

INTERNATIONAL SURGICAL
ANATOMY TEACHING
SERIES



ISATS HANDOUT 2026/27

ENT & Neck

ENT ANATOMY

Objectives: Explain the gross anatomy of the ear, nose and oral cavity

The Ear

External ear:

- Consists of auricle, external acoustic meatus and tympanic membrane
- Vasculature: Branches of the external carotid artery–posterior auricular artery, superficial temporal artery, occipital artery and maxillary artery. Venous drainage is via veins following the arteries listed above
- Lymphatic drainage: superficial parotid, mastoid, upper deep cervical and superficial cervical nodes

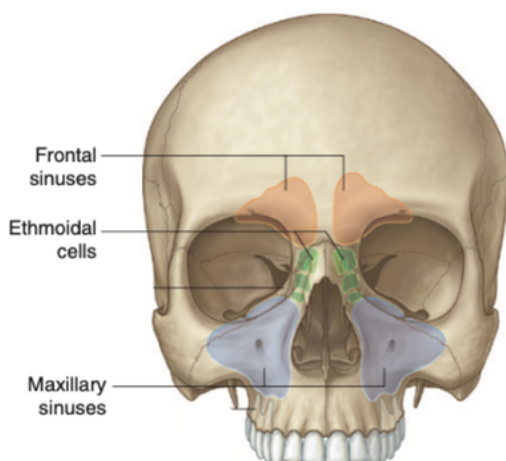
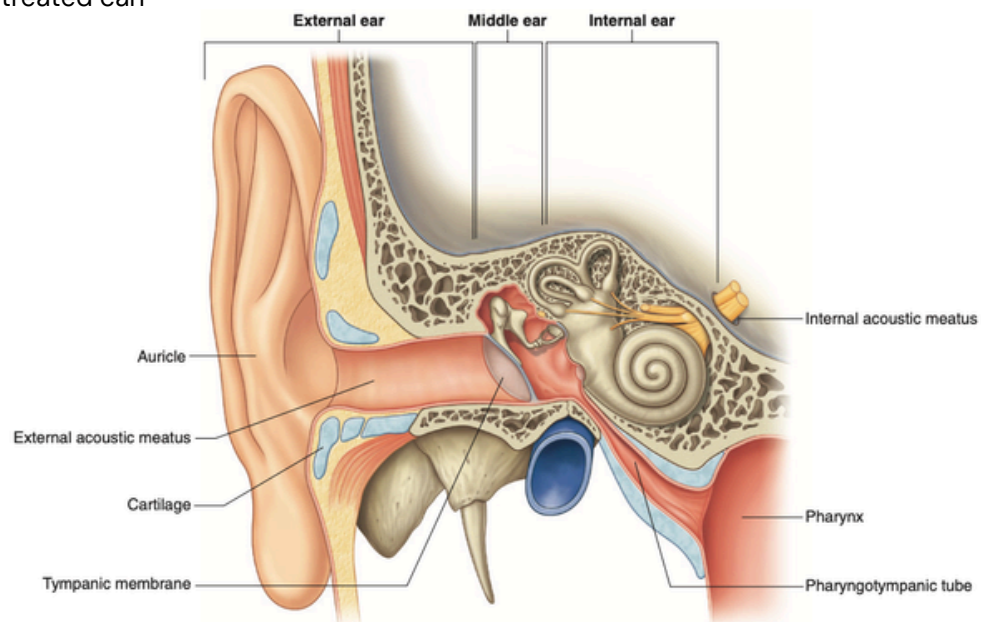
Middle ear:

- Lies within the temporal bone
- Consists of tympanic cavity and epitympanic recess
- Bones: auditory ossicles – malleus, incus, stapes
- **Clinical relevance:** mastoid air cells can get infected following otitis media. If untreated can lead to meningitis

Inner ear:

- **Function:** convert mechanical signals from the middle ear into electrical signals, maintain balance by detecting position and motion.
- Located in the petrous temporal bone
- It consists of: bony labyrinth (contains vestibule, cochlea and three semi-circular canal) and membranous labyrinth (composed of the cochlear duct, three semi-circular ducts, saccule and the utricle)
- Innervation: vestibulocochlear nerve (CNVIII)
- **Note:** Facial nerve (CNVII) passes through the inner ear, but does not innervate any of the structures present.

Nasal sinuses



ENT clinical relevance

Transphenoidal surgery

The pituitary gland can be accessed surgically through the nasal cavity followed by passing instruments through the sphenoid bone. This surgery is done mainly for pituitary adenomas

Sinusitis

Upper respiratory tract infection can spread to the sinuses. The maxillary nerve supplies both the maxillary sinus and teeth, and so inflammation of this sinus can present with toothache

FACE ANATOMY

Objectives: Objectives: Understand the bony anatomy of the viscerocranium and structure of the TMJ. Explain the gross anatomy of the muscles of facial expression & mastication, salivary glands of the face and important neurovascular structures of the face. Apply anatomical knowledge in context of common procedures within ENT surgery.

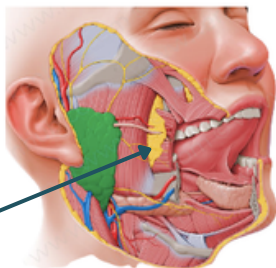
Salivary Glands of The Face

Parotid

Superficial & deep lobes
(parotid region)

Secretions: mostly serous

Duct: Stensen's (parotid)
duct

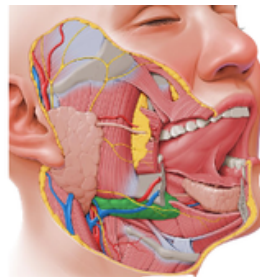


Submandibular

Submandibular triangle (inf &
post to mylohyoid muscle)

Secretions: mixed (80%
serous, 20% mucous)

Duct: Wharton's duct

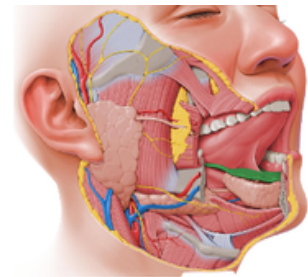


Sublingual

Between the mouth floor
and mylohyoid muscle

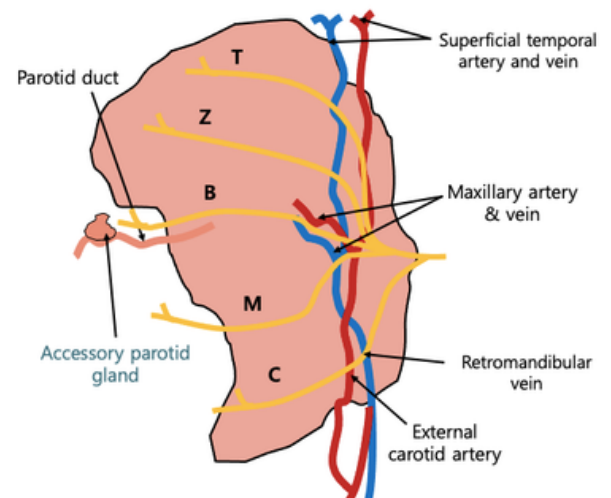
Secretions: mostly mucous

Duct: Bartholin's duct



Parotid Gland

- Largest of 3 salivary gland (lies in buccal region)
- **Structure**
 - Bilateral and lobular
 - Extends from zygomatic arch to inferior border of mandible.
- **Parotid duct course**
 - a. Anterior parotid gland
 - b. Medial border of masseter
 - c. Buccal fat
 - d. Buccinator muscle
 - e. 2nd upper molar



Important Anatomical Relations

External Carotid Artery

- Terminates into superficial temporal & maxillary artery branches

Retromandibular vein

- Formed from superficial temporal & maxillary veins

Facial nerve (CNVII)

- 5 terminal branches within parotid gland;
Temporal, Zygomatic, Buccal, Mandibular, Cervical

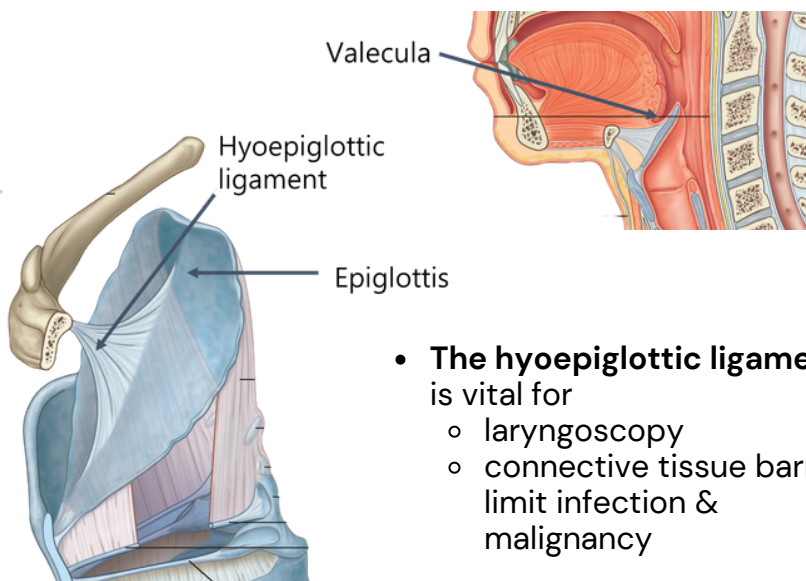
NECK ANATOMY

Objectives: Understand the anatomy of the hyoid bone as well as all of the relevant musculature and neurovasculature in the anterior neck. Appreciate the ultrastructure of the thyroid and parathyroid glands.

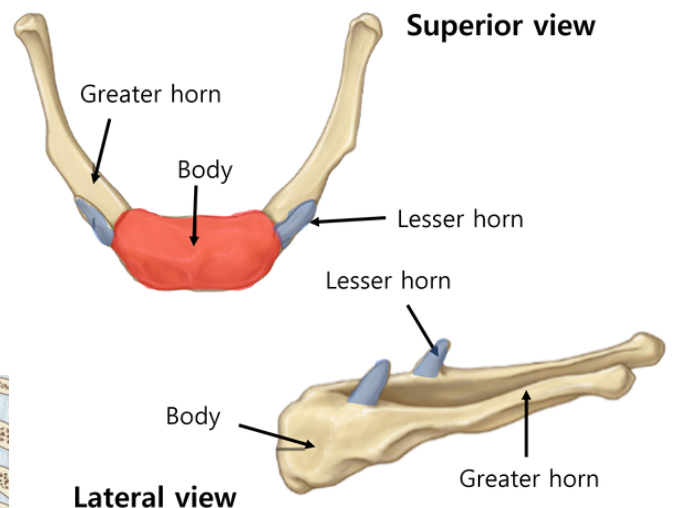
The hyoid bone

Gross anatomy

- The only bone to have no other bony articulations
- **Body**, greater horn and **lesser horn**
- Functions
 - Mobilise for **movements of jaw and tongue**
 - **Attach muscles and ligaments**
 - **Stabilise the airway**



- **The hyoepiglottic ligament** is vital for
 - laryngoscopy
 - connective tissue barrier limit infection & malignancy

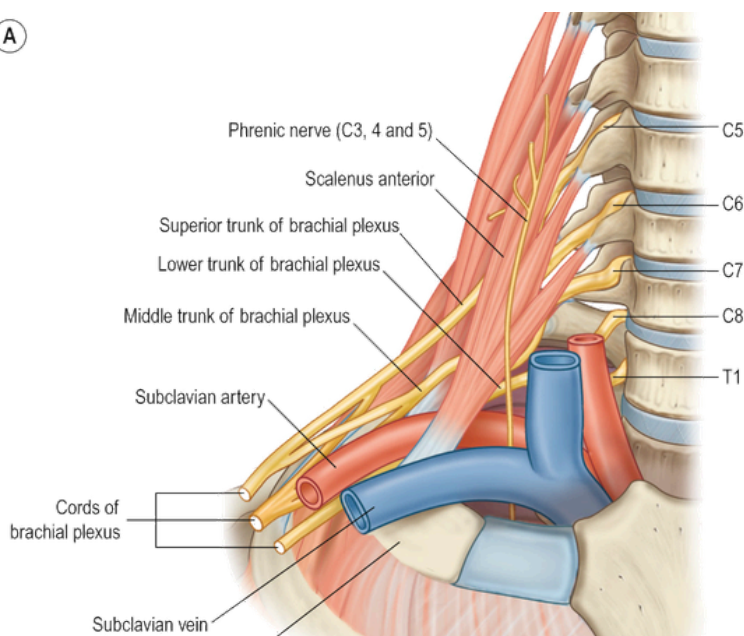


- **Attachments: 4 – 2 – 1**
 - **4 groups of muscles**
 - Suprahyoids
 - Infrahyoids
 - Extrinsic muscles of tongue
 - Middle constrictor
 - **2 ligaments**
 - Stylohyoid ligament
 - Hyoepiglottic ligament
 - **1 membrane**
 - Thyroid membrane

Scalenes

- **Scalene Actions**
 - Cervical flexion – all bilaterally and unilaterally
 - Elevate the 1st rib – anterior and middle scalenes
 - Elevate the 2nd rib – posterior scalene
- **Important anatomical relations**
 - Between middle and anterior scalenes
 - Trunks of **brachial plexus**
 - **Subclavian artery**
 - Anterior to anterior scalene
 - **Phrenic nerve**
 - **Subclavian vein**

A



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Suprahyoids

Innervation

- **Stylohyoid:** Facial nerve (CNVII)
- **Digastric**
 - **anterior** belly: Inferior alveolar nerve (mylohyoid branch)
 - **posterior** belly: Facial nerve
- **Mylohyoid:** Inferior alveolar nerve (mylohyoid branch)
- **Geniohyoid:** C1

My

God

(I'm)

So

Daft

Infrahyoids

Innervation

- **Sternohyoid:** Ansa cervicalis
- **Omohyoid:** Ansa cervicalis
- **Sternothyroid:** Ansa cervicalis
- **Thyrohyoid:** C1

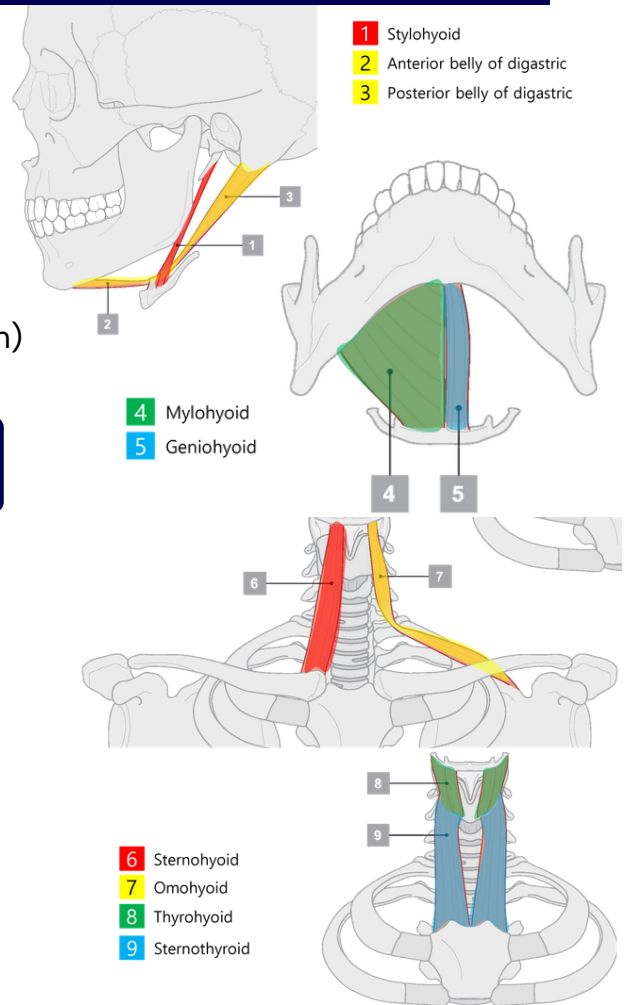
Oh

Sugar

This

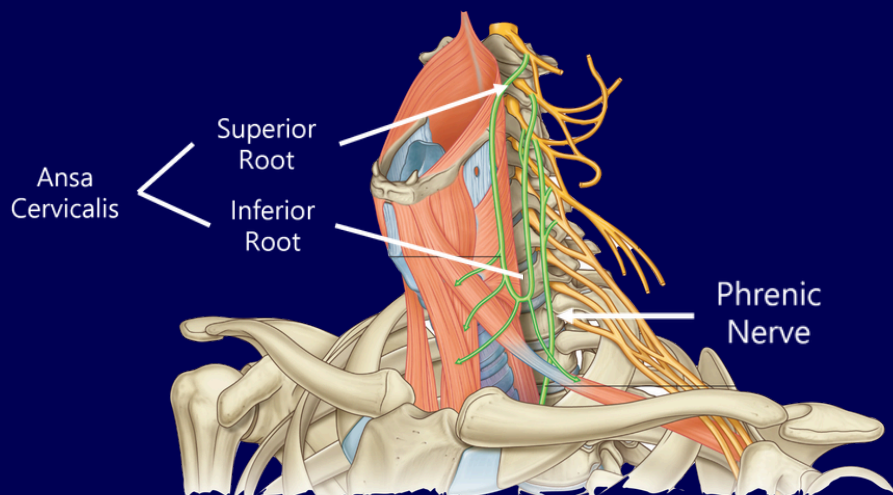
Sucks

- **Clinical Correlation:** all nerves to infrahyoids enter the muscles in their inferior half. Surgical incisions must be placed superiorly!



Ansa Cervicalis

- In latin *ansa* = handle
- Nerve roots **C1-3**
 - Off of the cervical plexus (C1-4)
- Provides **motor innervation** to the infrahyoids
 - **EXCEPT – thyrohyoid**
- Can be found in the **carotid triangle**
 - overlying the carotid sheath
- The phrenic nerve is not in ansa cervicalis!



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Triangles of the Neck

Anterior

Submandibular triangle

- Facial artery and vein
- Submandibular gland
- Submandibular lymph nodes
- Hypoglossal n. (CNXII)

Submental triangle

- Submental lymph nodes
- Anterior jugular vein

Muscular triangle

- Infrahyoids
- Thyroid (& parathyroid)
- Larynx, trachea & pharynx

Carotid triangle

- Internal & external carotid arteries
- Vagus n. (CNX)
- Branches of external carotid a.
- Ansa cervicalis
- Spinal accessory n. (CNXI) and Hypoglossal n. (CNXII)

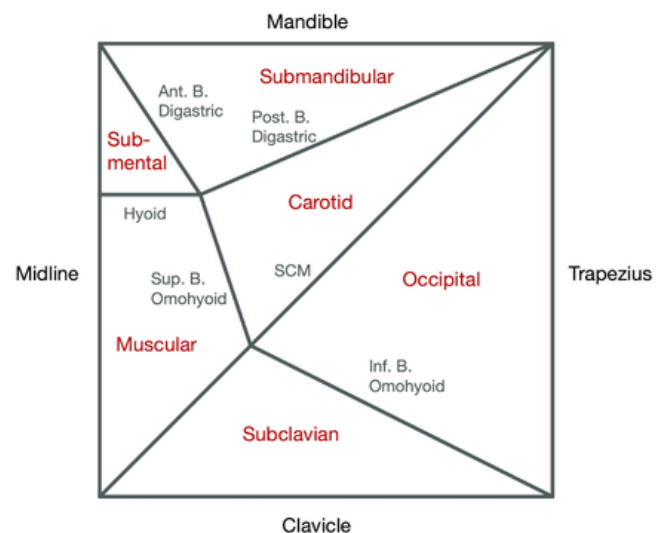
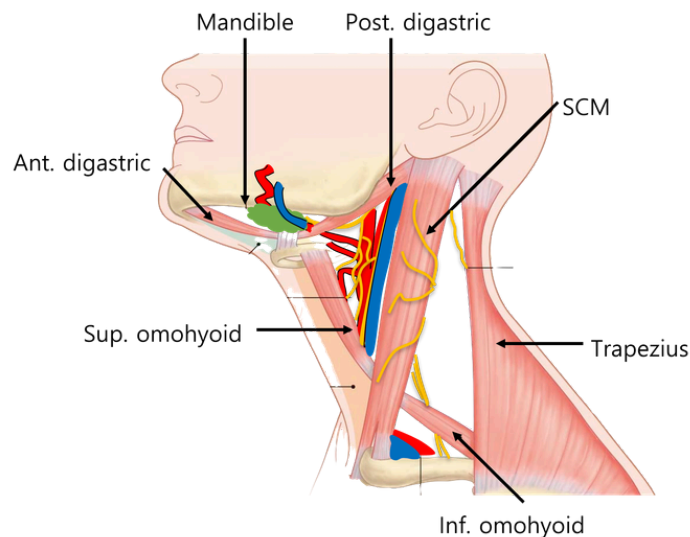
Posterior

Subclavian triangle

- Subclavian artery
- Subclavian veins
- Brachial Plexus

Occipital triangle

- Cutaneous cervical plexus
- Spinal accessory n. (CNXI)
- Upper part of brachial plexus

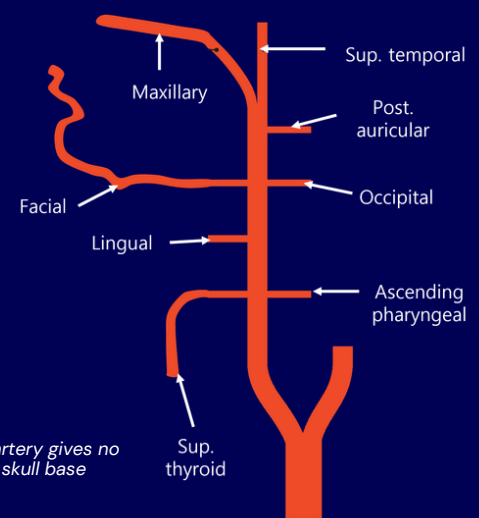


**To subdivide anterior and posterior triangles, the only extra muscles you need are:*

- **Digastric**
- **Omohyoid**

Branches of external carotid artery

- Supply the whole extracranial region of H&N
- Additionally supply the meninges
- 4 anterior branches – 4 posterior branches
- Remember the maxillary artery gives off the middle meningeal artery
 - clinical relevance: **extra-dural haematomas**
- **Mnemonic:** Some Anatomists Like Freaking Out Poor Medical Students



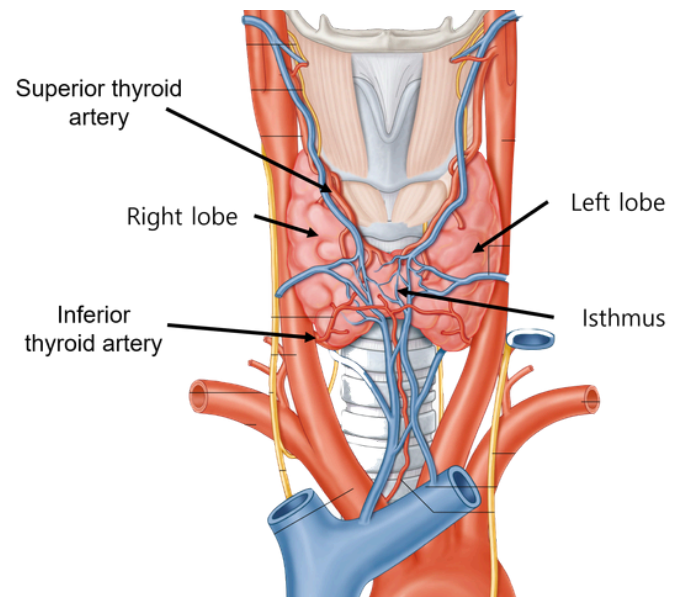
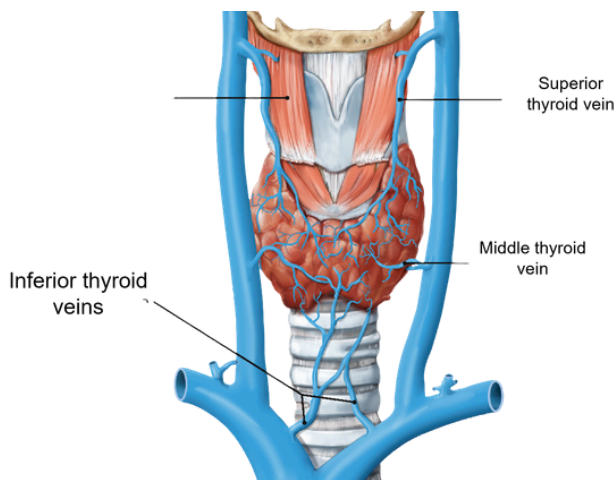
NB - the internal carotid artery gives no branches before entering skull base

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Thyroid Gland

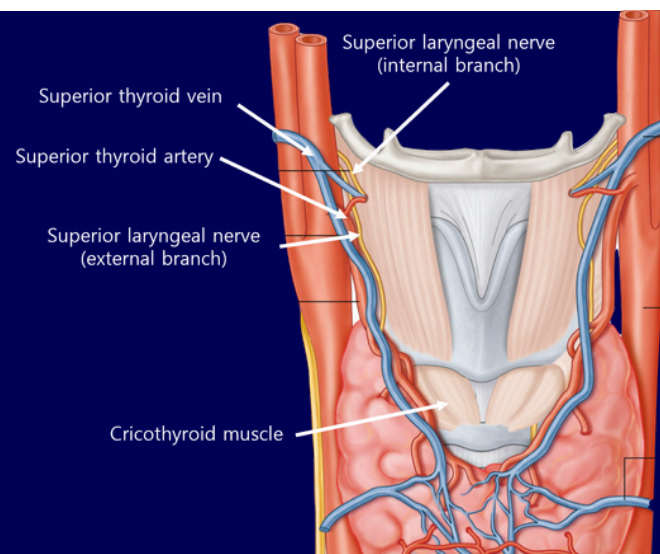
- Right and left lobes connected by a central isthmus
 - Pyramidal lobe in around 50% of people
- C5-T1 vertebral levels but ectopic tissue common
- Attached to cricoid cartilage by Berry's ligament
- **Superior thyroid artery:** anterior, medial and lateral aspects
- **Inferior thyroid artery:** posterior and inferior aspects
 - superior and inferior arteries anastomose posteriorly



- **3 veins responsible for drainage**
 - Superior thyroid vein → IJV
 - Middle thyroid vein → IJV
 - Inferior thyroid vein → Brachiocephalic trunk
- Glandular venous plexus superficially
- **The middle thyroid vein is most at risk of injury during neck surgery**
- **Thyroid lymph** drains into
 - Pretracheal nodes
 - Deep cervical nodes
 - Brachiocephalic nodes

Superior Laryngeal Nerve

- Branch of vagus nerve (CNX)
- Divides into internal and external branches
 - **Internal:** sensation to mucosa above vocal cords
 - **External:** motor to cricothyroid + sensory to the associated area
- External branch runs close to superior thyroid artery
 - may be damaged when ligating the vessel
- If damaged:
 - low pitch hoarse voice – will recover with time due to contralateral compensation

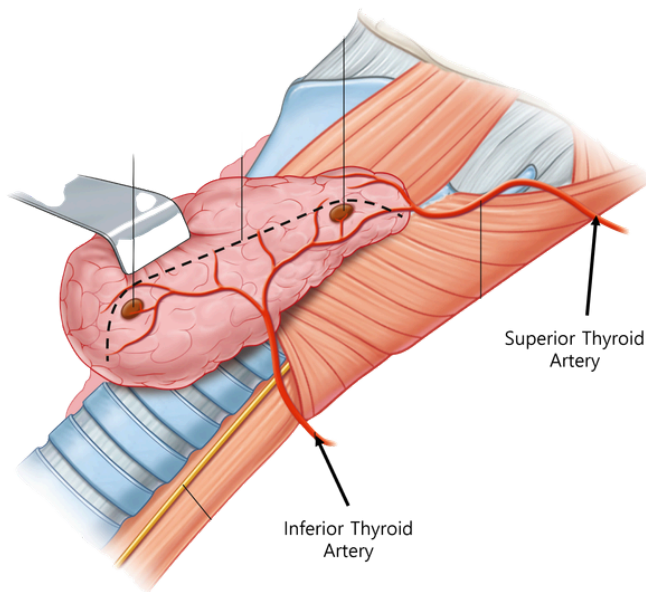
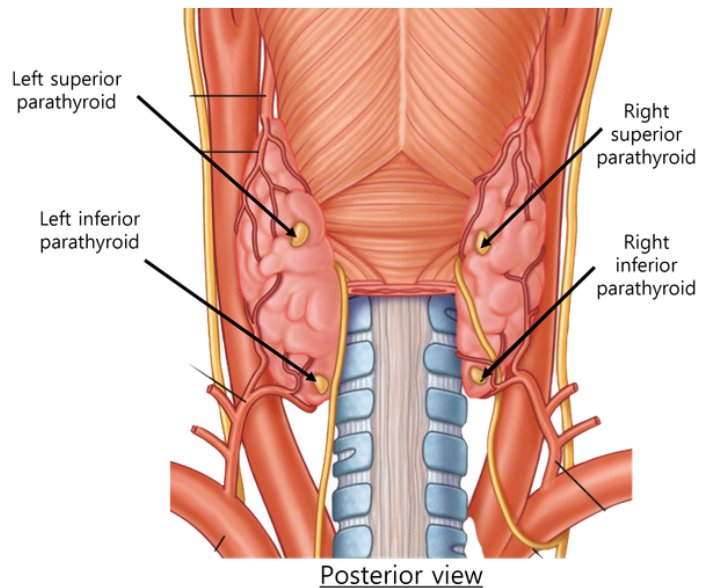


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Parathyroid Glands

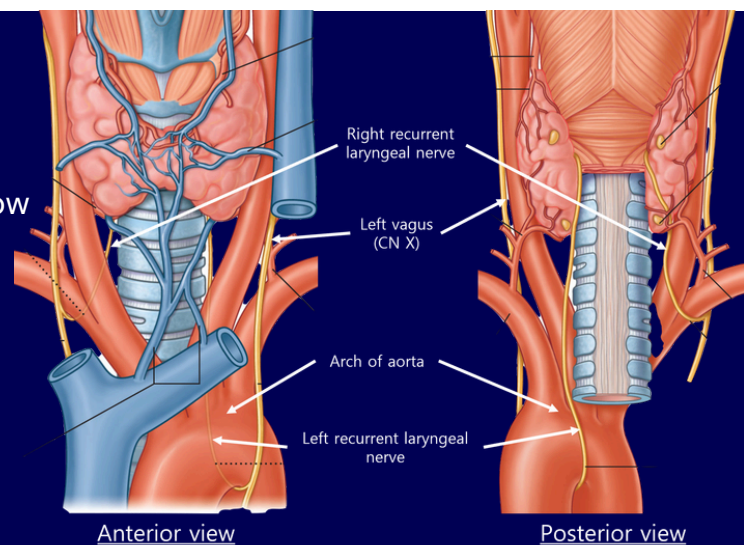
- 4 small ovoid glands on the posterior aspect of the thyroid gland
 - 4% may be intrathyroidal
- Each only 6mm in length
- **Superior parathyroid glands** are almost always in normal anatomical position
- **Inferior parathyroid glands** are quite variable and may be found as far as the thymus



- The parathyroids are predominantly supplied by the **inferior thyroid artery**
 - The superior parathyroids may be supplied by the posterior anastomosis between the superior and inferior thyroid arteries
 - The superior parathyroids may even be supplied by superior thyroid artery
- **This supply is delicate!**
- **Venous drainage** via the thyroid glandular venous plexus
- **Lymph drainage** is associated with the thyroid and/or the thymus lymphatic systems

Recurrent Laryngeal Nerve

- Branch of vagus nerve (CNX)
- Supplies all of the intrinsic muscles of the larynx (except cricothyroid) + sensation to mucosa below the vocal cords
 - **nerve palsy** = total paralysis of vocal cords
 - hoarse voice that does not improve with time
- On the left:
 - curves posteriorly under arch of aorta
- On the right:
 - curves posteriorly under subclavian artery

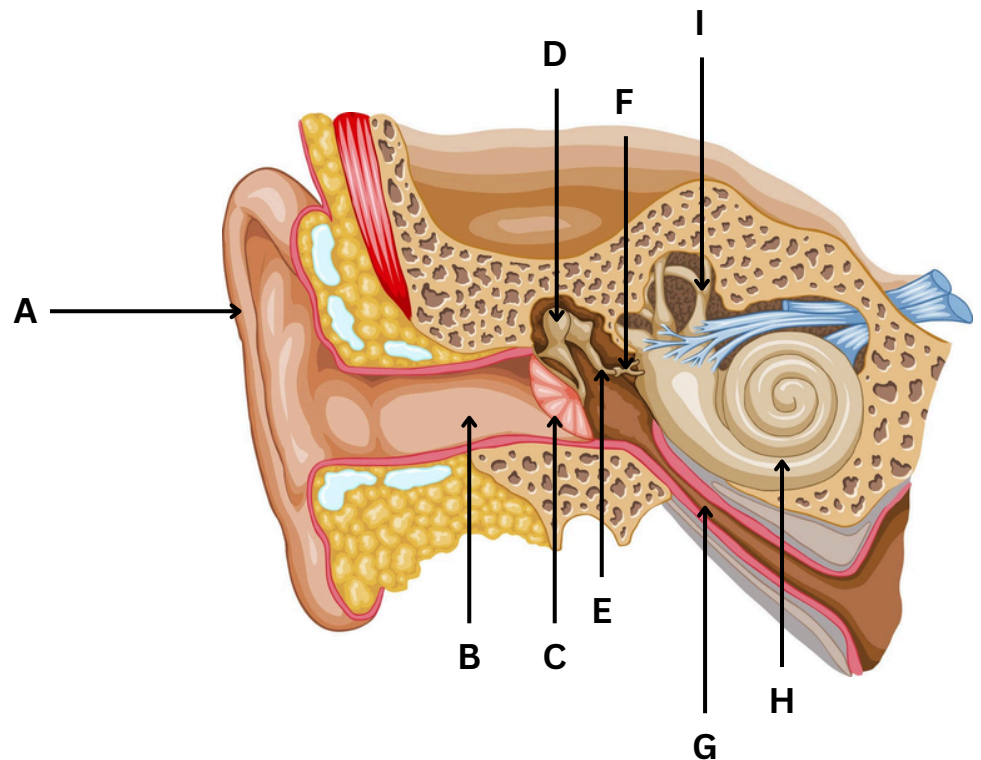


ENT & NECK ANATOMY

Test yourself

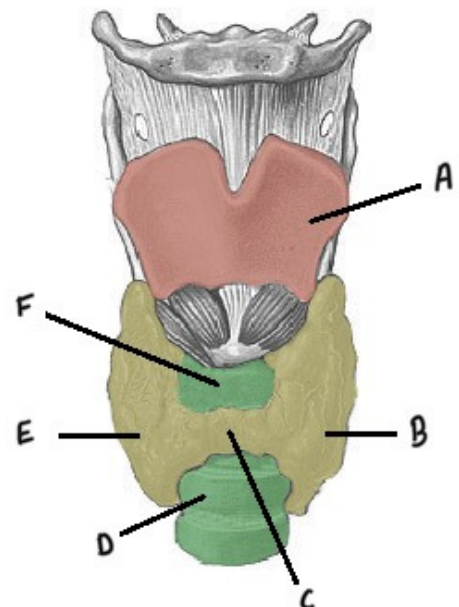
1) Label the structures of the ear:

- A)
- B)
- C)
- D)
- E)
- F)
- G)
- H)
- I)



2) Label the structures of the larynx

- A)
- B)
- C)
- D)
- E)
- F)



ENT & NECK ANATOMY

Test yourself

MCQ 1

A 24-year-old patient with recurrent otitis media is reviewed in ENT clinic. The clinician explains that infection can spread from the middle ear into the nasopharynx through a structure that also helps equalise pressure across the tympanic membrane. Which structure is being described?

- A. External acoustic meatus
- B. Eustachian tube
- C. Mastoid antrum
- D. Oval window
- E. Semicircular canal

MCQ 2

During a neck operation, the surgeon identifies a nerve travelling through the occipital triangle. Injury to this nerve would be an important surgical complication. Which cranial nerve is most at risk?

- A. Facial nerve
- B. Glossopharyngeal nerve
- C. Hypoglossal nerve
- D. Spinal accessory nerve
- E. Vagus nerve

MCQ 3

During thyroid surgery, the surgeon identifies a nerve closely related to the posteromedial aspect of the thyroid gland. Damage to this nerve may affect most intrinsic muscles of the larynx. Which nerve is this?

- A. External laryngeal nerve
- B. Glossopharyngeal nerve
- C. Hypoglossal nerve
- D. Recurrent laryngeal nerve
- E. Superior laryngeal nerve

MCQ 4

During parotid surgery, a vein within the gland is identified. It is formed by the union of the superficial temporal and maxillary veins. Which vein has been identified?

- A. Anterior jugular vein
- B. External jugular vein
- C. Facial vein
- D. Internal jugular vein
- E. Retromandibular vein

MCQ 5

A patient undergoes an interscalene block before upper-limb surgery. Local anaesthetic is introduced between the scalene muscles to target the brachial plexus. Which other nerve shown in this anatomical region is particularly important to recognise?

- A. Facial nerve
- B. Hypoglossal nerve
- C. Phrenic nerve
- D. Recurrent laryngeal nerve
- E. Spinal accessory nerve

MCQ 6

A surgeon is operating within the submandibular triangle. Which combination of structures would they expect to encounter in this region?

- A. Brachial plexus and phrenic nerve
- B. Common carotid artery and vagus nerve
- C. Facial artery and hypoglossal nerve
- D. Spinal accessory nerve and cervical plexus
- E. Thyroid gland and superior thyroid artery

ENT & NECK ANATOMY

Test yourself

OSCE Station – Case Based Discussion

A 42-year-old man presents to the ENT clinic with a 9-month history of recurrent, foul-smelling discharge from his right ear and progressively worsening hearing loss. He reports occasional dizziness but denies significant ear pain or fever. He has experienced recurrent ear infections since childhood.

On examination, Rinne's test is negative on the right, and Weber's test lateralises to the right ear. The remainder of the cranial nerve examination is normal.

An otoscopic image of the patient's right ear is provided.



- Q1. What is the most likely diagnosis based on this presentation?
- Q2. What other differential diagnoses should be considered in this patient?
- Q3. What complications may arise if this condition is left untreated?
- Q4. Which auditory ossicle is most commonly affected by erosion in this condition?
- Q5. How does erosion of the ossicular chain contribute to the patient's hearing loss?
- Q6. What are the main principles of management?

Answers

Labeling: 1) A – Pinna, B – Ear Canal, C – Ear Drum, D – Malleus, E – Incus, F – Stapes, G – Tympanic Membranes, H – Cochlea, I – Semicircular canal, 2) A – Thyroid Cartilage B – Left lobe of thyroid gland C – Isthmus D – Trachea E – Right lobe of thyroid gland F – Cricoid Cartilage

MCQs: 1) B, 2) D, 3) D, 4) E, 5) C, 6) C

OSCEs: 1) Acquired middle ear cholesteatoma. This is suggested by recurrent foul-smelling otorrhoea, progressive conductive hearing loss and an otoscopic retraction pocket containing keratinous debris. 2) Chronic suppurative otitis media, which similarly presents with persistent otorrhoea and conductive hearing loss but typically involves tympanic membrane perforation without keratinous debris. 3) Ossicular erosion causing conductive hearing loss, facial nerve palsy, labyrinthine fistula, labyrinthitis and mastoiditis. Intracranial complications include meningitis, brain abscess and sigmoid sinus thrombosis. 4) Incus (particularly the long process) due to its susceptibility to bony destruction. 5) Ossicular erosion disrupts the transmission of sound vibrations from the tympanic membrane to the oval window, resulting in conductive hearing loss. 6) ENT assessment, audiometry and CT temporal bone where indicated to assess disease extent. Aural toilet and topical antibiotics may control infection, but definitive treatment is surgical excision, with tympanoplasty and/or mastoidectomy as appropriate. Long-term surveillance is required for residual or recurrent disease.