

INTERNATIONAL SURGICAL  
ANATOMY TEACHING  
SERIES



# ISATS HANDOUT 2023/24

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

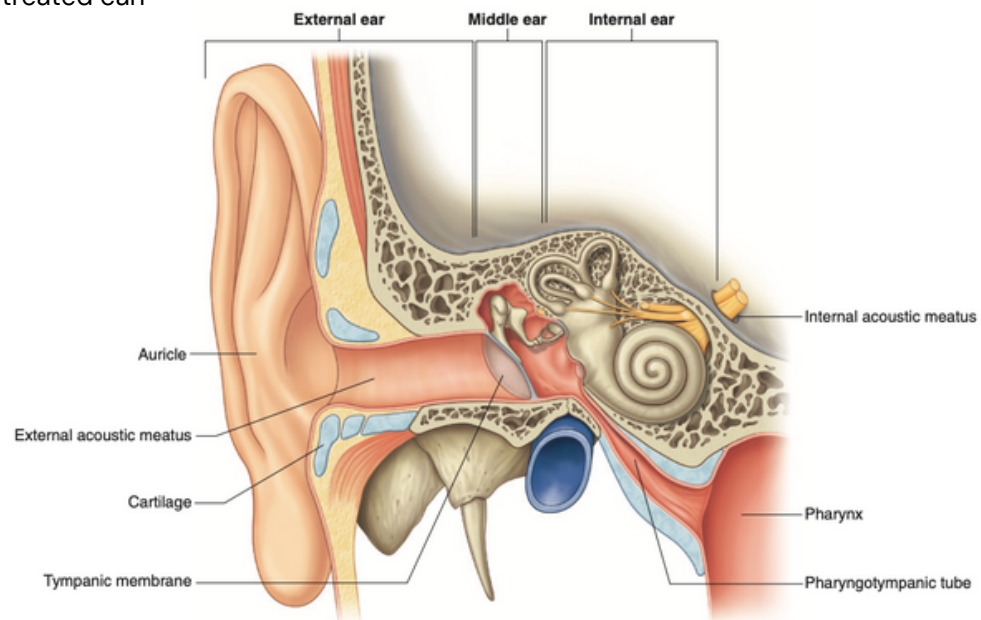
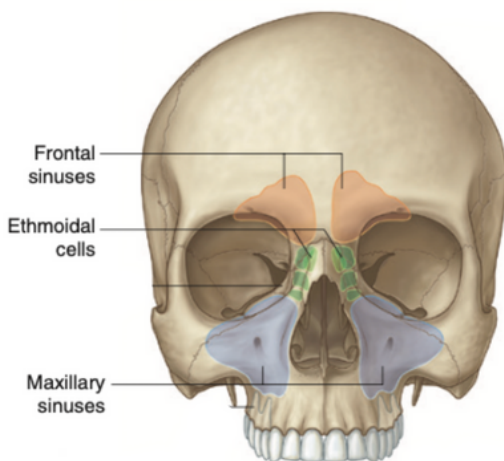
### Middle ear:

- 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.

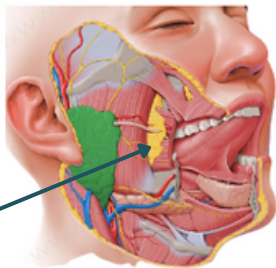
## Salivary Glands of The Face

### Parotid

Superficial & deep lobes (parotid region)

Secretions: mostly serous

Duct: Stensen's (parotid) duct



Parotid duct

### Submandibular

Submandibular triangle (inf & post to mylohyoid muscle)

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

Duct: Wharton's duct

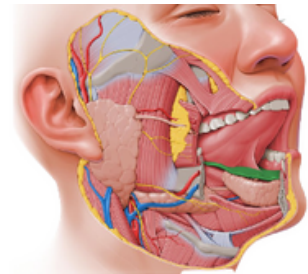


### Sublingual

Between the mouth floor and mylohyoid muscle

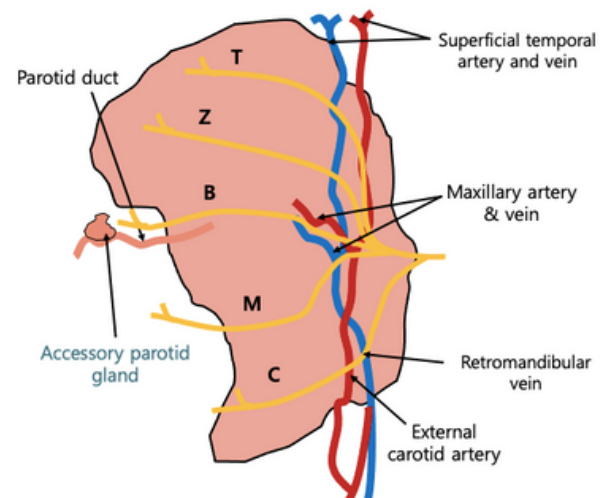
Secretions: mostly mucous

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



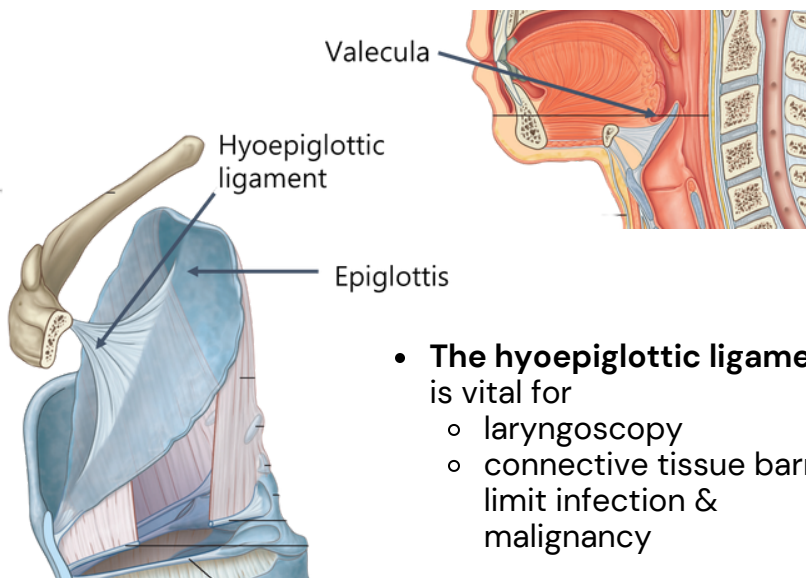
# NECK ANATOMY

**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.

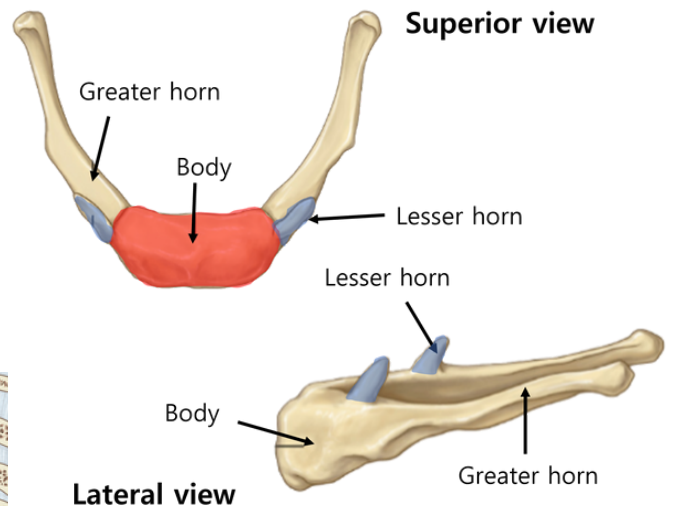
## The hyoid bone

### 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**

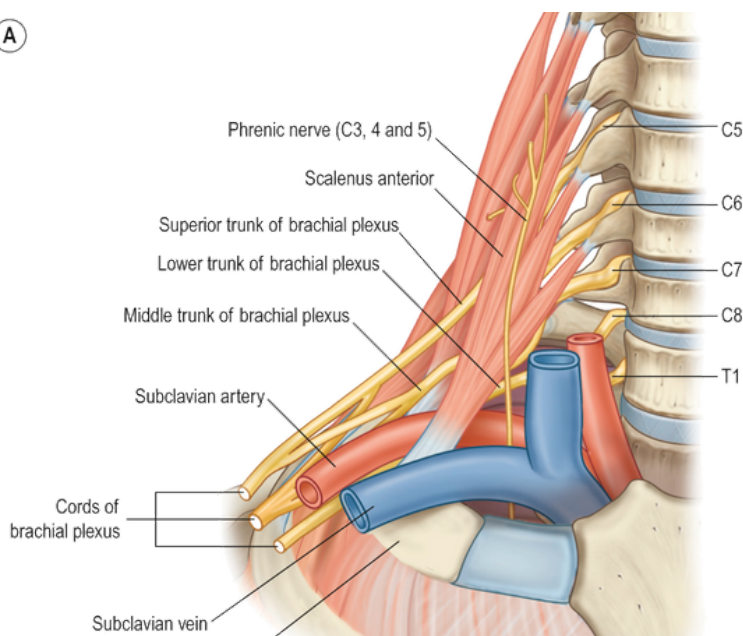


- **The hyoepiglottic ligament** is vital for
  - laryngoscopy
  - connective tissue barrier limit infection & malignancy



- **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

A



## 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**



# NECK ANATOMY

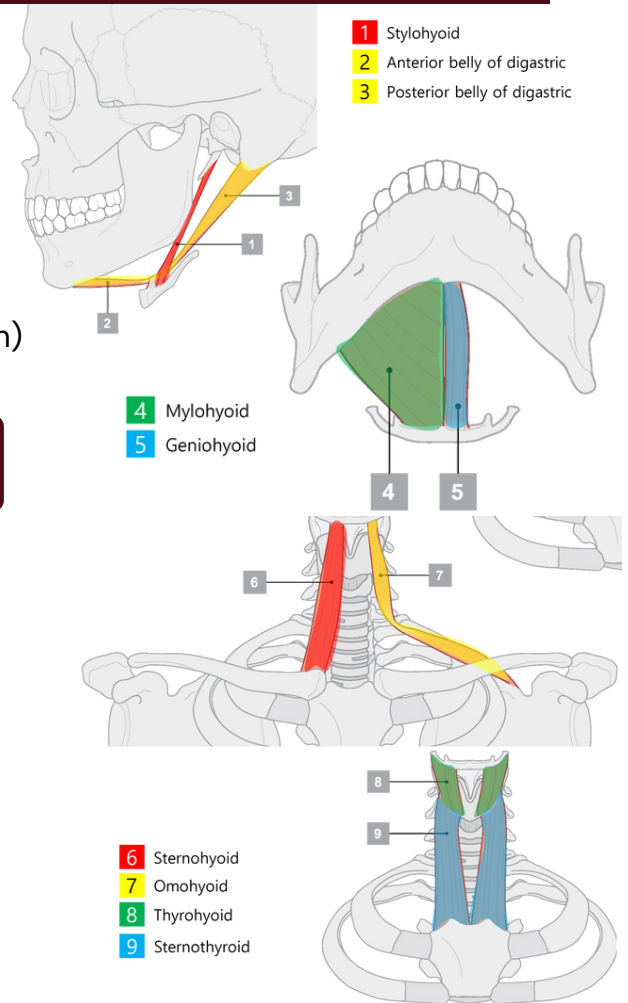
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## Suprahyoids

### 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

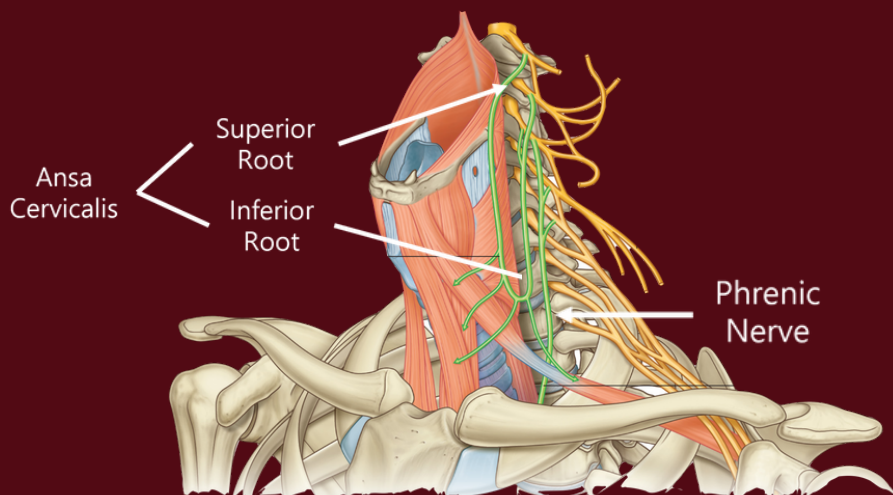
- **Sternohyoid:** Ansa cervicalis
- **Omohyoid:** Ansa cervicalis
- **Sternothyroid:** Ansa cervicalis
- **Thyrohyoid:** C1

**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)

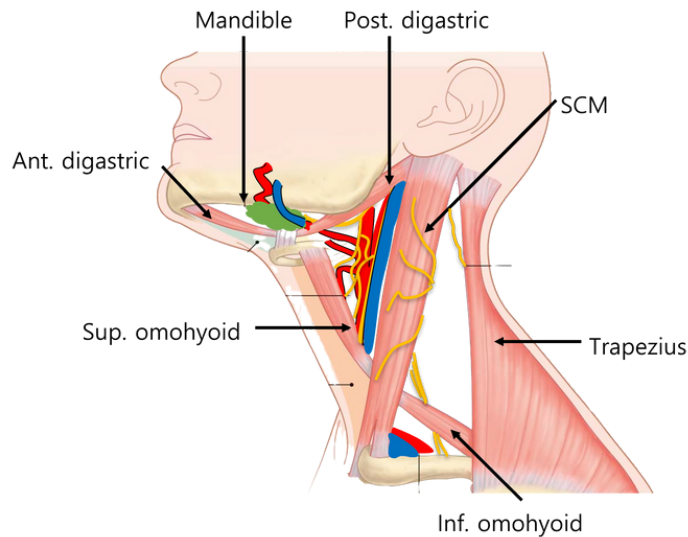
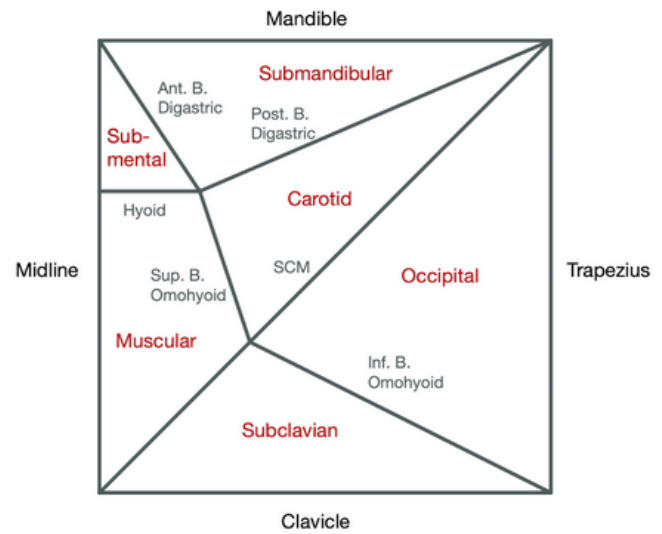
### Posterior

#### Subclavian triangle

- Subclavian artery
- Subclavian veins
- Brachial Plexus

#### Occipital triangle

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

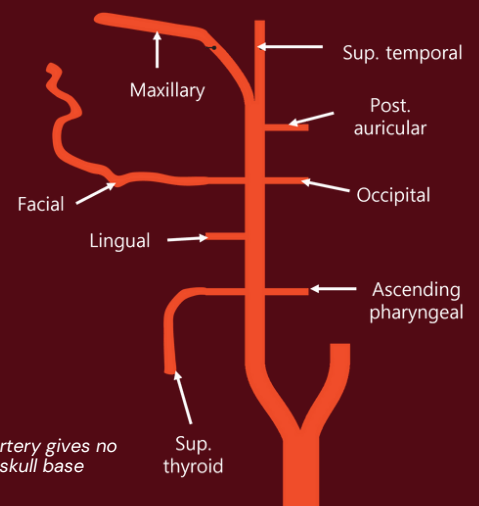


*\*To subdivide anterior and posterior triangles, the only extra muscles you need are:*

- **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



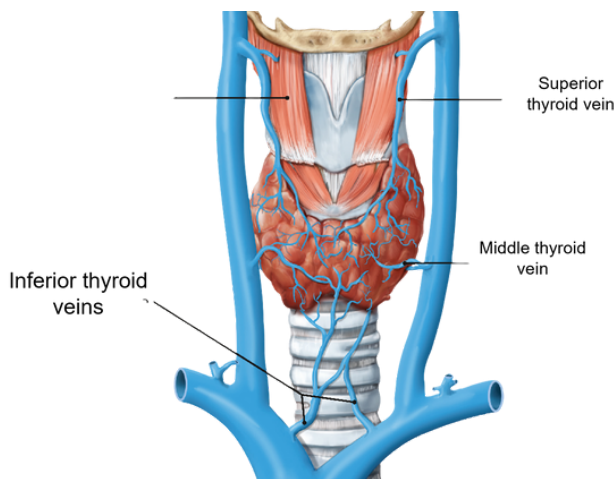
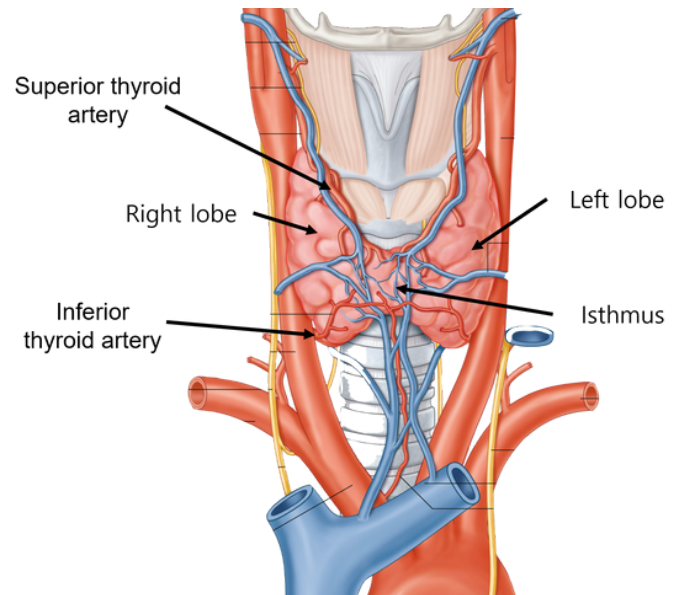
*NB – the internal carotid artery gives no branches before entering skull base*

# NECK ANATOMY

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## Thyroid Gland

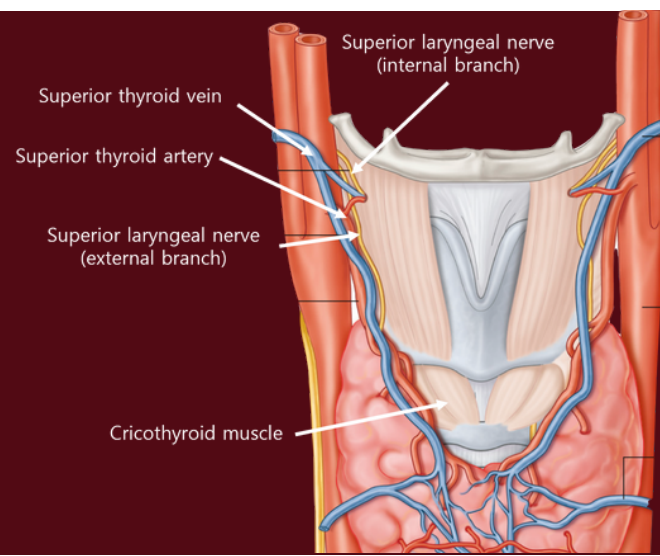
- Right and left lobes connected by a central isthmus
  - Pyramidal lobe in around 50% of people
- C5-T1 vertebral levels but ectopic tissue common
- Attached to cricoid cartilage by Berry's ligament
- **Superior thyroid artery:** anterior, medial and lateral aspects
- **Inferior thyroid artery:** posterior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



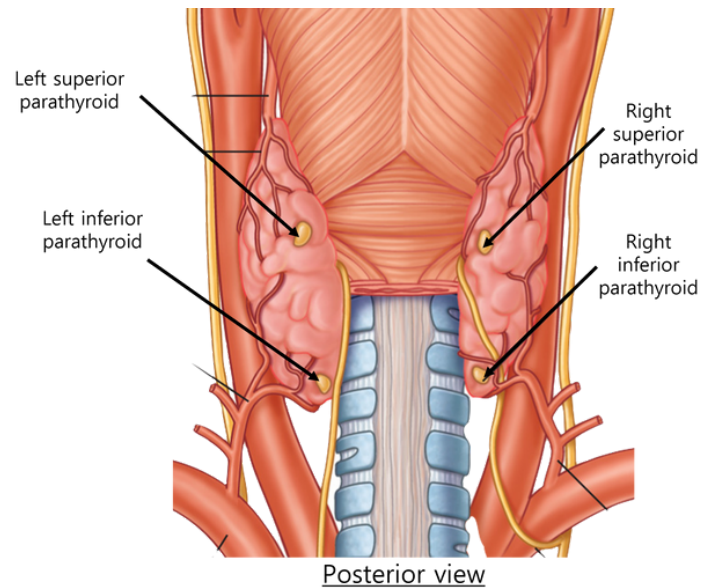
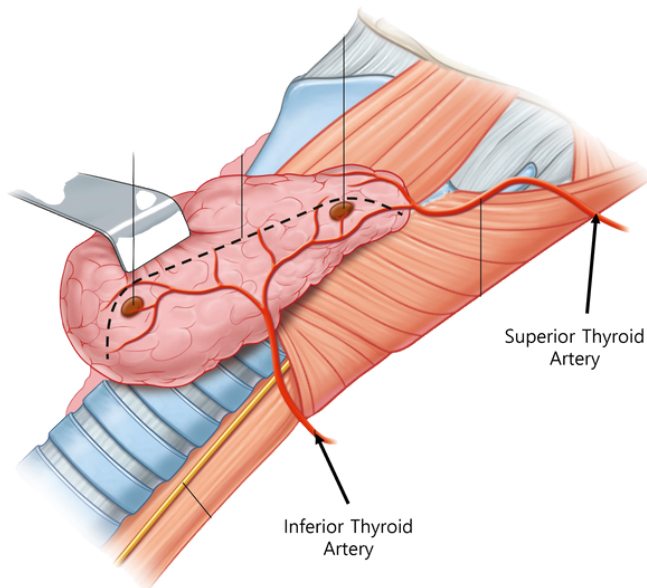


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## Parathyroid Glands

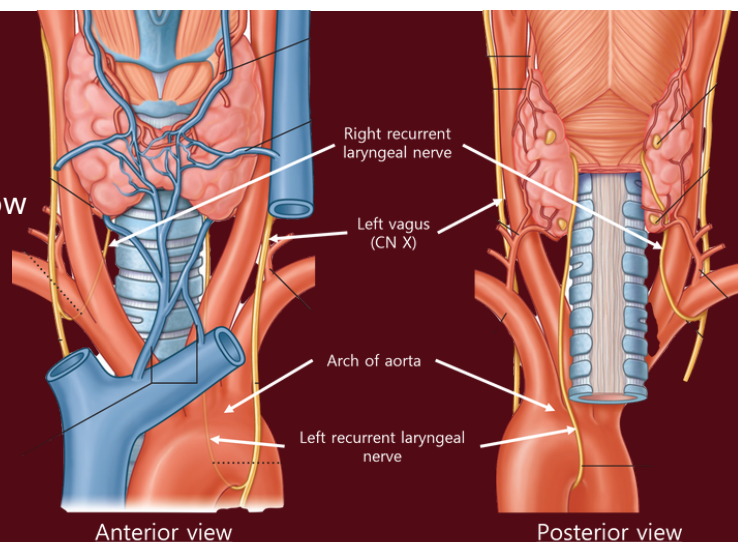
- 4 small ovoid glands on the posterior aspect of the thyroid gland
  - 4% may be intrathyroidal
- Each only 6mm in length
- **Superior parathyroid glands** are almost always in normal anatomical position
- **Inferior parathyroid glands** are quite variable and may be found as far as the thymus



- 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 (CN X)
- 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

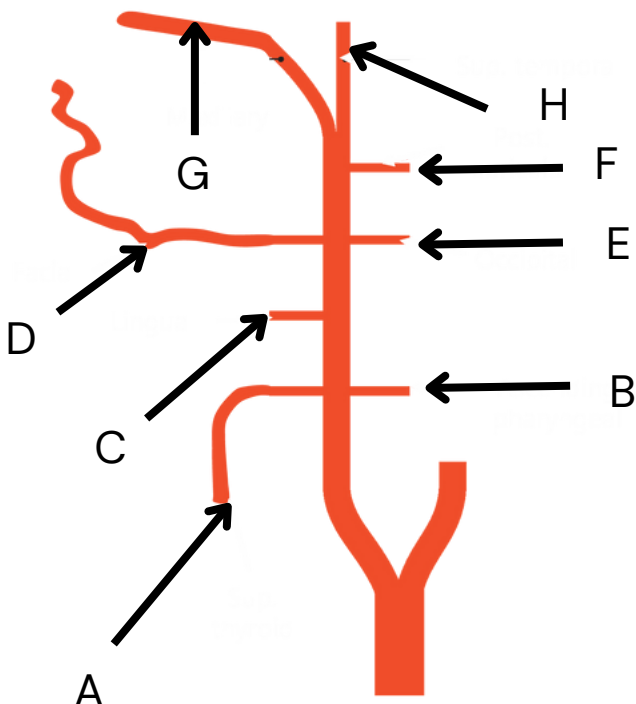
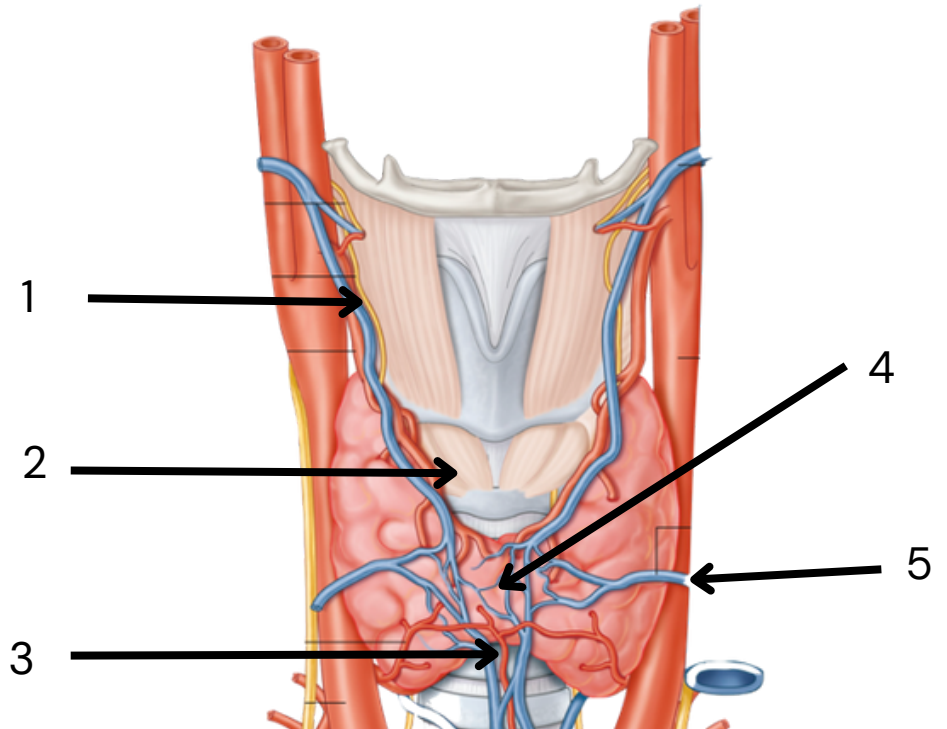


# ENT & NECK ANATOMY

## Test yourself

1) Label the structures:

- 1)
- 2)
- 3)
- 4)
- 5)



2) Label the branches of the external carotid artery:

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

# ENT & NECK ANATOMY

## Test yourself

### MCQ 1

A 74-year-old male patient complained of submandibular pain that increases while eating. This gland has close anatomical location to all of these structures except;

- A. Lingual nerve
- B. Hypoglossal nerve
- C. Mylohyoid muscle
- D. Facial nerve
- E. Superior thyroid nerve

### MCQ 3

A 75-year-old female is about to undergo parathyroid surgery. Which is the main arterial supply to the parathyroid glands?

- A. Superior thyroid artery
- B. Thyroid ima artery
- C. Common carotid artery
- D. Ascending pharyngeal artery
- E. Inferior thyroid artery

### MCQ 5

During a thyroidectomy, the superior thyroid artery is identified and ligated. Which vessel directly gives rise to the superior thyroid artery?

- A. External carotid artery
- B. Thyrocervical trunk
- C. Internal carotid artery
- D. Aortic arch
- E. Subclavian artery

### MCQ 2

Which of the following structures can't be found in the posterior triangle?

- A. Subclavian artery
- B. Vagus n. (CNX)
- C. Brachial plexus
- D. Spinal accessory nerve (CNXI)
- E. Subclavian vein

### MCQ 4

The Ansa Cervicalis provides motor innervation to most of the infrahyoids, which infrahyoid muscle is an exception to this?

- A. Sternohyoid
- B. Omohyoid
- C. Sternothyroid
- D. Thyrohyoid
- E. Mylohyoid

### MCQ 6

Which muscle divides the submandibular and carotid triangle in the anterior triangle of the neck

- A. Inferior belly of the Omohyoid
- B. Superior belly of the Omohyoid
- C. Posterior belly of the Digastric
- D. Anterior belly of the Digastric
- E. Sternocleidomastoid



# ENT & NECK ANATOMY

## Test yourself

### OSCE Station – Case Based Discussion

A 23-year-old female presents to her GP as her parents have noticed that her neck looks bigger than normal. She has no other problems and has no medical conditions. On examination, the doctor can palpate a thyroid mass that moves on swallowing but not on tongue protrusion. The GP suspects thyroid cancer and refers the patient via the two-week wait system. Upon further investigation, the patient is found to have the most common type of thyroid cancer.



- Q1. What is the most common type of thyroid cancer? List the 4 other types of thyroid cancer;**
- Q2. What is a frequent complication with the most common thyroid malignancy?**
- Q3. Which investigations will be useful in confirming a diagnosis?**
- Q4. How will you initially manage this patient ?**
- Q5. What yearly follow up test will this patient require any why?**
- Q6. Which nerve may be damaged if a surgical management is chosen, and what are the implications of this**

Labeling: 1) Superior laryngeal nerve 2) Cricothyroid muscle 3) Thyroid ima artery 4) Isthmus 5) Middle thyroid vein A) Superior thyroid B) Ascending pharyngeal C) Lingual D) Facial E) Occipital F) Posterior auricular G) Maxillary H) Superficial temporal  
 MCQs: 1) E, 2) C, 3) E, 4) D, 5) B, 6) C  
 OSCES: 1) The most common thyroid cancer is Papillary. From most to least common, the others are: follicular, medullary, anaplastic, and lymphoma 2) Tendency to spread to cervical lymph nodes early 3) Thyroid function tests; TSH & T4, ultrasound neck, fine-needle aspiration, CT / MRI scan. Q4) Total thyroidectomy, followed by radioiodine (I-131) to kill residual cells. 5) Yearly thyroglobulin levels to detect early recurrent disease 6) Recurrent laryngeal nerve. Damage causes unilateral vocal cord paralysis. Patients with this typically complain of new-onset hoarseness, changes in vocal pitch, or noisy breathing.