

Anterior cerebral artery

Middle cerebral artery

Posterior communicating artery



The carotid bifurcation → side predilection of an atherosclerosis

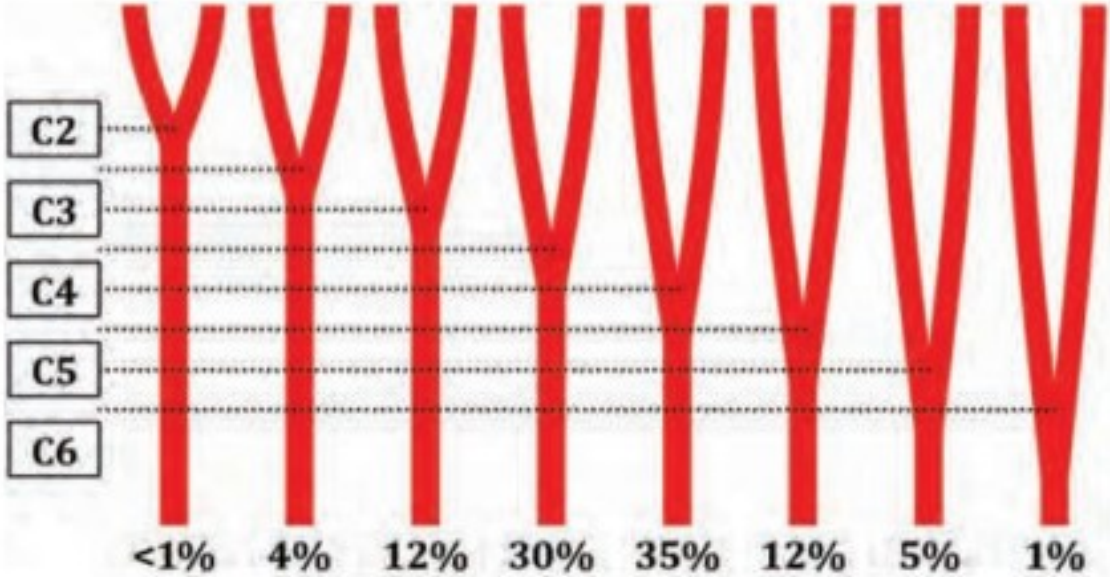
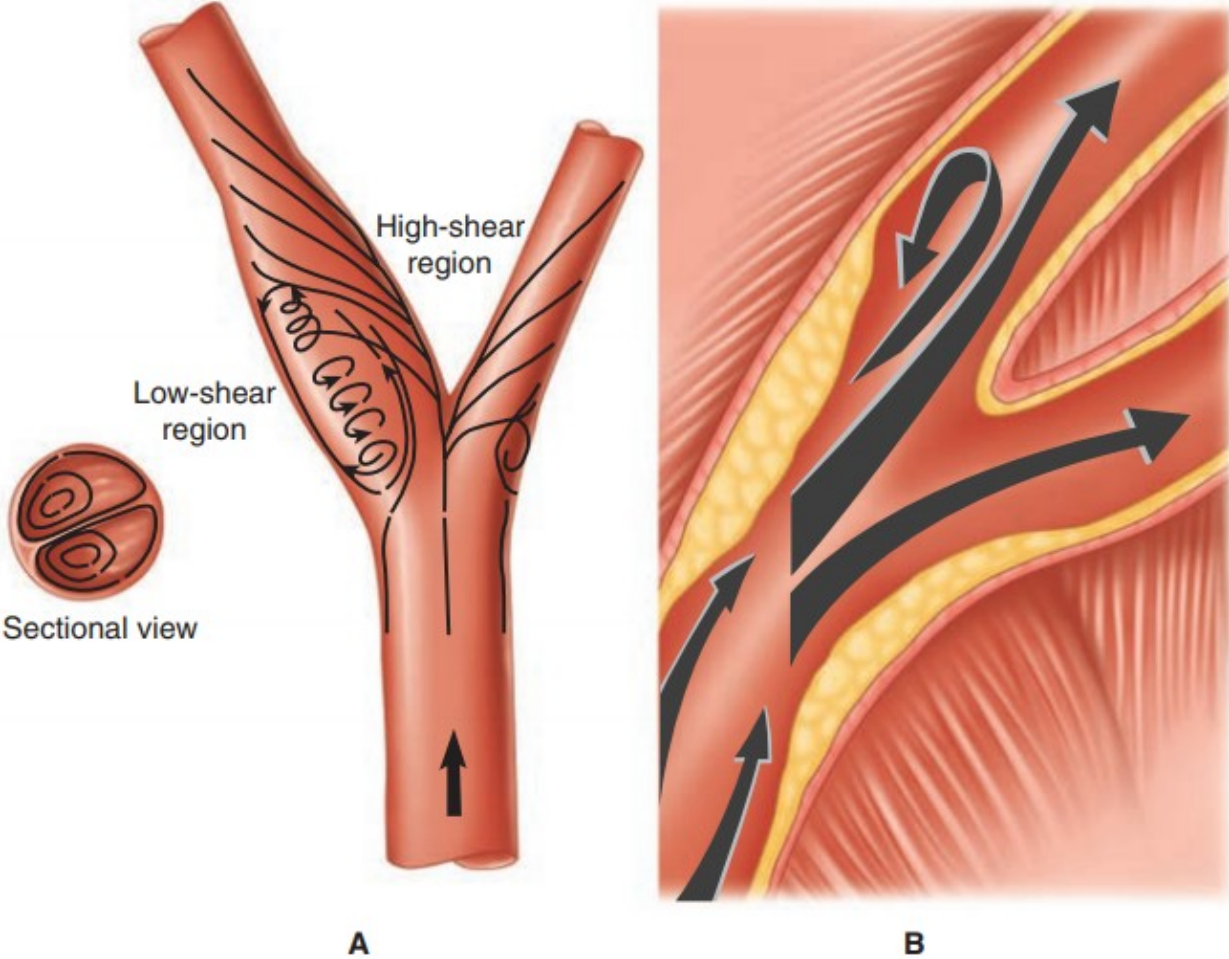


Figure 47.1 Illustration showing the bifurcation of the common carotid artery.

Figure 23-14. A. The carotid bifurcation is an area of low flow velocity and low shear stress. As the blood circulates through the carotid bifurcation, there is separation of flow into the low-resistance internal carotid artery and the high-resistance external carotid artery. B. The carotid atherosclerotic plaque typically forms in the outer wall opposite to the flow divider due in part to the effect of the low shear stress region, which also creates a transient reversal of flow during the cardiac cycle.

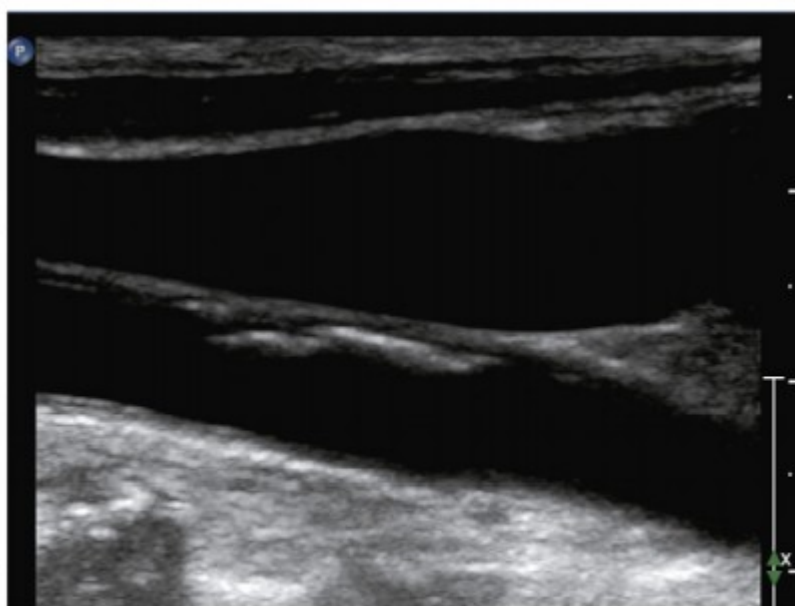
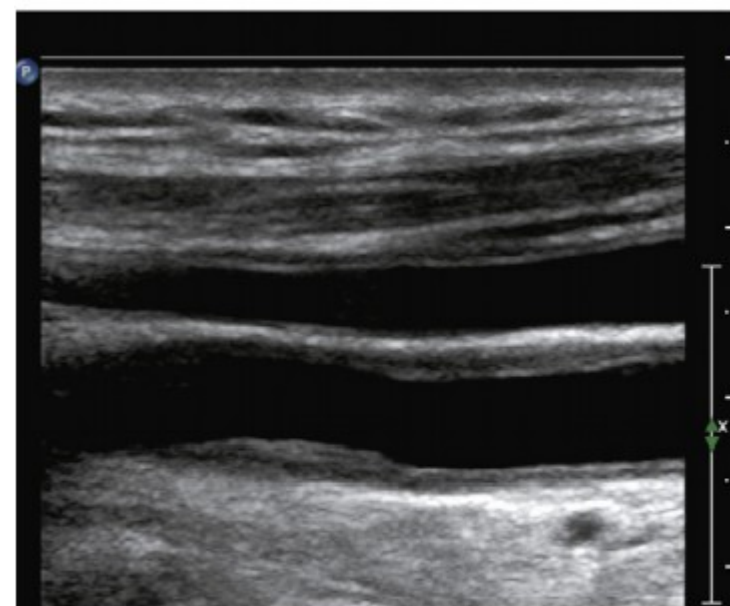
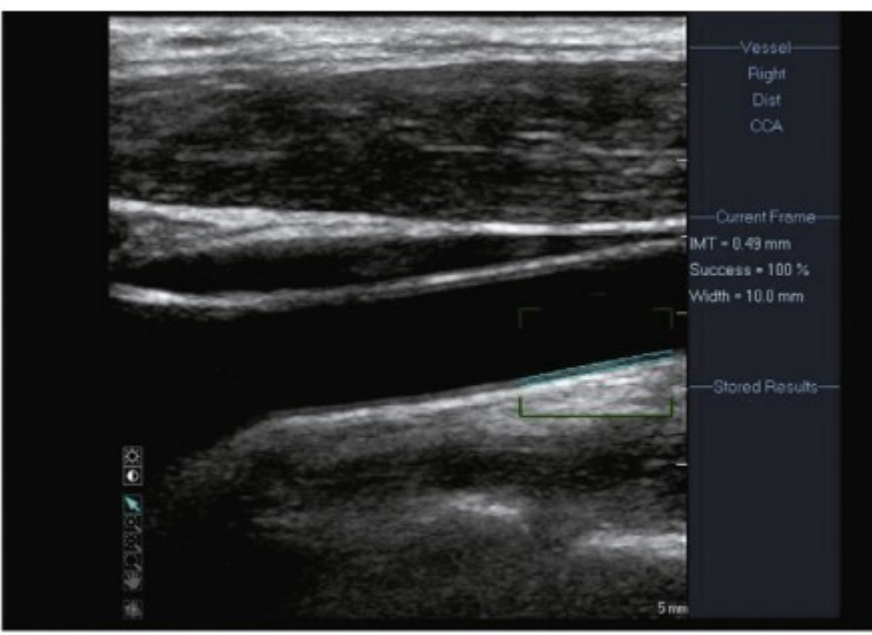
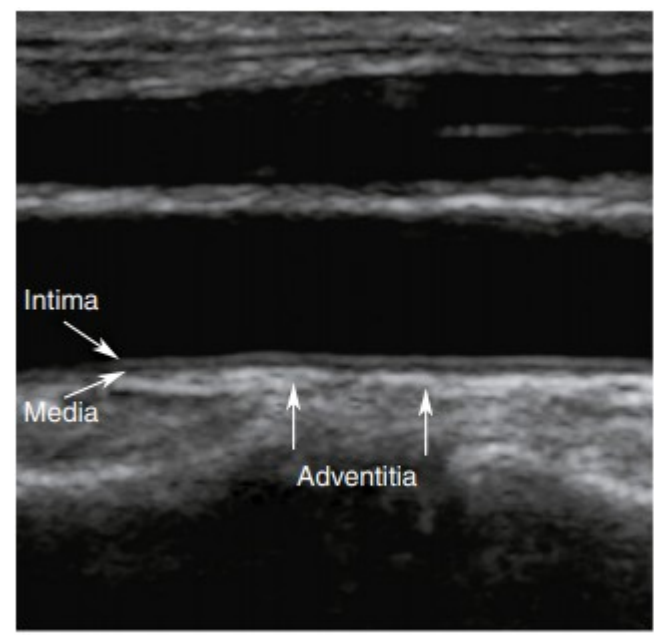
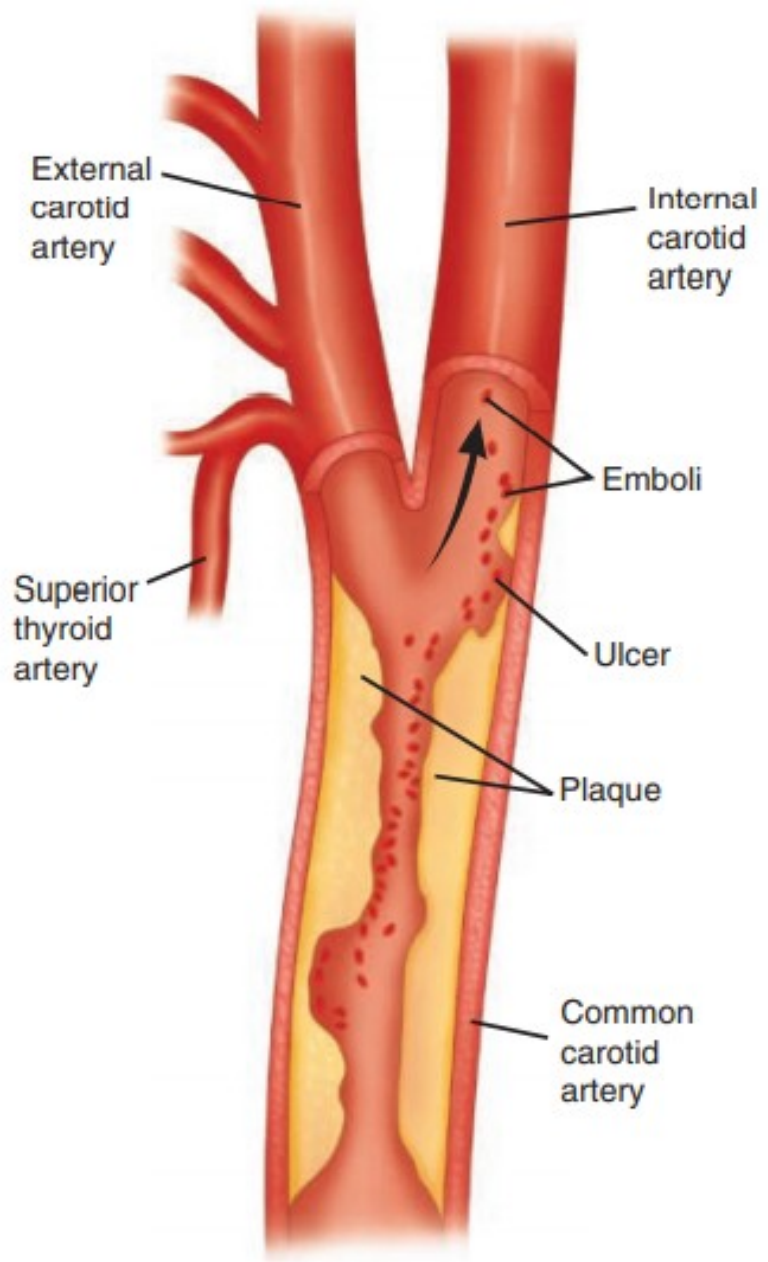


FIGURE 5-2 Normal intima-media thickness (IMT) appearance (*top left*), IMT measurement example (*top right*), fatty streak (*bottom left*), and a homogenous hyperechoic nonstenosing plaque (*bottom right*).

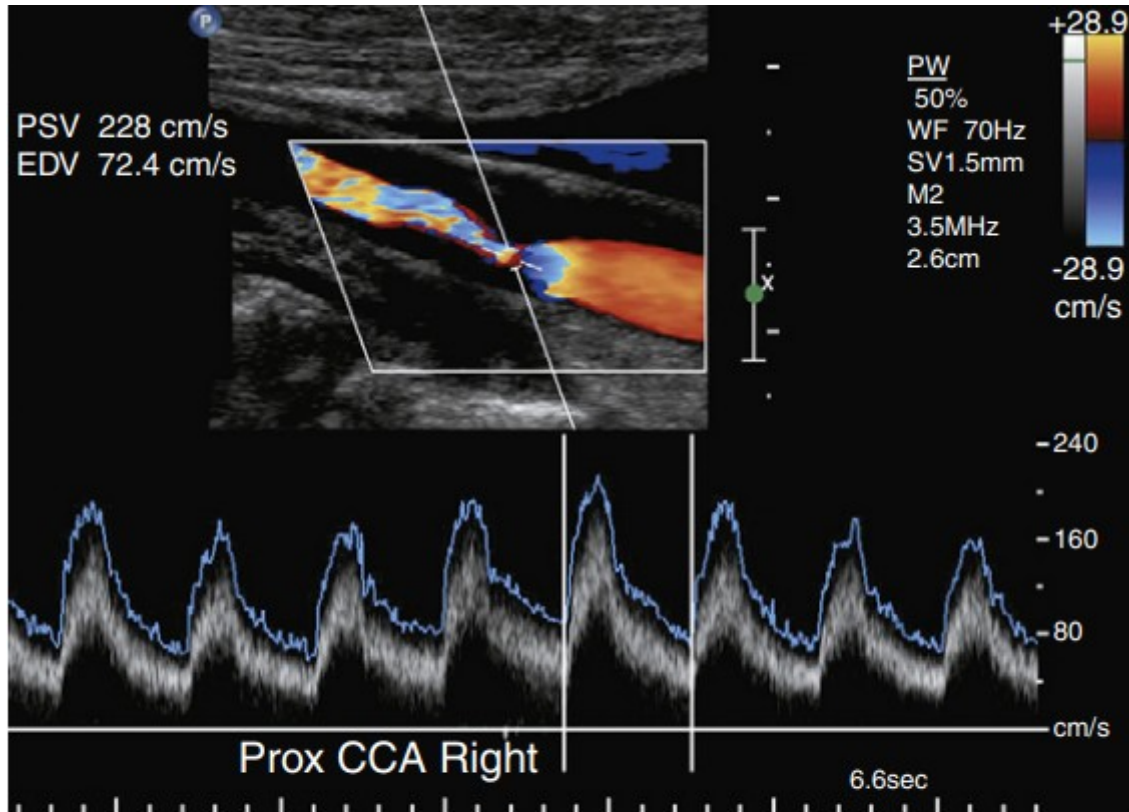


FIGURE 5-6 Hypoechoic (echolucent) plaque causing a significant internal carotid artery stenosis. Note the Doppler velocity tracing with a narrow spectral window, indicating that the sample site is at the point of maximal narrowing.

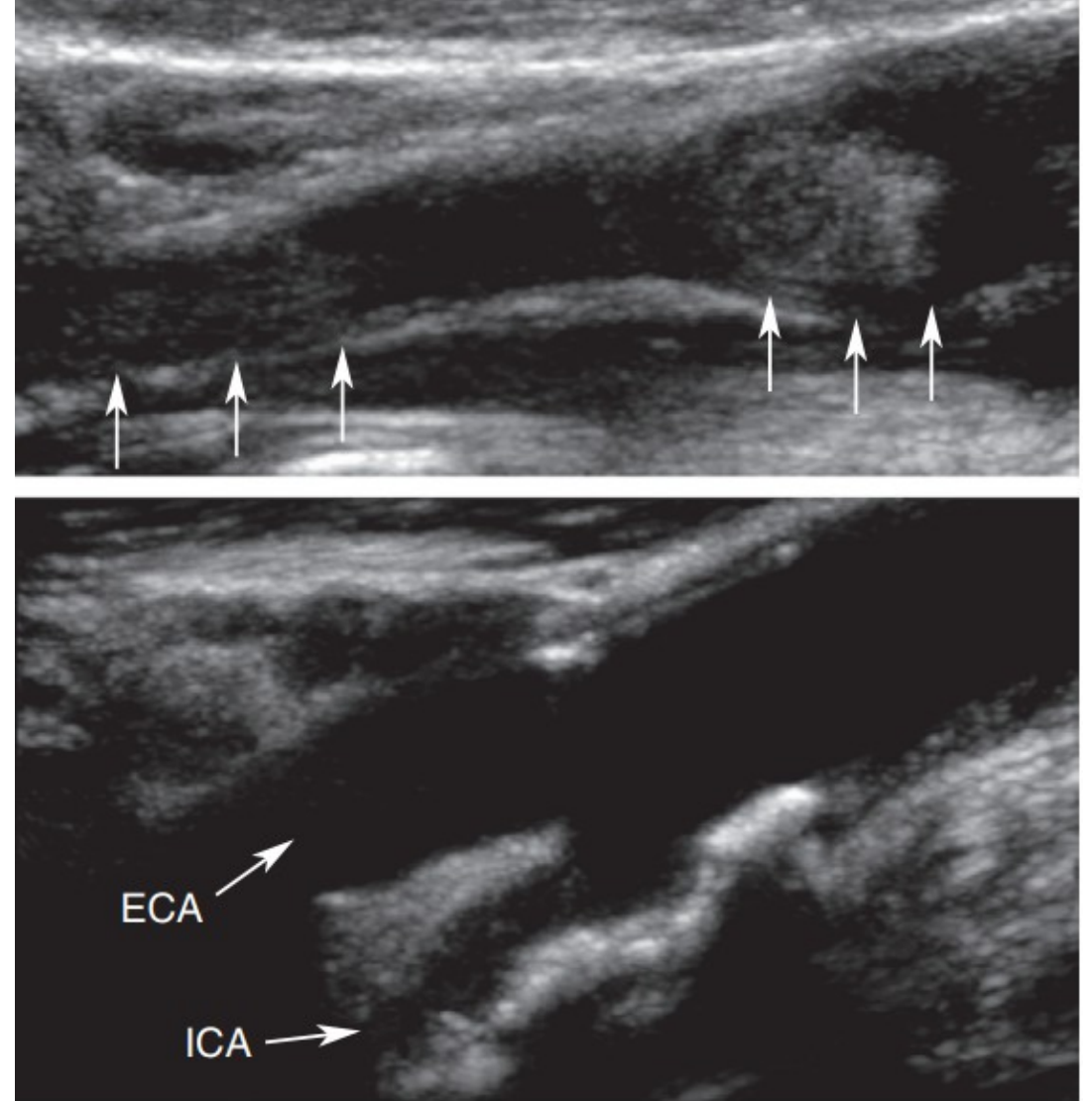


FIGURE 5-8 Acute (*top*) thromboembolic internal carotid artery (ICA) occlusion. Note intima-media thickness preservation between mixed echogenic parts of a thrombus (*arrows*), and normal ICA lumen size. Chronic (*bottom*) ICA occlusion with vessel collapse and fibrosis. ECA, external carotid artery.

CAROTID ENDARTERECTOMY

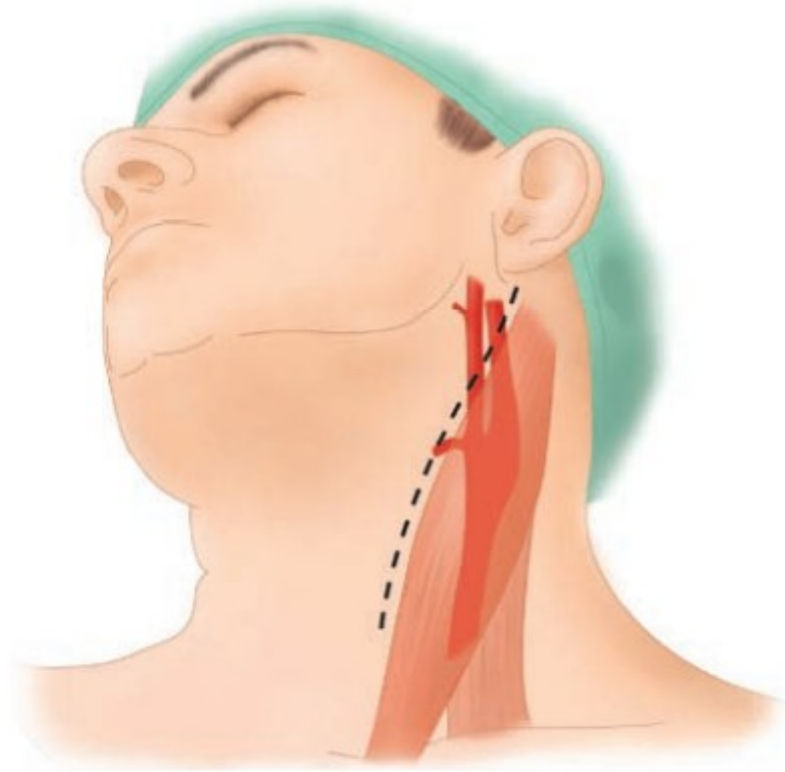


Figure 23-17. To perform carotid endarterectomy, the patient's neck is slightly hyperextended and turned to the contralateral side. An oblique incision is made along the anterior border of the sternocleidomastoid muscle centered on top of the carotid bifurcation.

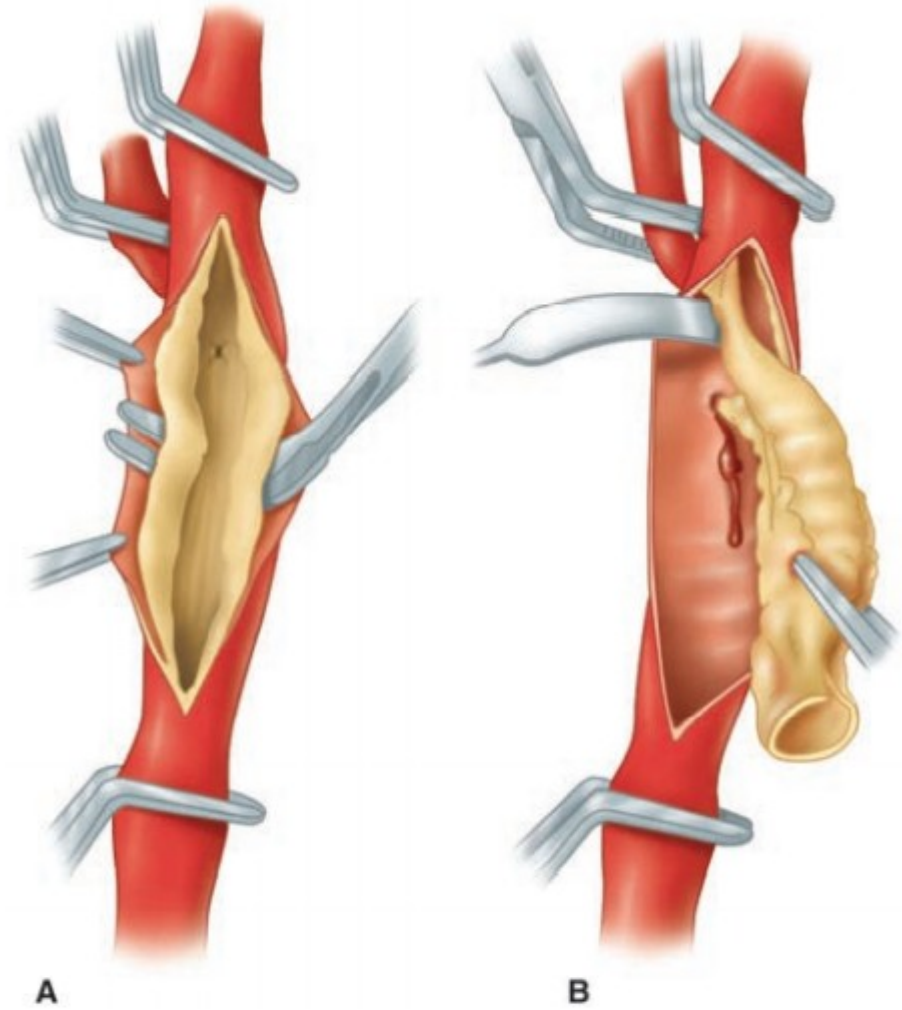


Figure 23-18. **A.** During carotid endarterectomy, vascular clamps are applied in the common carotid, external carotid, and internal carotid arteries. Carotid plaque is elevated from the carotid lumen. **B.** Carotid plaque is removed, and the arteriotomy is closed either primarily or with a patch angioplasty.

VERTEBRAL ARTERY

Cervical branches

Spinal branches

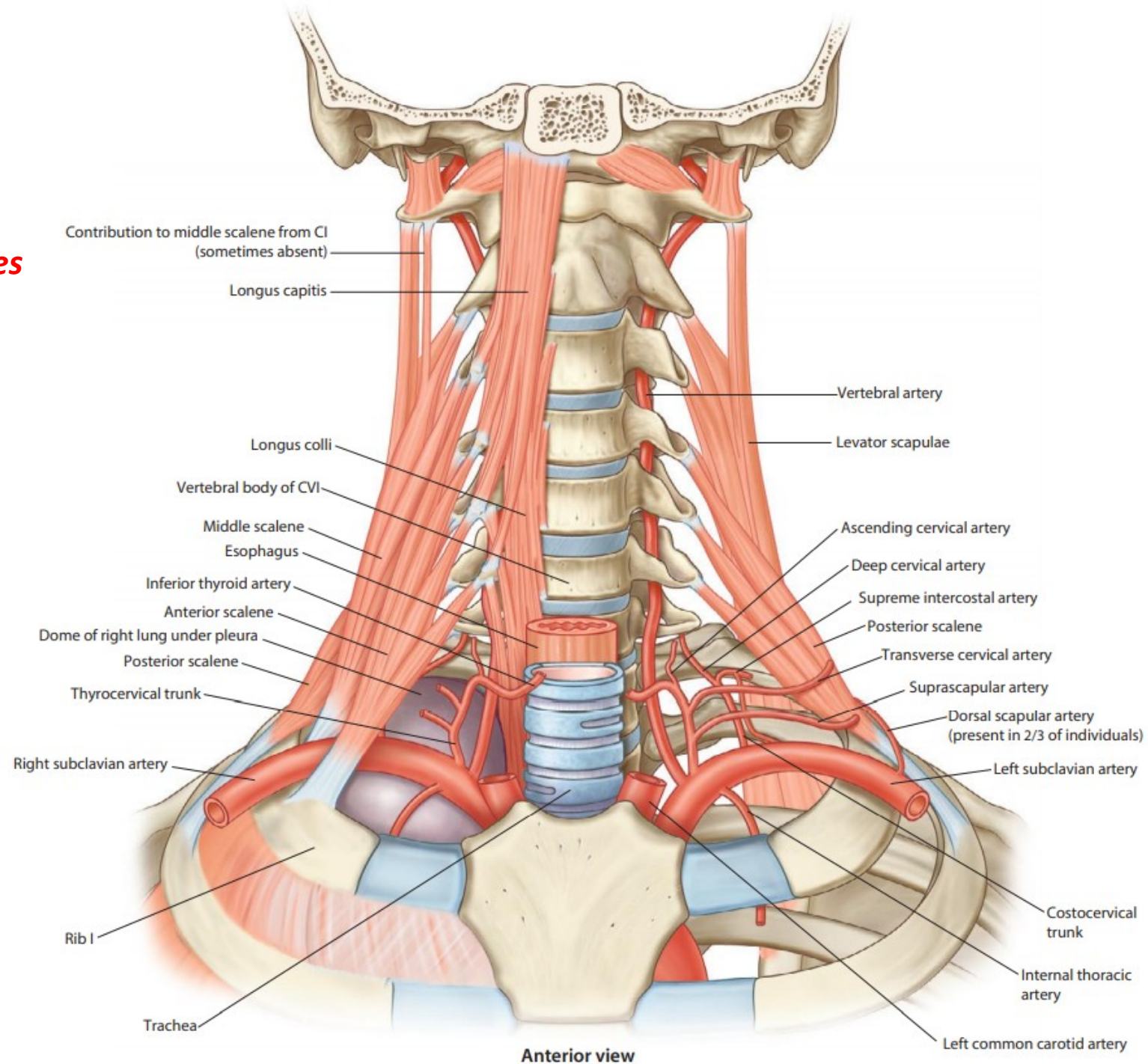
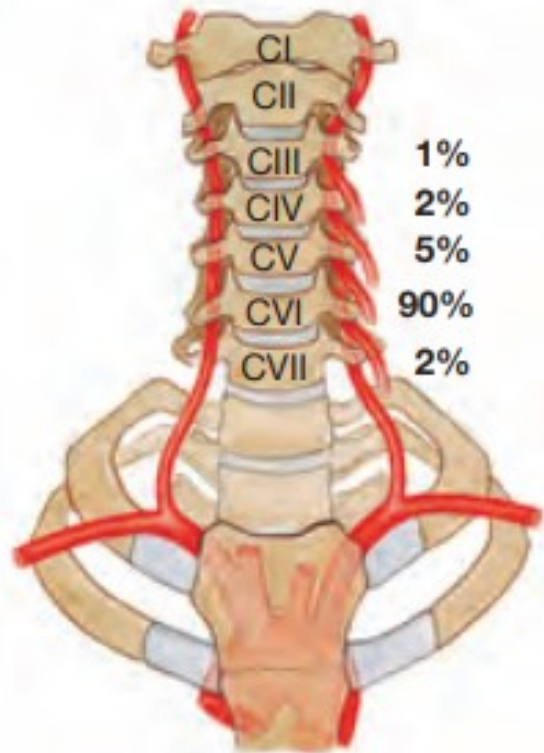
Muscular branches

Meningeal branch

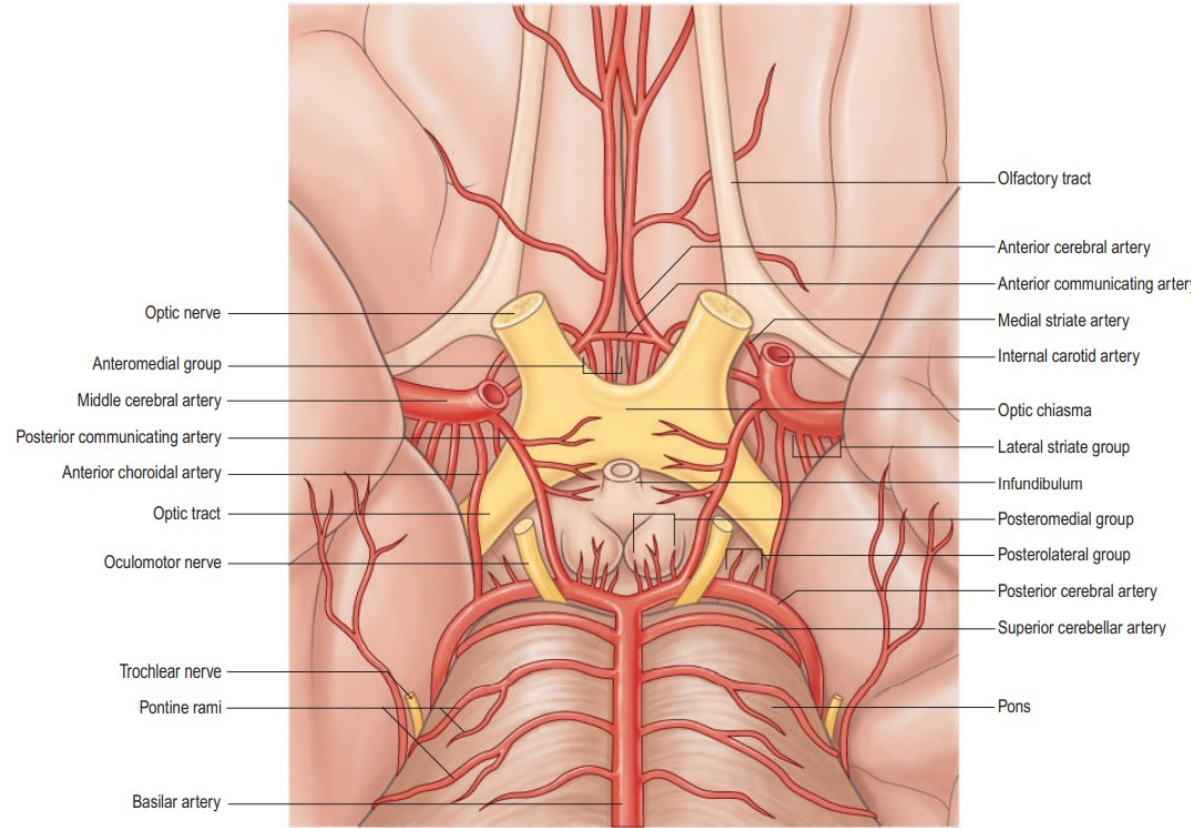
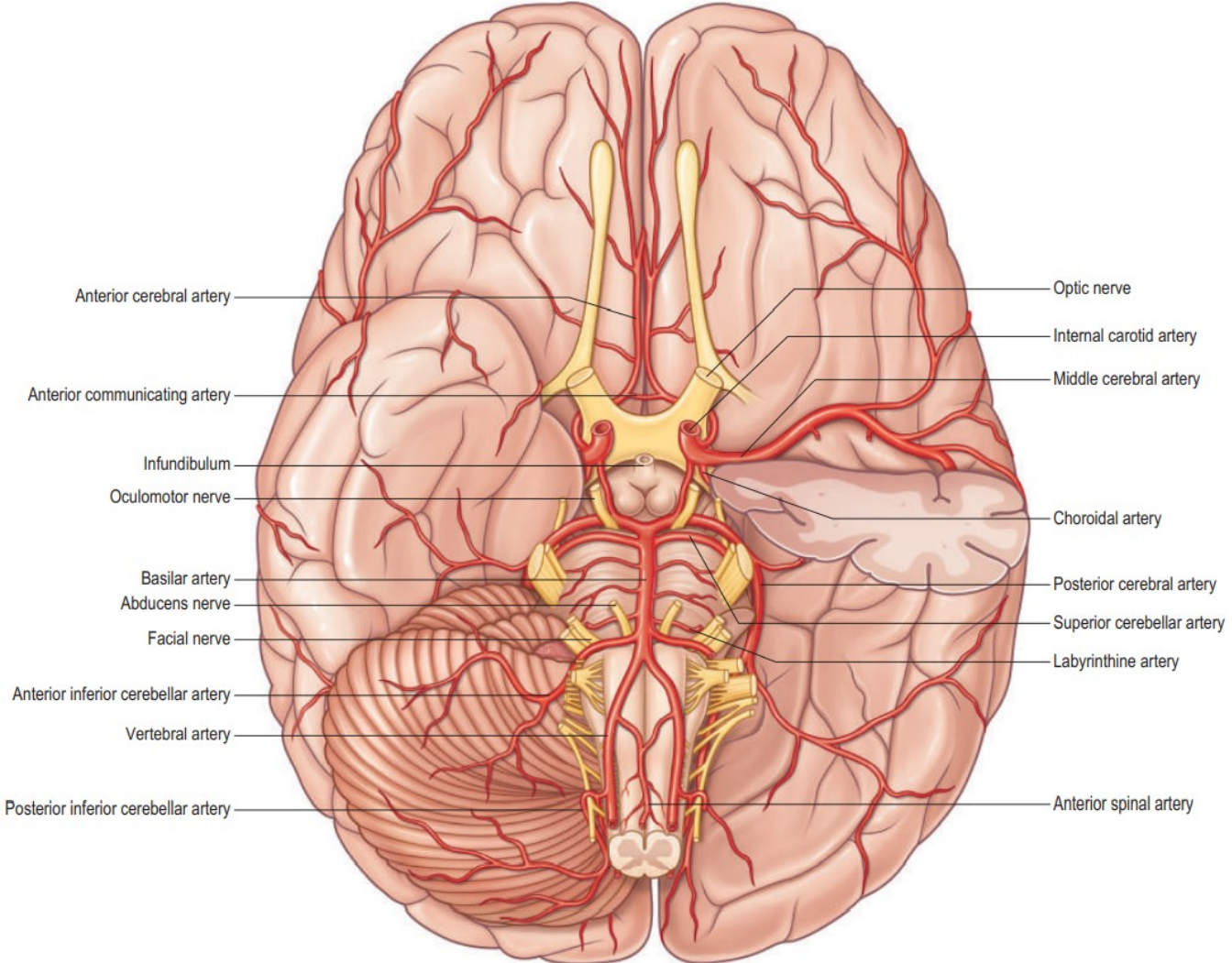
Cranial branches

Basilar artery

Posterior cerebral arteries



CIRCULUS ARTERIOSUS CEREBRI WILLISI

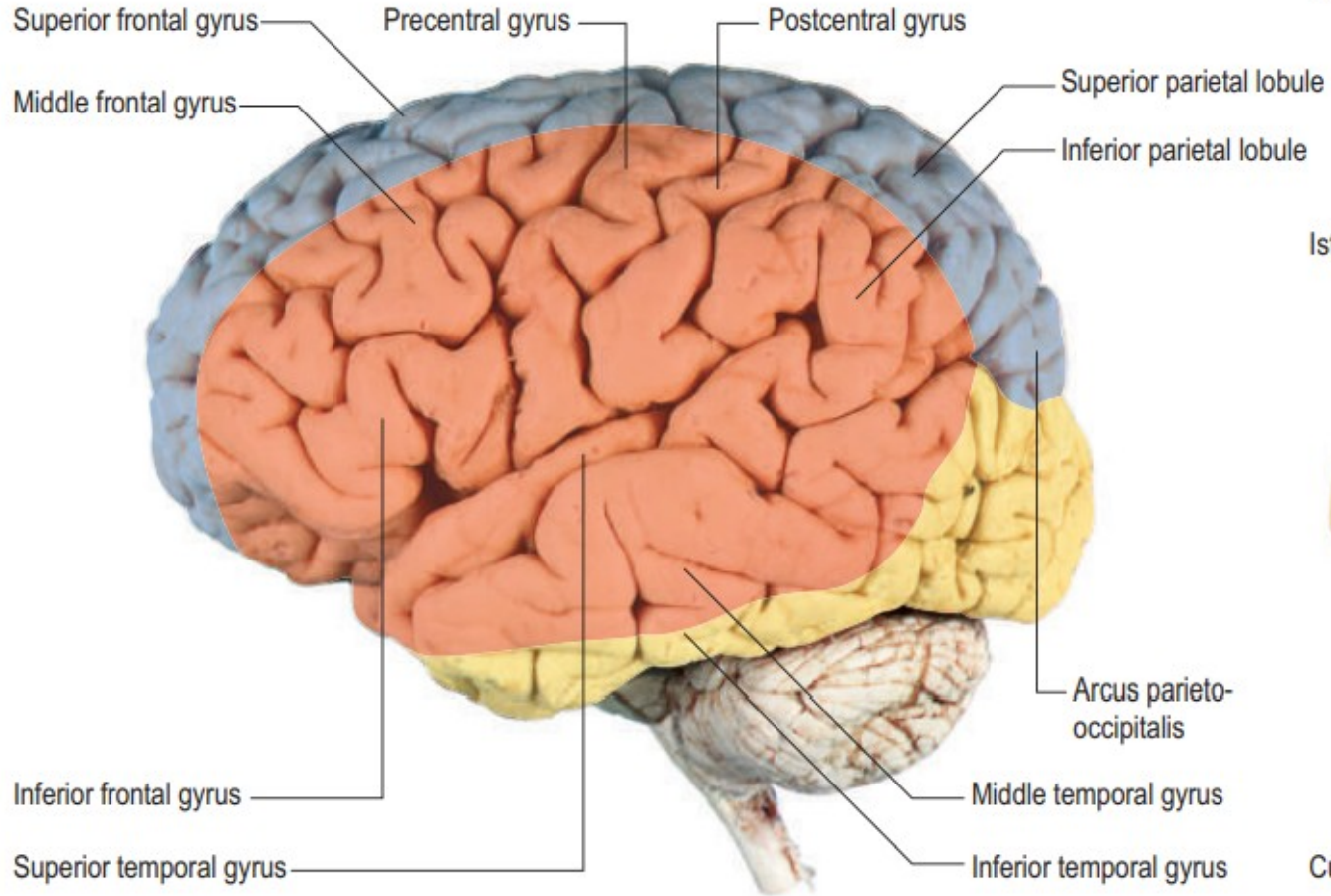


ARTERIAL SUPPLY OF THE BRAIN

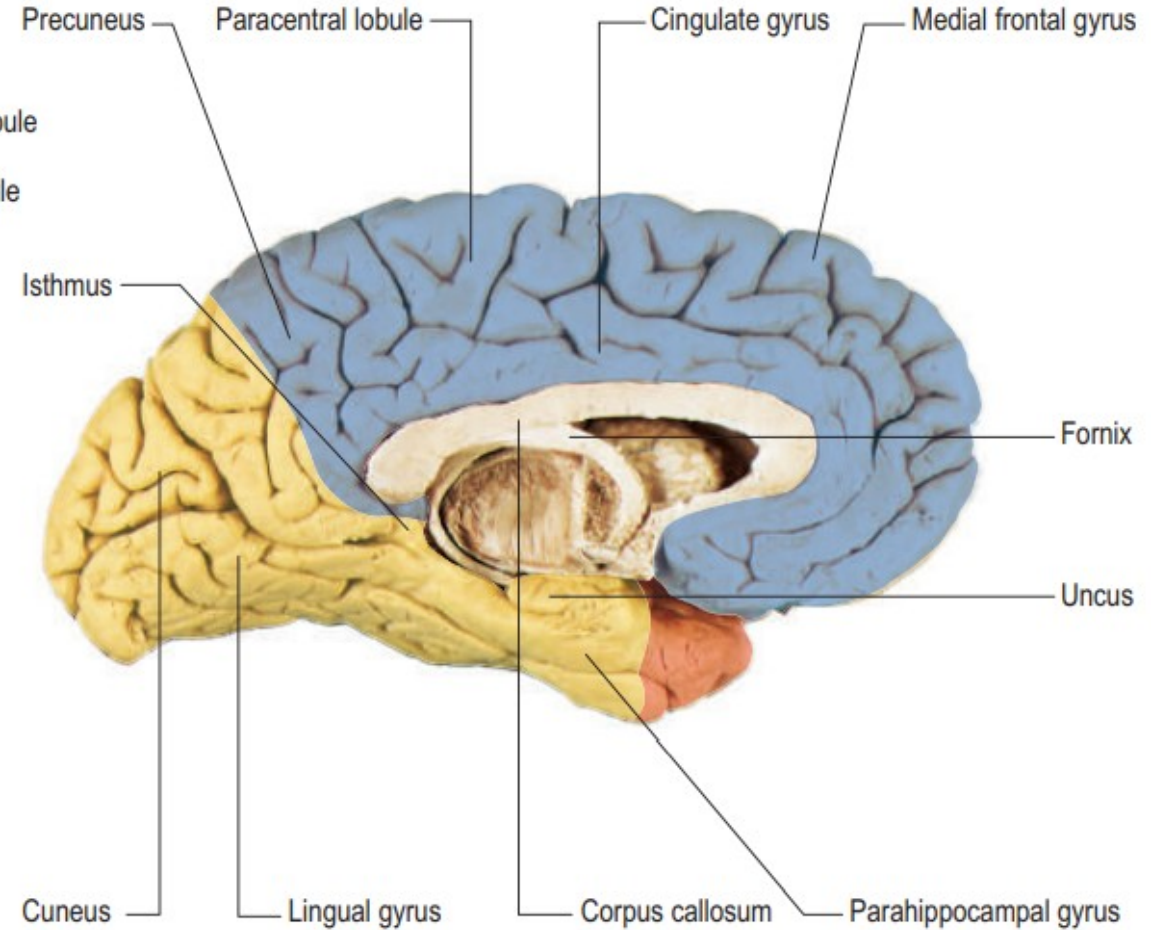
Anterior 2/3 → internal carotid artery

Posterior 1/3 → vertebral artery

A



B



Area supplied by anterior cerebral artery Area supplied by middle cerebral artery Area supplied by posterior cerebral artery

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

ANEURYSMS IN THE CIRCLE OF WILLIS

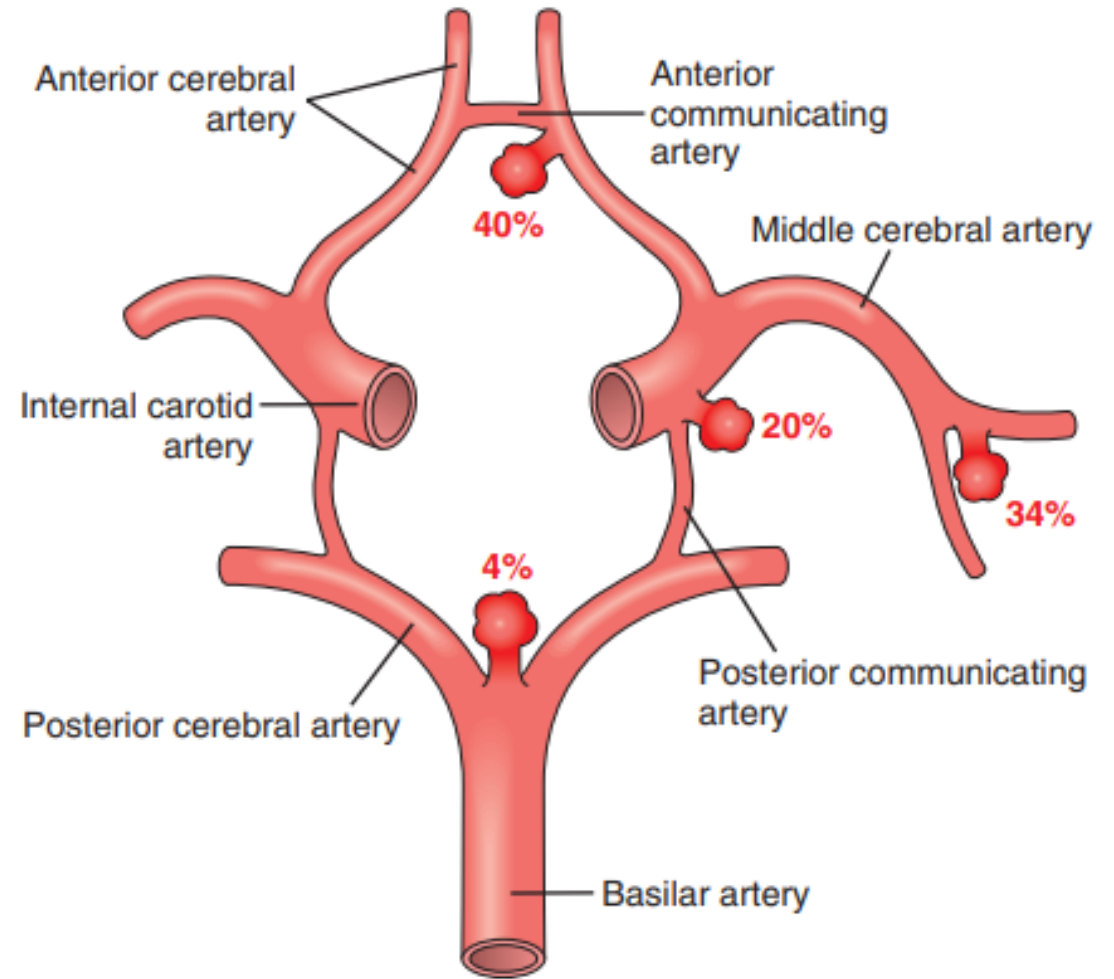
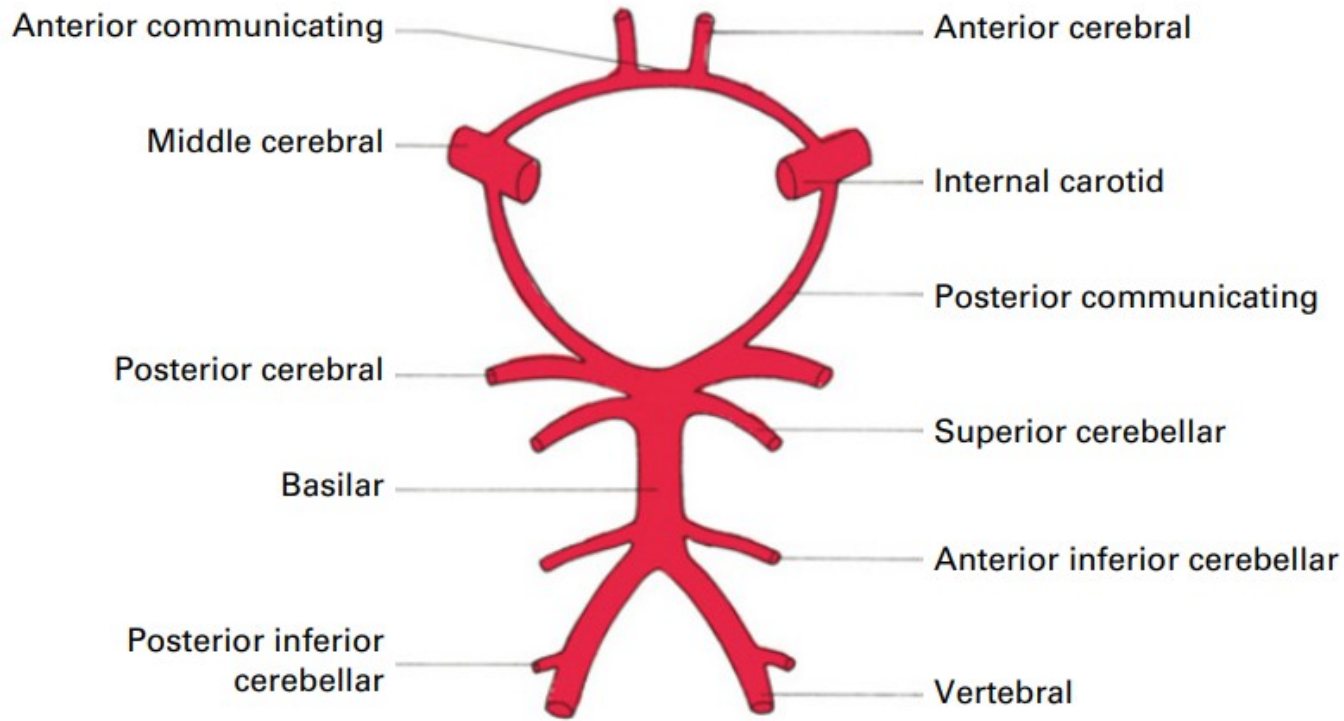


Figure 28-19 Common sites of saccular (berry) aneurysms in the circle of Willis.

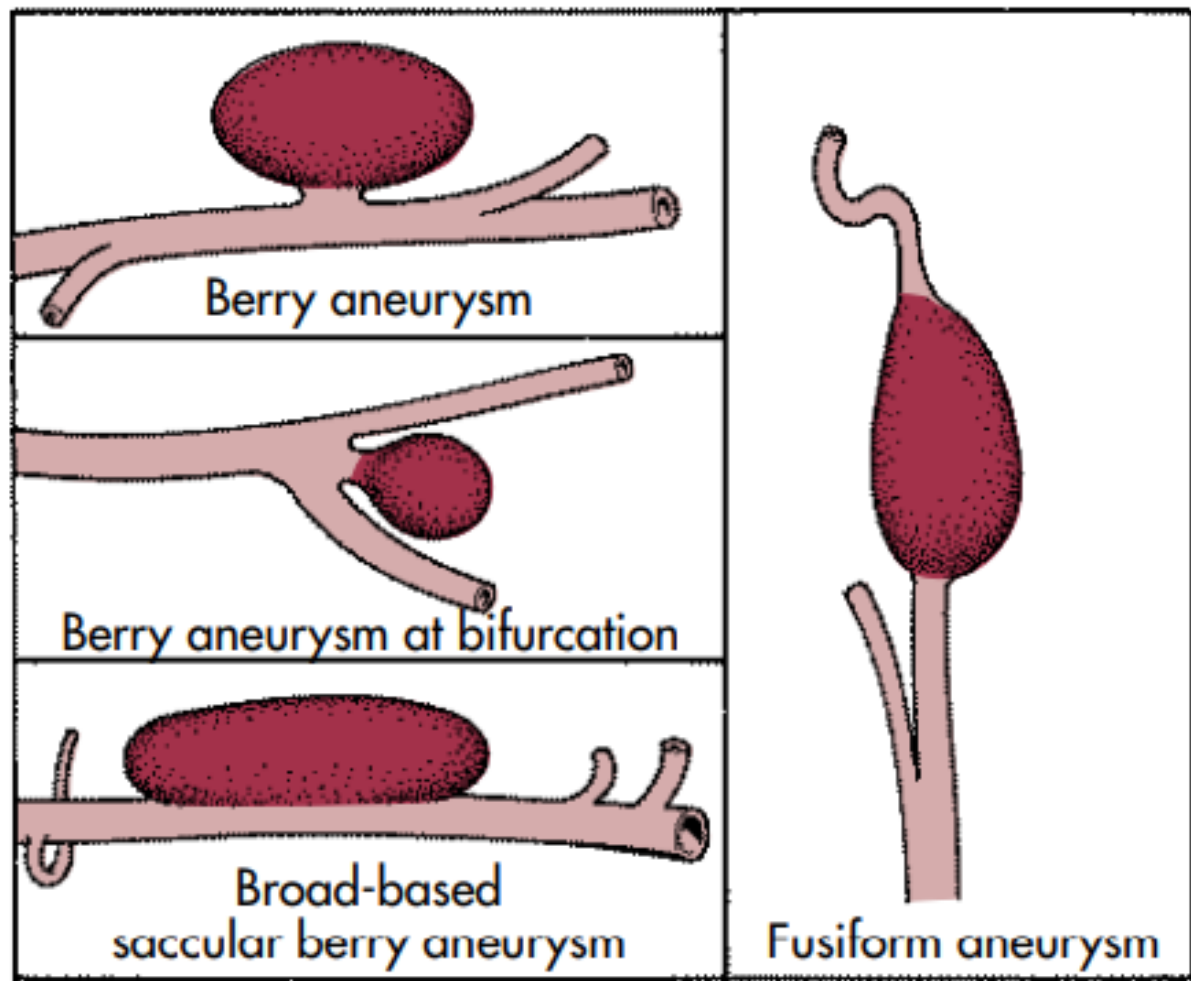
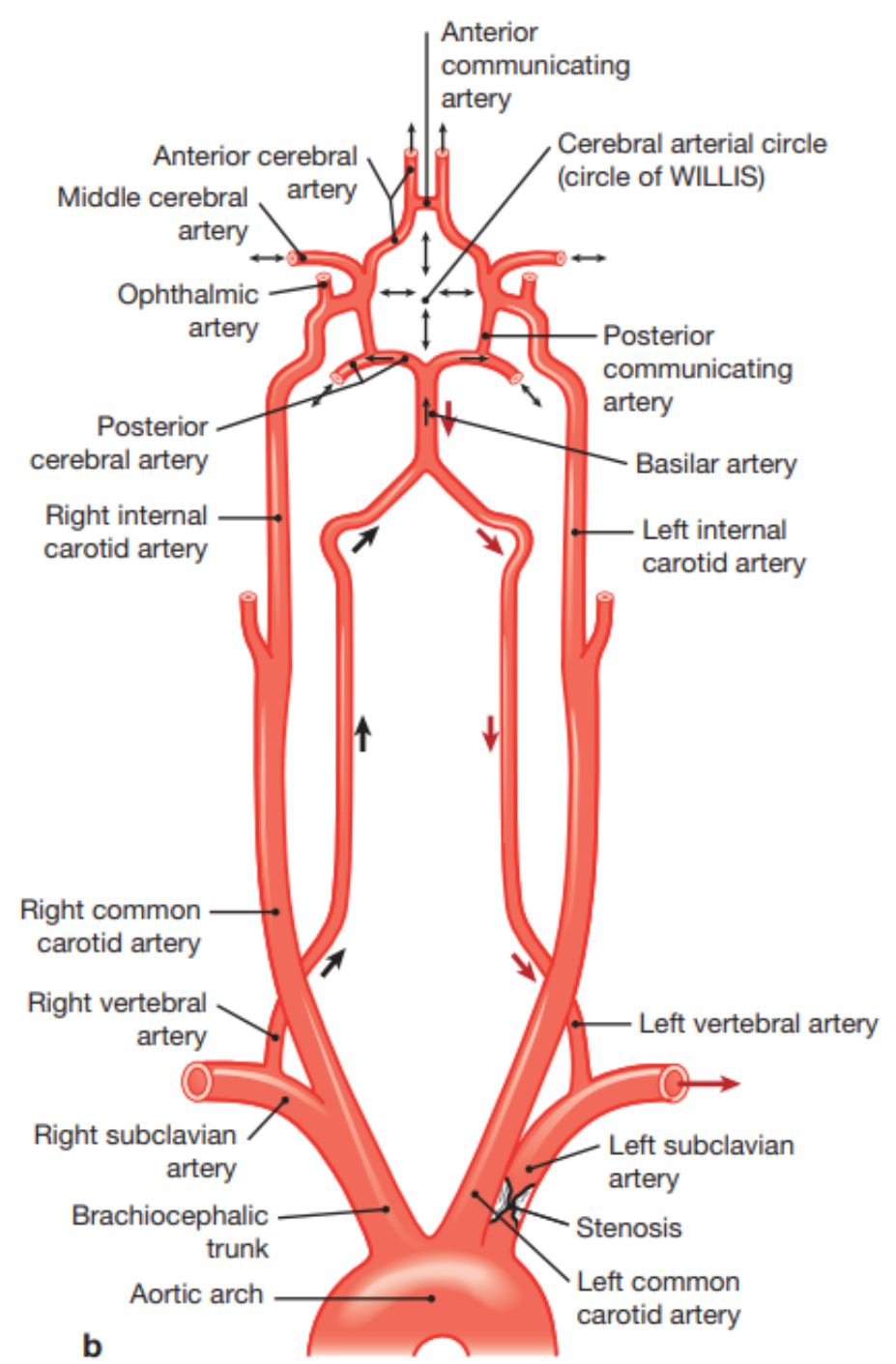
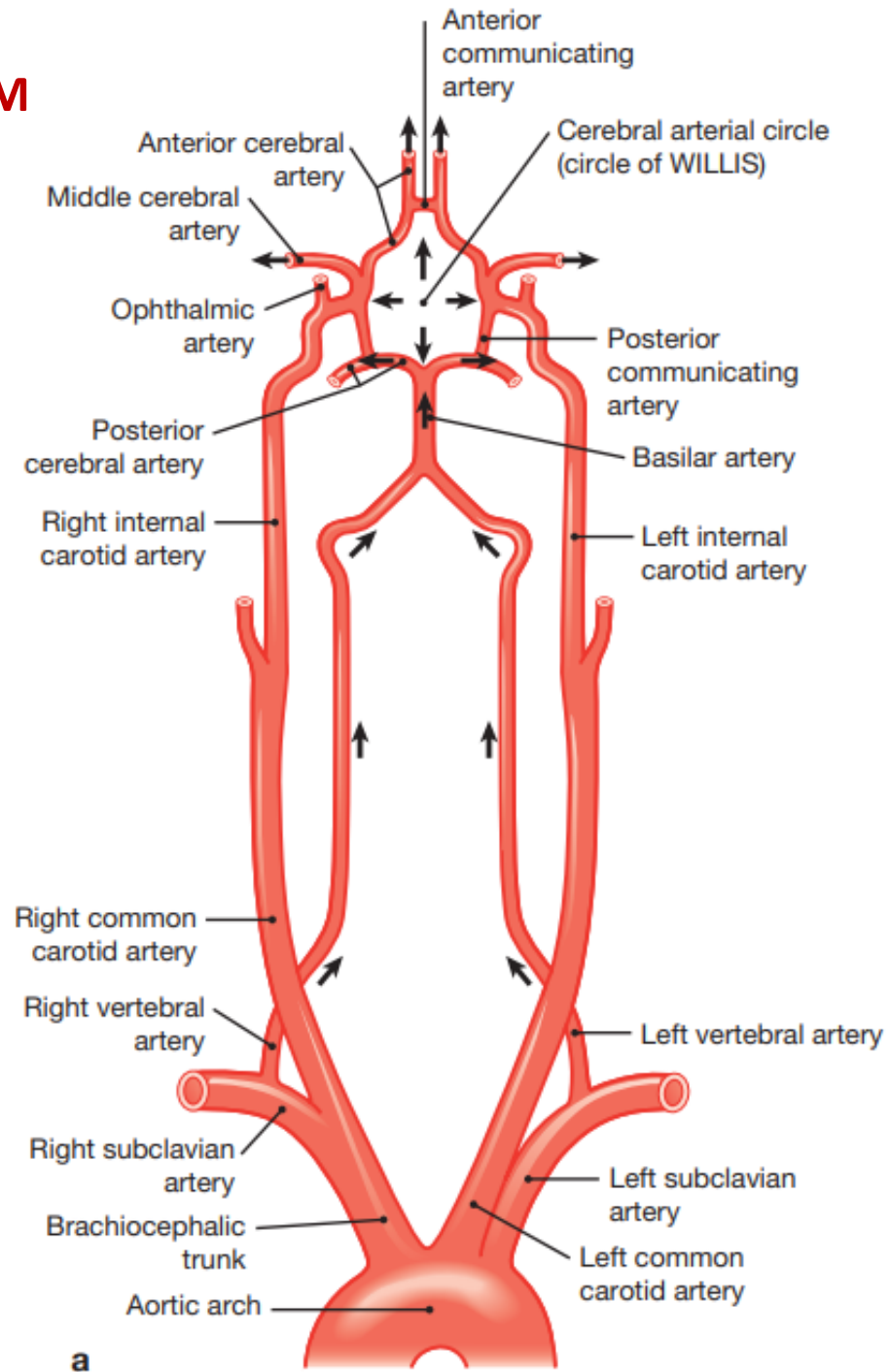


FIGURE 18-18 Types of Aneurysms.



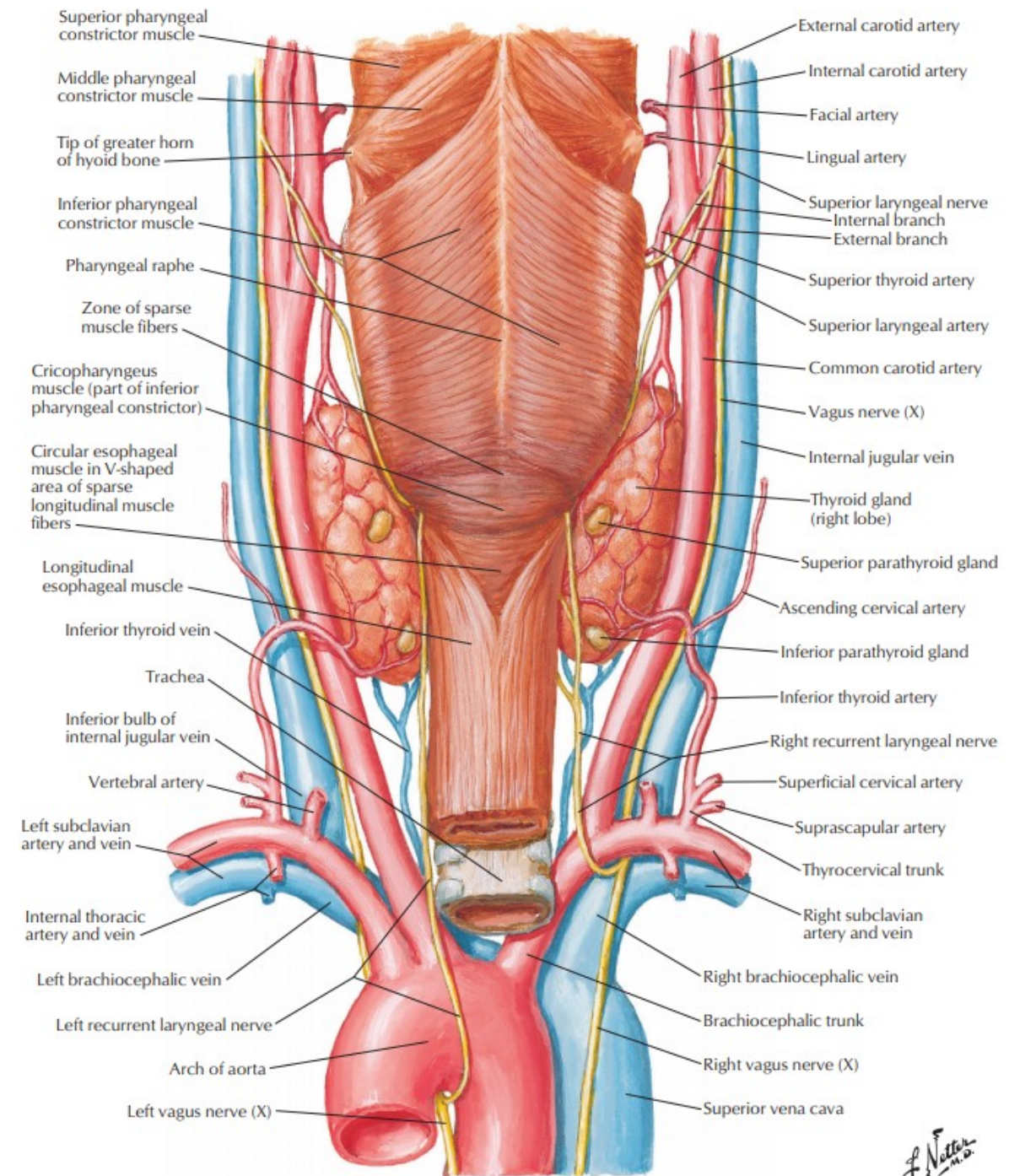
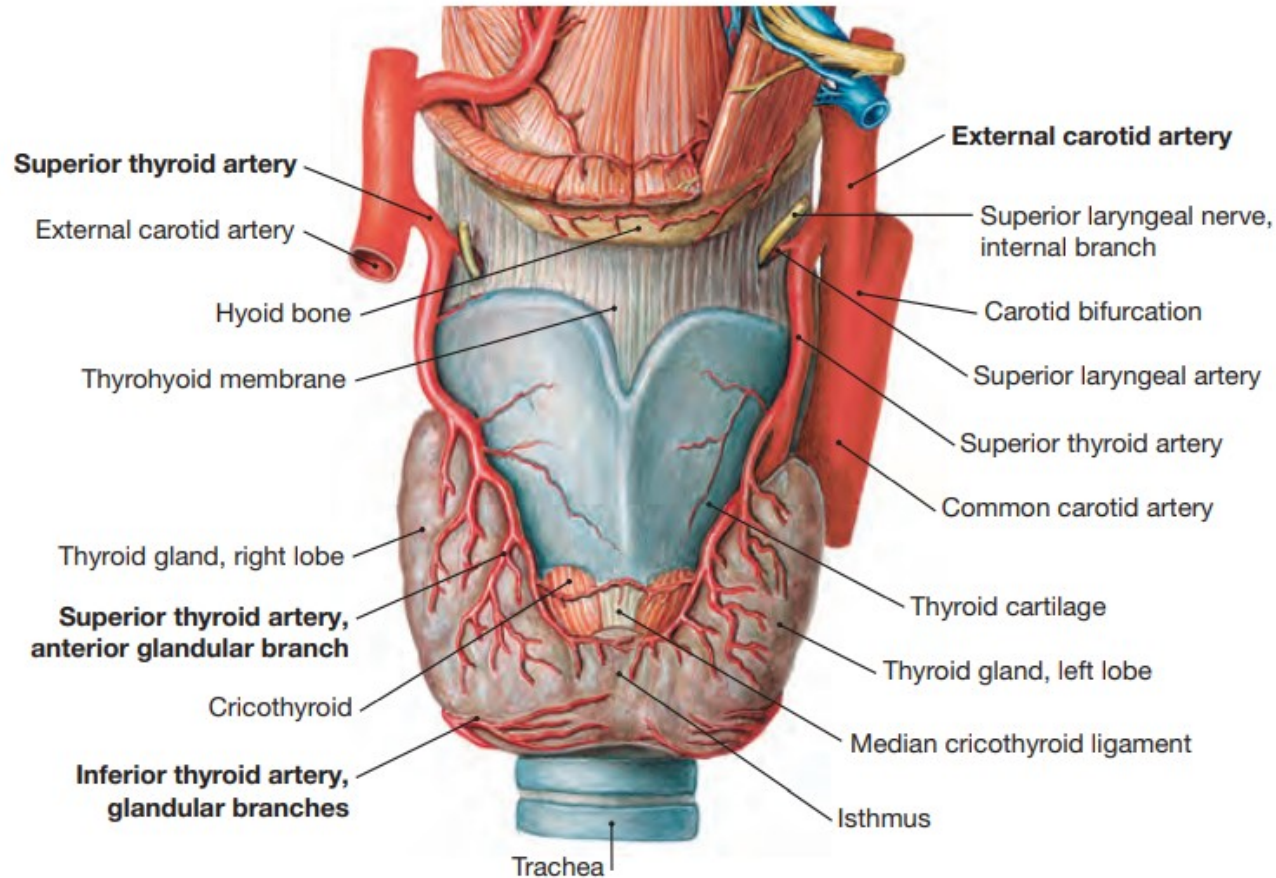
FIGURE 18-19 Berry Aneurysm, Angiogram. In this lateral view with contrast filling a portion of the cerebral arterial circulation can be seen a berry aneurysm (*arrow*) involving the middle cerebral artery of the circle of Willis at the base of the brain. (From Klatt EC: *Robbins and Cotran atlas of pathology*, Philadelphia, 2006, Saunders.)

SUBCLAVIAN STEAL SYNDROME



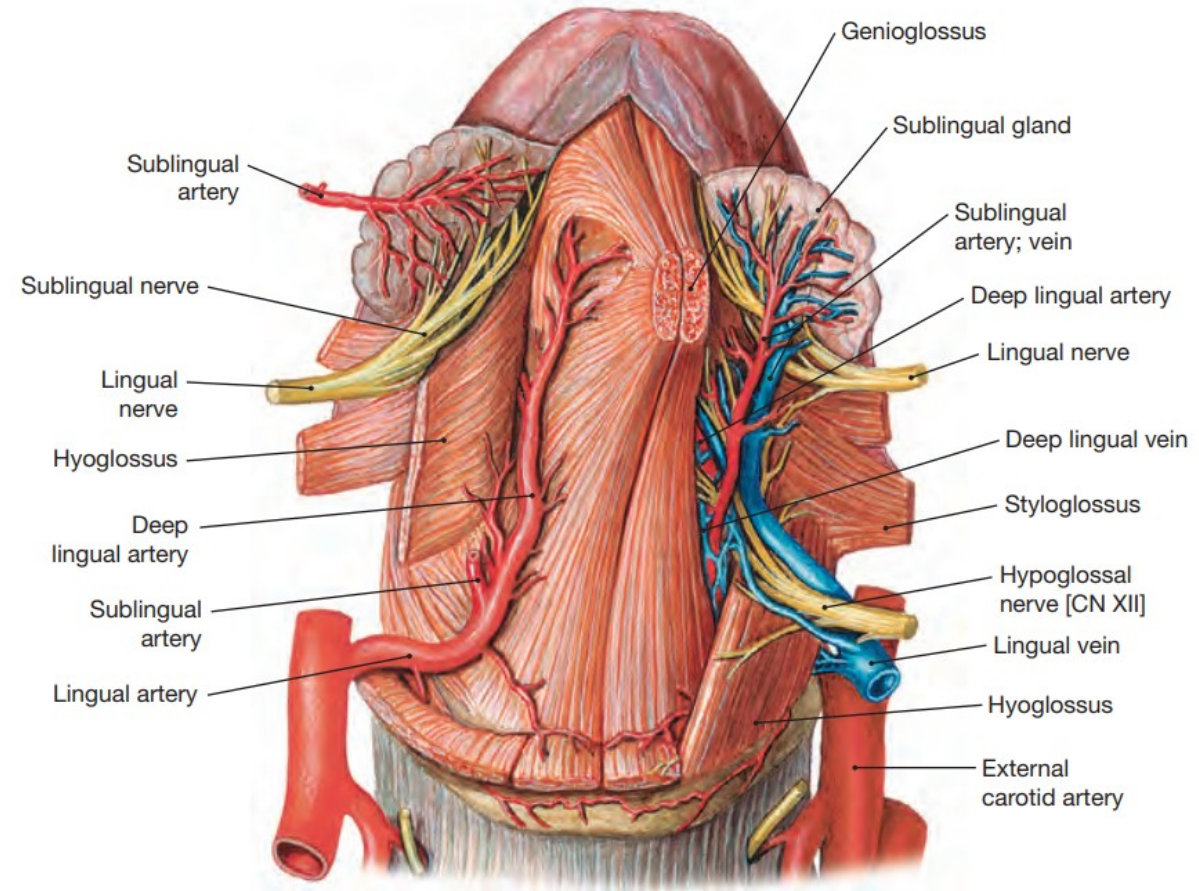
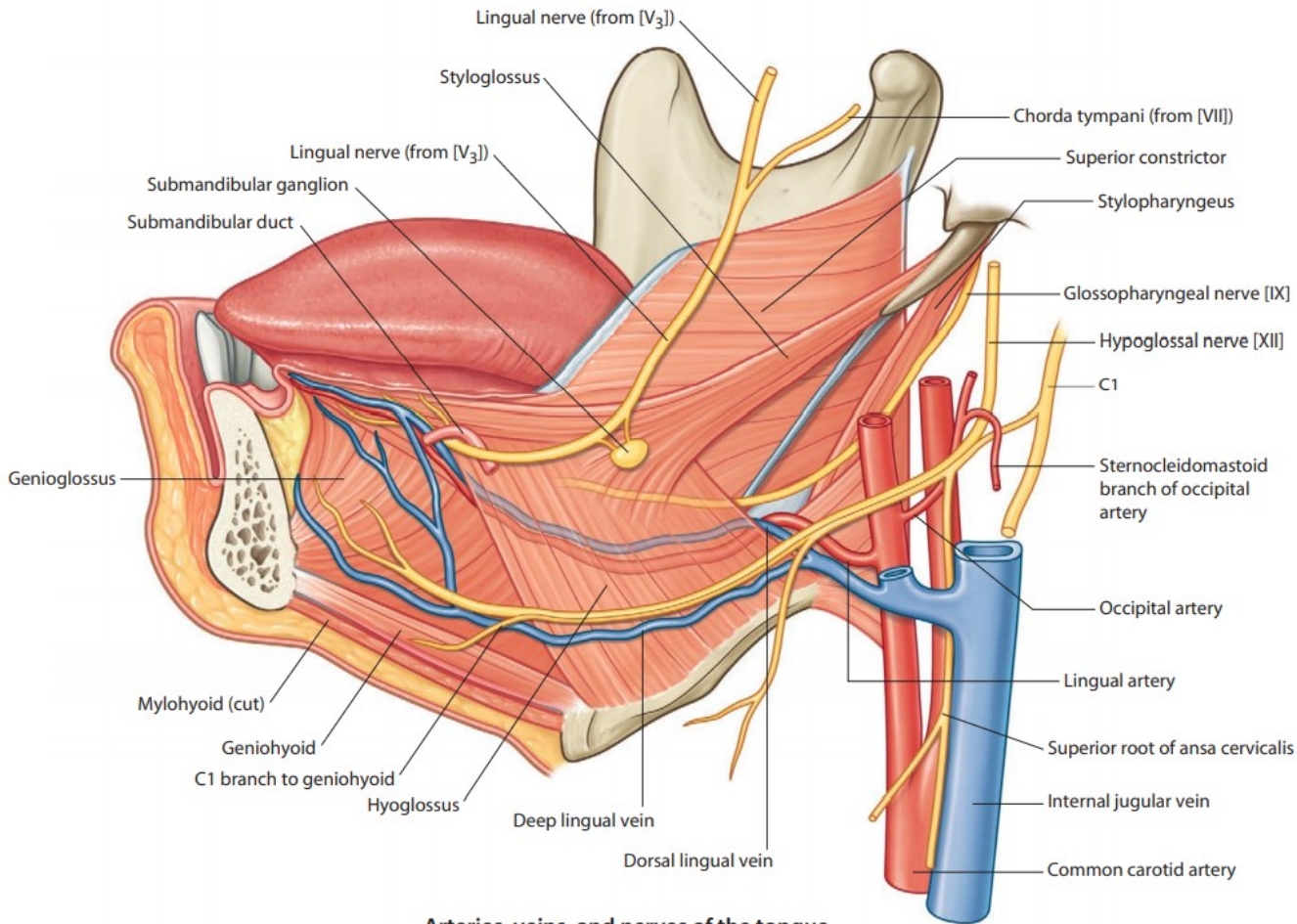
SUPERIOR THYROID ARTERY

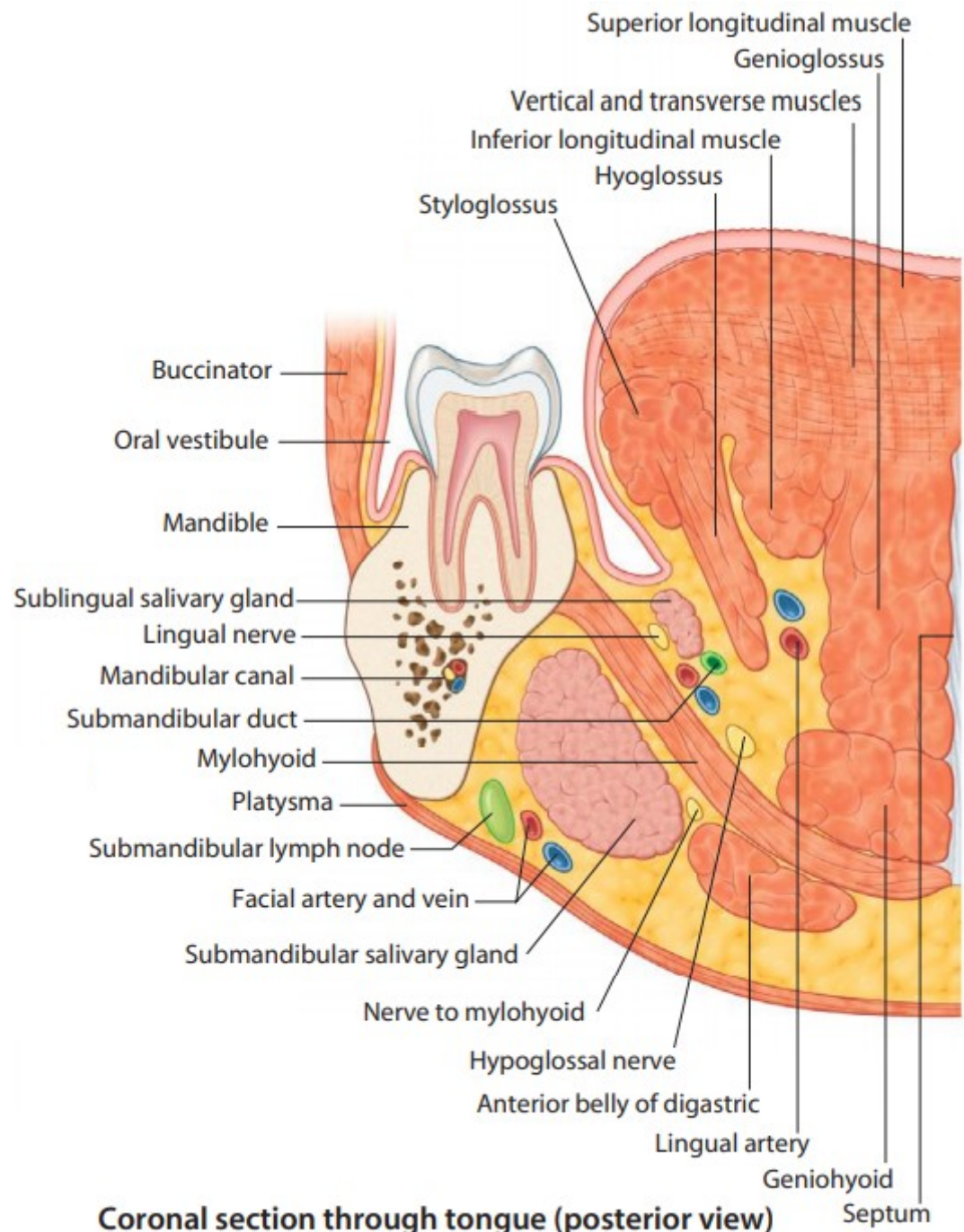
- *Superior laryngeal artery*
- *Cricothyroid artery*
- *Infrahyoid branch*
- *Sternocleidomastoid branch*
- *Glandular branches (anterior, lateral and posterior)*



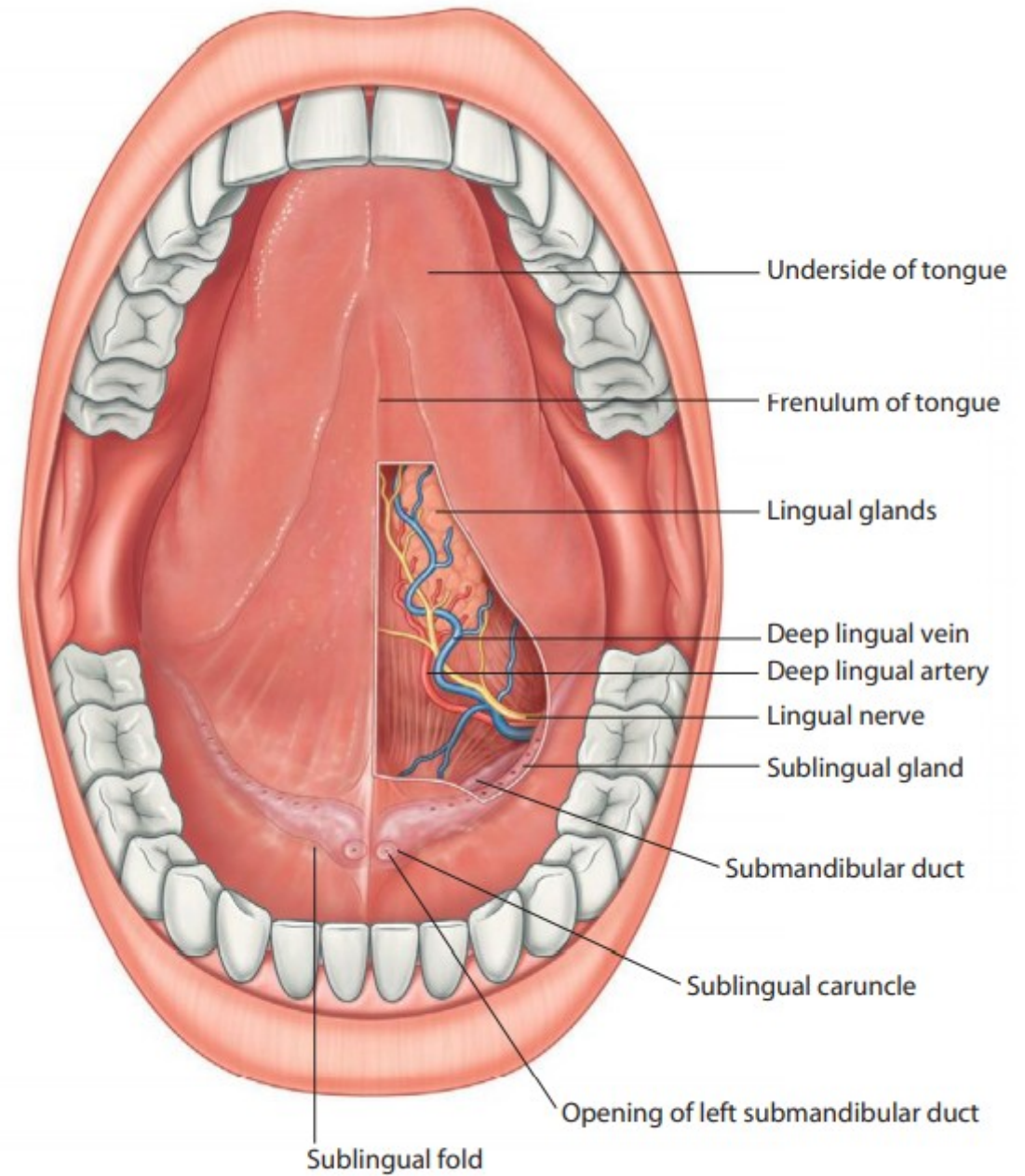
LINGUAL ARTERY

- *Suprahyoid branch*
- *Sublingual artery*
- *Dorsal lingual branches*
- *Deep lingual artery*





Coronal section through tongue (posterior view)



Inferior surface of tongue and floor of oral cavity

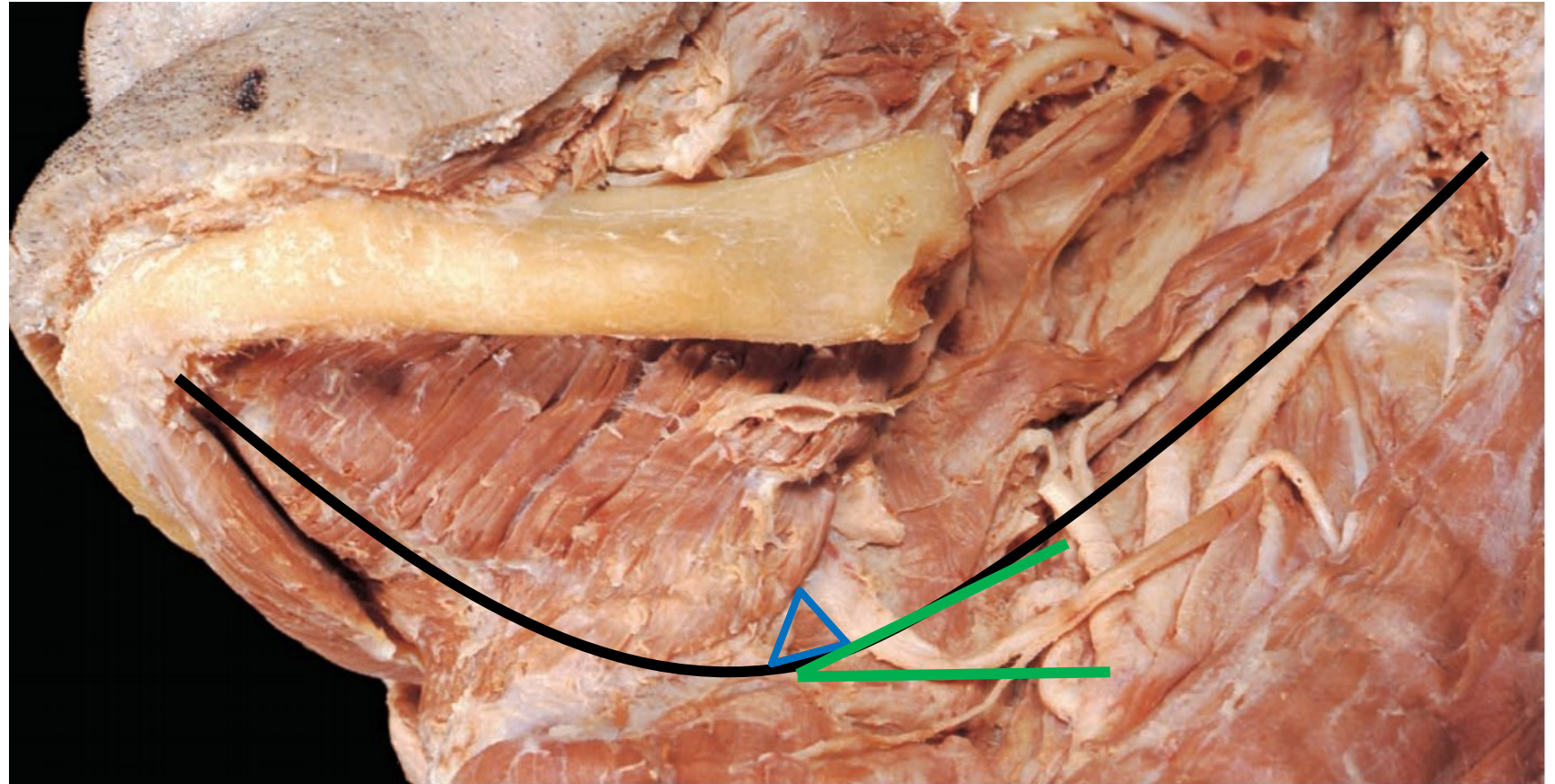
THE LINGUAL ARTERY LIGATION

1. The Béclard's angle

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

2. The Pirogov triangle

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



BEHCET'S DISEASE

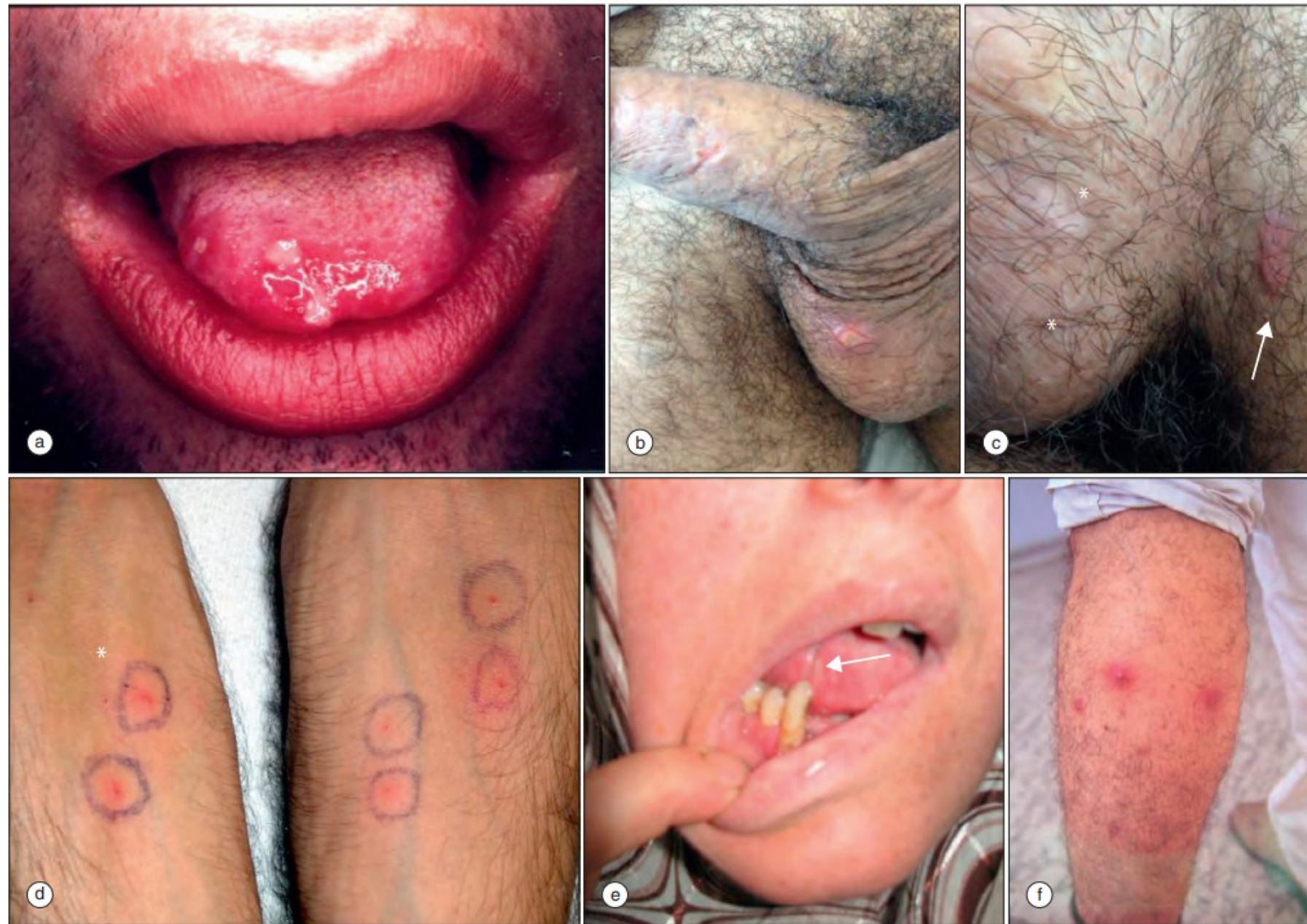
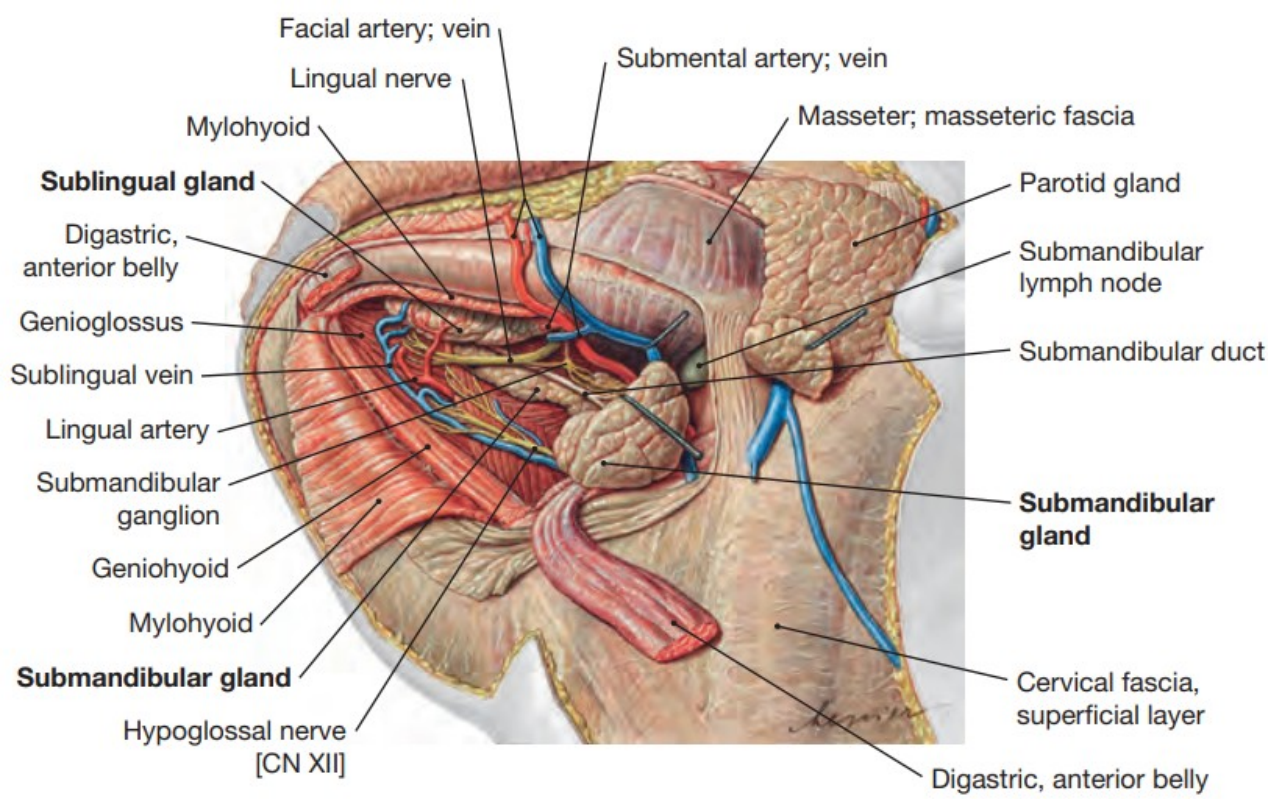
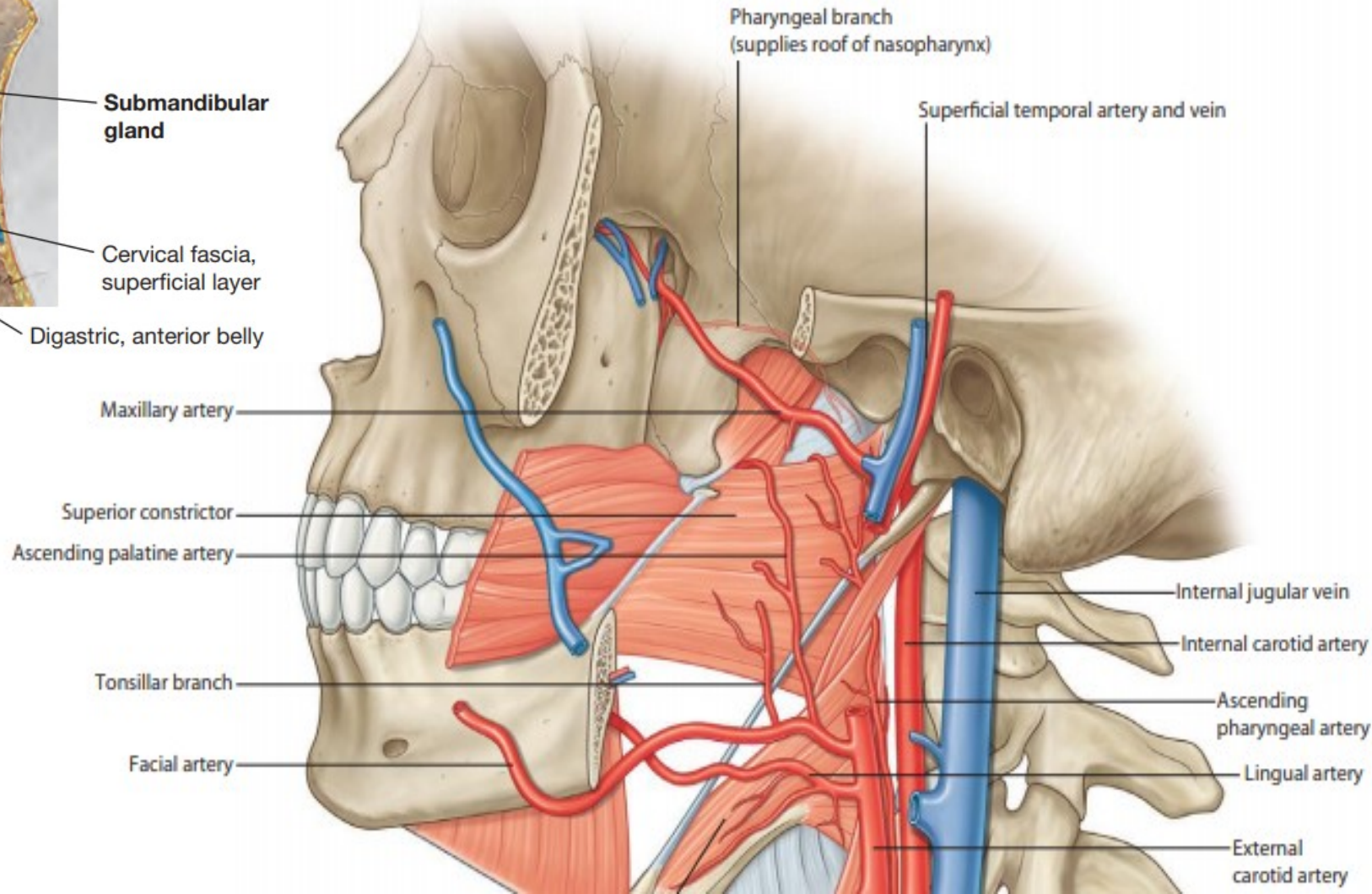


FIG. 167.1 Mucocutaneous manifestations of Behçet disease. **(a)** Oral aphthous ulcers. **(b)** Genital ulcers in the scrotum and skin of the shaft of the penis. **(c)** Ulcers in the groin (*arrow*) and scars of previous ulcers in the scrotum (*asterisks*). **(d)** Skin pathergy response in the forearm as erythematous pustule (*asterisk*) or papule at the needle prick sites at 48 hours. **(e)** Pathergic tongue ulcer (*arrow*) induced by dental trauma. **(f)** Papulopustular lesions in the calf.

FACIAL ARTERY

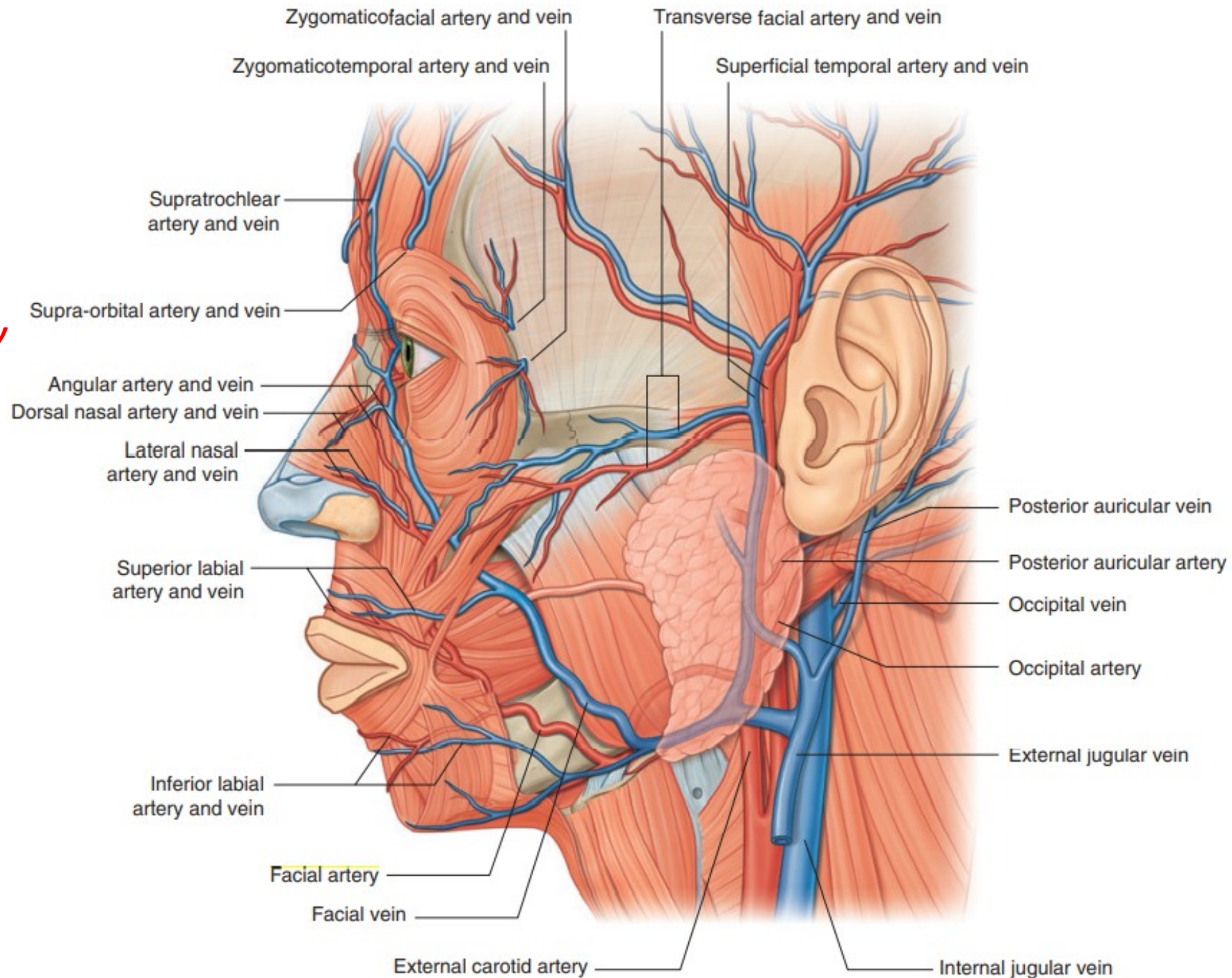


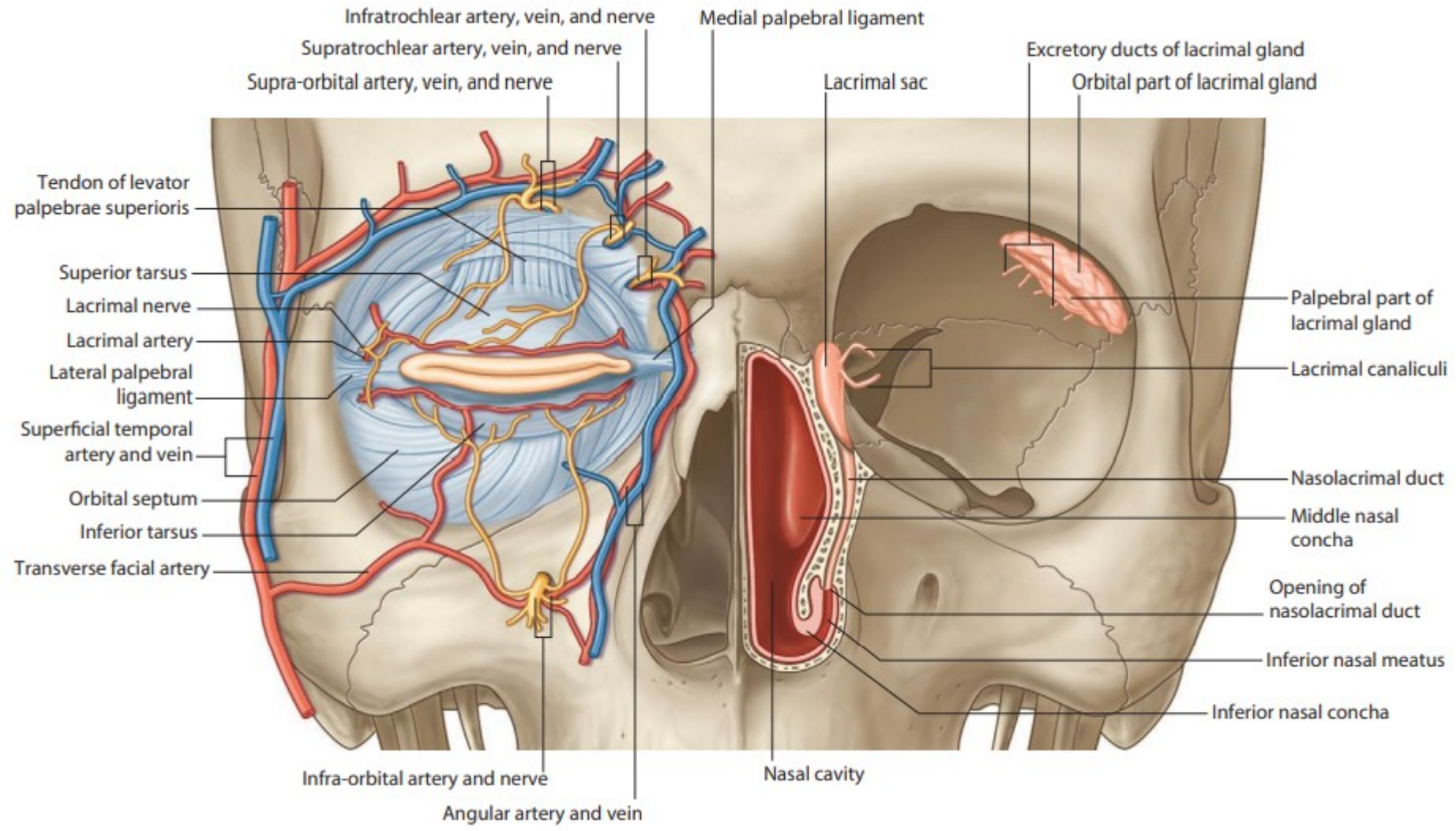
- **Ascending palatine artery**
- **Submental artery**
- **Tonsillar branch**
- **Glandular branches**
- **Superior and inferior labial artery**
- **Lateral nasal branch**
- **Angular artery**



FACIAL ARTERY

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





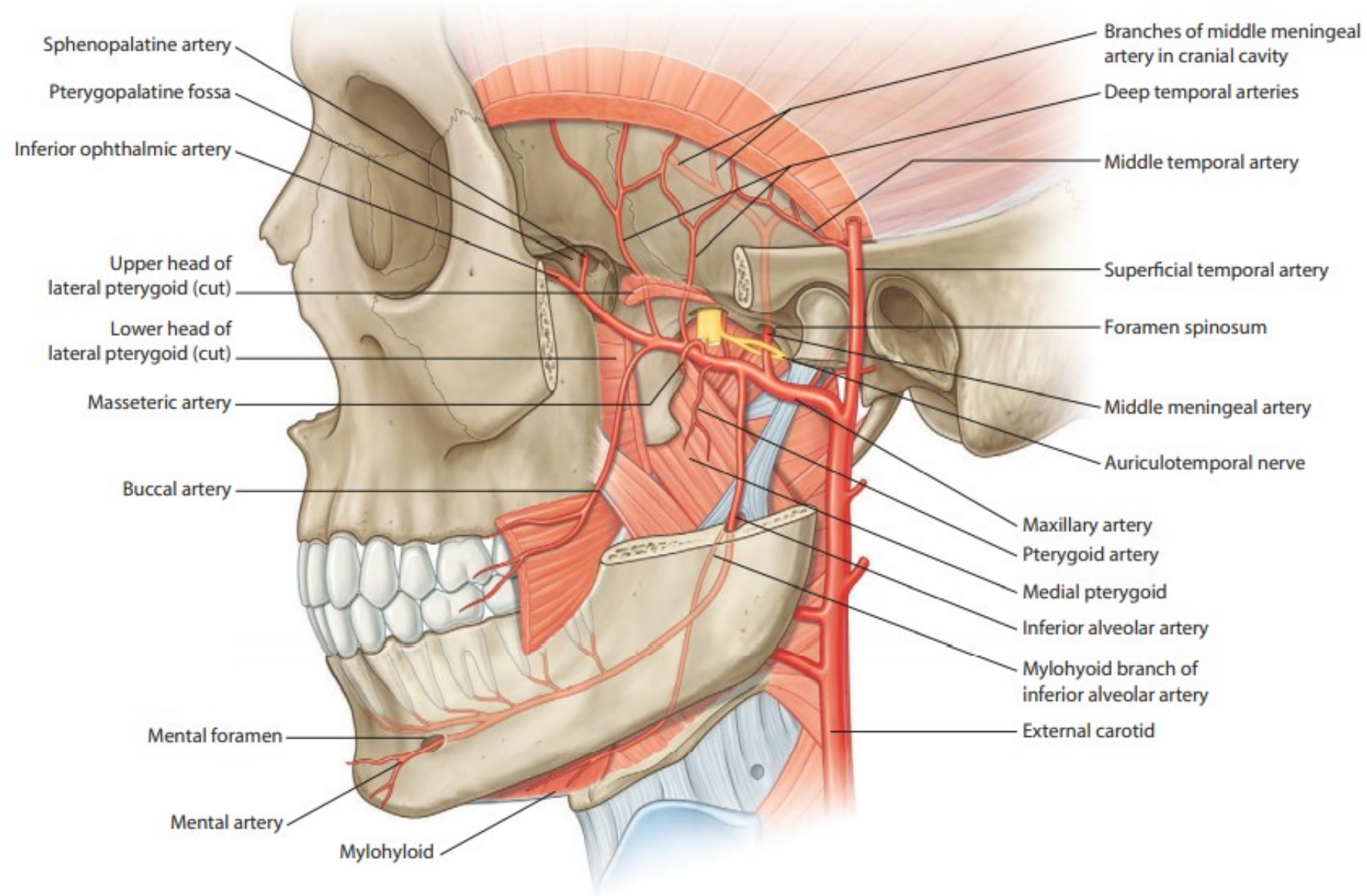
MAXILLARY ARTERY

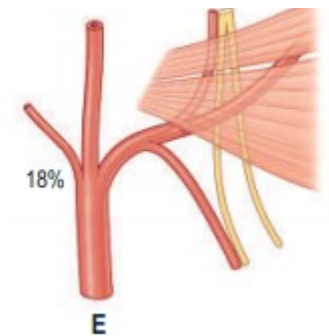
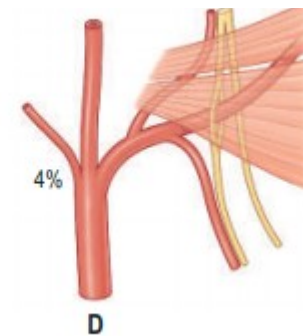
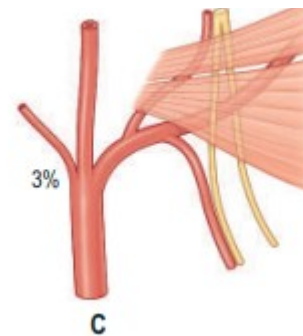
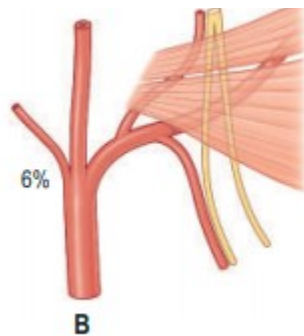
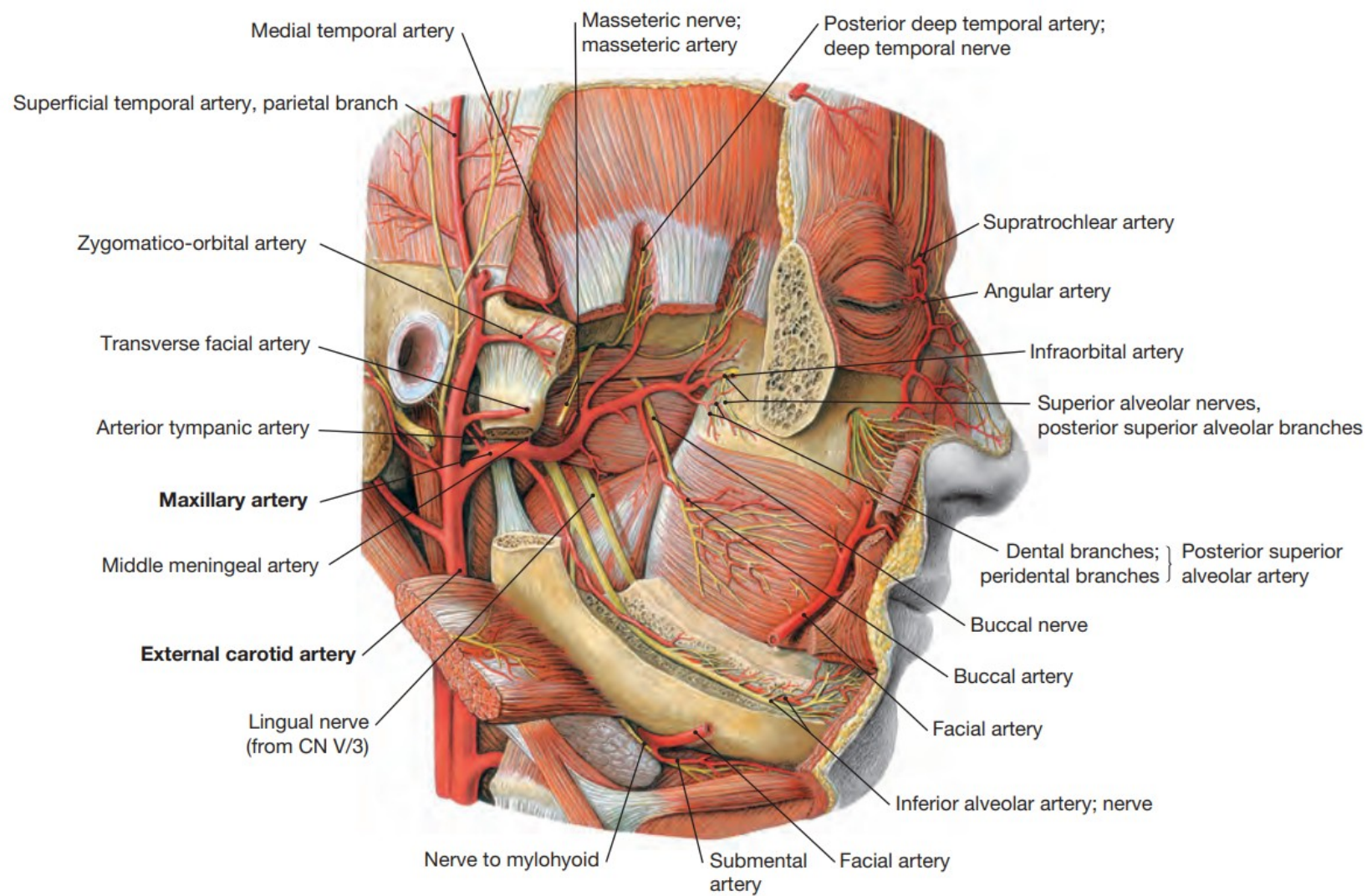
1. MANDIBULAR PORTION

- **Deep auricular artery**
- **Anterior tympanic artery**
- **Middle meningeal artery**
 - Frontal branch
 - Parietal branch
 - Orbital branch
 - Superior tympanic artery
- **Inferior alveolar artery**
 - Mylohyoid branch
 - Dental branches
 - Gingival branches
 - Mental artery

2. PTERYGOID PORTION

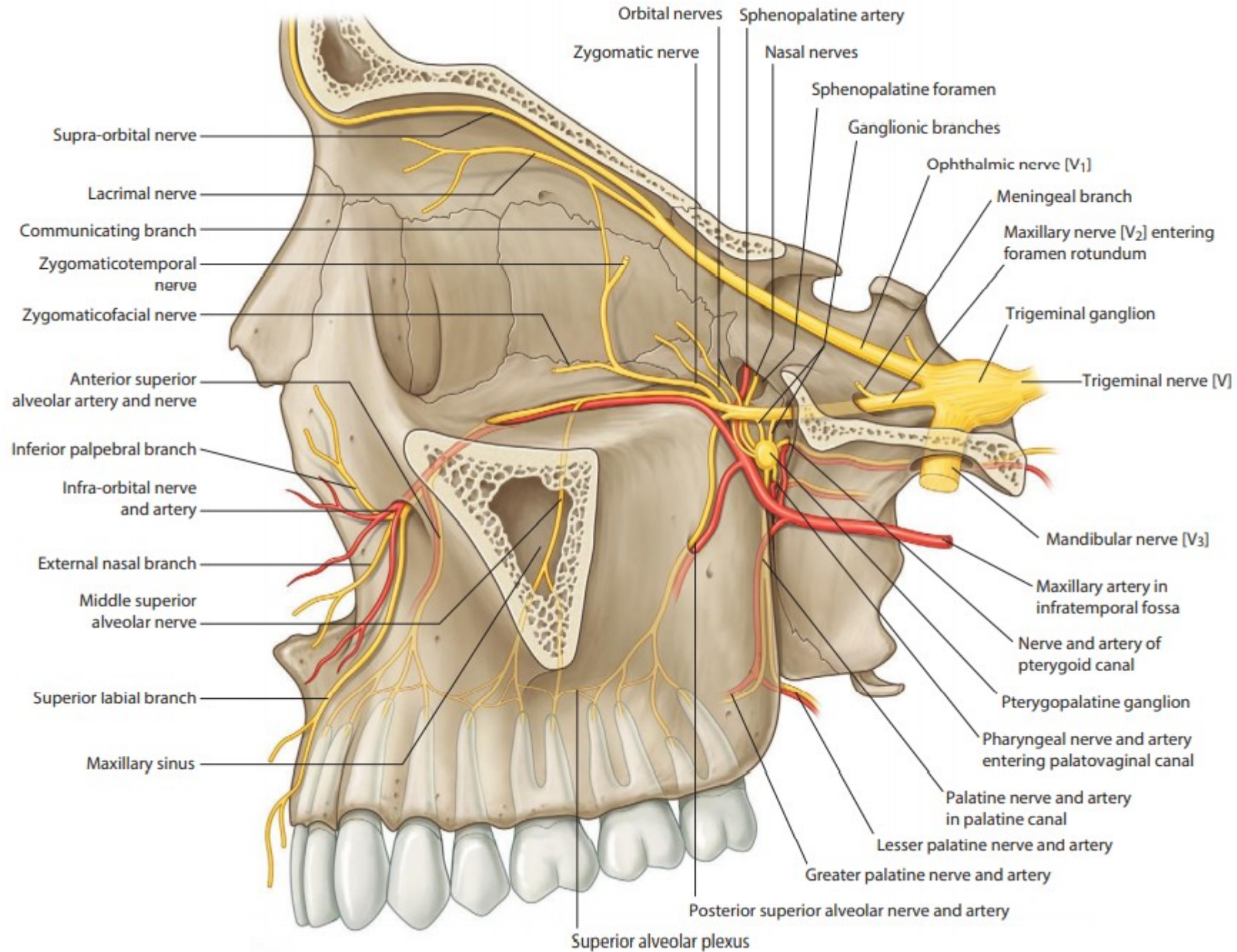
- **Masseteric artery**
- **Pterygoid arteries**
- **Deep temporal arteries**
- **Buccal artery**

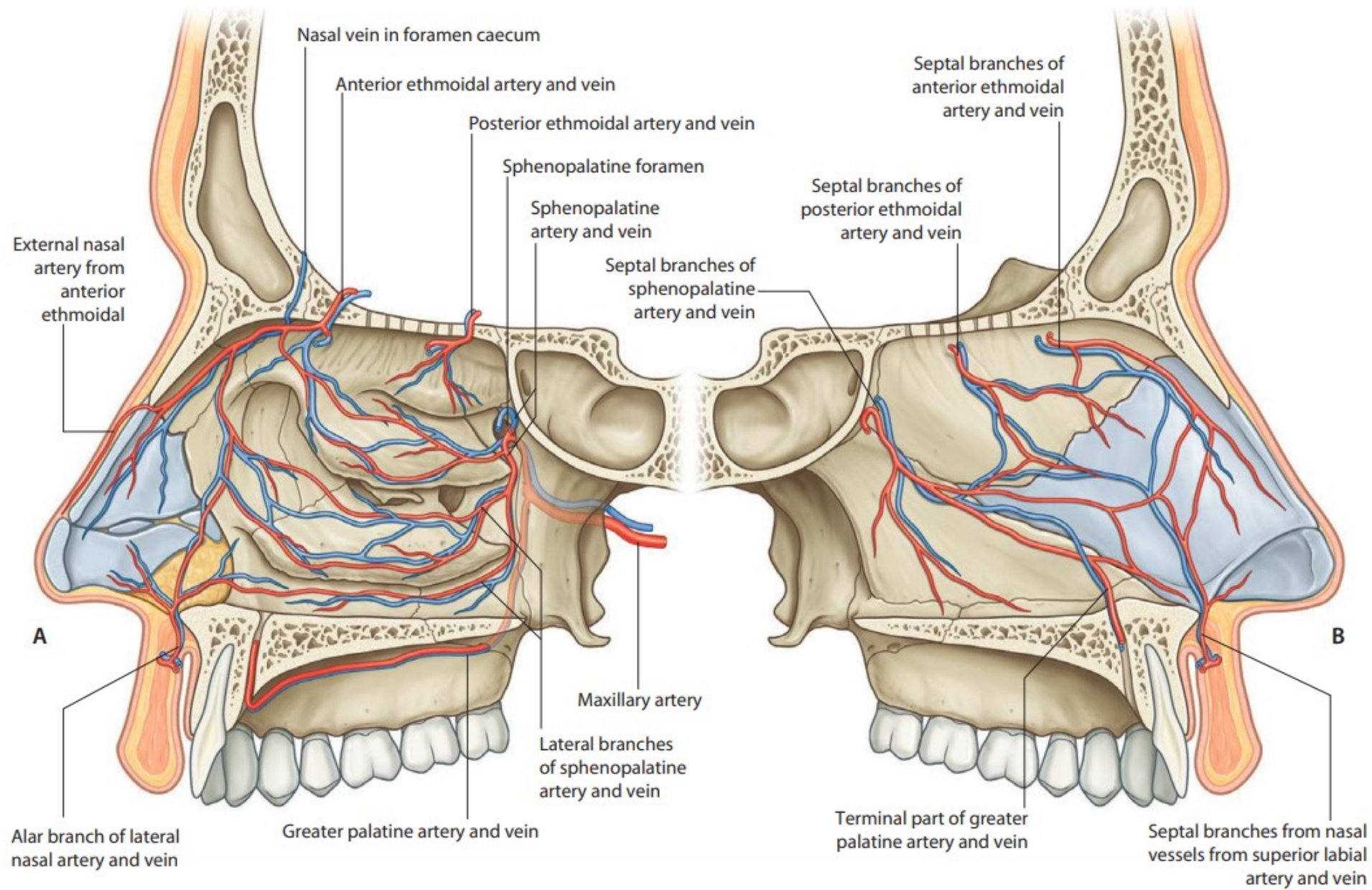




3. PTERYGOPALATINE PORTION

- **Posterior superior alveolar artery**
 - Dental branches
 - Gingival branches
- **Infraorbital artery**
 - Anterior superior alveolar arteries
 - Dental branches
 - Gingival branches
- **Artery of pterygoid canal**
- **Descending palatine artery**
 - Greater palatine artery
 - Lesser palatine arteries
- **Sphenopalatine artery**
 - Posterior lateral nasal arteries
 - Posterior septal branches
 - Nasopalatine branch



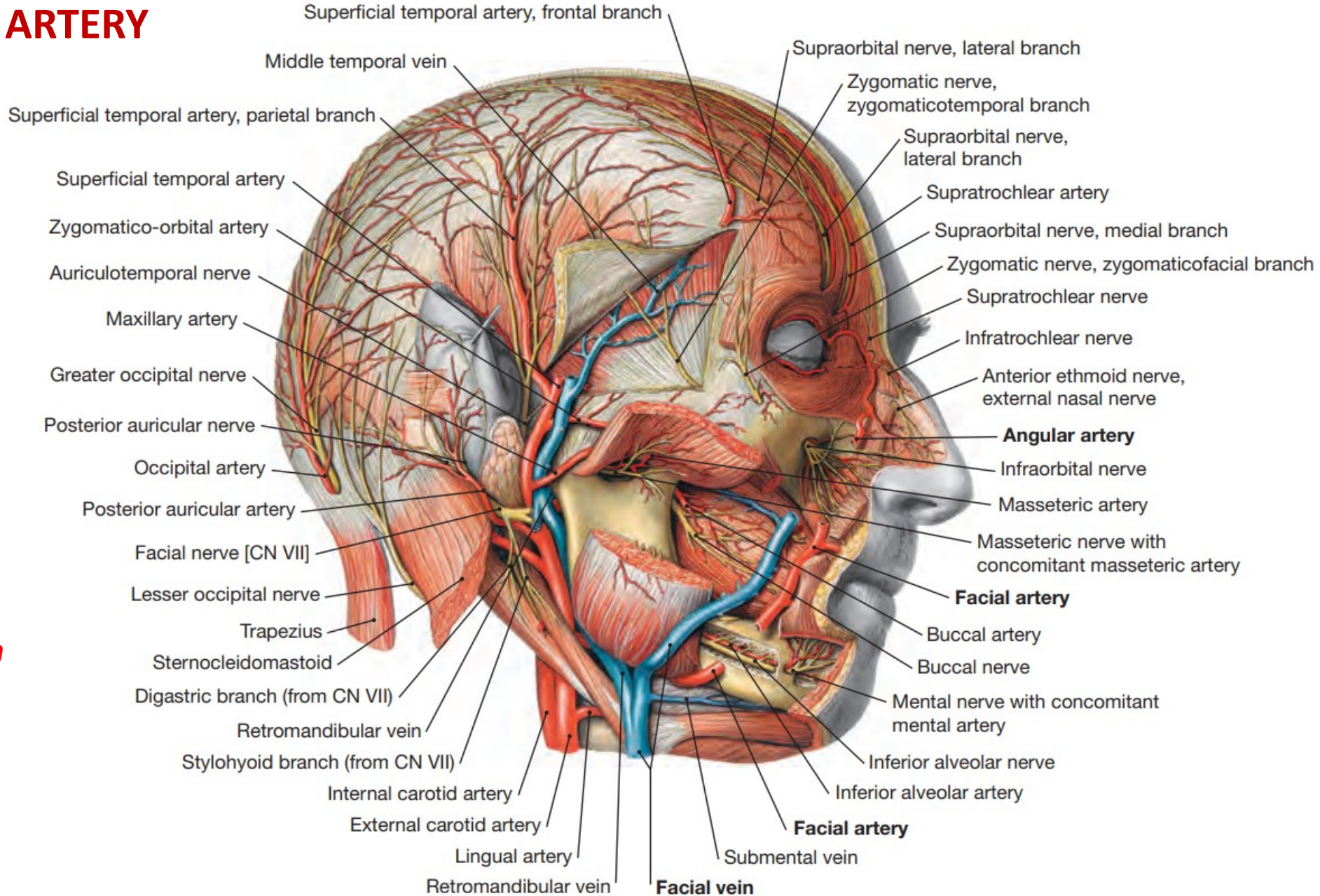


POSTERIOR AURICULAR ARTERY

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

OCCIPITAL ARTERY

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



ASCENDING PHARYNGEAL ARTERY

- *Pharyngeal branches*
- *Posterior meningeal artery*
- *Inferior tympanic artery*

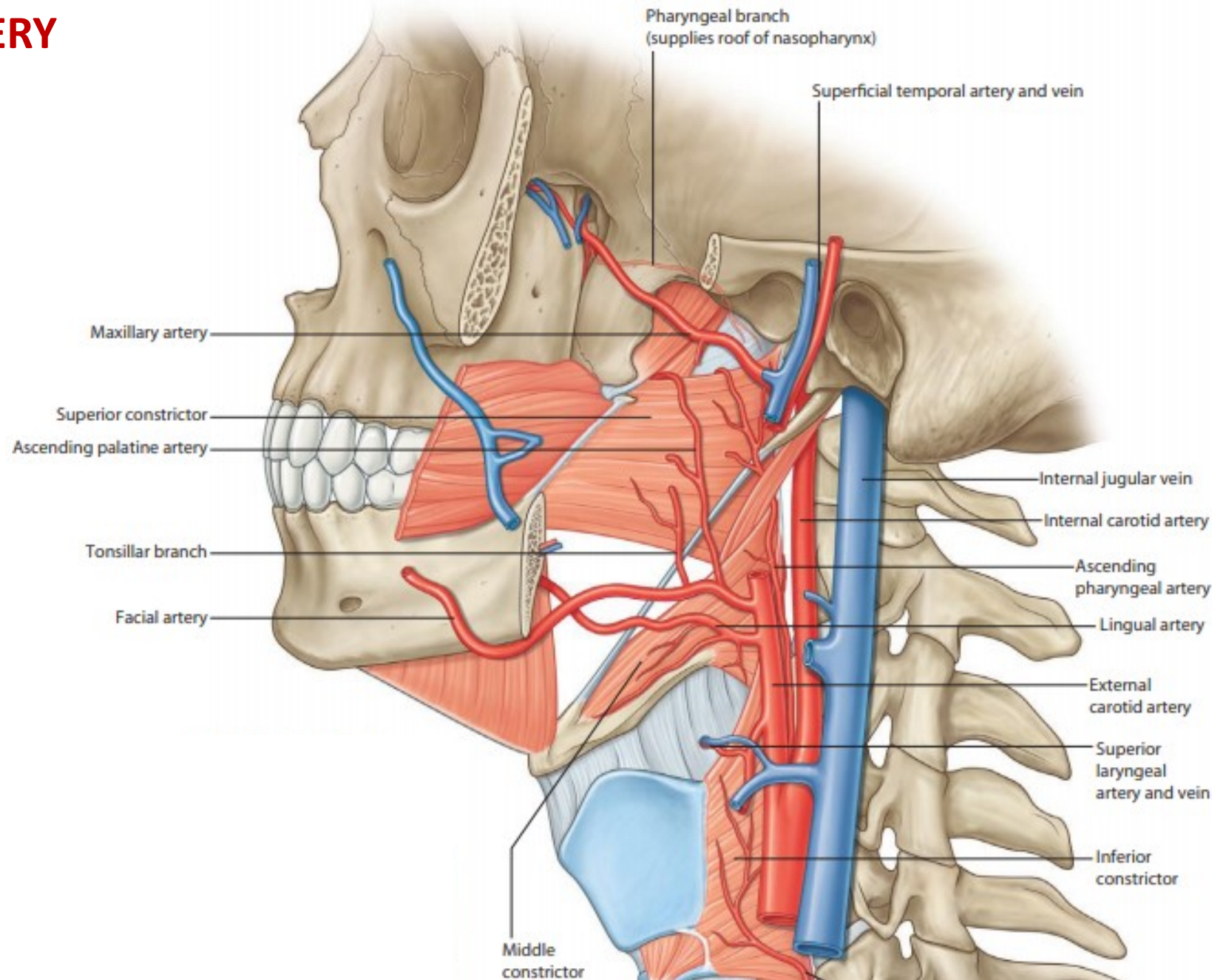
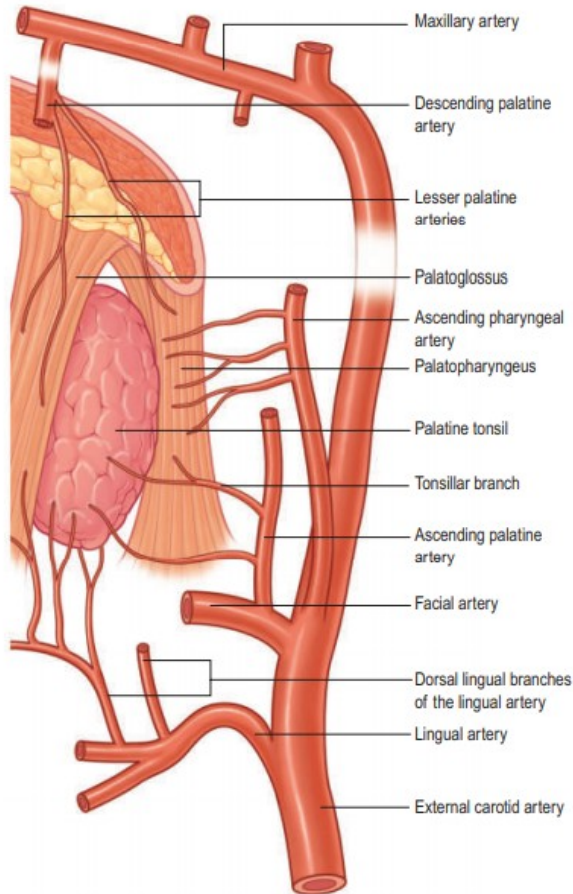
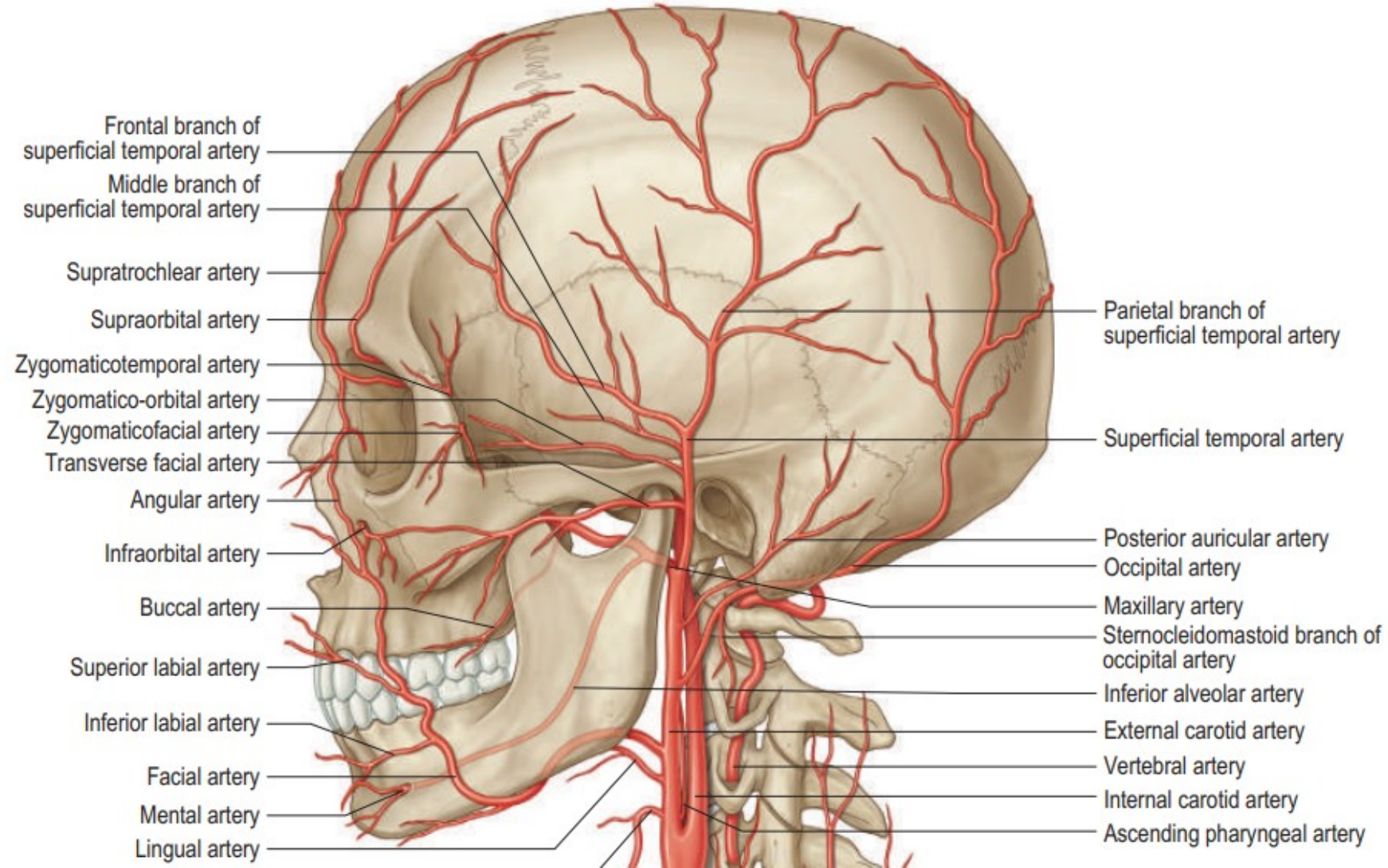


Fig. 34.7 The arterial supply to the palatine tonsil.

SUPERFICIAL TEMPORAL ARTERY

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



TEMPORAL ARTERITIS



Fig. 4.28 Prominent temporal artery in arteritis temporalis (giant-cell arteritis, arteritis temporalis Horton).

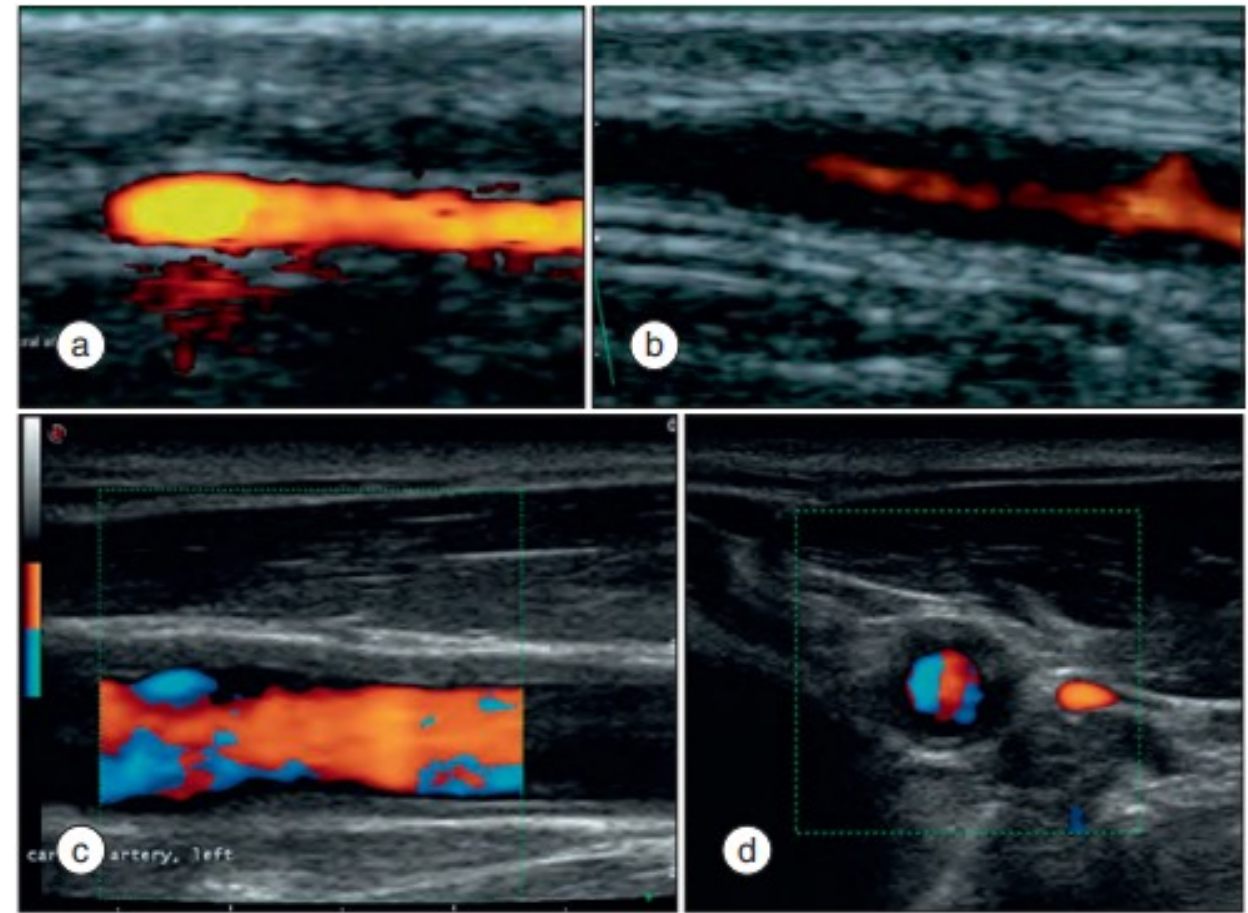


FIG. 48.12 Temporal arteritis and large-vessel giant cell arteritis. **(a)** Normal temporal artery after temporal artery biopsy. The artery lumen is patent with no stenosis, and the vessel wall is hyperechoic and of normal thickness (confirmed on histologic analysis). **(b)** Temporal arteritis. The artery shows a narrowed lumen and thickened hypoechoic arterial wall. **(c)** Arteritis of the carotid artery. A skip lesion is seen on longitudinal view with hypoechoic arterial wall thickening. **(d)** Transverse view of the carotid artery showing the halo sign, a circumferential hypoechoic thickening of the arterial wall.

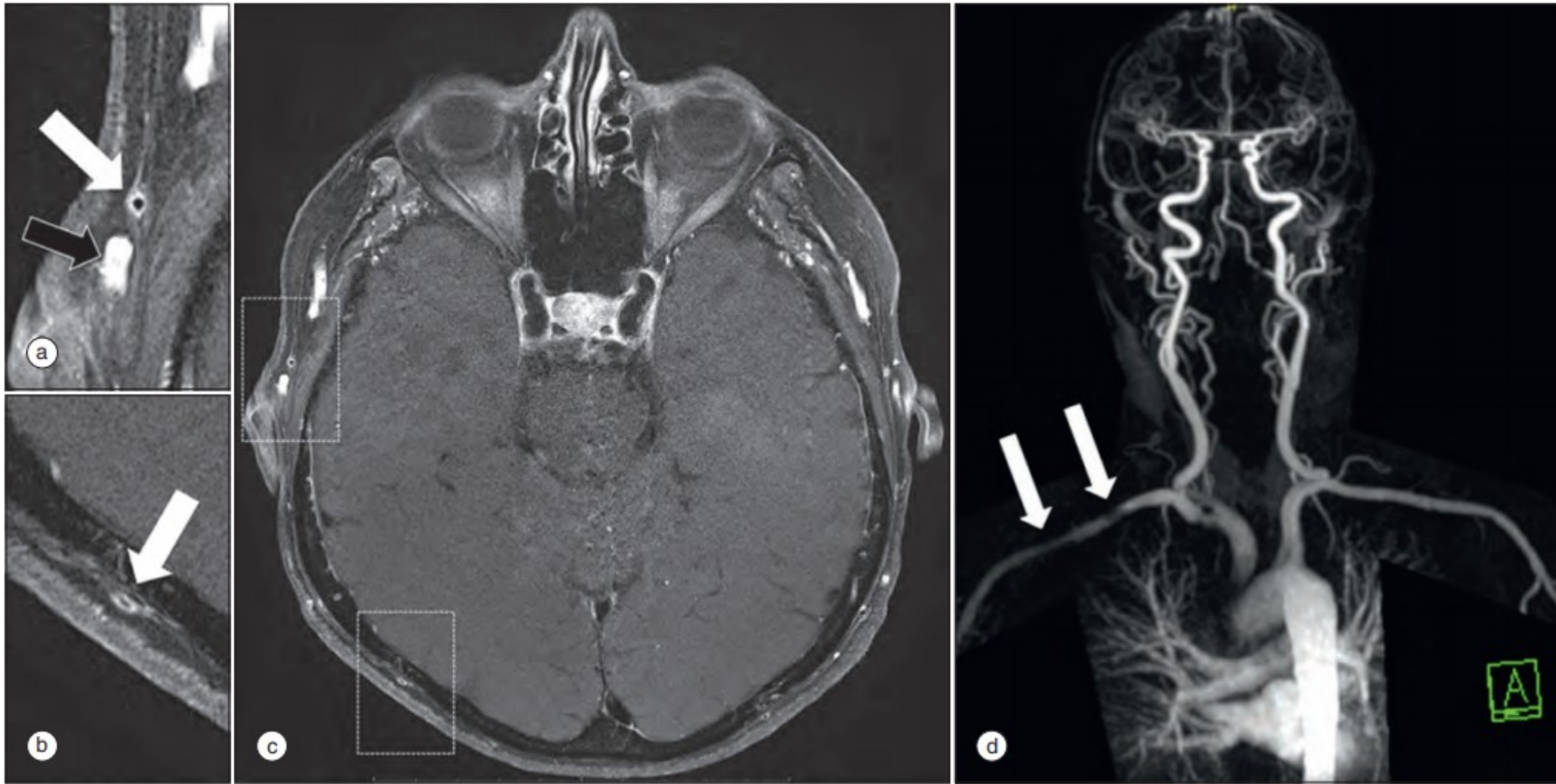
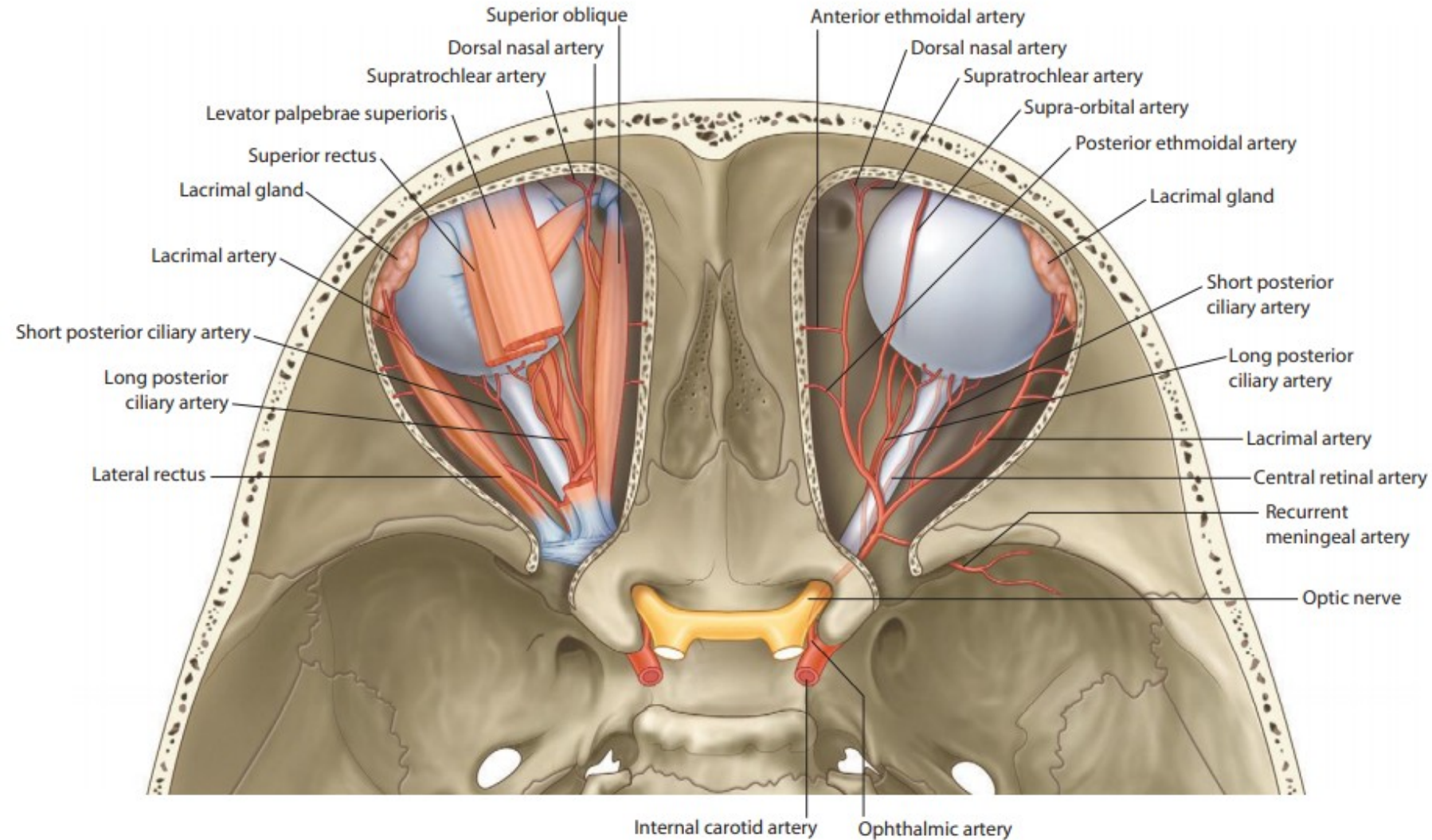


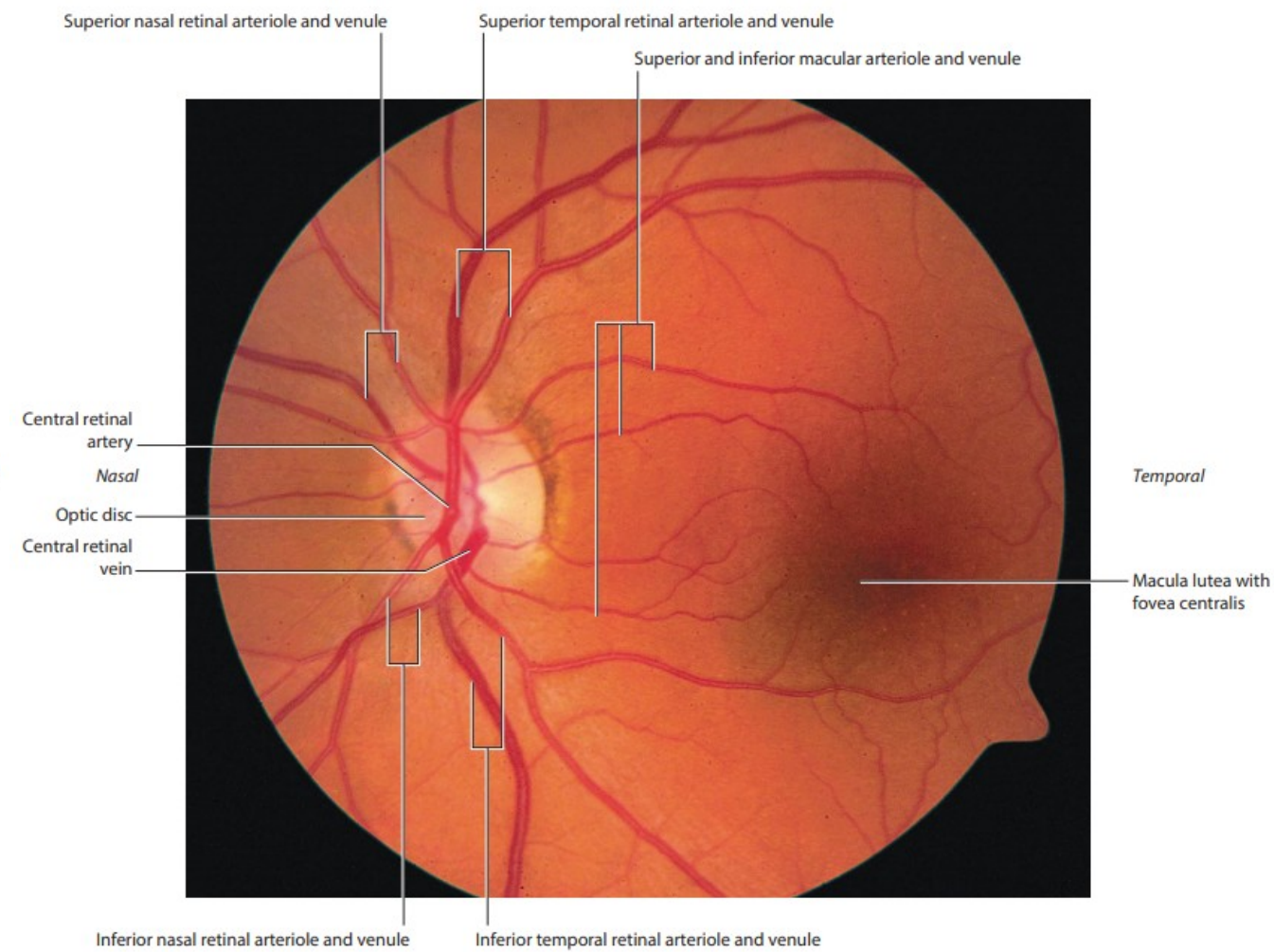
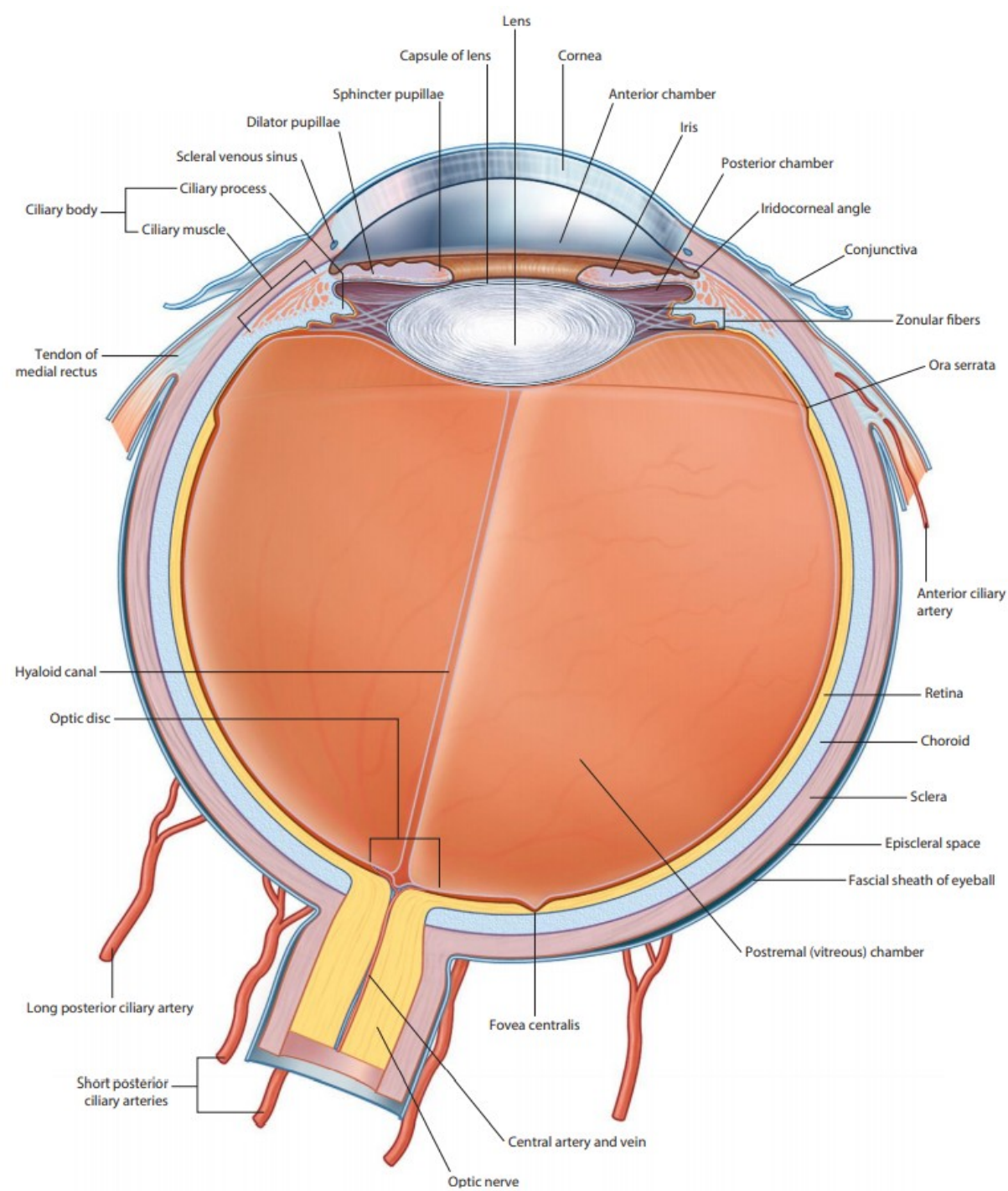
FIG. 166.5 High-resolution cranial magnetic resonance imaging of a 72-year-old woman with giant cell arteritis (GCA) readily reveals inflammatory mural thickening and contrast enhancement of the right superficial temporal artery (*white arrow* in enlargement in **a**) and right superficial occipital artery (*white arrow* in enlargement in **b**). Please note missing signal within the artery's lumen because of high arterial flow, the so-called flow void phenomenon. Because of its slower venous flow, the concomitant right superficial temporal vein (*dark arrow* in enlargement **a**) displays homogeneous contrast and no flow void phenomenon. By depicting the entire cranial circumference, the superficial temporal and occipital arteries and their branches can be assessed within one single scan (**c**). (**d**) Magnetic resonance angiography of the supraaortic arteries in the same patient as in the previous image displays segmental inflammatory stenoses of the right subclavian artery. (*a–d*, Courtesy of Dr. T.A. Bley, Universität Würzburg, Germany.)

BLOOD VESSELS OF THE ORBIT

Ophthalmic artery

- ***Central retinal artery***
- ***Lacrimal artery***
 - *Anterior ciliary arteries*
 - *Lateral palpebral arteries*
- ***Short posterior ciliary arteries***
- ***Long posterior ciliary arteries***
- ***Anterior ciliary arteries***
- ***Muscular arteries***
- ***Supraorbital artery***
- ***Posterior ethmoidal artery***
- ***Anterior ethmoidal artery***
 - *Anterior meningeal branch*
- ***Medial palpebral arteries***
- ***Supratrochlear artery***
- ***Dorsal nasal artery***





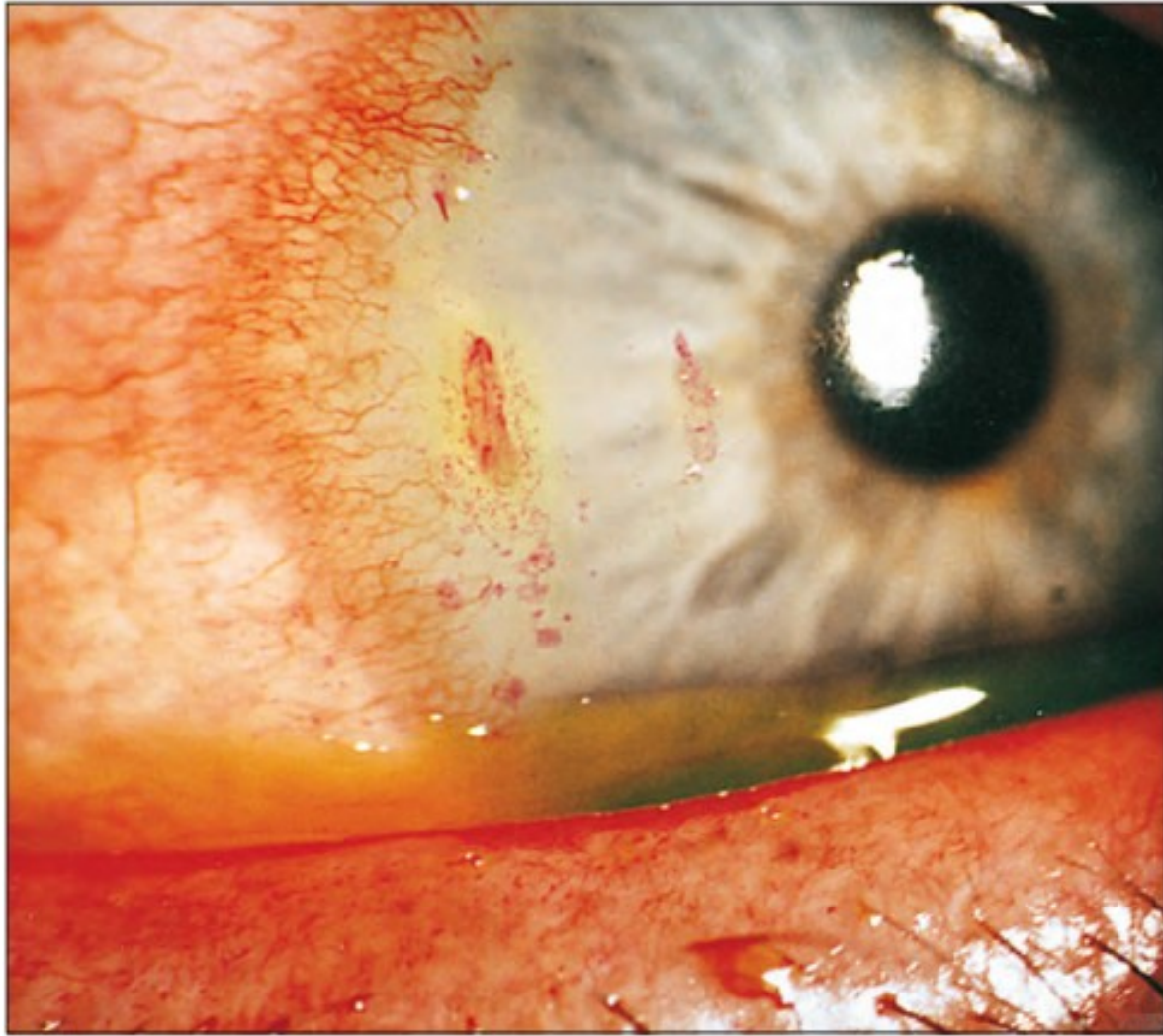


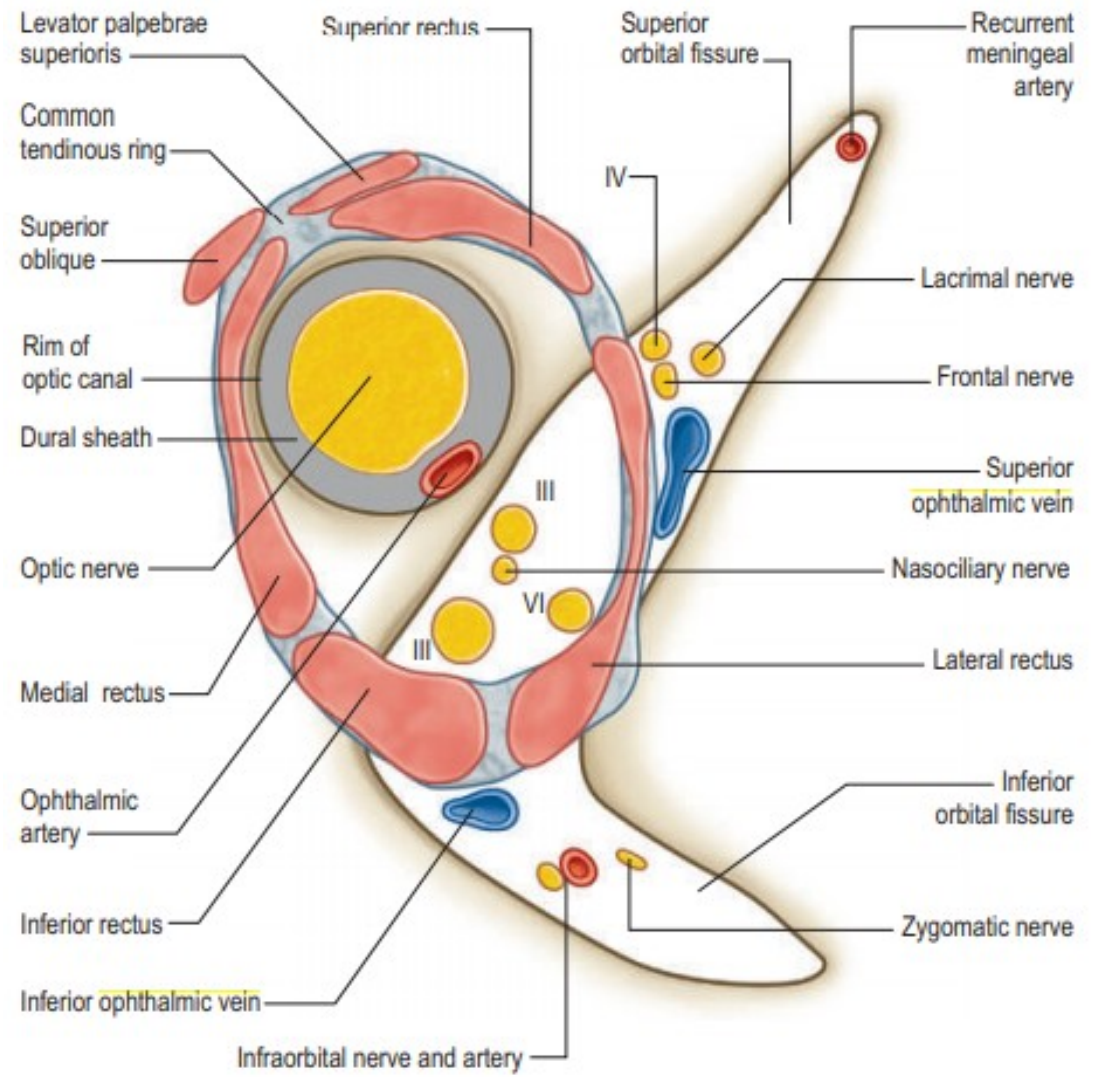
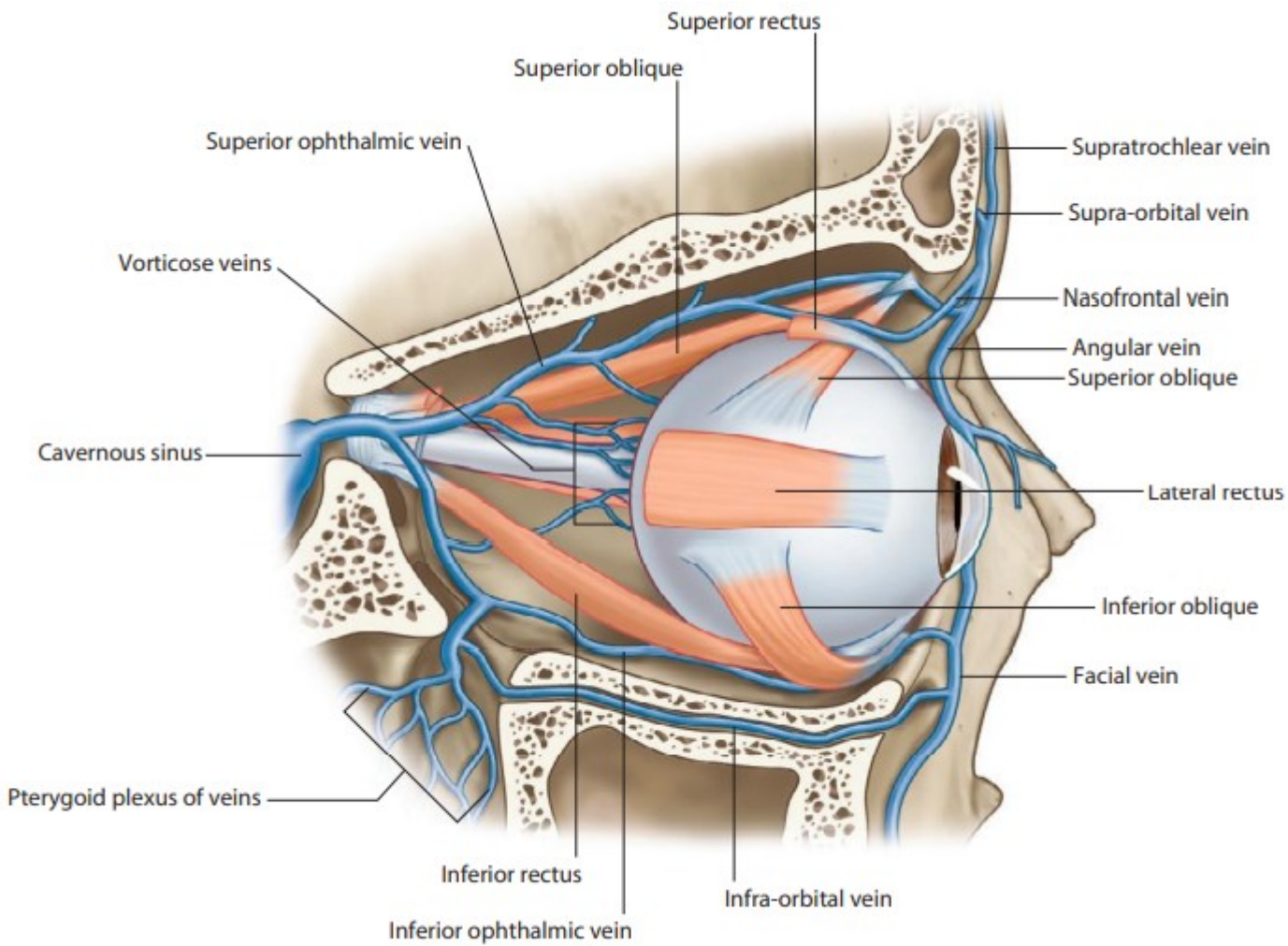
FIG. 36.12 Keratoconjunctivitis sicca.



FIG. 36.3 Chronic uveitis in a patient with oligoarticular juvenile idiopathic arthritis: "white eye" uveitis.

RETINAL ARTERY OCCLUSION





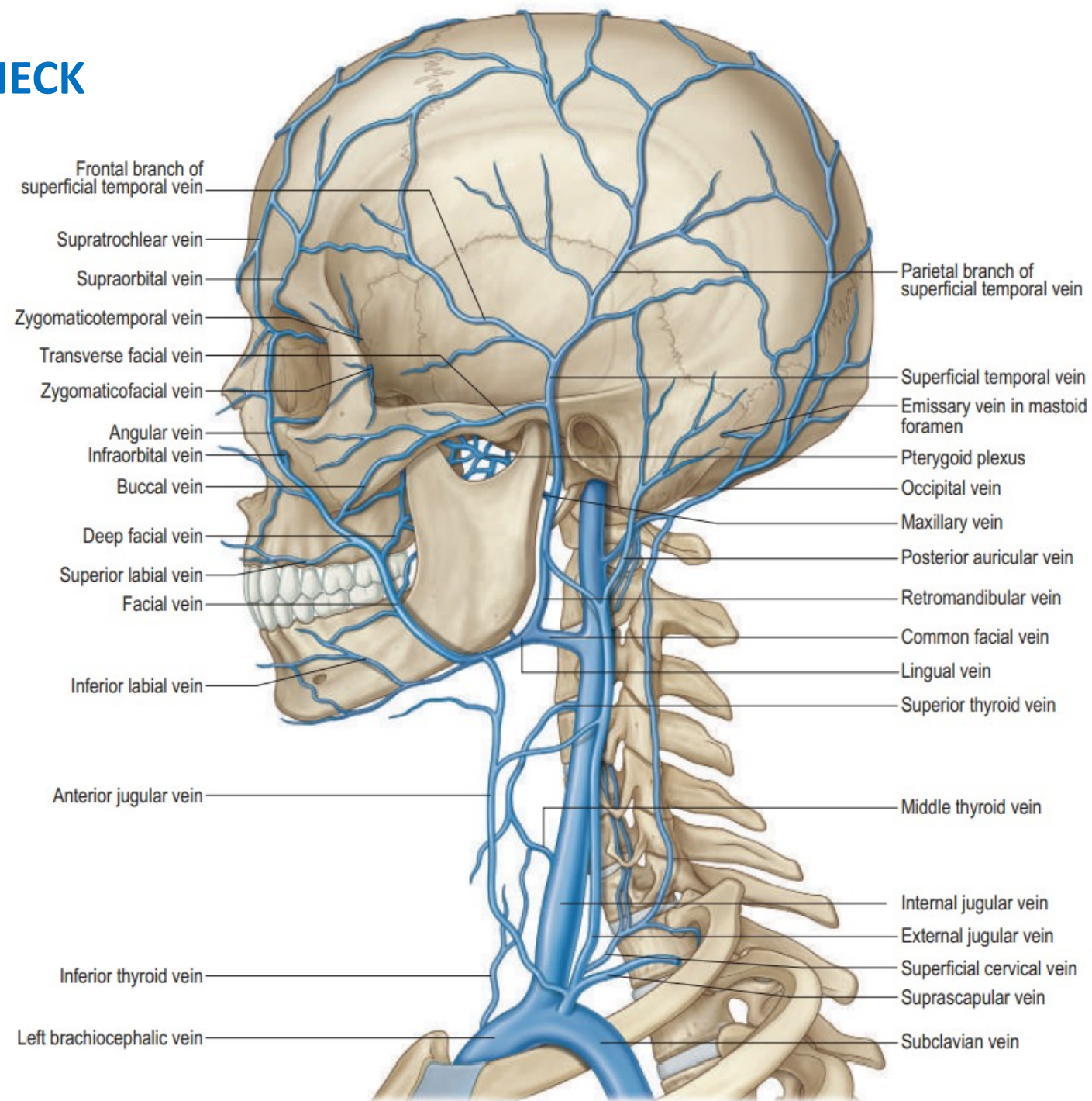
CENTRAL RETINAL VEIN OCCLUSION

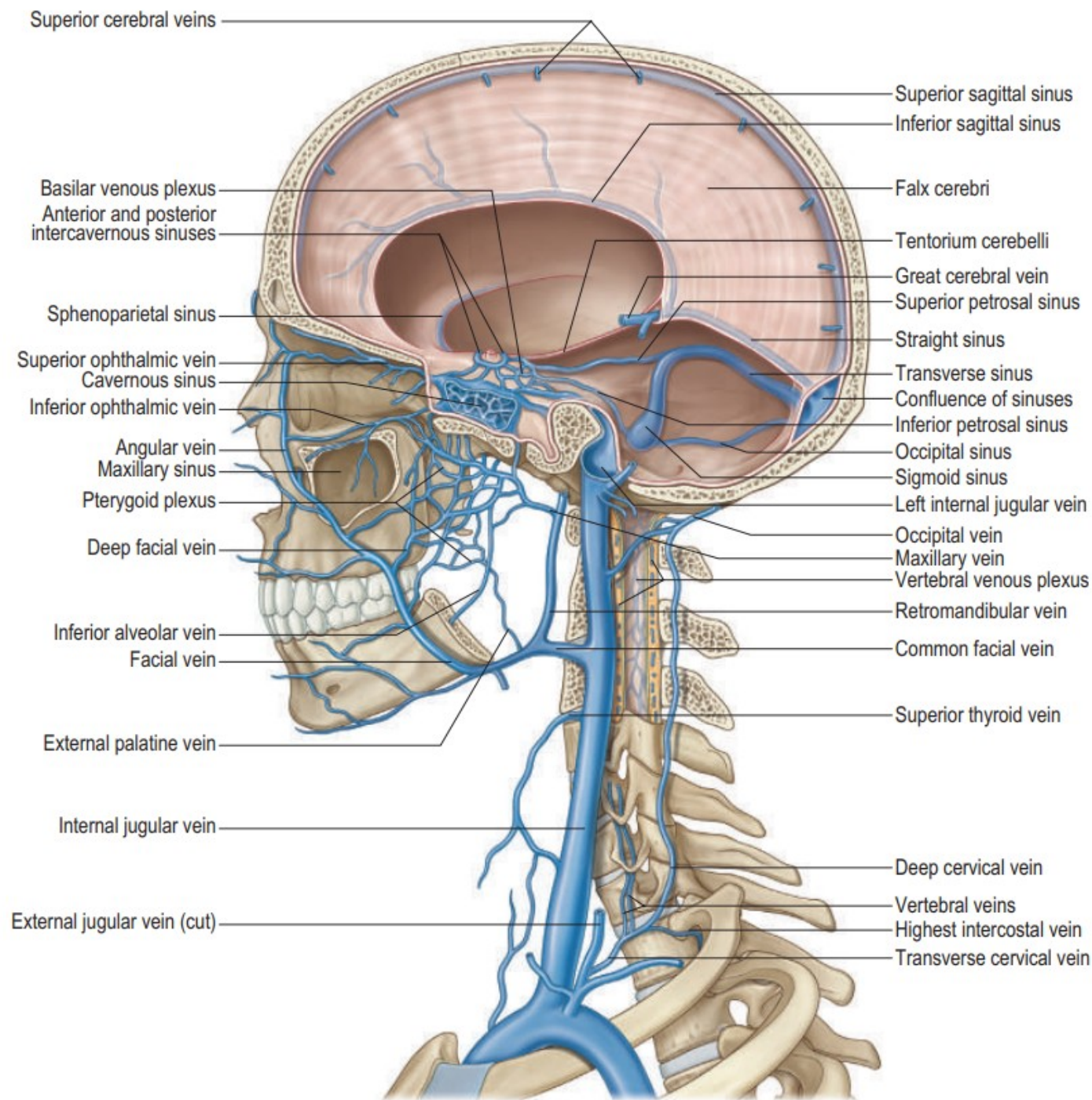
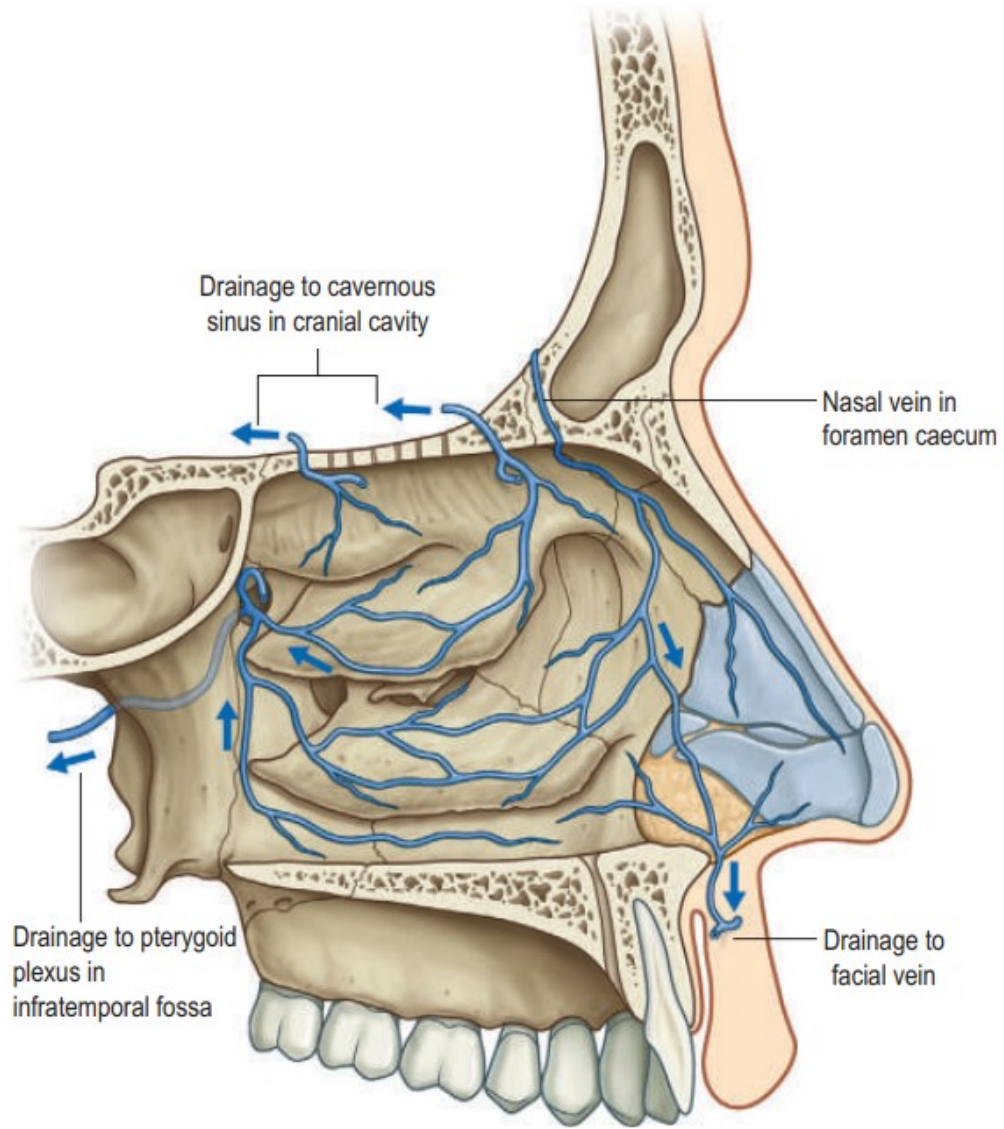


Fig. 13.29 Impending central retinal vein occlusion (A) before and (B) after spontaneous resolution

VENOUS DRAINAGE OF THE HEAD AND NECK

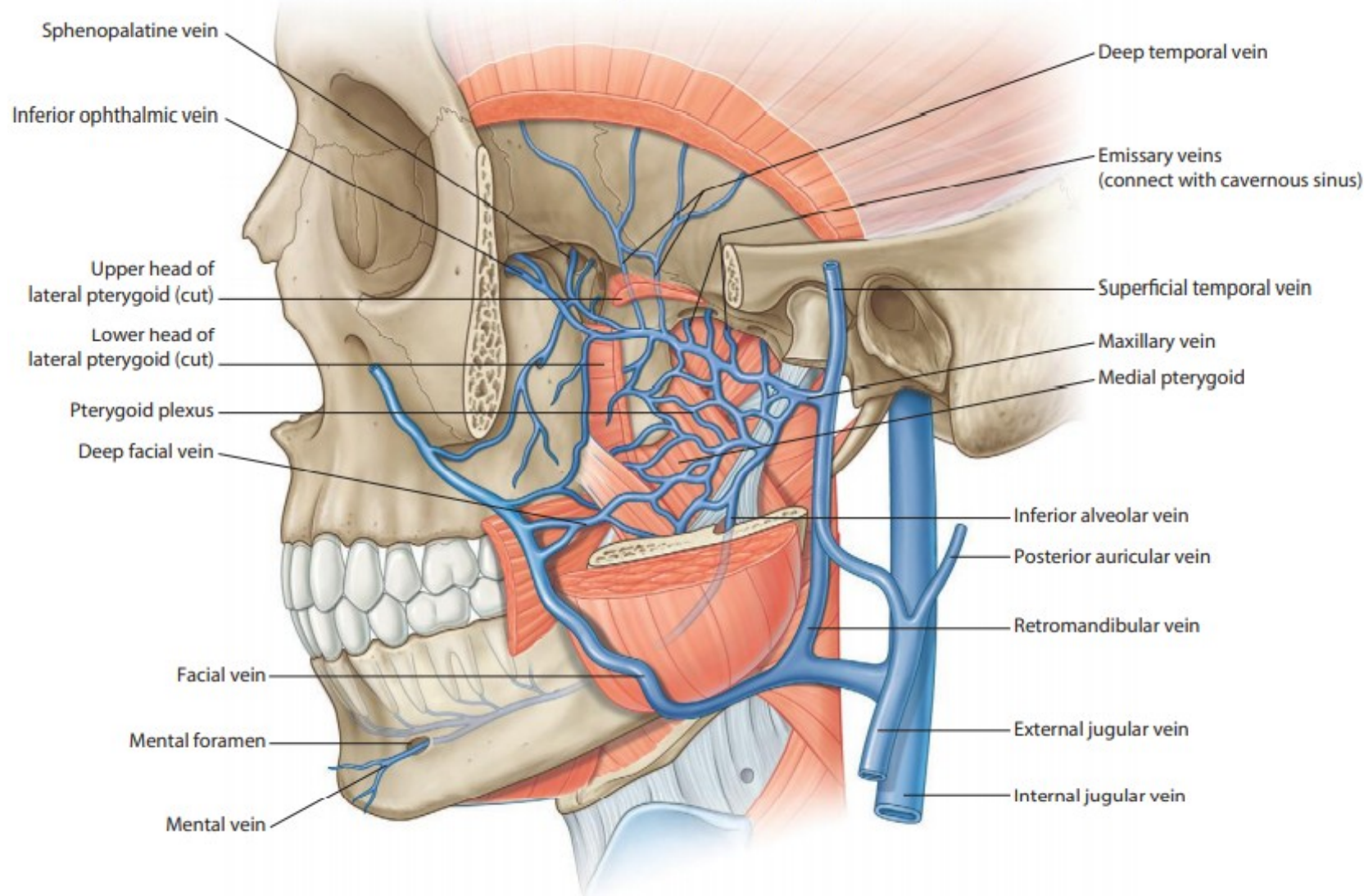
1. *Cerebral veins*
2. *Meningeal veins*
3. *Dural venous sinuses*
4. *Diploic veins*
5. *Veins of labyrinth*
6. ***Emissary veins***
7. ***Retromandibular vein***
 - *Superficial temporal vein*
 - *Middle temporal vein*
 - *Transvers facial vein*
 - *Maxillary veins*
8. ***Ophthalmic veins***
9. ***Pharyngeal 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***





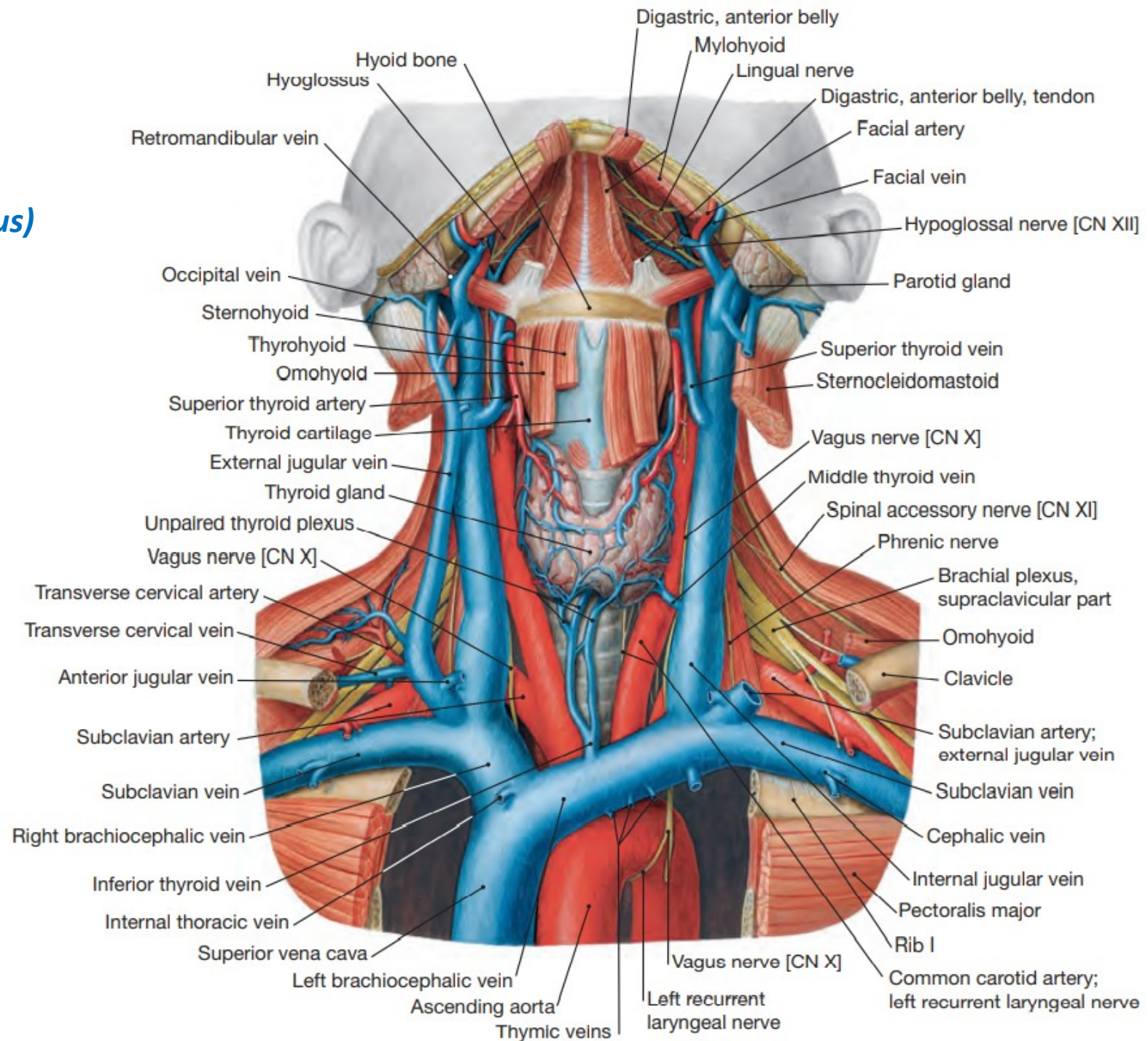
PTERYGOID PLEXUS

- *Middle meningeal veins*
- *Venous plexus of foramen ovale*
- *Internal carotid venous plexus*
- *Venous shunt in the foramen rotundum*
- *Deep temporal veins*
- *Vein of pterygoid canal*
- *Anterior auricular veins*
- *Articular veins*
- *Tympanal veins*
- *Stylomastoid vein*
- *Parotid veins*
- *Pharyngeal veins*
- *Sphenopalatine vein*
- *Inferior ophthalmic vein*
- *Infraorbital vein*
- *Deep facial vein*
- *Descending palatine vein*
- *Posterior superior alveolar veins*
- *Inferior alveolar vein*

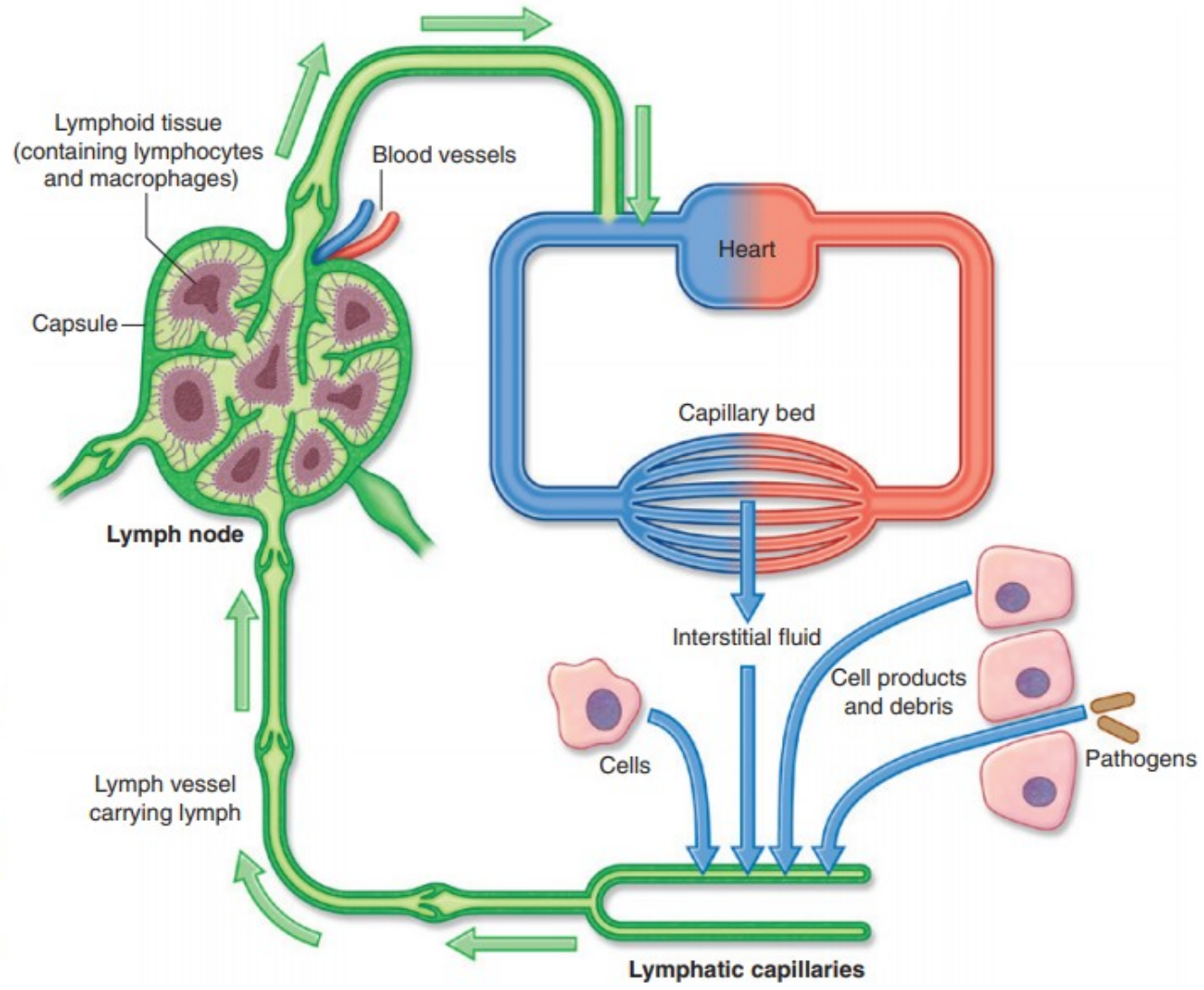
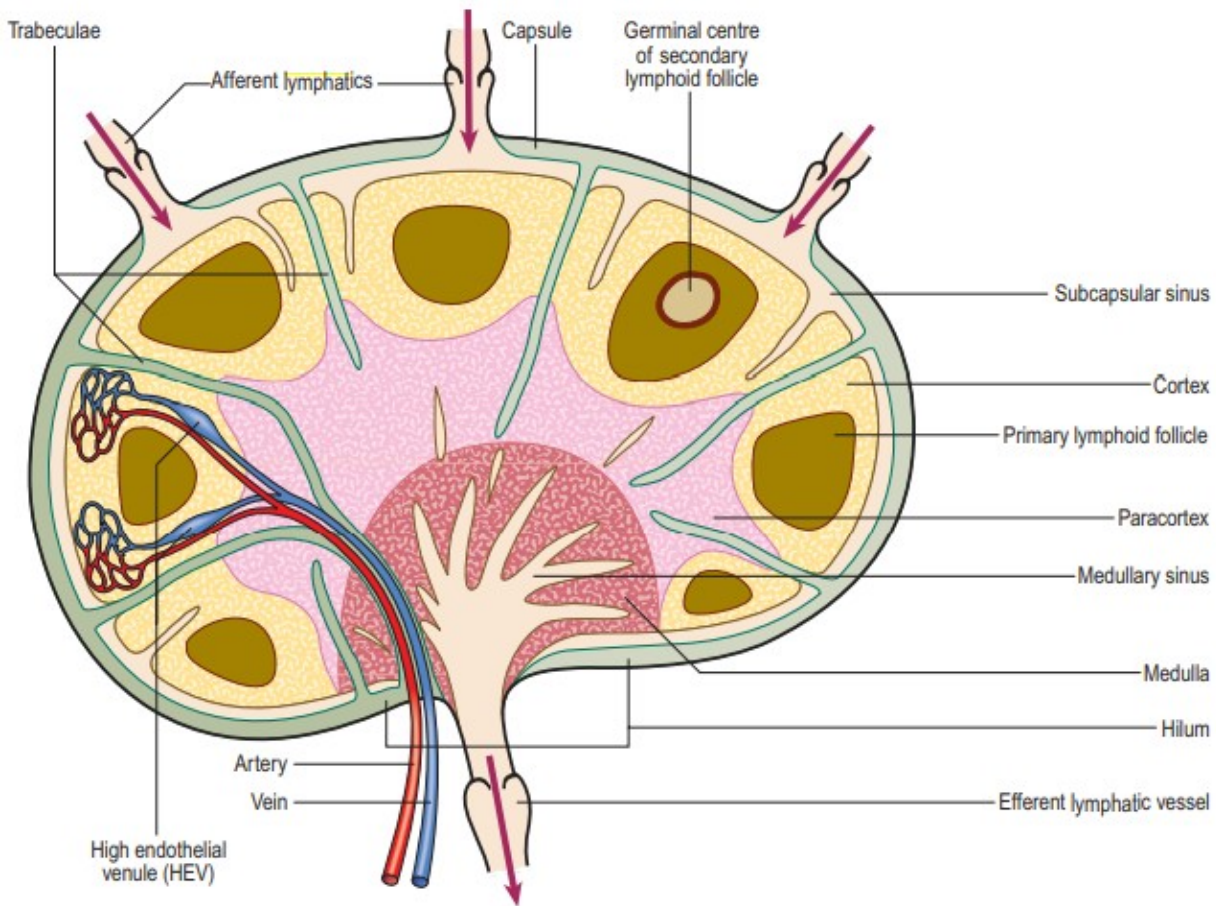


INTERNAL JUGULAR VEIN

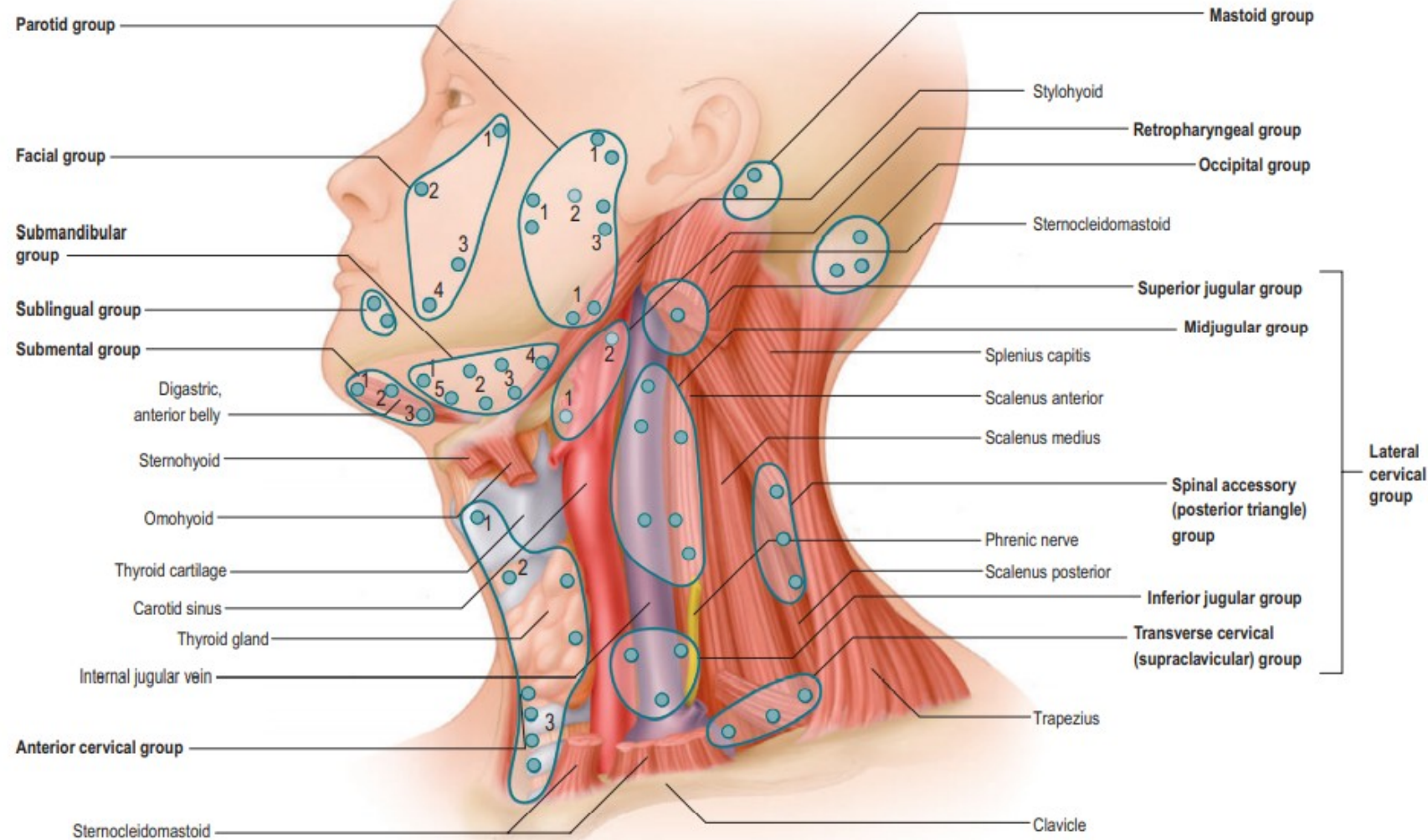
- *Sigmoid sinus + Inferior petrosal sinus*
- *Pharyngeal veins (pharyngeal venous plexus)*
- *Retromandibular vein*
- *Facial vein*
- *Lingual vein*
 - *Sublingual vein*
 - *Vena comitans nervi hypoglossi*
- *Superior thyroid vein*
 - *Superior laryngeal vein*
 - *Sternocleidomastoid vein*
- *Middle thyroid vein (inconsistent)*
- *External jugular vein*
 - *Anterior jugular vein*



LYMFATIC SYSTEM - OVERVIEW



OVERVIEW OF THE HEAD AND NECK LYMPH NODES



Facial group	1. Malar 2. Infraorbital 3. Buccinator 4. Inferior maxillary	Submandibular group	1. Preglandular 2. Prevascular 3. Retrovascular 4. Retroglandular 5. Intracapsular	Retropharyngeal group	1. Lateral 2. Medial
Parotid group	1. Subfacial, extraglandular 2. Deep intraglandular 3. Suprafacial	Submental group	1. Anterior 2. Middle 3. Posterior	Anterior cervical group	1. Superficial anterior jugular chain 2. Prelaryngeal 3. Pretracheal

LYMPH NODES OF THE HEAD

Occipital nodes

- afferents: scalp in the occipital region
- efferents: *superficial cervical nodes* and *deep cervical nodes*

Mastoid nodes

- afferents: scalp behind the auricle, posterior side of the auricle
- efferents: *superficial cervical nodes* and *deep cervical nodes*

Superficial and deep parotide nodes

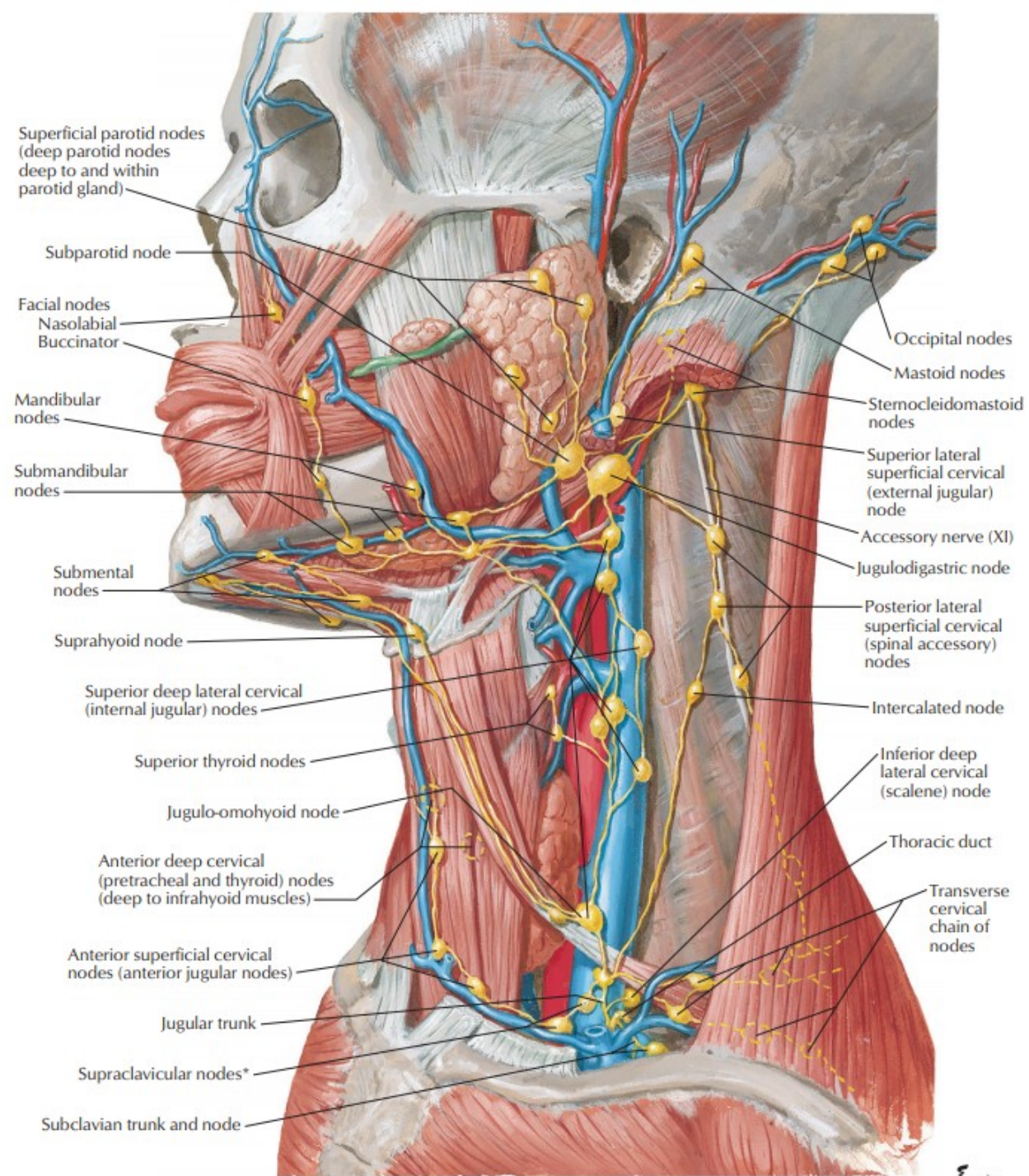
- afferents: scalp in the temporal and frontal region, lateral part of the eyelids, buccal region, anterior side of the auricle and external auditory meatus, middle ear, parotide gland, soft palate
- efferents: *superficial cervical nodes* and *deep cervical nodes*

Submandibular nodes

- afferents: lower eyelids, nose, upper lip, cheeks, paralingual region, hard palate, floor of mouth, teeth
- efferents: *deep cervical nodes*

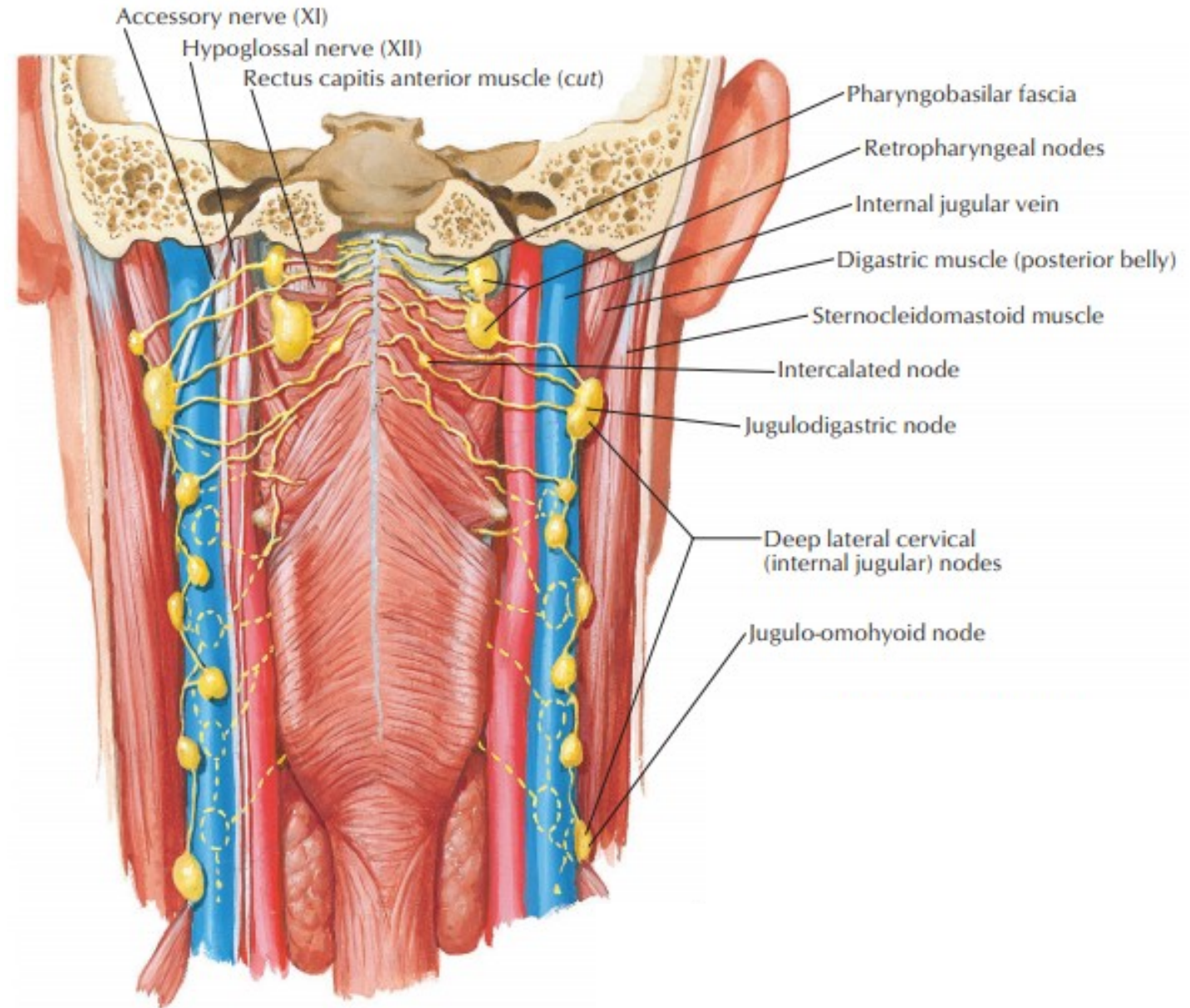
Submental nodes

- afferents: lower lip, chin, anterior floor of mouth, anterior teeth, tip of tongue
- efferents: *superficial cervical nodes* and *deep cervical nodes*



Nodi retropharyngei

- afferents: pharynx, middle ear, Eustachian tube, posterior and superior nasal cavity, paranasal sinuses
- efferents: *nodi cervicales profundi*



LYMPH FROM THE TONGUE

Apical collecting vessels

→ *juguloomohyoid node* or via *submental nodes*

External marginal collecting vessels

→ *submental nodes*

Internal marginal collecting vessels

→ *internal jugular nodes* from anterior tongue

→ *jugulodigastric node* from posterior tongue

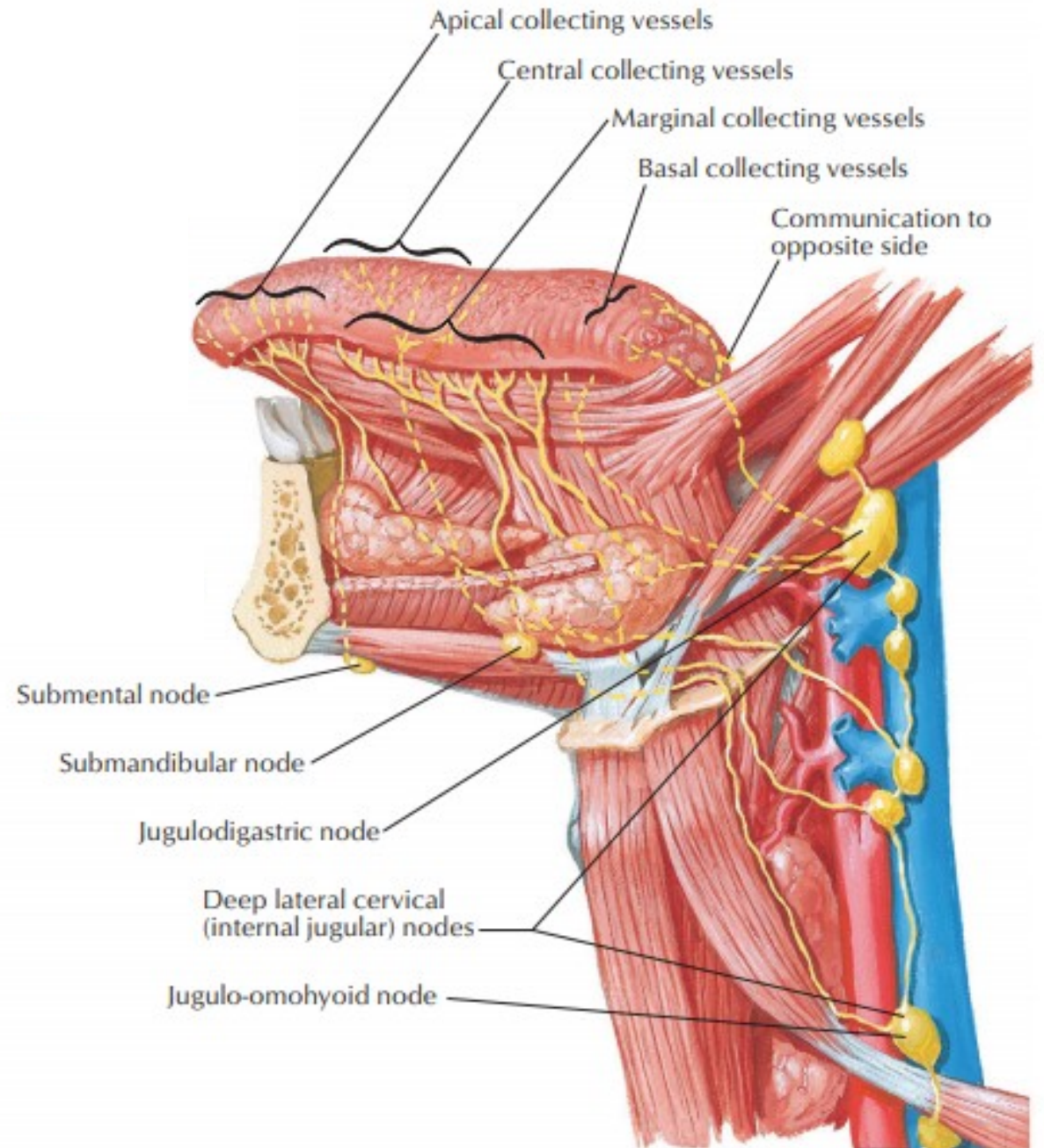
Central collecting vessels

→ *submandibular nodes* and *juguloomohyoid node*

Basal collecting vessels

→ *internal jugular nodes* and *jugulodigastric node*

+ *lingual nodes* in the lingual base



Lateral superficial cervical nodes

- external jugular nodes

Lateral deep cervical nodes

a. internal jugular nodes

- tonsillar node (Wood's node)
- jugulodigastric node (Küttner's node)

b. spinal accessory nodes

c. supraclavicular nodes

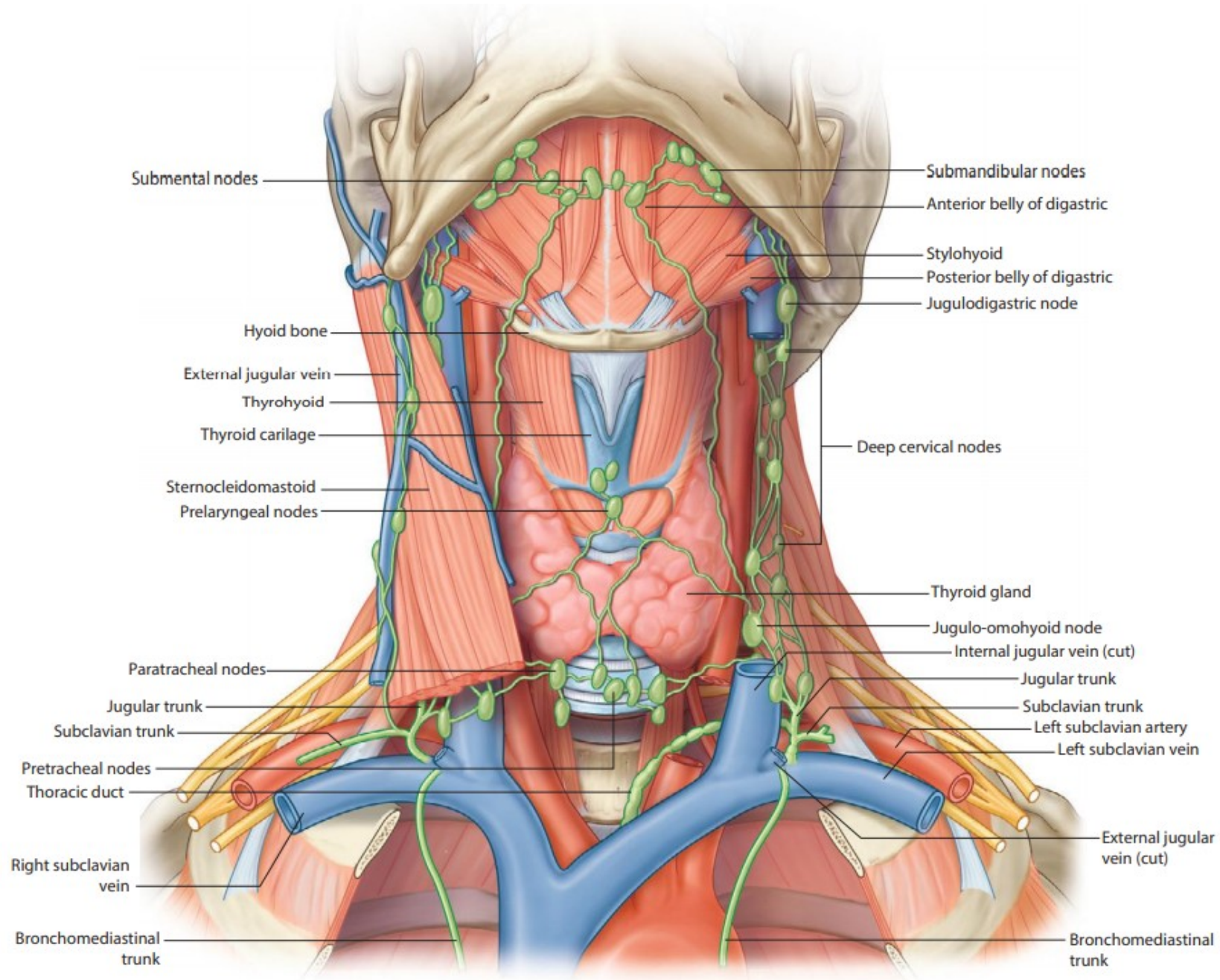
- Virchow's nodes on the left side

Anterior superficial cervical nodes

- anterior jugular nodes

Anterior deep cervical nodes

- prelaryngeal nodes
- thyroid nodes
- preglanglular nodes
- pretracheal nodes
- paratracheal nodes



References:

HOMBACH-KLONISCH, S., T. KLONISCH and J. PEELER. *Sobotta: Clinical Atlas of Human Anatomy*. Munich, Germany: Elsevier Science, 2019, 680 s. ISBN 978-0-7020-5273-3.

STANDRING, S, et al. *Gray's Anatomy: The Anatomical Basis of Clinical Practice*. 41st. Philadelphia: Elsevier, 2016, 1562 s. ISBN 978-0-7020-5230-9.

DRAKE, R. L., A. WAYNE VOGL and A. W. M. MITCHELL. *Gray's Anatomy for Students*. 4th. Philadelphia: Elsevier, 2020. ISBN 978-0-323-39304-1.

DRAKE, R. L., A. WAYNE VOGL, A. W. M. MITCHELL, R. M. TIBBITTS and P. E. RICHARDSON. *Gray's Atlas of Anatomy*. 2. Philadelphia: Churchill Livingstone, 2015, 648 s. ISBN 978-1-4557-4802-0.

NETTER, F. H. *Atlas of Human Anatomy*. 6. Philadelphia: Saunders, 2014, 624 s. ISBN 978-1-4557-0418-7.

BRUNICARDI, F. Ch., D. K. ANDERSEN, T. R. BILLIAR, D. L. DUNN, J. G. HUNTER, L. S. KAO, J. B. MATTHEWS and R. E. POLLOCK. *Schwartz's Principles of Surgery*. 11. New York: McGraw-Hill Education, 2019, 2448 s. ISBN 978-1-25-983537-7.

PELLERITO, J. S. and J. F. POLAK. *Introduction to vascular ultrasonography*. 6. Philadelphia: Saunders, 2012, 704 s. ISBN 978-1-4377-1417-3.

GOSLING, J. A., P. F. HARRIS, J. R. HUMPHERSON, I. WHITMORE, P. L. T. WILLAN et al. *Human Anatomy, Color Atlas and Textbook*. 6. Philadelphia: Elsevier, 2017, 456 s. ISBN 978-0-7234-3827-4.

KANSKI, J. J. and B. BOWLING. *Kanski's Clinical Ophthalmology: A Systematic Approach*. 8. Philadelphia: Saunders, 2016, 928 s. ISBN 978-0-7020-5572-0.

HOCHBERG, M. C., A. J. SILMAN, E. M. GRAVALESSE, J. S. SMOLEN, M. E. WEINBLATT, M. H. WEISMAN et al. *Rheumatology*. 7. Philadelphia: Elsevier, 2019, 2048 s. ISBN 978-0-7020-6865-2.

SIEGENTHALER, W. et al. *Differential Diagnosis in Internal Medicine: From Symptom to Diagnosis*. New York: Thieme Medical Publishers, 2007, 1140 s. ISBN 978-3-13-142141-8.

MCCANCE, K. L., S. E. HUETHER et al. *Pathophysiology: The Biologic Basis for Disease in Adults and Children*. 7. St. Louis: Mosby, 2014, 1840 s. ISBN 978-0-323-08854-1.

ČIHÁK, Radomír. *Anatomie 3*. Třetí, upravené a doplněné vydání. Praha: Grada, 2016, 832 s. ISBN 978-802-4756-363.

PÁČ, Libor. *Anatomie člověka II: splachnologie, kardiovaskulární systém, žlázy s vnitřní sekrecí*. Brno: Masarykova univerzita, 2012, 192 s. ISBN 978-802-1042-919.