
MIDLANDS SURGICAL
ANATOMY TEACHING
SERIES



MSATS HANDOUT 2021/22

High Yield | Surgical Relevance | CPD Accredited

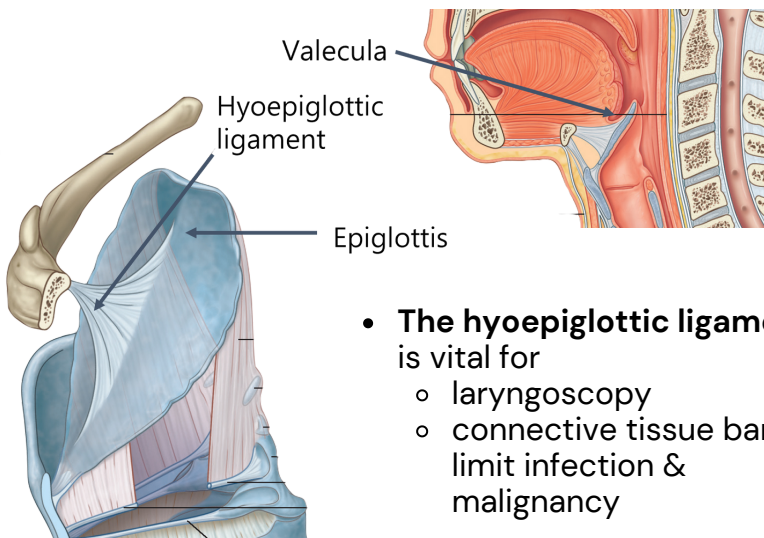
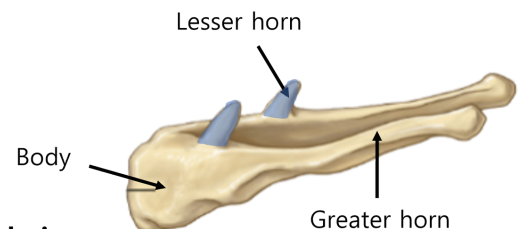
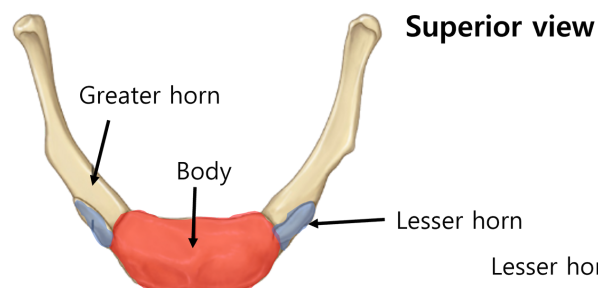
NECK ANATOMY

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

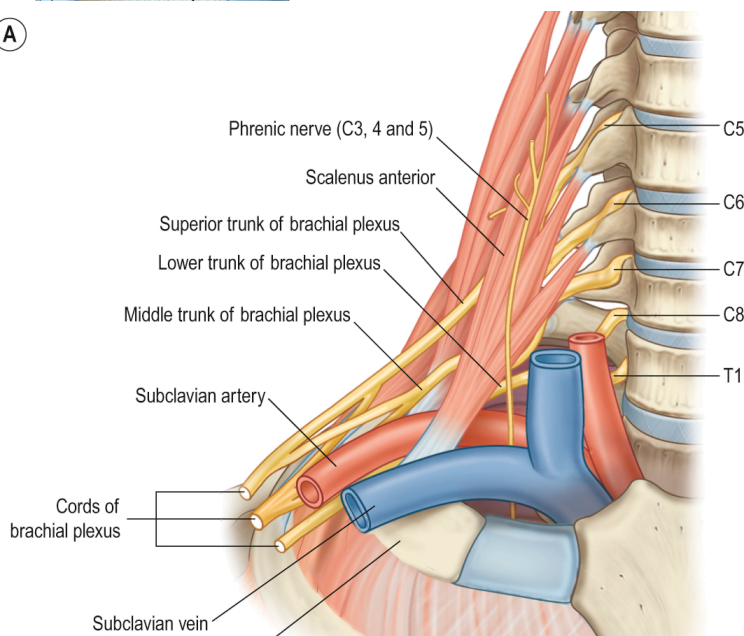
- The only bone to have no other bony articulations
- Body, greater horn and lesser horn
- Functions
 - Stabilise the airway
 - Attach muscles and ligaments
 - Mobilise for movements of jaw and tongue



- **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

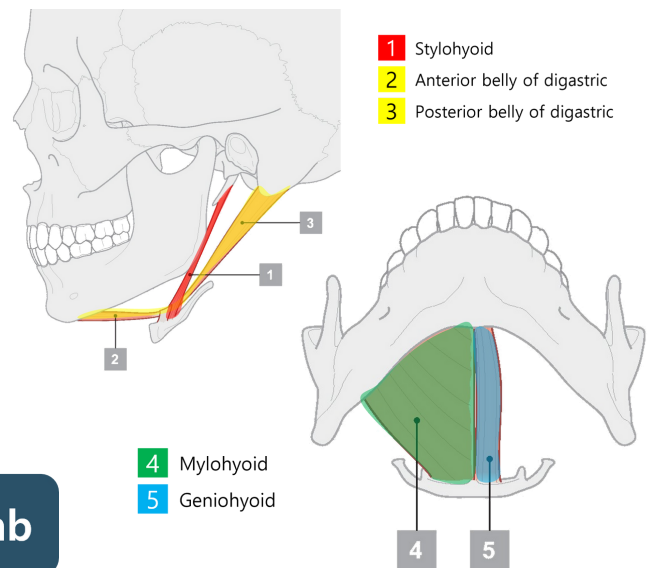
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Suprahyoids

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

Dumb

Infrahyoids

Innervation

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

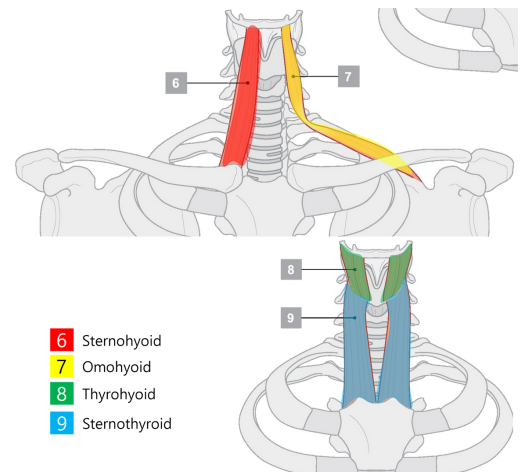
Oh

Sugar

This

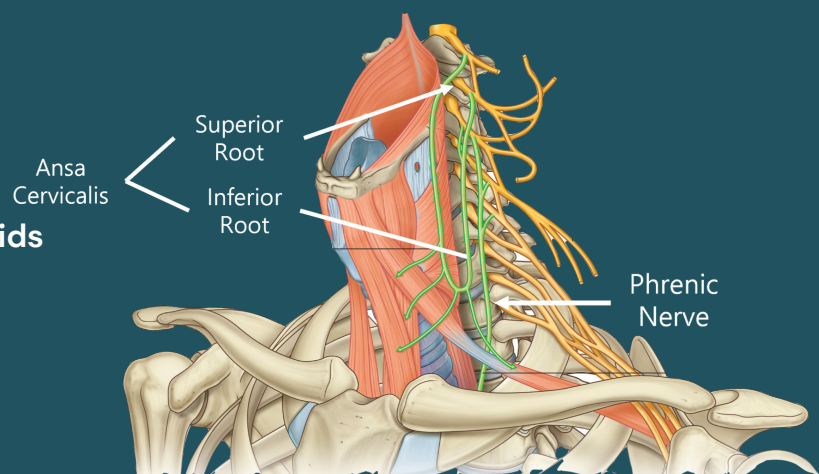
Sucks

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



Ansa Cervicalis

- In latin *ansa* = loop i.e.
- 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 nerve

Submental triangle

- Submental lymph nodes
- Anterior jugular vein

Muscular triangle

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

Carotid triangle

- Internal & external carotid arteries
- Vagus (CNX)
- Internal jugular vein
- Branches of external carotid artery
- Ansa cervicalis
- Spinal accessory nerve (CNXI) and hypoglossal nerve (CNXII)

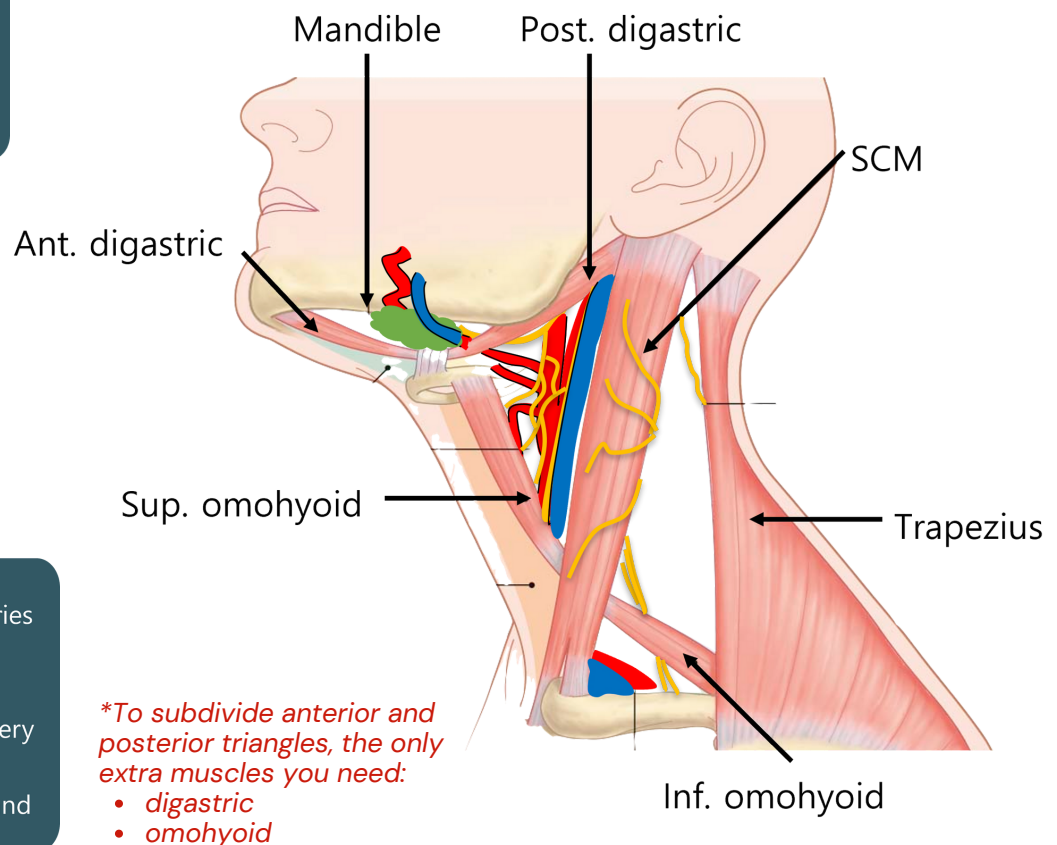
Posterior

Subclavian triangle

- Subclavian artery
- Subclavian vein
- Brachial plexus

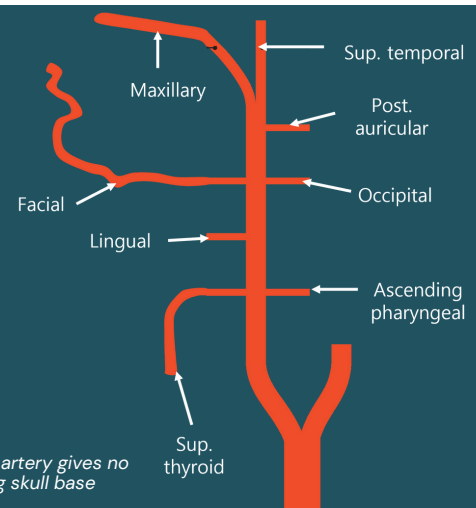
Occipital triangle

- Cutaneous cervical plexus
- Spinal accessory nerve (CN XI)
- Upper part of brachial plexus



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**



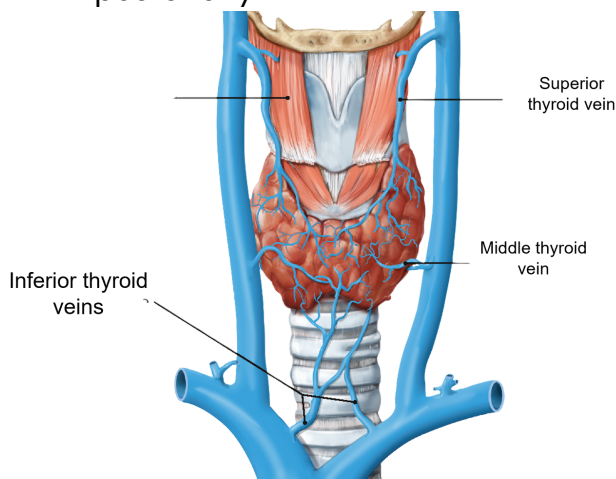
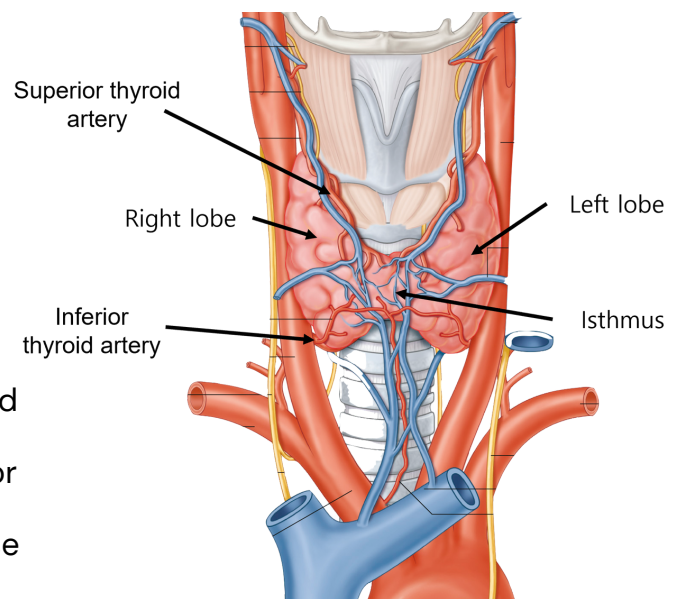
NB – the internal carotid artery gives no branches before entering skull base

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Thyroid Gland

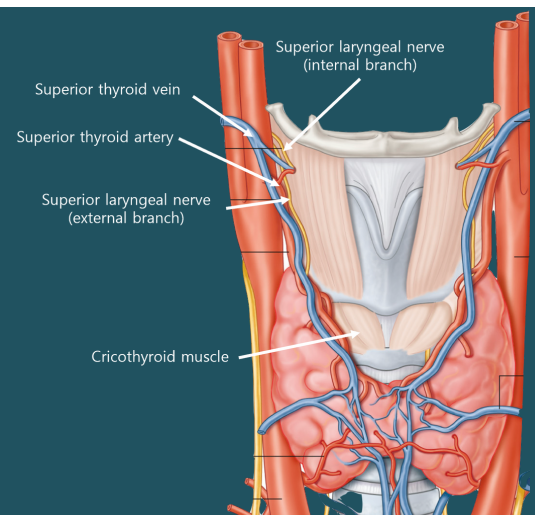
- Right and left lobes connected by a central isthmus
 - Pyramidal lobe in around 50% of people
- C5–T1 vertebral levels but ectopic tissue common
- Attached to cricoid cartilage by Berry's ligament
- **Superior thyroid artery:** anterior, medial and lateral aspects
- **Inferior thyroid artery:** posterior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



- **3 vein 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 to**
 - 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

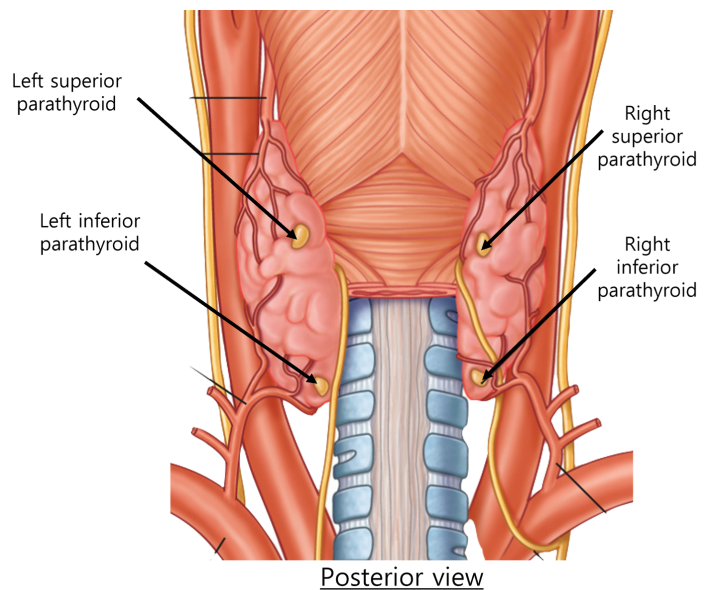
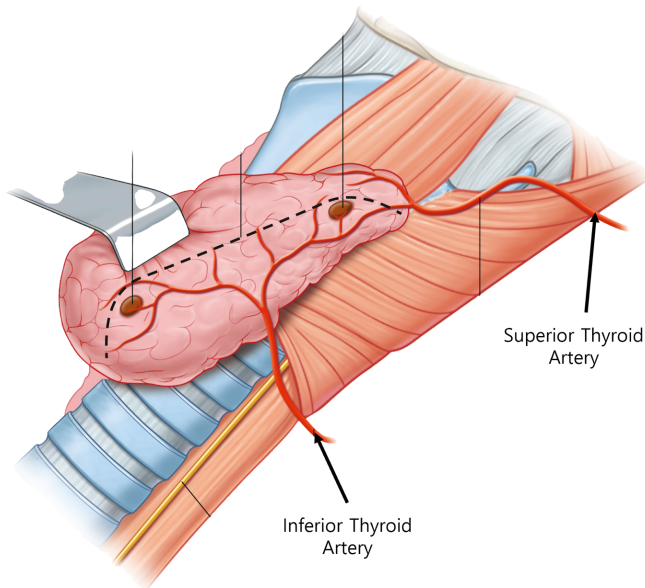


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Parathyroid Glands

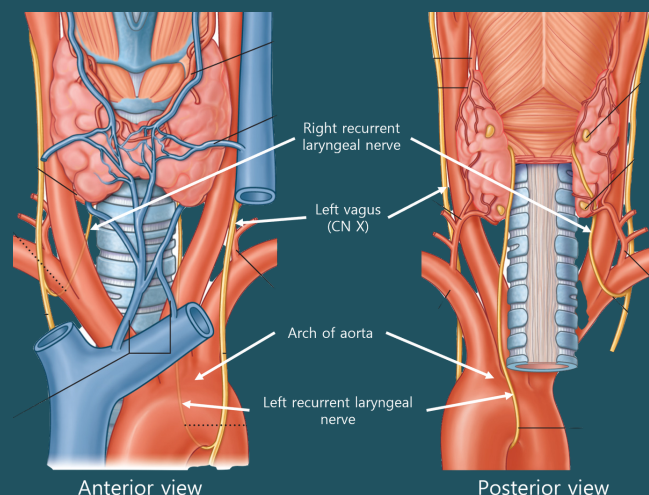
- 4 small ovoid glands on the posterior aspect of the thyroid gland
 - 4% may be intrathyroidal
- Each only 6mm in length
- **Superior parathyroid glands** are almost always in normal anatomical position
- **Inferior parathyroid glands** are quite variable and may be found as far as the thymus



- 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

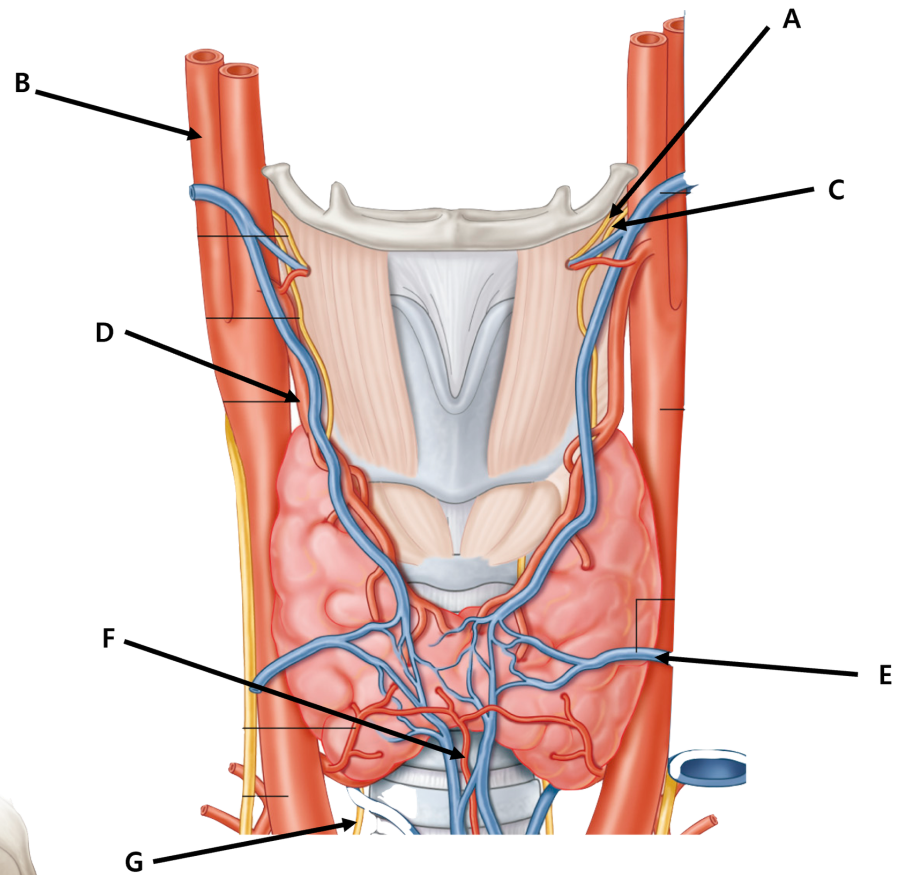


ANATOMY

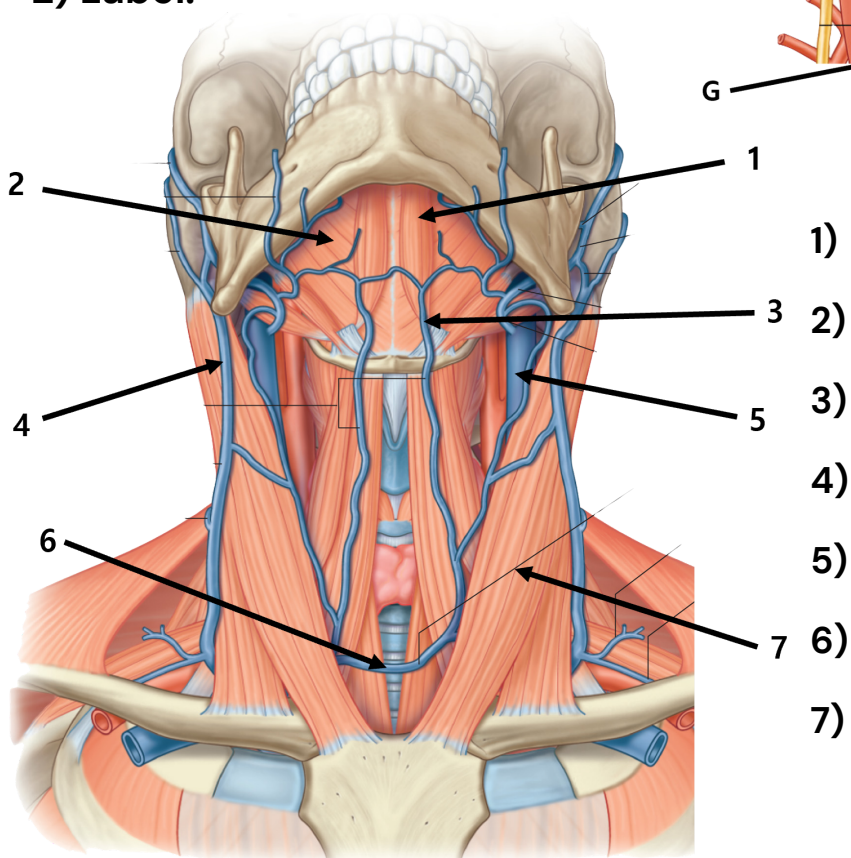
Test yourself...

1) Label the structures...

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



2) Label:



ANATOMY

Test yourself...

MCQ 1

A 64 year old female who recently had a total thyroidectomy due to papillary thyroid cancer has been struggling with a deep hoarse voice and is unable to hit the high notes when singing for his local choir. Which nerve is likely damaged?

- A. Recurrent laryngeal nerve
- B. Main branch of the vagus nerve
- C. Superior laryngeal nerve – internal branch
- D. Superior laryngeal nerve – external branch
- E. Anterior ramus of C1

MCQ 2

When carrying out a total thyroidectomy, a surgeon may identify Beahr's triangle. Why?

- A. Identify and preserve the recurrent laryngeal nerve
- B. Identify and preserve the inferior thyroid vein
- C. Avoid damaging the middle thyroid vein
- D. Identify any ectopic parathyroid glands
- E. Open a window for a posterior approach

MCQ 3

Which artery is the predominant 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 4

A 22 year old was the victim of a recent strangulation assault but thankfully survived the ordeal. They have recently been in hospital for pneumonia and this is the 4th major chest infection this year. What is the likely underlying pathology?

- A. Thyroid cartilage instability
- B. Hyoid bone fracture
- C. Stylohyoid ligament tear
- D. Injury to the mylohyoid branch of inferior alveolar nerve
- E. Damage to the ansa cervicalis

MCQ 5

Which nerve innervates the posterior belly of digastric, and what other muscle does this nerve innervate?

- A. Facial nerve (CNVII) + geniohyoid
- B. Mylohyoid branch of inferior alveolar nerve + mylohyoid
- C. Facial nerve (CNVII) + stylohyoid
- D. Mylohyoid branch of inferior alveolar nerve + stylohyoid
- E. Ansa cervicalis + omohyoid

MCQ 6

When reflecting the infrahyoid muscles, where must you place your incision?

- A. Inferior half of the muscle belly
- B. Superior half of the muscle belly
- C. Along the insertion on the hyoid bone
- D. Midline of the muscle belly
- E. Never incise the infrahyoids

ANATOMY

Test yourself...

OSCE Station – Case Based Discussion

During an Ear, Nose and Throat clinic as a part of your surgical training you encounter a 52 year old female patient with a palpable, painless nodule about 5cm inferior to her thyroid eminence and 1-2cm lateral to her sternocleidomastoid. The nodule is hard and immobile, measuring about 5cm at its widest point. Her family history is negative and she experiences no other symptoms except some mild dysphagia when eating.



- Q1. What should be the 1st investigations you order in this case?**
- Q2. List the main working diagnosis that must be ruled out and 2 potential differential diagnoses**
- Q3. Investigations confirm your primary diagnosis, how will this patient need to be managed?**
- Q4. Which 2 nerves may be damaged if a surgical option is chosen and at which stage of the surgery might they be damaged?**
- Q5. How might each palsy progress and why?**
- Q6. Which adjuvant/neoadjuvant therapy is indicated in this patient?**

Answers
Labels Image 1: A-superior laryngeal nerve internal branch B-internal carotid C-superior laryngeal nerve external branch D-superior thyroid artery E-middle thyroid ima artery F-thyroid ima artery G-recurrent laryngeal nerve Image 2: 1-ant. belly of digastric 2-mylohyoid 3-anteior jugular vein 4-external jugular vein 5-internal jugular vein 6-jugular arch 7-sternocleidomastoid
MCQs: 1) D 2) A 3) E 4) B 5) C 6) B
OSCE
1-TSH levels, ultrasound of the nodule, laryngoscopy, fine-needle biopsy
2-working: Papillary thyroid cancer, differentials: benign thyroid nodule, thyroglossal duct cyst
3-surgical resection of the mass by total thyroidectomy with or without neck dissection
4-superior laryngeal nerve (during ligation of superior thyroid artery), recurrent laryngeal nerve (any point, in particular when dissecting inferior thyroid artery and working posteriorly on the gland)
5-superior laryngeal nerve palsy will recover with time due to contralateral cricothyroid compensation. Recurrent laryngeal nerve palsy will not improve/recover because of total paralysis of the ipsilateral vocal cord
6-Radioactive iodine ablation therapy – indicated in this patient because nodule >2cm and >45 years of age