

Infrahyoid Muscles

★ Attachments:

	Origin	Insertion
Sternohyoid	<ul style="list-style-type: none"> • Back of manubrium and medial end of clavicle 	<ul style="list-style-type: none"> • Lower border of body of hyoid bone .
Omohyoid	1) Superior belly : Intermediate tendon of omohyoid muscle. 2) Inferior belly : Supra-scapular notch and ligament.	1) Body of hyoid bone lateral to sternohyoid muscle. 2) Intermediate tendon which is attached to the medial end of the clavicle by a fibrous sling.
Sternothyroid	<ul style="list-style-type: none"> • Back of manubrium medial to sternohyoid and 1st costal cartilage. 	<ul style="list-style-type: none"> • Oblique line of thyroid cartilage.
Thyrohyoid	<ul style="list-style-type: none"> • Oblique line of thyroid cartilage. 	<ul style="list-style-type: none"> • Body and greater horn of hyoid bone.

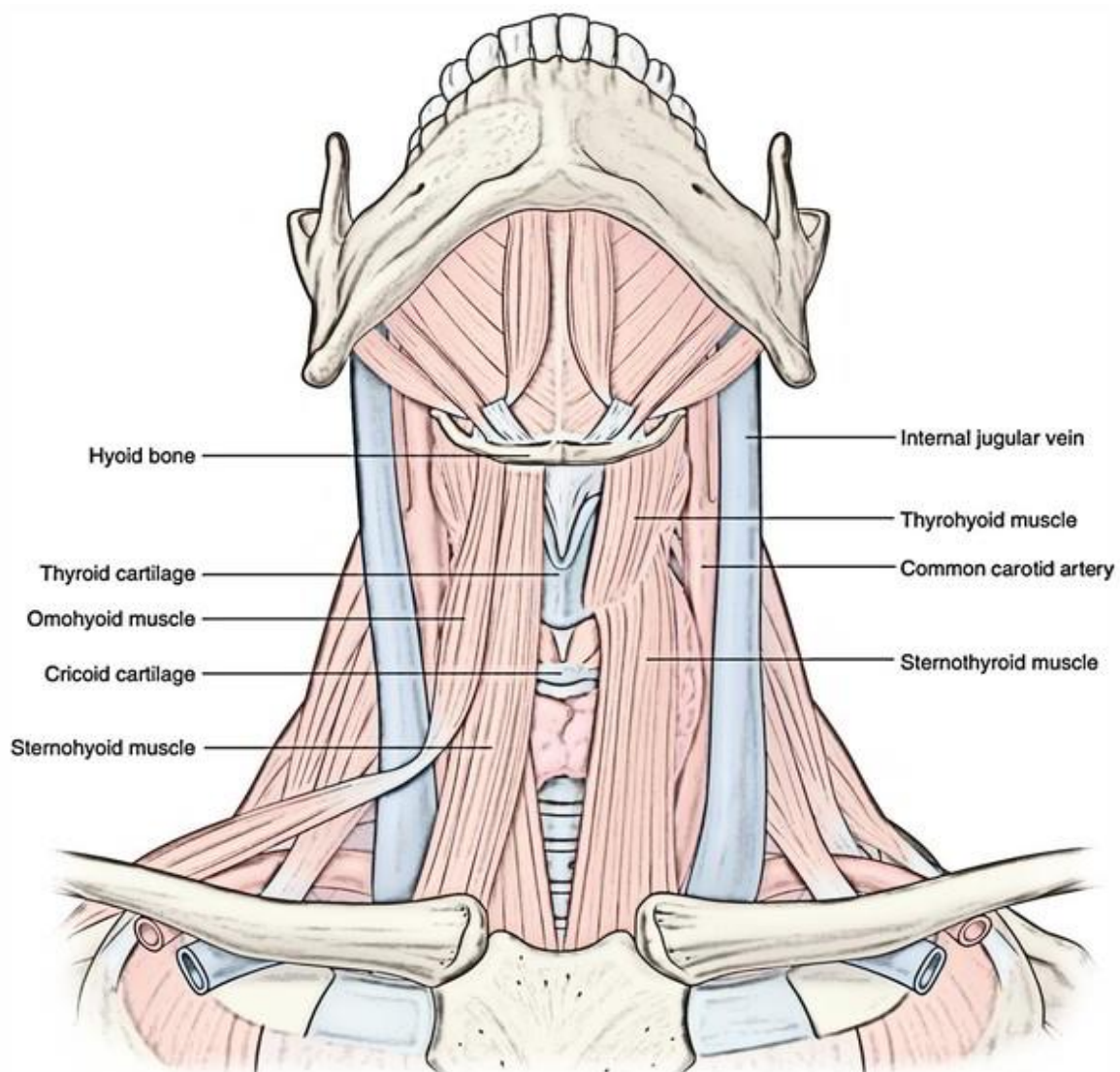
★ **Action:** They act together during swallowing to **depress hyoid bone** and **thyroid cartilage**.

★ **Nerve supply:** All muscles are supplied by branches from **ansa cervicalis** except **thyrohyoid** which is supplied by C1 through hypoglossal nerve.

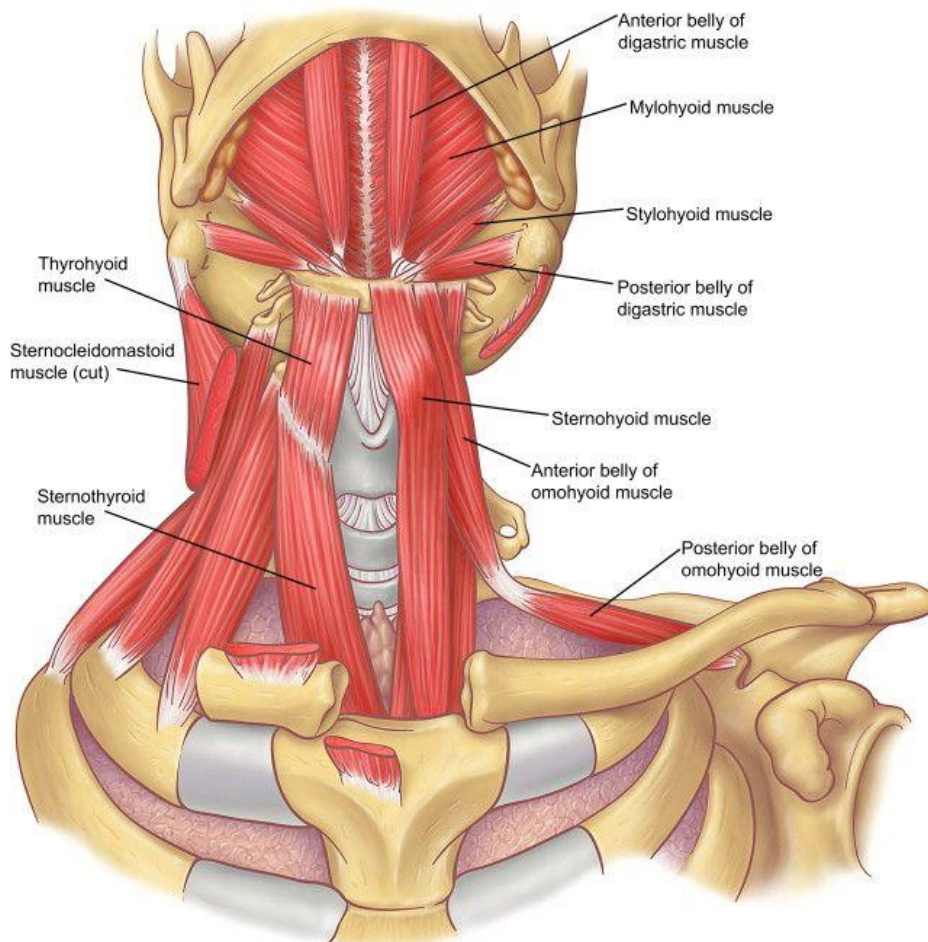
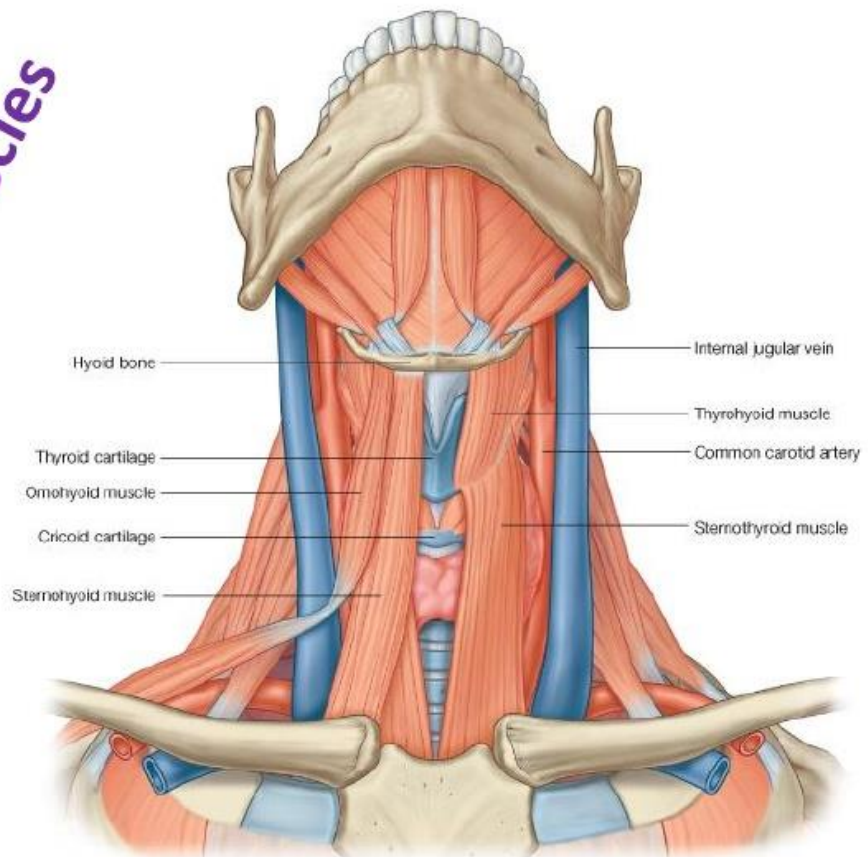
★ Relations:

- Infrahyoid muscles are four **strap muscles** on each side of the midline of the neck.
- They lie **below the hyoid** bone **deep to** the skin, superficial fascia, platysma and general investing fascia.
- They **cover** the larynx (thyroid and cricoid cartilages), trachea and thyroid gland.
- These muscles are **2 superficial** and **2 deep muscles**:
 - The **superficial muscles** are **sternohyoid** (medially) and **superior belly of omohyoid** (laterally).

- The **deep muscles** are **sternothyroid** (below) and **thyrohyoid** (above).
- The **intermediate tendon** of omohyoid is deep to sternomastoid, the **inferior belly** of omohyoid lies in the posterior triangle of the neck and divide the posterior triangle into subclavian and occipital triangles, while the **superior belly** of omohyoid lies in the anterior triangle of the neck and separating the carotid triangle from muscular triangle.



Infrahyoid muscles



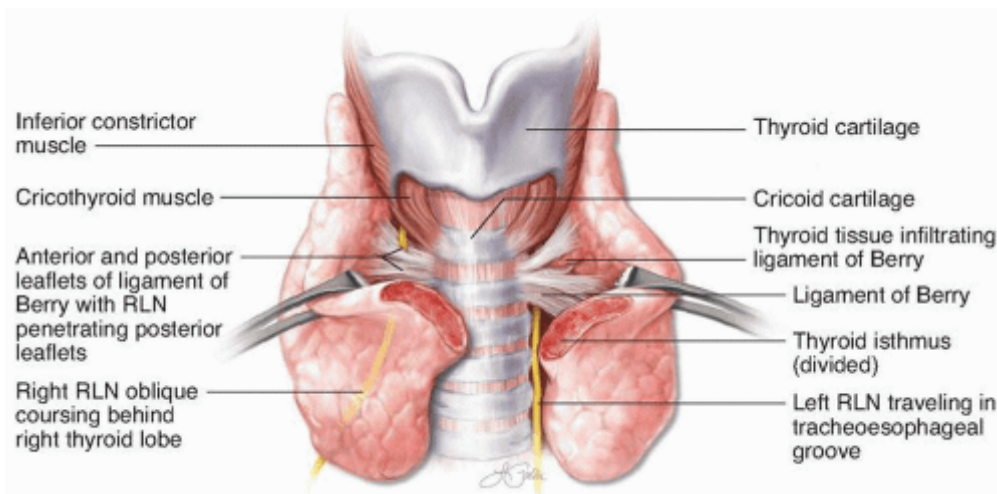
Thyroid Gland

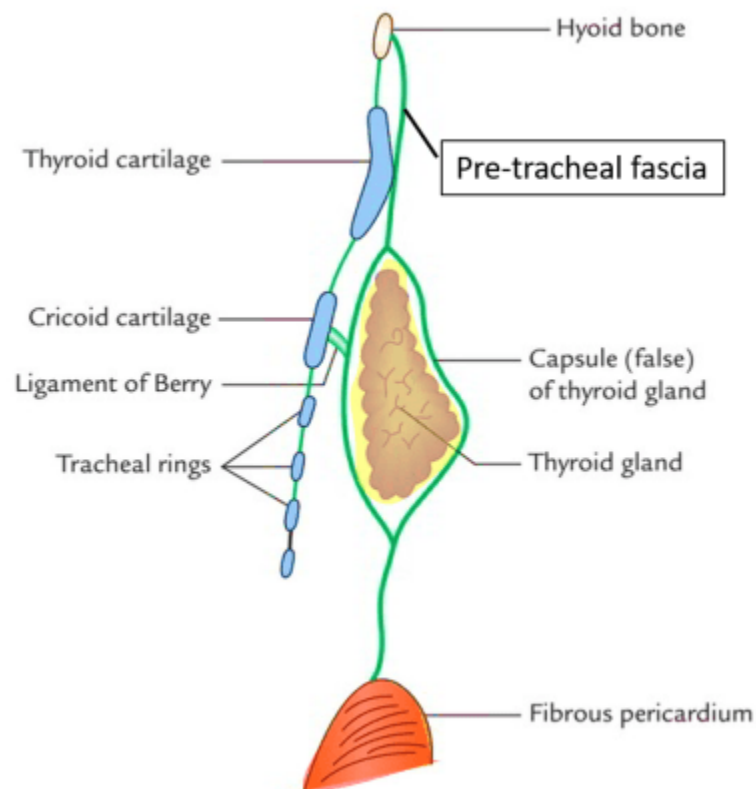
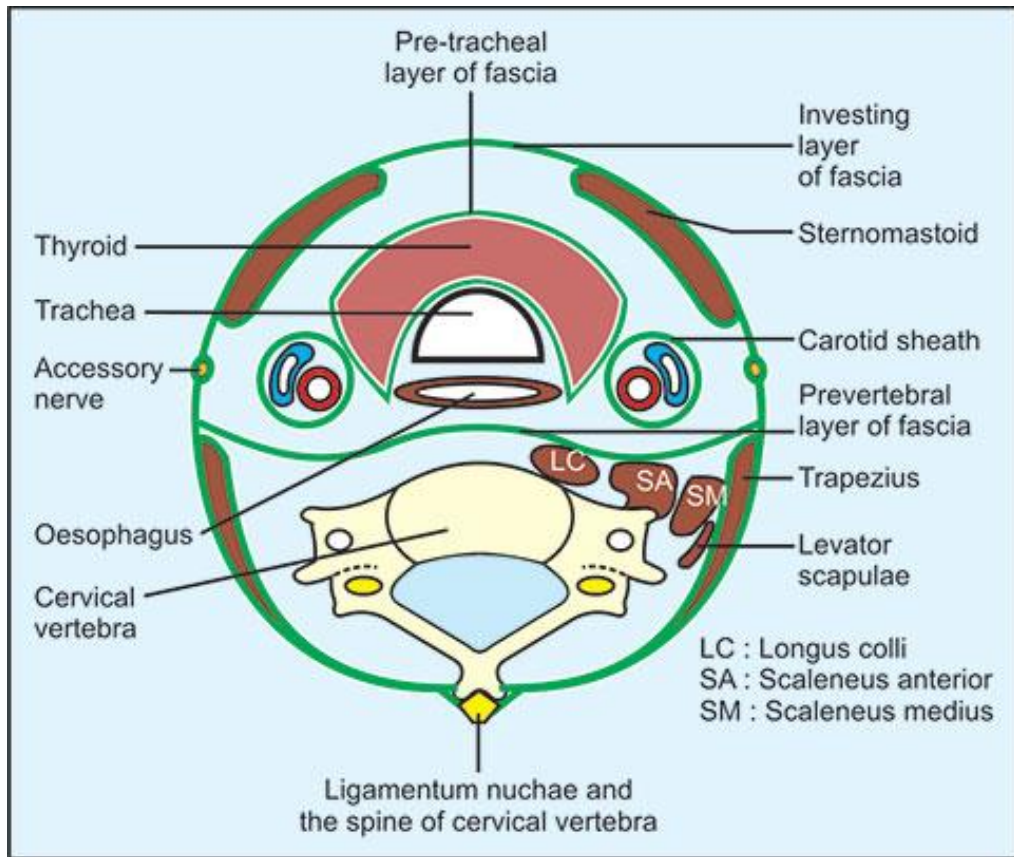
★ Site & Shape:

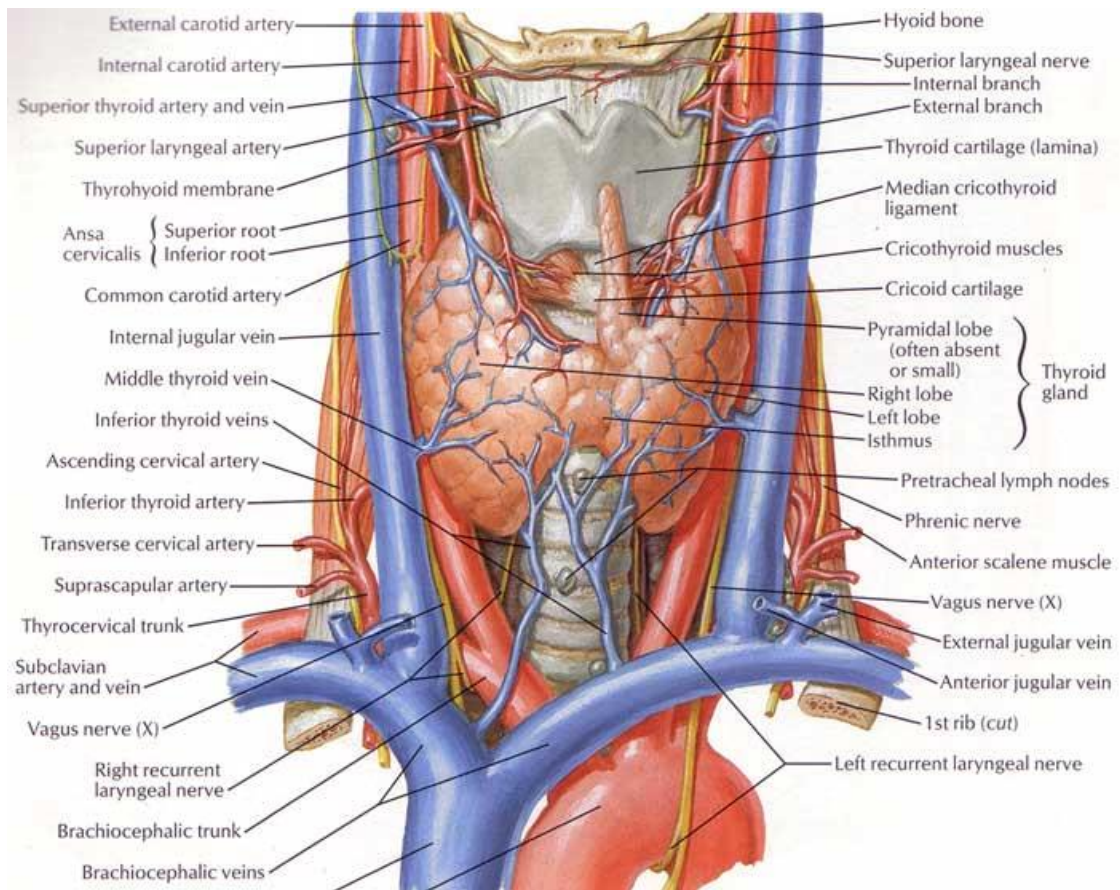
- It is an endocrinal gland, about 20-25 gm in adults, lies in the **lower part of front of the neck**.
- It is **butterfly** in shape & formed of **2 lateral lobes** connected together by an **isthmus**.
- Each **lobe** is **pyramidal** in shape, its **apex** reaches the **oblique line** of thyroid cartilage, its **base** reaches the level of **6th** tracheal ring.
- The **isthmus** lies opposite **2, 3, 4** tracheal rings.

★ Capsule:

- It has a **fibrous capsule** which is separated from the **pre-tracheal fascia** by a network of **nerve fibers** and **anastomosing vessels**.
- It is enclosed within the **pre-tracheal fascia** which is attached upwards to the **thyroid cartilage & hyoid bone** (so moves with swallowing).
- There is **thickening** of this fascia that fix the back of each lobe to cricoid cartilage & upper tracheal rings (**Suspensory ligament of thyroid** or **ligament of Berry**). RLN is embedded in the back of this ligament.







★ **Surfaces & relations:**

- **Relation of lateral lobes:**

1. Antero-lateral surface: is related to 3 infrahyoid muscles (sternohyoid, sternothyroid, superior belly of omohyoid) overlapped by sternomastoid muscles.

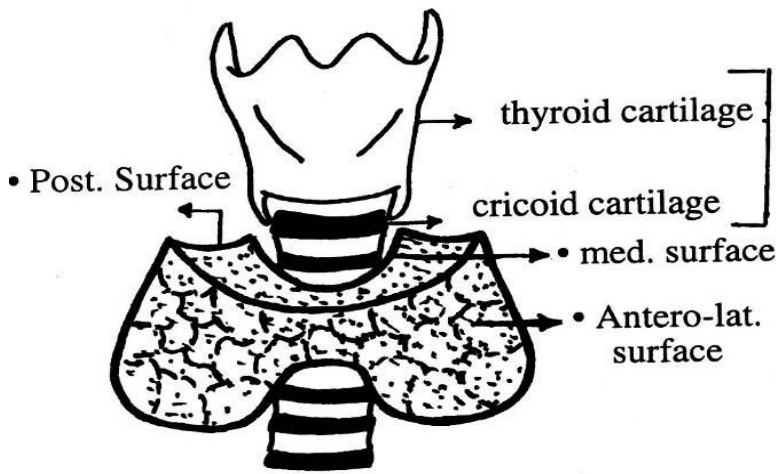
2. Medial surface:

a) Above: 2 cartilages (thyroid & cricoid), 2 muscles (cricothyroid & inferior constrictor of pharynx).

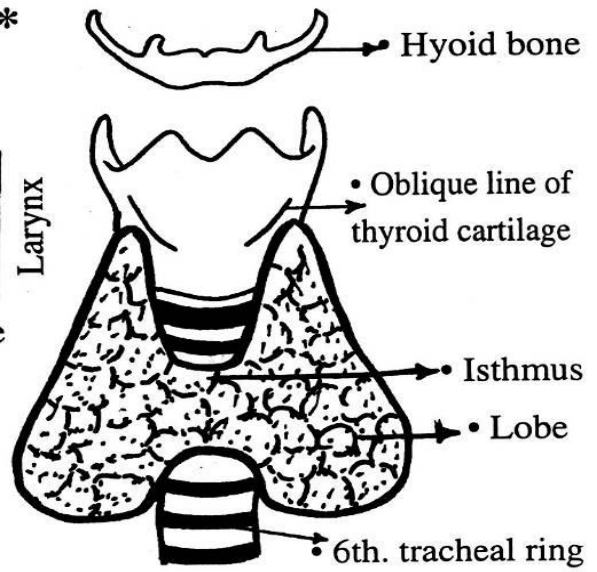
b) Below: Esophagus, trachea & R.L.N. in between

3. Posterior surface: Common carotid artery in the carotid sheath, inferior thyroid artery & parathyroid glands embedded in the posterior surface of the gland.

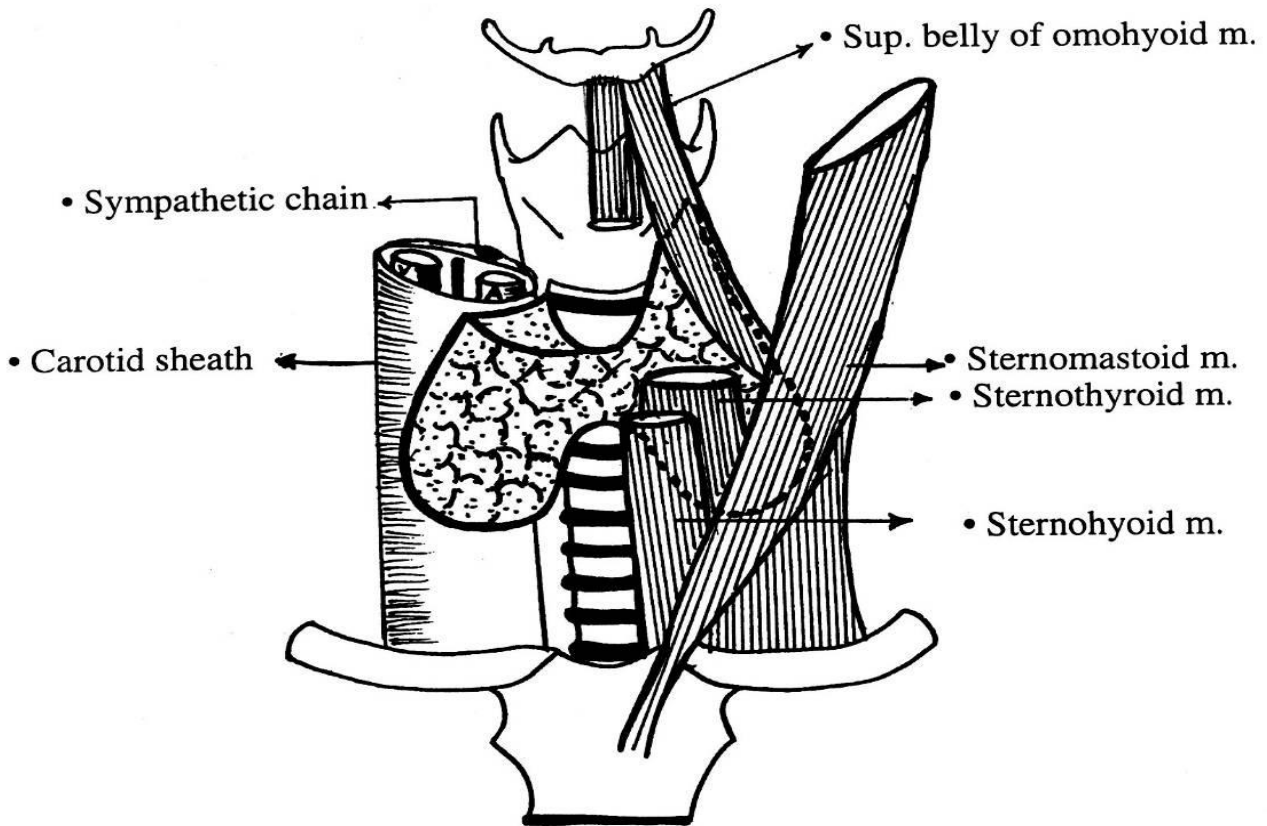
*** Thyroid Gland ***



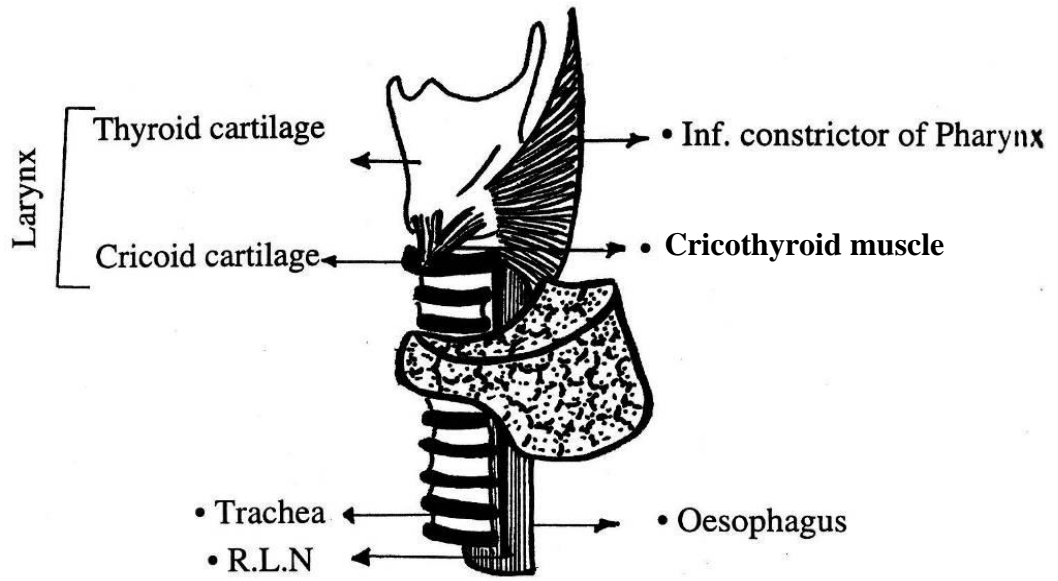
Surfaces



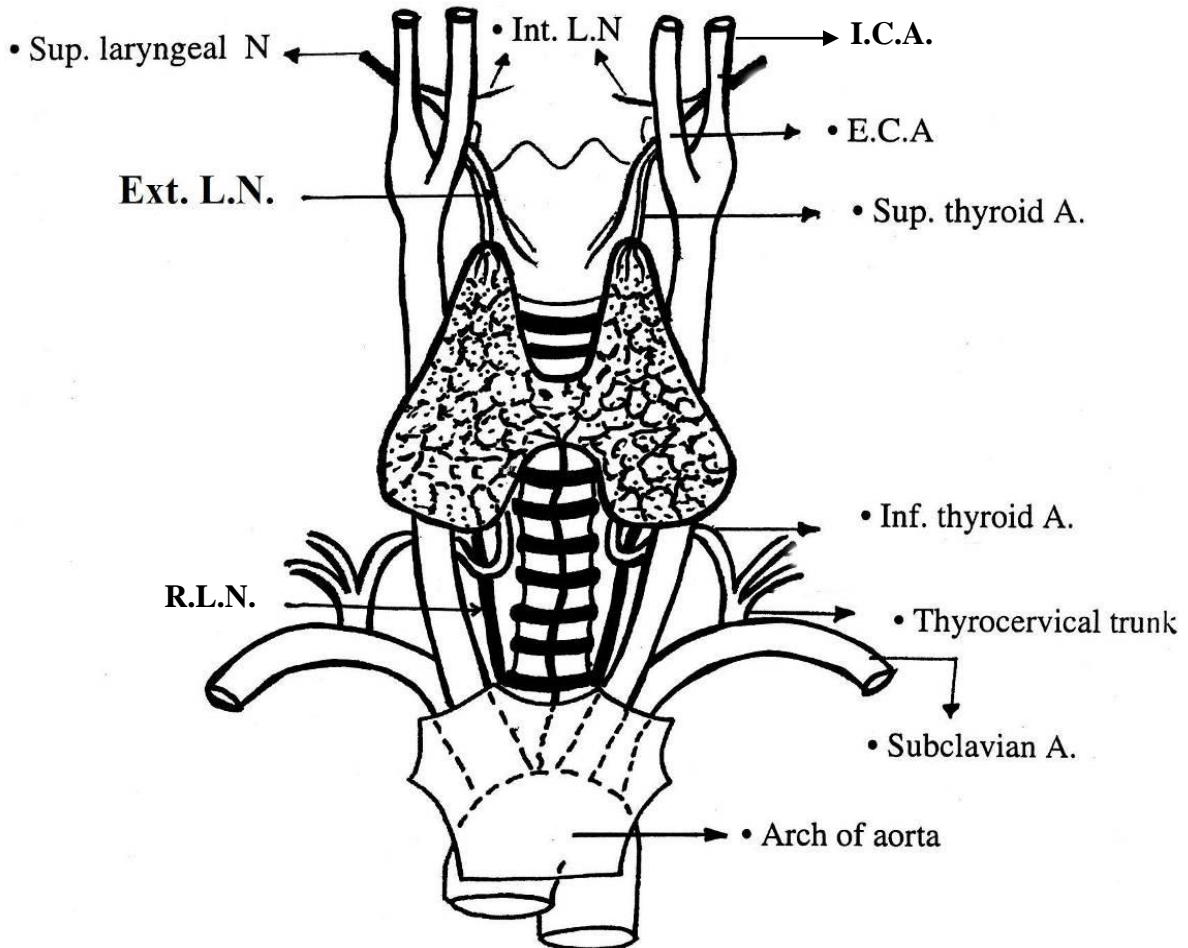
Parts, Shape and Level



Relations Of Anterolat. & Post. Surfaces

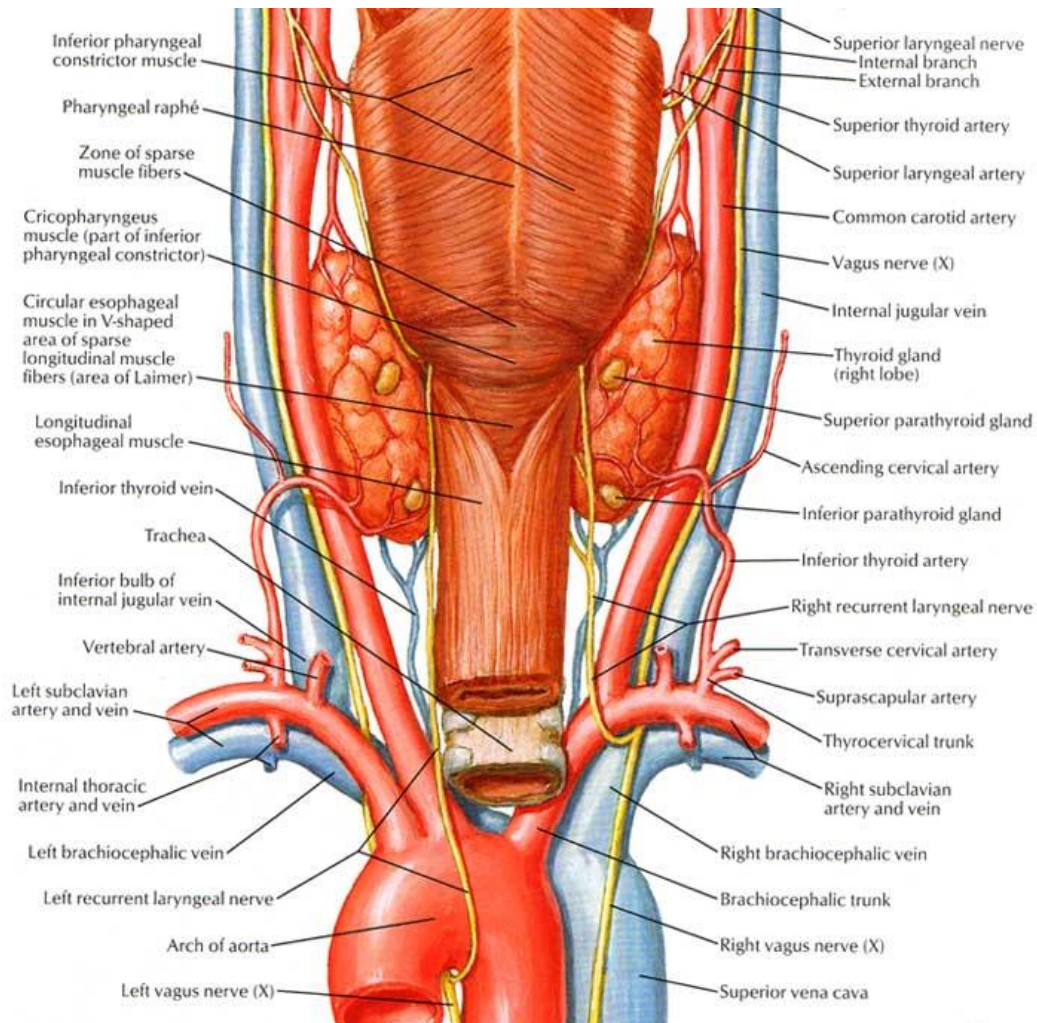
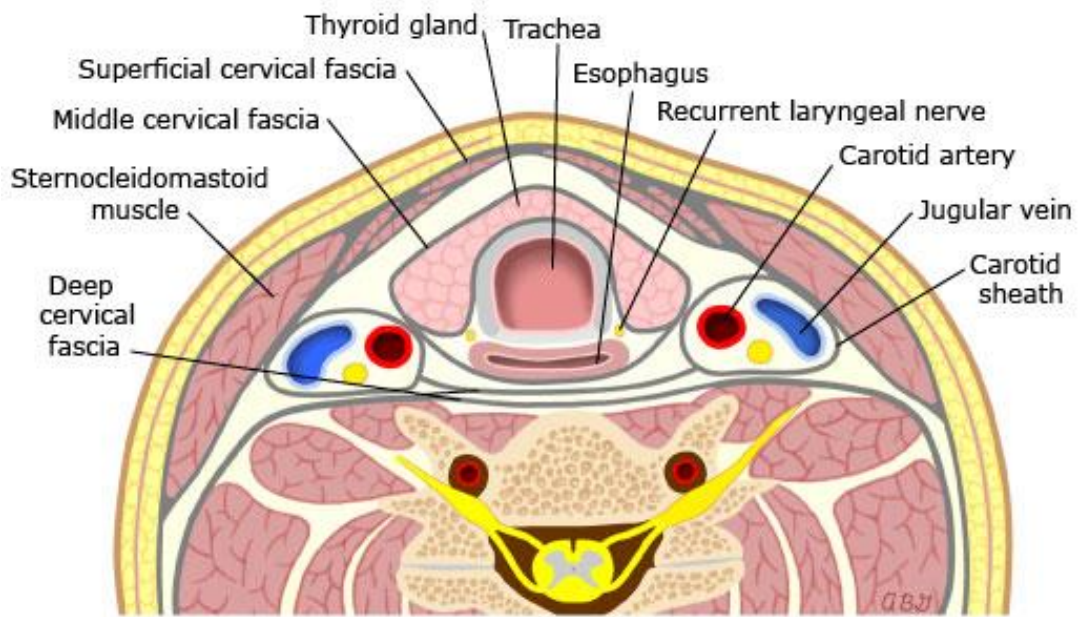


Relations of medial surface



Arterial Supply & Nerves Related To Thyroid Gland

***T.S in the neck showing relations of thyroid gland ***



- **Relations of the isthmus:**

- It is about 1.5 cm breadth connecting lower parts of both lobes.

a- **Deep relations:** 2nd, 3rd, and 4th tracheal rings.

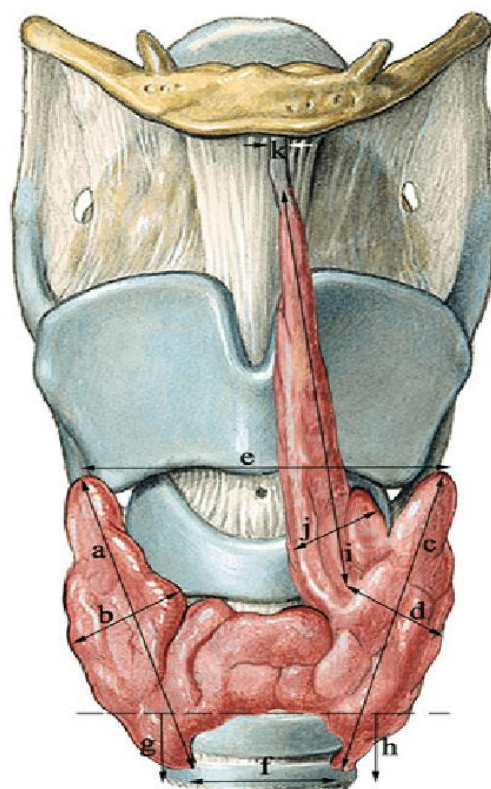
b- **Superficial relations:** Skin, fascia, platysma, anterior jugular veins, sternohyoid muscle.

c- **At the upper border:**

➤ The vascular anastomosis between the 2 superior thyroid arteries.

➤ **Pyramidal lobe** is conical thyroid tissue attached just to the left side of the middle of the upper border of the isthmus in about 50% of populations. It is a remnant of **thyroglossal duct**. **Levetor glandulae thyroideae** is a fibromuscular band connect the apex of the pyramidal lobe to the hyoid bone.

- **At the lower border:** is related to the beginning of inferior thyroid veins and termination of thyroidea ima artery



★ **Blood Supply:**

- Both arteries and veins form a plexus between the true thyroid capsule and the pretracheal fascia.

Arteries	Veins
<p>1.Superior thyroid artery:</p> <ul style="list-style-type: none"> ➤ From external carotid artery. ➤ It supply the upper part of the gland. <p>2.Inferior thyroid artery: (main supply)</p> <ul style="list-style-type: none"> ➤ From thyrocervical trunk of 1st part of subclavian artery ➤ It supply the lower part of the gland. <p>3.Thyroidea ima artery: From arch of aorta to supply isthmus (it may be absent)</p>	<p>•Thyroid venous plexus on the thyroid capsule drain into:</p> <p>1.Superior thyroid vein: From the apex of the gland to end in IJV.</p> <p>2.Middle thyroid vein: It is a very thin short vein which arises from each lobe to end in IJV.</p> <p>3.Inferior thyroid vein: From the isthmus, descends to end in brachio-cephalic vein</p>

• **Superior thyroid artery:**

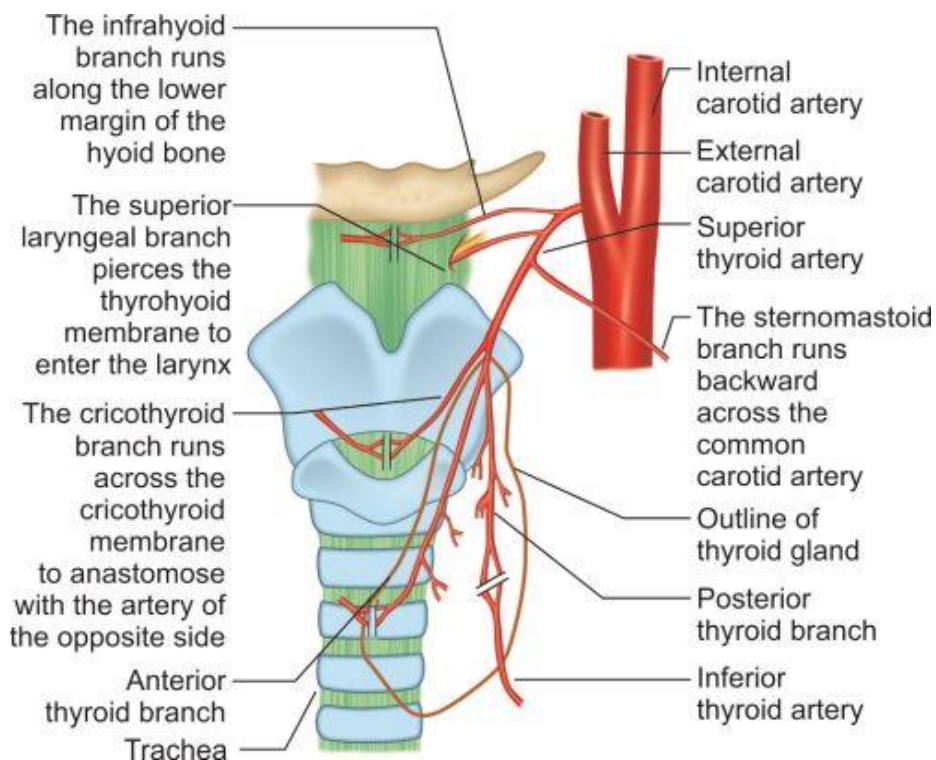
- It **arises** from the anterior aspect of **external carotid** artery below the tip of the **greater horn** of hyoid bone.
- It descends **downwards and forwards**, towards the **apex** of the gland where it divides into **terminal anterior and posterior** branches.
- It is accompanied by the **external laryngeal** nerve which descends behind the artery (**during thyroidectomy superior thyroid artery should be ligated as near as possible to the apex of lateral lobe to avoid injury of this nerve**).
- It **supplies** the upper 1/3 of each lobe and upper 1/2 of isthmus.

To avoid injury to the external laryngeal nerve, the superior thyroid artery is ligated and sectioned near the superior pole of the thyroid gland where it is **not** so closely related to the nerve as it is at its origin.



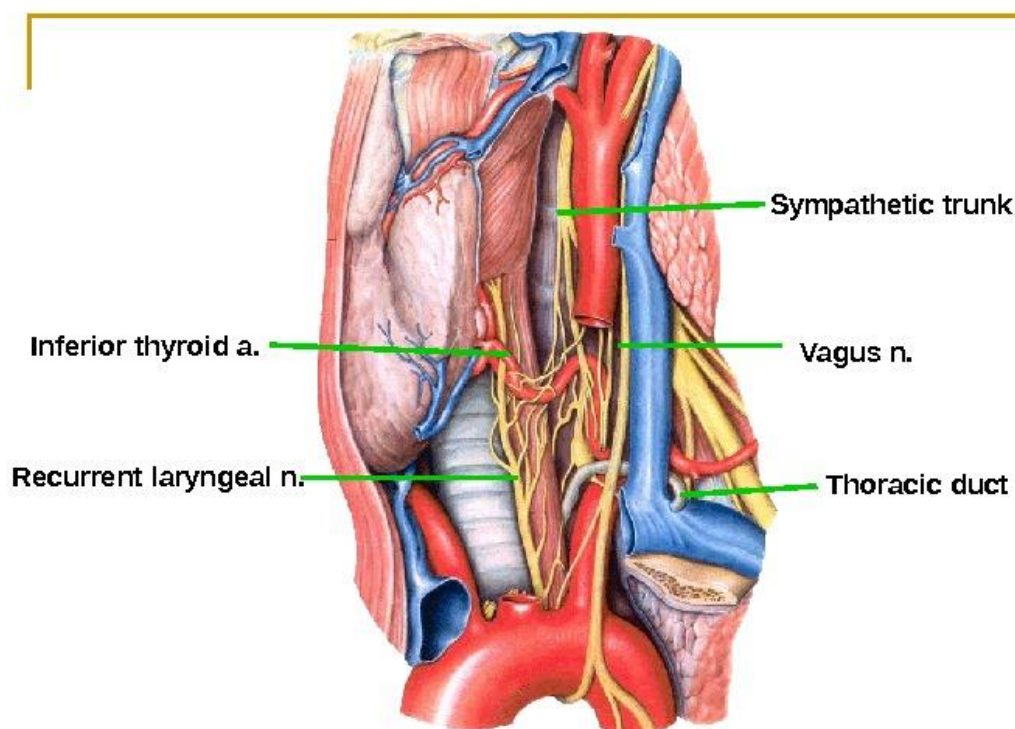
▪ **Branches:**

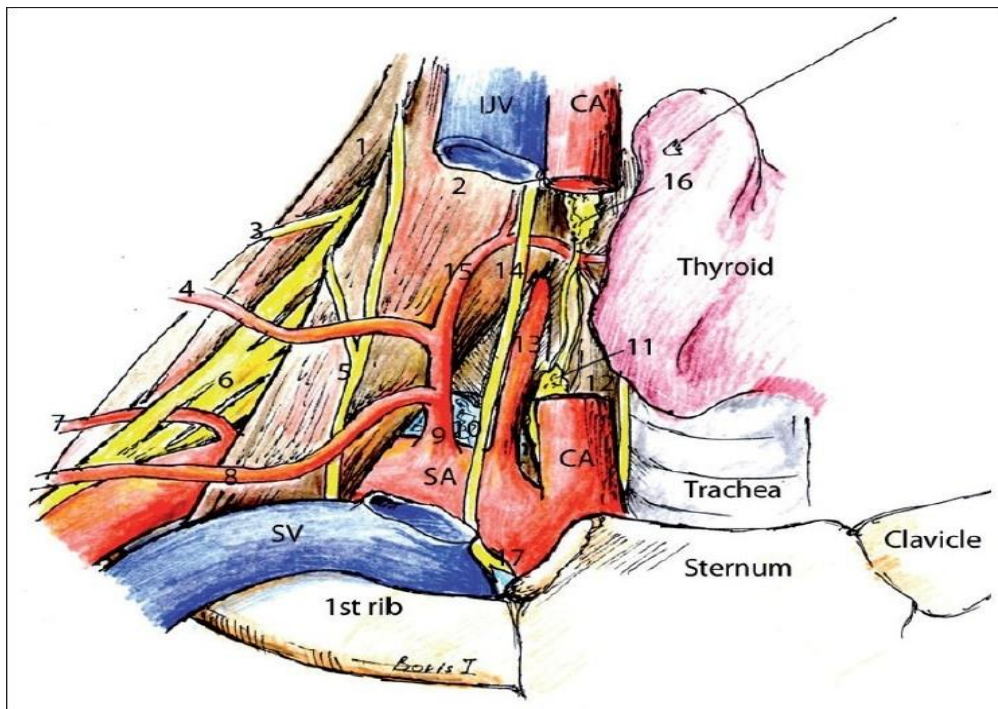
- a- **Infrahyoid artery:** It runs along the lower border of the hyoid bone anastomosing with the opposite artery.
- b- **Superior laryngeal artery:** It pierces the thyrohyoid membrane with internal laryngeal nerve to supply larynx.
- c- **Muscular branches:** To sternomastoid and cricothyroid muscles.
- d- **Glandular branches (anterior and posterior):** Supply the upper 1/3 of each lobe and upper 1/2 of isthmus.



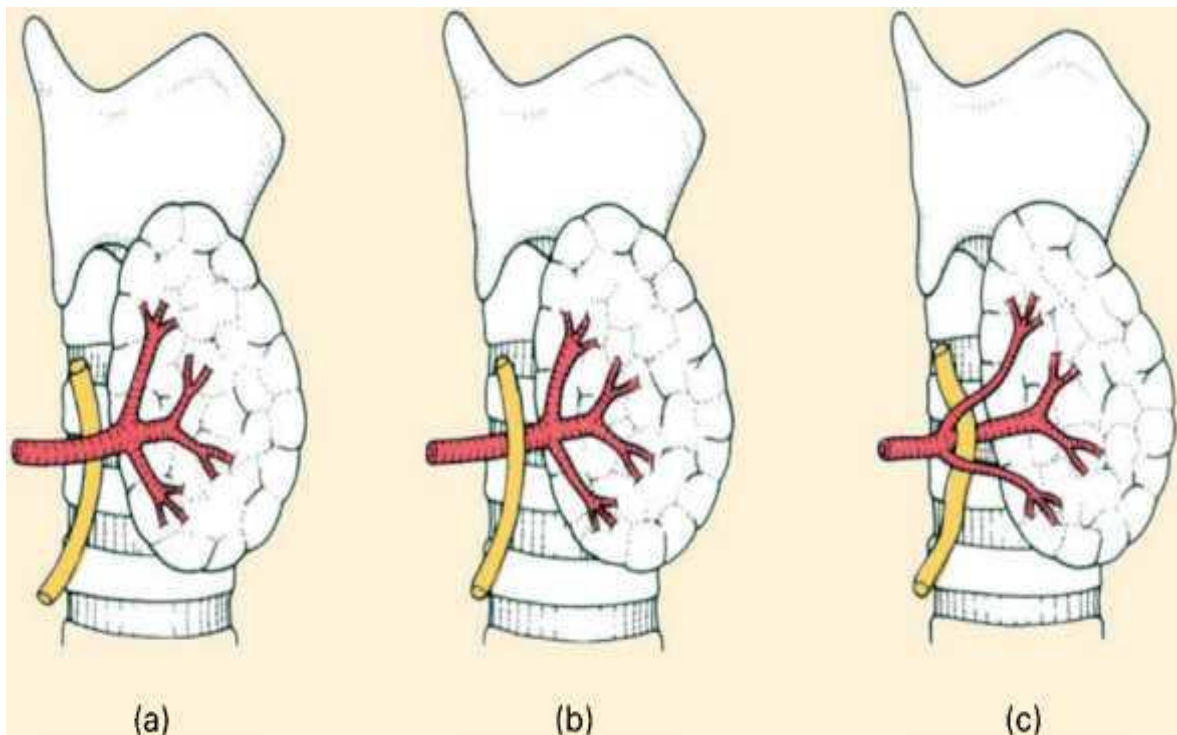
- **Inferior thyroid artery:**

- It **arises** from the thyrocervical trunk of the 1st part of subclavian artery.
- It **ascends** along the medial border of **scalenus anterior** till the transverse process of **C6** vertebra.
- Then it **curves medially** in front of **vertebral artery** and behind the **carotid sheath** to reach the posterior surface of the thyroid gland.
- Finally, it **descends** to reach the **base of the lateral lobe** where it comes into direct relation with **RLN**.
- **Branches:**
 - a- **Ascending cervical** artery (in front of scalenus anterior).
 - b- **Inferior laryngeal** artery.
 - c- **Tracheal and esophageal** arteries.
 - d- **Glandular branches: supply** the lower 2/3 of each lobe and lower 1/2 of isthmus together with parathyroid glands (**main arterial supply to thyroid and parathyroids**).

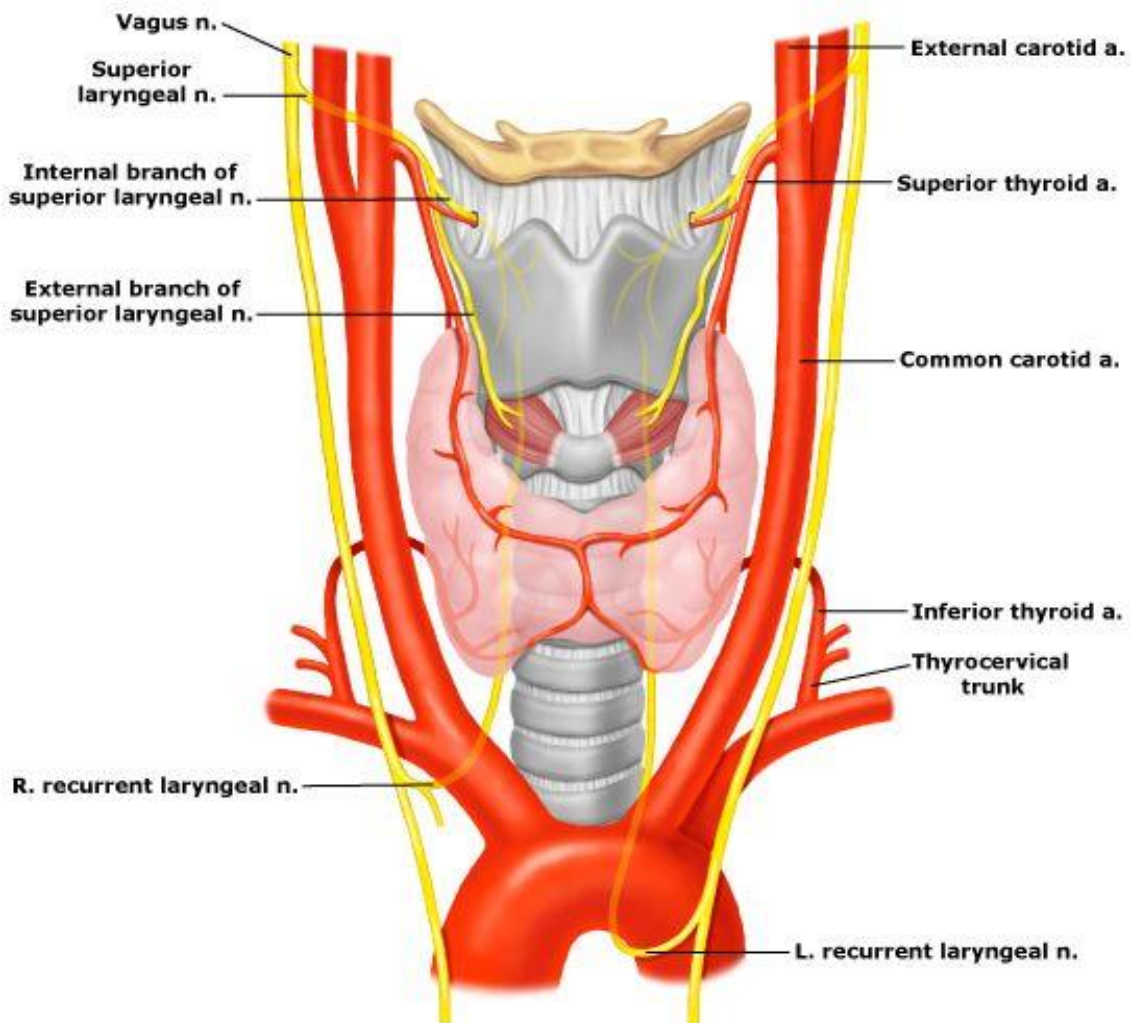




- The artery comes in direct relation with the **RLN** (superficial, deep or in between the branches of the artery) → during thyroid-ectomy this artery should be ligated **as lateral as possible from the base of the thyroid lobe** to avoid injury of this nerve).



Relations of RLN to inferior thyroid artery

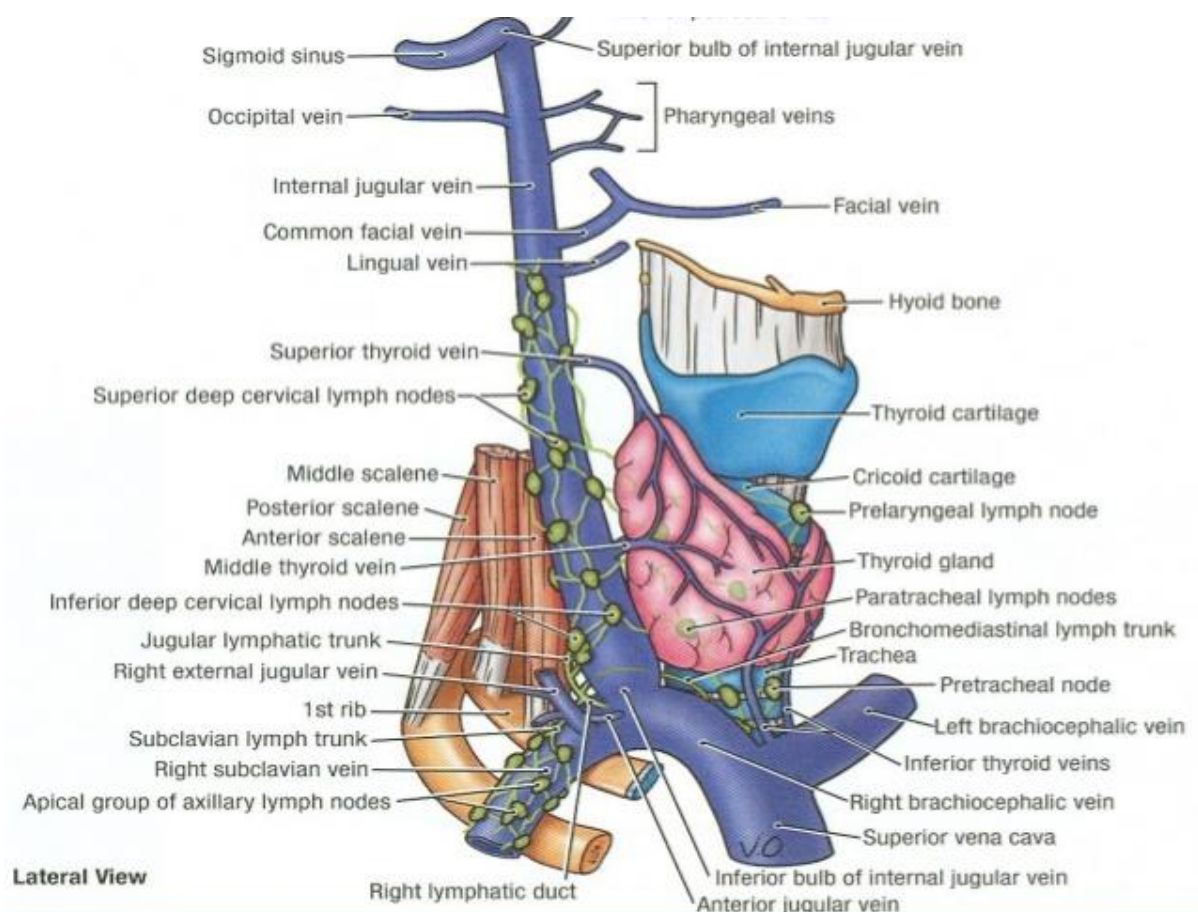


★ Nerve supply:

- **Sympathetic supply:** From all cervical sympathetic ganglia the fibers form plexus around the superior and inferior thyroid arteries. These fibers are vasomotor, not secretomotor as the endocrine secretion of thyroid gland is controlled by pituitary gland.
- **Sensory supply:** to the capsule of the gland is derived from recurrent laryngeal branches of both vagi.

★ **Lymphatic Drainage:** There is an extensive lymphatic plexus within the gland which is drained **into the following nodes:**

- 1) **Prelaryngeal nodes:** In front of the cricothyroid membrane, draining the upper part of the isthmus.
- 2) **Pretracheal nodes:** In front of the trachea, draining the lower part of the isthmus.
- 3) **Paratracheal nodes:** On the sides of the trachea, draining the posterior surface of the gland.
- 4) **Upper & Lower deep cervical nodes:** Along the internal jugular vein, forming the main lymphatic drainage of the gland.
- 5) **Brachiocephalic nodes:** In the superior mediastinum, draining the lower part of the gland.



★ **Applied anatomy:**

- 1) Thyroid gland **moves up and down with deglutition** because it is enclosed in **pretracheal fascia** and presence of **ligament of Berry**.
- 2) **Pretracheal fascia is attached to:**
 - ◆ **Upwards** to oblique line of thyroid cartilage and hyoid bone which move with deglutition.
 - ◆ **Inferiorly** it fuses with the adventitia of arch of aorta and fibrous pericardium.
 - ◆ **Lateral:** forms the carotid sheathes.
- 3) **Ligament of Berry** is a thickening of posterior part of pretracheal fascia that fixes the back of each lobe to the cricoid cartilage & upper tracheal rings.
- 4) **Structures enclosed within pretracheal fascia:**
 - ◆ Thyroid gland & Parathyroid glands.
 - ◆ Pretracheal and prelaryngeal L.Ns.
 - ◆ Remnants of thyroglossal tract. ◆ Remnant of thymus gland.
- 5) **Movement with deglutition is also exhibited** by any swelling related to floor of mouth, hyoid bone, larynx or trachea e.g., thyroglossal cyst, submental, prelaryngeal and pretracheal L.Ns enlargement, subhyoid and Adam's apple bursitis, parathyroid swelling , tracheocele and laryngocele.
- 6) Thyroid swelling always moves with deglutition unless **fixed by:**
 - ◆ Malignancy. ◆ Riedel's thyroiditis. ◆ Huge goiter.
 - ◆ Scarring of the previous operation. ◆ Retrosternal goiter.
- 7) Thyroglossal cyst & fistula and subhyoid bursitis moves **with deglutition and protrusion of tongue.**

- 8) Enlargement of thyroid gland is called **goiter** which is single swelling, in the lower part of the front of the neck, moves with deglutition, deep to sternomastoid and may be butterfly in shape (if diffuse enlargement).
- 9) Goitre is the **2nd common neck swelling** (the 1st is L.Ns enlargement).
- 10) The gland **cannot enlarge above the oblique line** of thyroid cartilage due to the attachment of sternothyroid muscle in front of the gland.
- 11) During thyroidectomy **pretracheal muscles are retracted or divided** (in case of huge goiter, thyrotoxicosis or carcinoma), transversely near their upper attachment (to preserve their nerve supply from ansa cervicalis which comes from below)
- 12) In **subtotal thyroidectomy**, leave only the **postero-medial part** of each lobe to **protect** behind it the RLNs and parathyroid glands.
- 13) **Middle thyroid** vein is thin short vein and should be **ligated first** to avoid its injury.
- 14) **Nerves related to thyroid gland** which are liable for injury during thyroidectomy:

1. Superior laryngeal nerve: divides into:

- a. **Internal laryngeal** nerve supply m.m. of larynx above vocal cords, its bilateral injury → chocking.
- b. **External laryngeal** nerve: Supply the cricothyroid muscle which is the tensor of vocal cord:
 - **Its bilateral injury** → loss of high pitched voice → loss of changing pitch of voice.
 - **Unilateral injury** is gradually compensated.

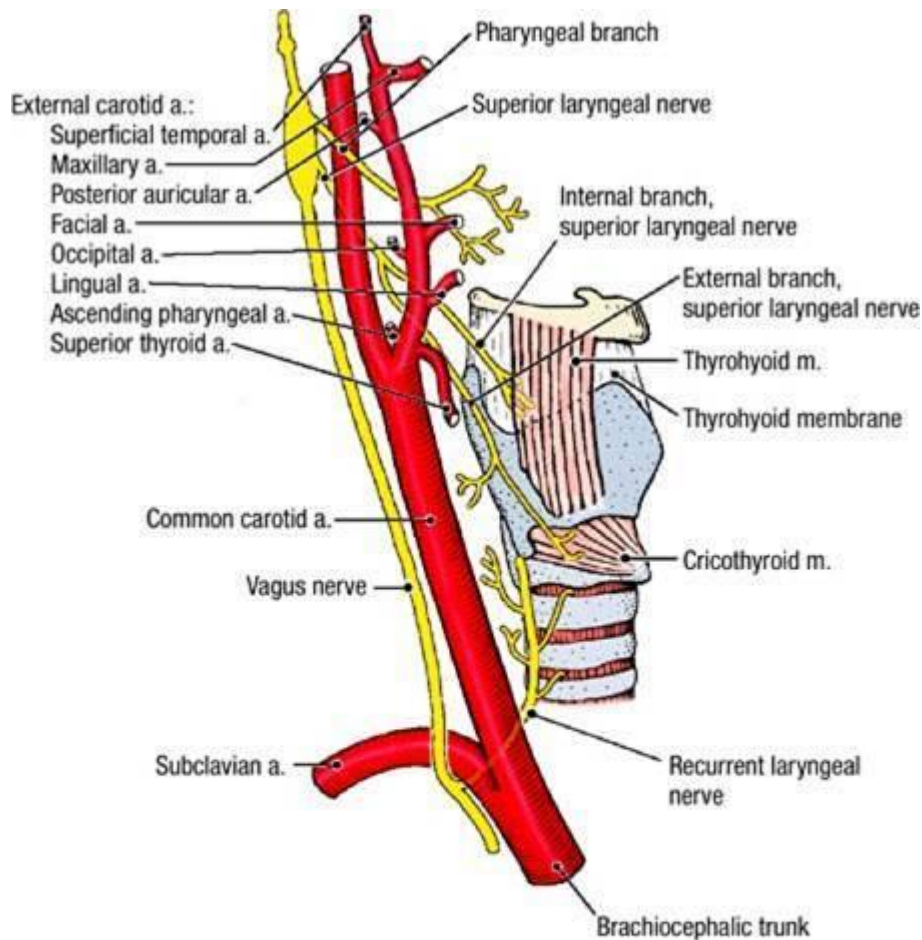
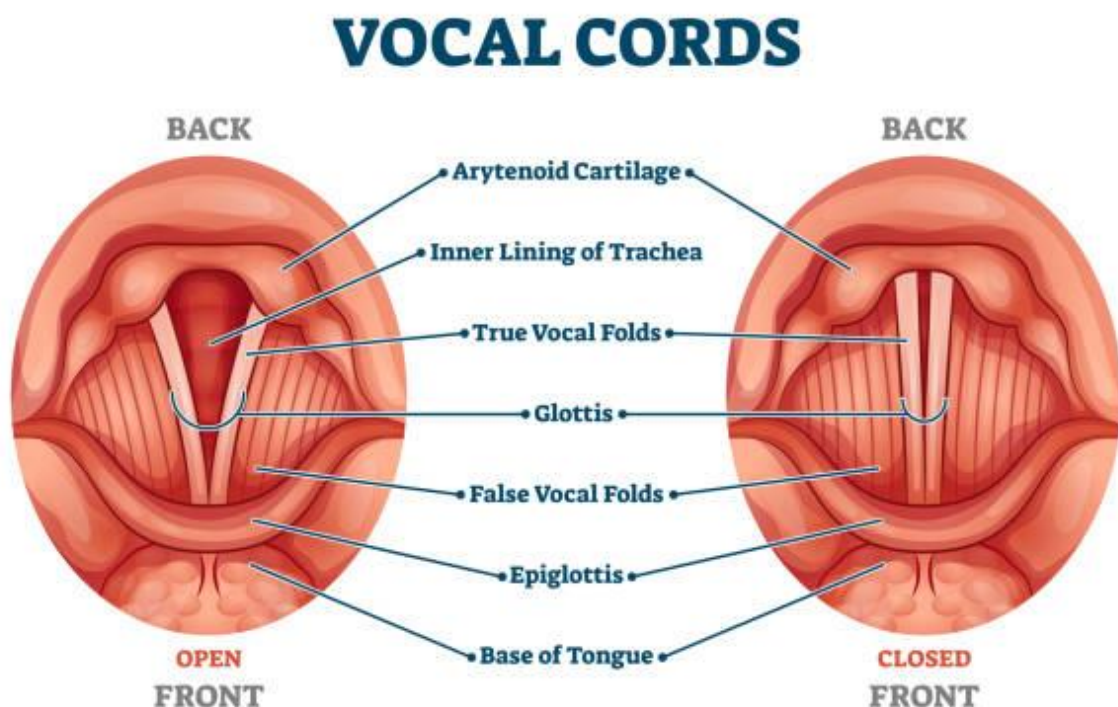


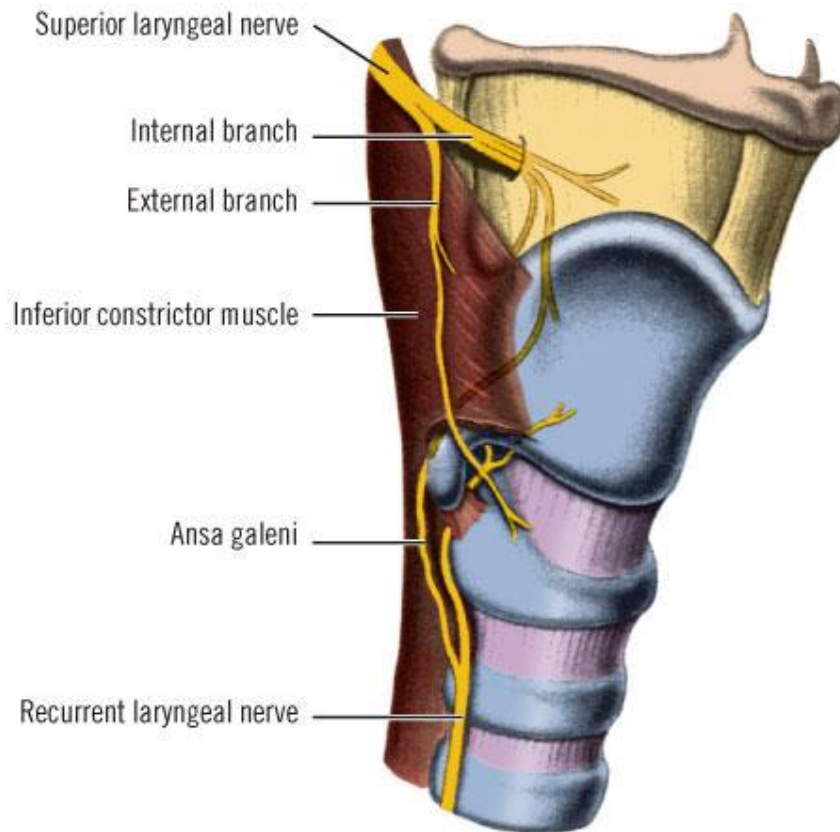
Figure 7.9. Branches of the external carotid artery and right vagus nerve (X) in the neck.

2. **Recurrent laryngeal nerve** :(RLN)

- It supplies all muscles of larynx except cricothyroid & sensory to m.m. below vocal cord.
- It is the commonest nerve to be damaged during thyroid surgery.
- Most cases are due to partial injury and recovered within 2-6 months.
- If no recovery after one year, the condition is considered permanent.

- In mild incomplete injury there are paralysis of abductors of vocal cords only but in severe complete injury there is paralysis of both abductors and adductors of both vocal cords.
- **Unilateral injury** (complete or incomplete) → hoarsness of voice & dyspnea on the exertion. Hoarsness of voice gradually disappear when the other cord crossing the middle line to meet the paralysed cord.
- **Bilateral injury** → Aphonia & dyspnea on exertion (if complete injury) or stridor (most dangerous injury ,if bilateral incomplete injury).





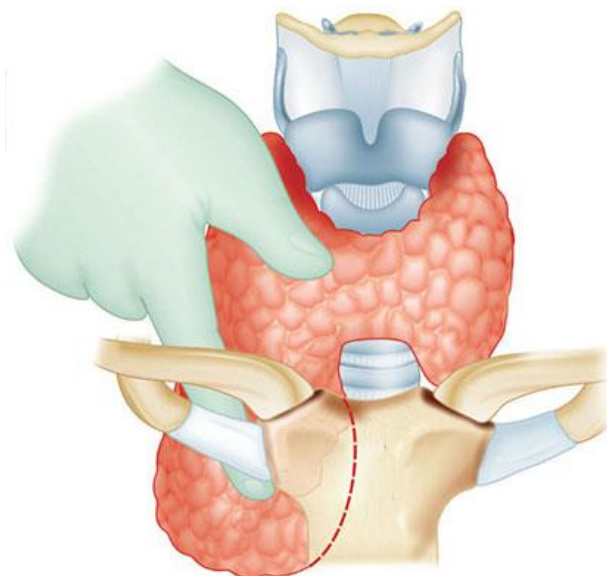
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- 15) When incising the trachea inferior to the isthmus of thyroid gland (**during tracheostomy**), thyroidea ima artery and inferior thyroid veins are liable for injury.
- 16) The capsule of thyroid gland is surrounded by nerve plexus derived from the laryngeal branches of vagus. Infiltration of this plexus by extra-thyroidal tumour → referred pain along the auricular branch of vagus (Arnold's nerve) → **pain in the auricle is one of early manifestations of extra-thyroidal spread of malignancy.**
- 17) Goiter with **hoarsness of voice** (R.L.N injury) is one of early manifestations of local infiltration by thyroid cancer.
- 18) In benign goiters , **the common carotid artery (CCA)** is shifted backwards and have equal volume but malignancy surrounds and

compress the artery (never infiltrate it) → CCA in place but of weak or absent volume (**Berry's sign**).

19) The thyroid gland is **closely related to the trachea** → benign goitre compress or displace the trachea but malignant goitre infiltrate and become fixed to the trachea.

20) **Retrosternal goitre compress brachiocephalic veins and SVC** → congested oedematous face with dilated veins crossing the manubrium sterni due to opening of anastomosis between cervical and thoracic veins.



Retrosternal Goiter

Parathyroid Glands

★ The parathyroid glands are small (20-40 mg, 2x4x6 mm), yellow, oval endocrine glands, responsible for the production of parathormone hormone, which control calcium levels in the body.

★ Parathyroid Anatomy is the most variable anatomy in the body.

★ **Position:**

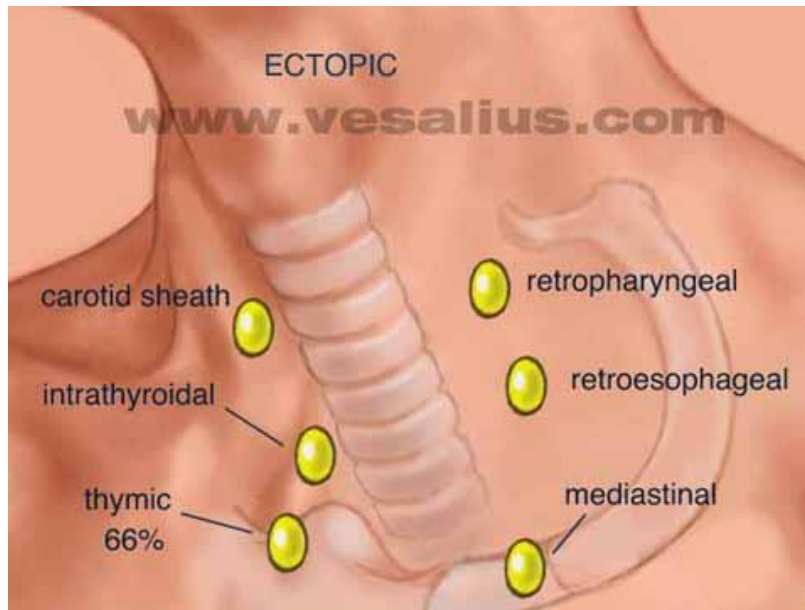
- The parathyroid glands are located on the medial half of the posterior surface of the lateral lobes of the thyroid gland , usually situated external to the capsule of the gland but within its sheath.
- Superior & inferior parathyroid glands are usually located respectively approximately 1cm superior & inferior to the point of entry of the inferior thyroid arteries into the thyroid gland .
- Superior parathyroid glands are more constant in position , usually at the level of lower border of cricoid cartilage , than inferior ones .
- Although inconsistent in location between individuals, the inferior parathyroid glands are usually found near the inferior poles of the thyroid gland.
- The parathyroid glands may be located any where along the line embryological migration of thymus gland i.e. retropharyngeal , retroesophageal , related to carotid sheath , mediastinal , thymic or intrathyroidal .

★ **Number:** The majority of people have four parathyroid glands, although variation in number is common (2-8).

★ **Relations:**

- **Anterior:** Thyroid gland .

- **Posterior:** Common carotid artery .

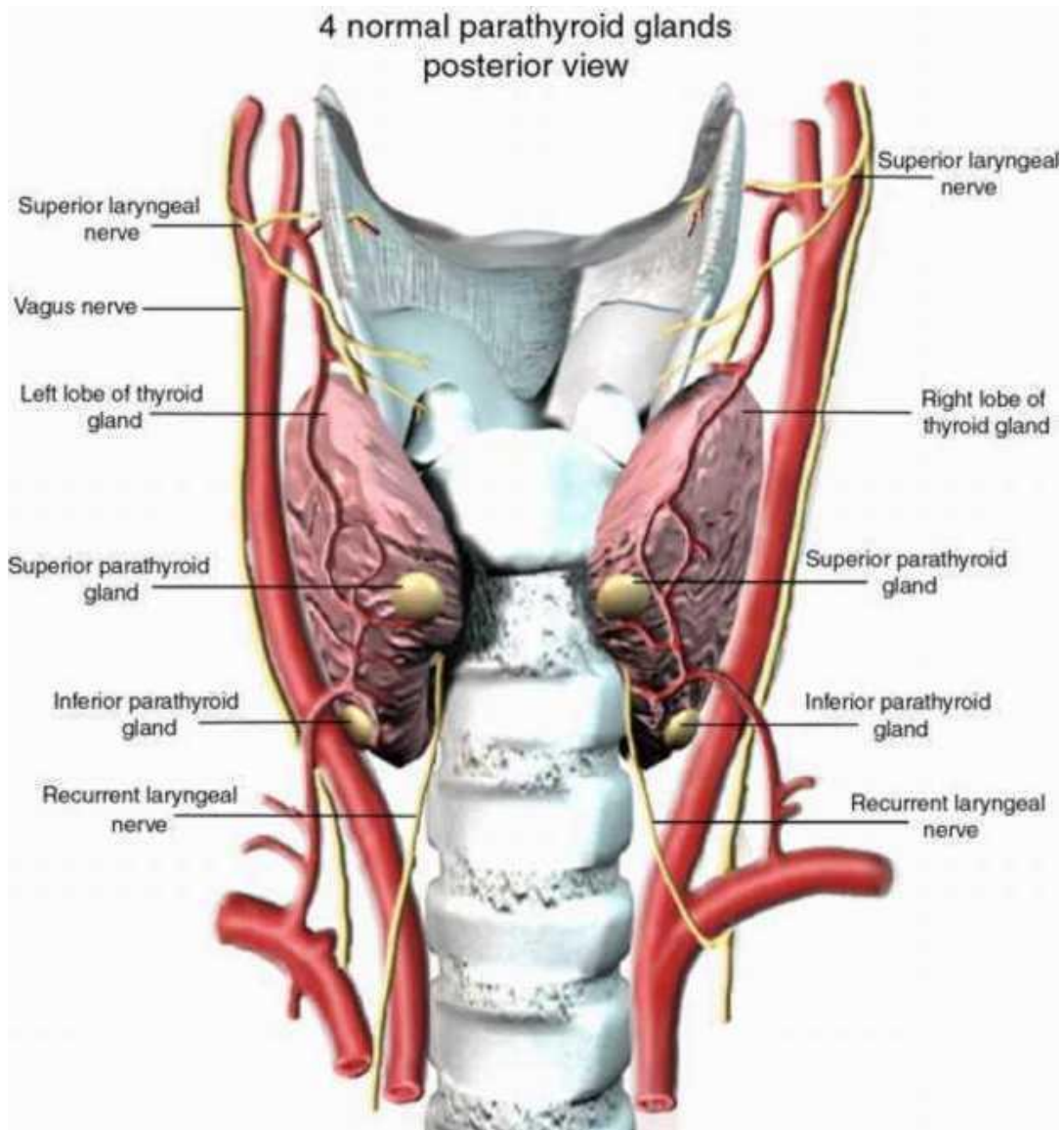


★ **Blood supply :**

- **Inferior thyroid arteries** supply the 4 parathyroid glands.
- Collateral circulation is delivered by the superior thyroid arteries, thyroid ima artery, pharyngeal , laryngeal, tracheal and oesophageal arteries.
- The parathyroid veins drain into the **thyroid venous plexus**.
- Lymphatic drainage (**like thyroid gland**) but mainly to paratracheal lymph nodes.

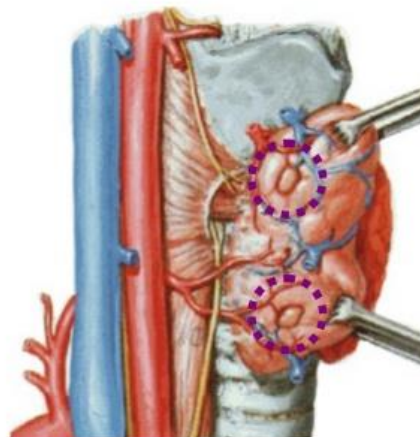
★ **Nerve supply :** branches of the **cervical sympathetic ganglia**.

These nerves are **vasomotor, not secretomotor** – endocrine secretion of parathyroid hormone is controlled hormonally.



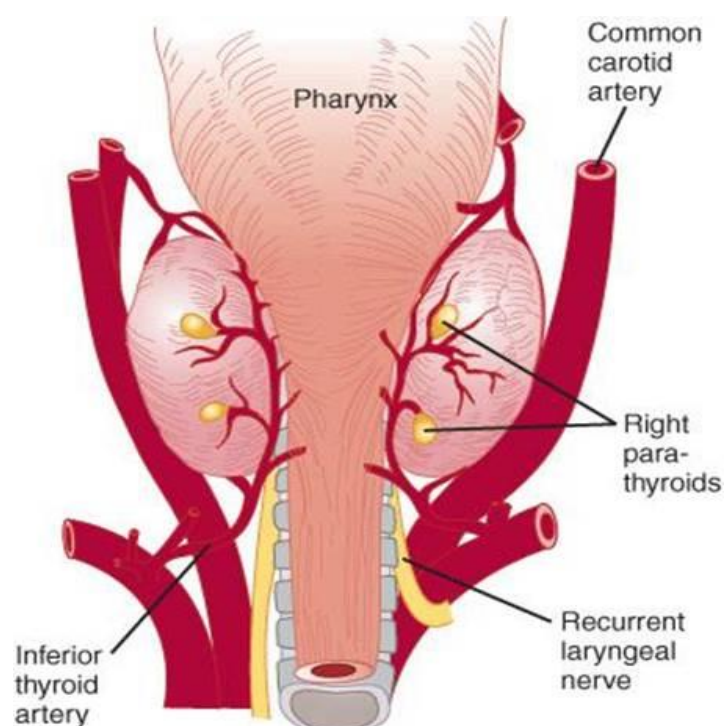
Parathyroid glands

- Awareness of the close relationship between the parathyroid glands and the thyroid gland is essential to prevent removal or damage of the parathyroid glands during thyroidectomy.

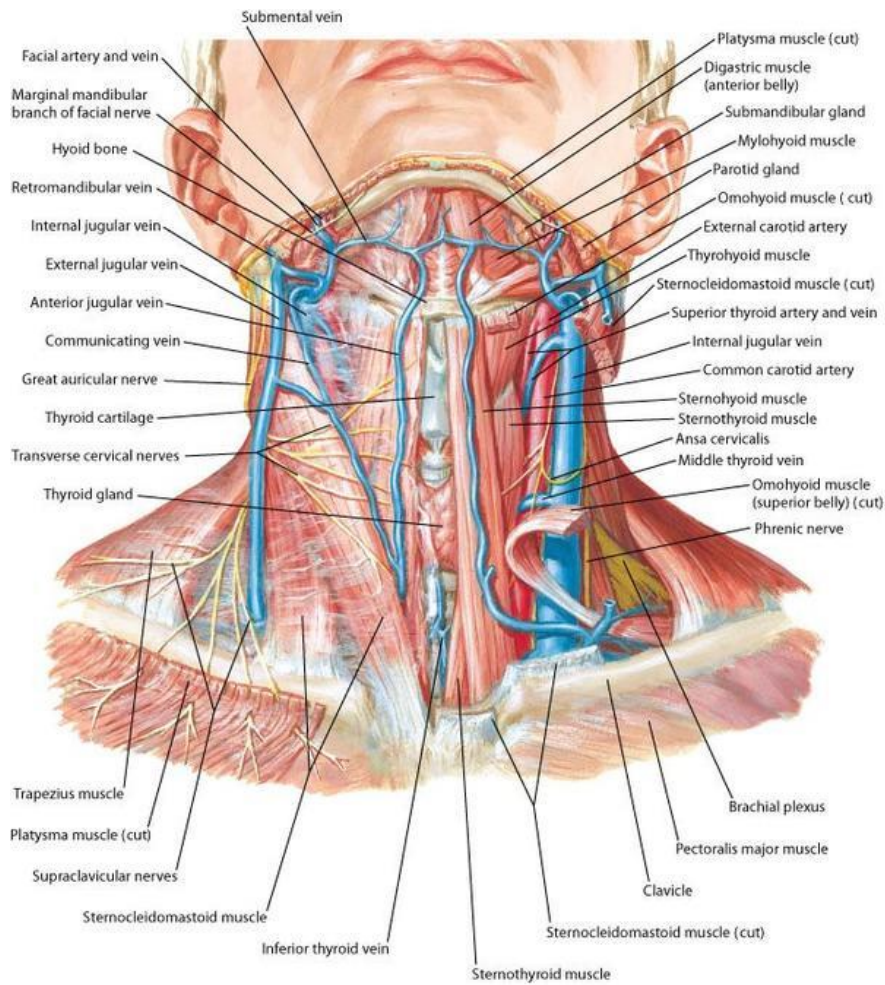


★ **Applied anatomy:**

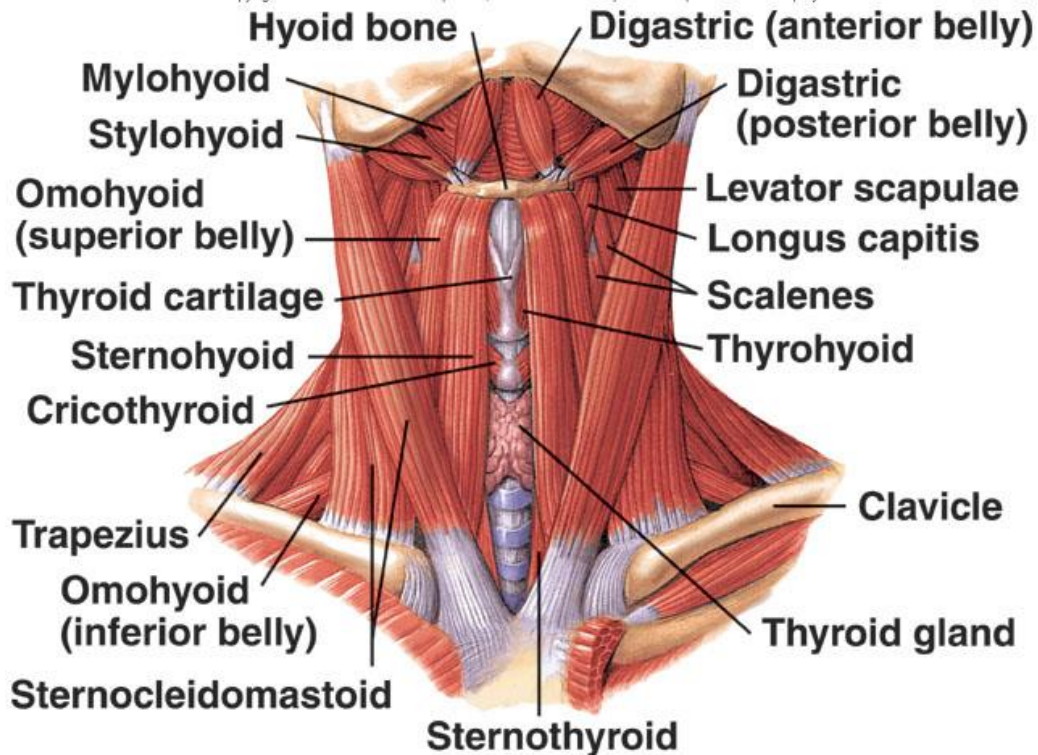
- **Localization** of the site of parathyroid glands by preoperative ultrasound, CT scan, MRI, radioactive isotopic scan and BET scan.
- Damage of parathyroid glands is a dangerous complication of thyroidectomy which can be avoided by exposure of parathyroid glands & its blood supply before removal of thyroid gland, intra-operative frozen section or preserving the posteromedial aspect of the lateral lobes.
- During total thyroidectomy preserve at least one parathyroid.
- If all parathyroid glands are removed or devascularized, at least one parathyroid gland is implanted in the subcutaneous tissues of arm to avoid its injury by subsequent neck surgery or radiotherapy.
- **Removal of all the parathyroid glands would cause hypocalcaemia , in turn leading to tetany (numbness , severe muscle twitches and cramps). Without urgent treatment this will result in death due to spasm of laryngeal muscles .**



Median Region in the Front of the Neck



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★ A small median space 2-3 cm in width, extending from the chin to the sternum.

★ **It contains the following structures:**

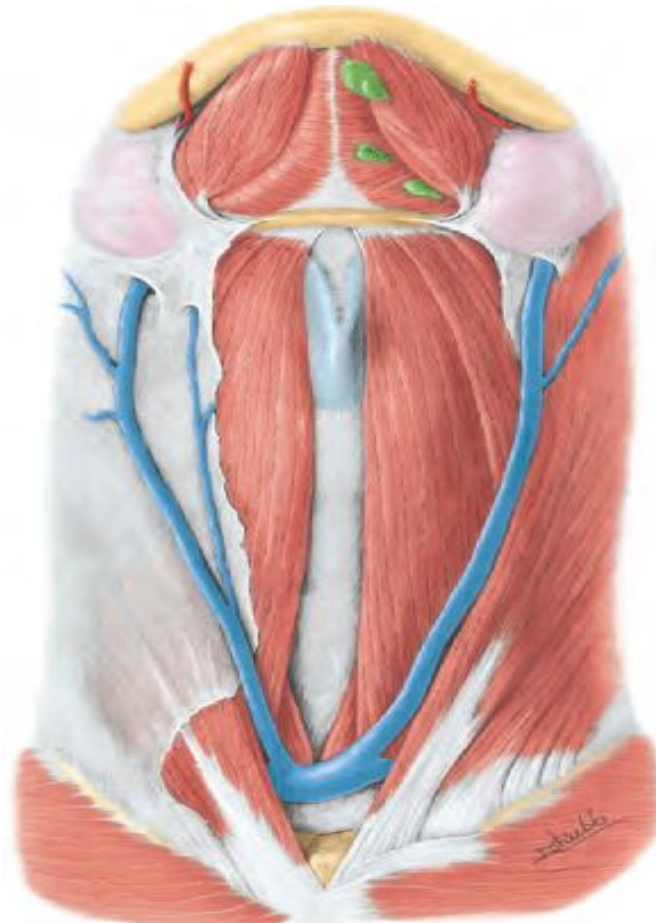
I) Suprahyoid structures:

1- **The beginning of the anterior jugular veins** from submental veins.

2- **Submental lymph nodes:** Lie in submental triangle and drain the tip of tongue, lower incisors and anterior part of floor of mouth.

3- **Mylohyoid raphe:** Receives the insertion of both mylohyoid muscles.

4- **Hyoid bone:** Situated at the level of C2 vertebra, with arterial anastomosis above it (formed by both suprahyoid arteries) and below it (formed by both infrahyoid arteries).



II) Infrahyoid structures:

- 1- **Thyrohyoid membrane:** Extends from the upper border of thyroid cartilage to the upper border of hyoid bone. It is pierced by 2 structures: superior laryngeal artery and internal laryngeal nerve.
- 2- **Laryngeal prominence (Adam's apple):** The convex anterior part of the thyroid cartilage with thyroid notch on its upper margin.
- 3- **Cricothyroid ligament:** With cricothyroid muscles.
- 4- **Cricoid cartilage:** Situated at the level of C6 vertebra.
- 5- **Cricotracheal ligament:** Between the cricoid cartilage and 1st ring of trachea.
- 6- **Isthmus of thyroid gland:** It lies on the 2nd, 3rd and 4th rings of trachea, and has a vascular anastomosis on its upper border formed by the 2 superior thyroid arteries.
- 7- **Below the isthmus of the thyroid gland the following structures are present:**
 - a- **Inferior thyroid veins:** Descend in front of 5th, 6th and 7th tracheal rings.
 - b- **Thyroidea ima artery:** Ascends in front of trachea to reach the isthmus (in 10% of cases).
 - c- **Jugular arch:** Between the lower ends of the anterior jugular veins.

★ Lymph nodes in the median region in front of neck:

- a- **Superficial lymph nodes:** Submental lymph nodes.
- b- **Deep lymph nodes:** 4 groups:
 - Infrahyoid. - Prelaryngeal. - Pretracheal. - Paratracheal.

★ Vascular anastomoses in the middle of neck:

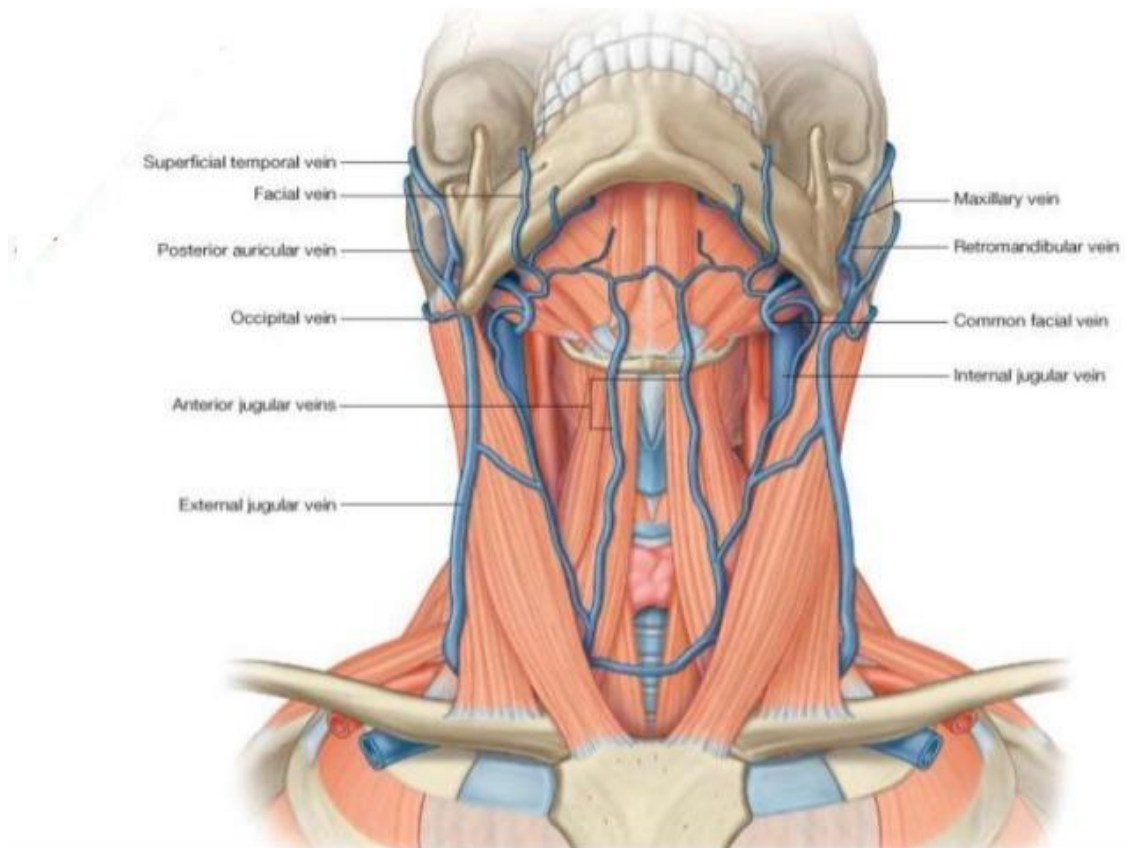
- a- Anastomosis between the suprahyoid arteries.

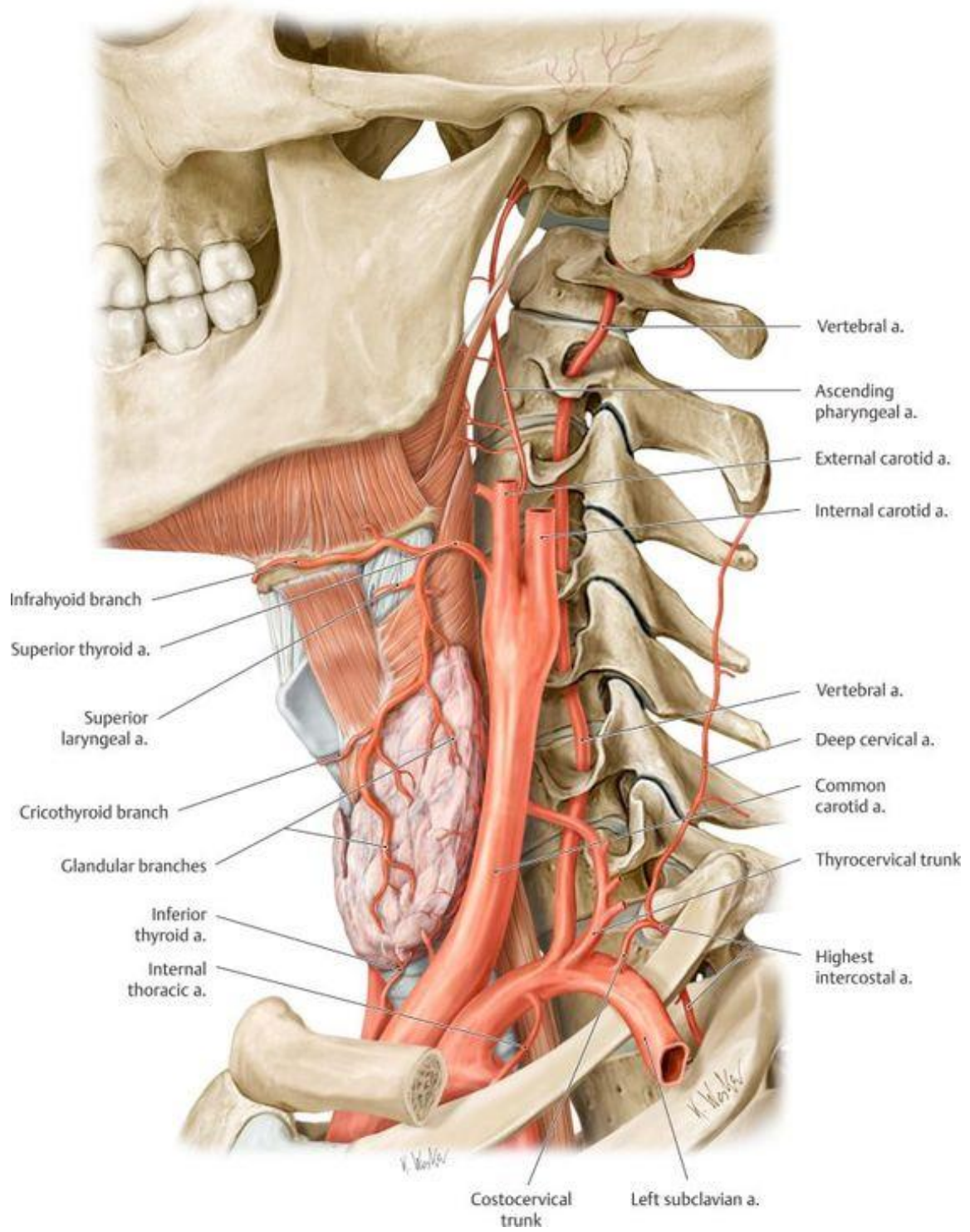
b-Anastomosis between the infrahyoid arteries.

c-Anastomosis between the superior thyroid arteries.

d-The jugular arch connecting the lower ends of both anterior jugular veins.

jugular arch





Vascular anastomoses in the middle of neck

Cervical Part of Trachea

★ It **begins** at the level of C6 vertebra (lower border of cricoid cartilage) and **ends** inside the thorax at the level of lower border of T4 vertebra.

★ Relations:

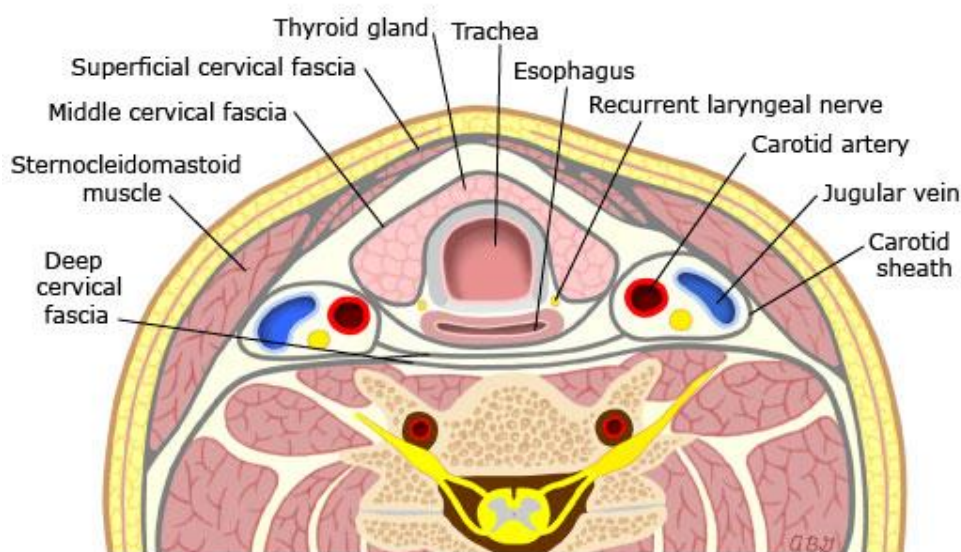
• Anteriorly:

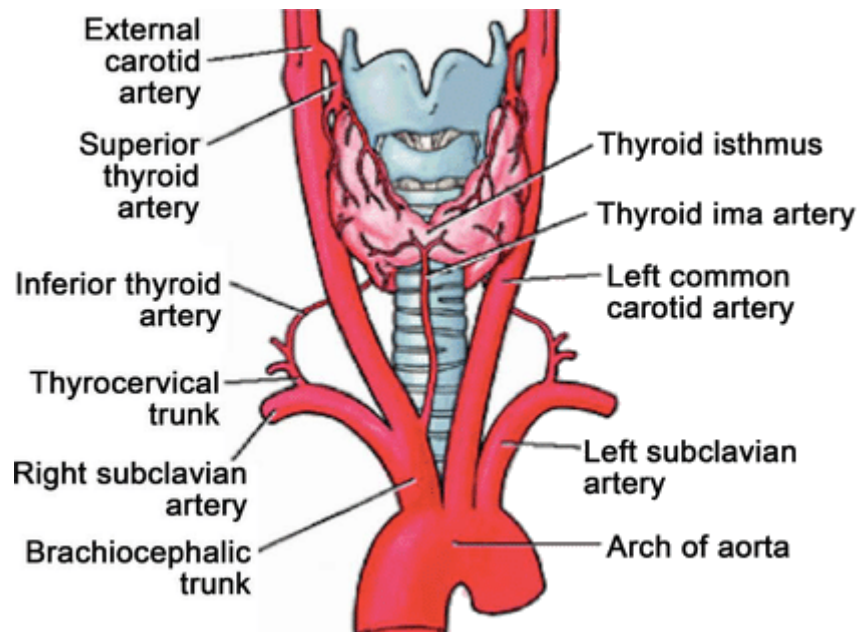
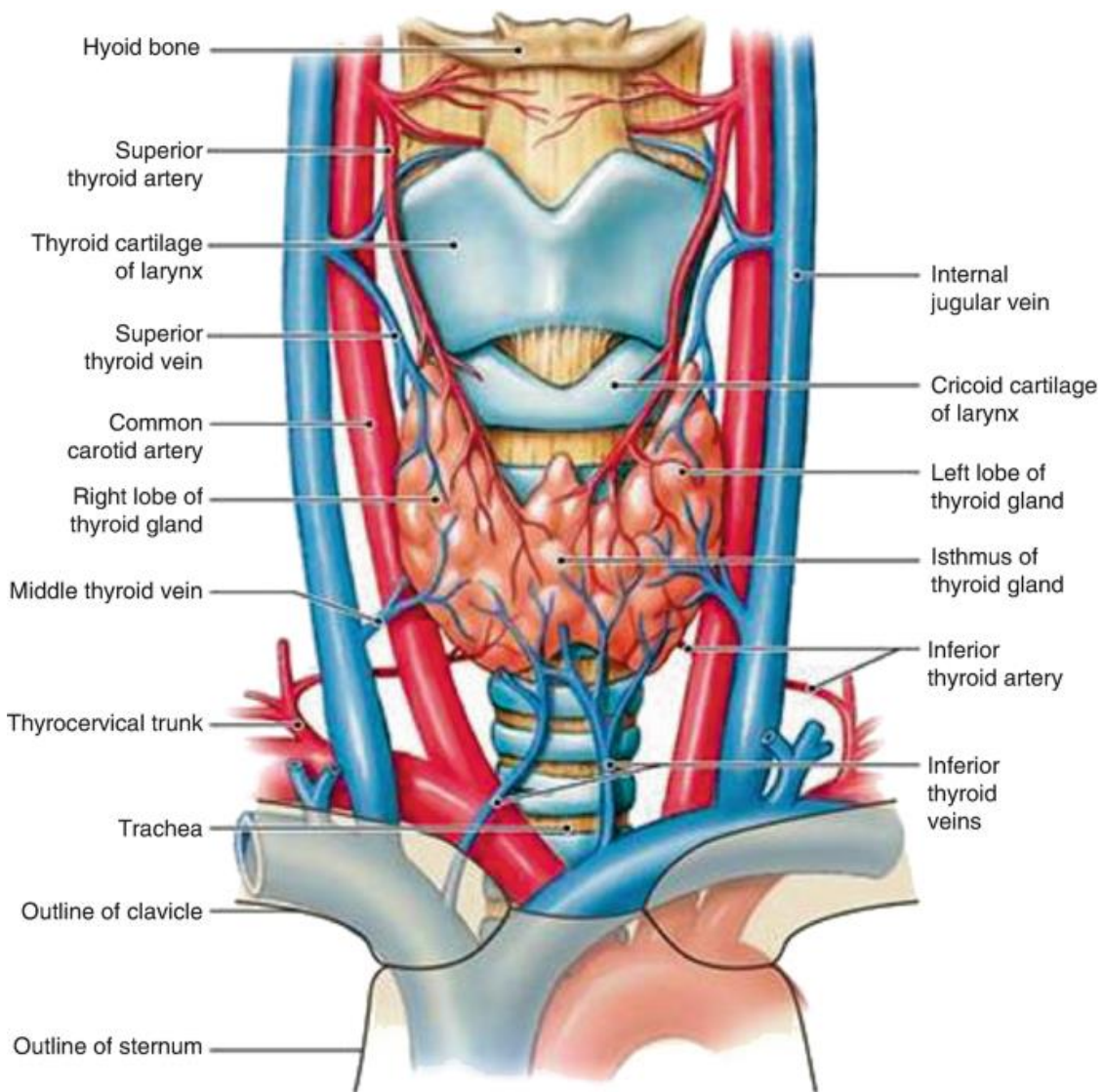
1. Skin and fascia.
2. Muscles: Sternohyoid and sternothyroid.
3. Isthmus of thyroid gland covers 2nd, 3rd and 4th tracheal rings.
4. Blood vessels: thyroidea ima artery, inferior thyroid veins, jugular arch and anastomosis between both superior thyroid arteries.
5. Lymph nodes: pretracheal.

• **Posteriorly:** Oesophagus and recurrent laryngeal nerves.

• On each side:

1. Lobe of thyroid gland.
2. Common carotid artery.
3. Inferior thyroid artery.





Cervical Part of Oesophagus

- ★ It **begins** at the level of C6 vertebra (lower border of cricoid cartilage)
- ★ It **ends** in the cardiac orifice of the stomach in the abdomen one inch to the left of the median plane opposite the 11th thoracic vertebra.
- ★ **Relation:**
 - **Anteriorly:** Trachea and recurrent laryngeal nerve.
 - **Posteriorly:** Cervical vertebra, longus colli muscle, prevertebral, fascia.
 - **Laterally** (on each side): Common carotid artery and thyroid gland.