

# RESPIRATORY SYSTEM

## ANATOMY



**Title:** Sheet 3 – The larynx 1

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### Maxillary artery:

Terminal branch of external carotid artery in the parotid gland (adjacent to the neck of mandible). It originates in the parotid then passes through infratemporal fossa then enters the pterygopalatine fossa through pterygomaxillary fissure.

it is divided into three parts by lateral pterygoid muscle:

### 1st part:

Before lateral pterygoid muscle and gives five branches (each one enters either a foramen or fissure). For example, **inferior alveolar artery** branch descends along the mandible through mandibular foramen and supplies lower jaw (teeth). others upper branches descend upward to middle cranial fossa:

**middle meningeal** (through foramen spinosum) and **accessory middle meningeal** (through foramen ovale) arteries. The last two branches are **deep auricular** and **anterior tympanic arteries** to the ear.

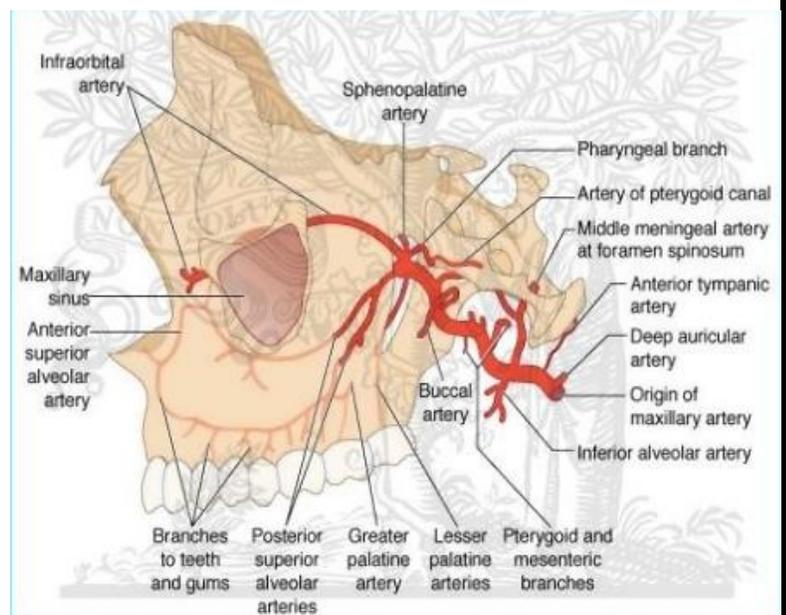
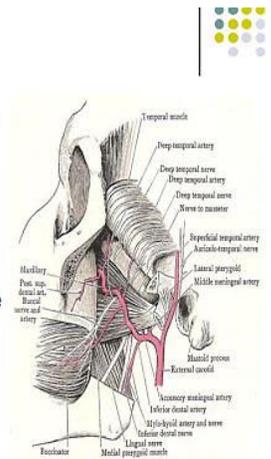
**2nd part:** Related to the lateral pterygoid muscle (anterior or posterior) and gives supply to the muscles of mastication (masseter, temporalis, medial pterygoid and lateral pterygoid) that's why it's called muscular artery. (Course with branches of the mandibular nerve).

### 3rd part:

In the pterygopalatine fossa anterior to the ganglion. Gives origin to branches that accompany branches of the maxillary nerve [V2] and the pterygopalatine ganglion. These branches supply much of the nasal cavity, the roof of the oral cavity, and all upper teeth. In addition, they contribute to the blood supply of the sinuses, oropharynx, and floor of the orbit, so, it gives orbital, palatine, sphenopalatine and nasal.

### First part

- The first part of the maxillary artery is the part between the neck of mandible (Lat.) and the sphenomandibular ligament (Med.)
- Also related to the auriculo.temporal nerve (above) and the maxillary vein (below).
- Gives origin to two major branches (the middle meningeal and inferior alveolar arteries)
- Smaller branches (deep auricular, anterior tympanic, and accessory meningeal);



### 3<sup>rd</sup> part branches:

1. The posterior superior alveolar (in the infratemporal fossa): to the upper molars.

2. Infra-orbital (in the orbit): gives branches: middle sup alveolar artery and ant sup alveolar artery (incisors and canine).

3. Greater and lesser palatine: to the oral cavity

4. **Pharyngeal branch**: Travels posteriorly and leaves the pterygopalatine fossa through the palatovaginal canal with the pharyngeal nerve. It Supplies the posterior aspect of the roof of the **Nasal cavity**, the sphenoidal sinus, and the pharyngotympanic tube.

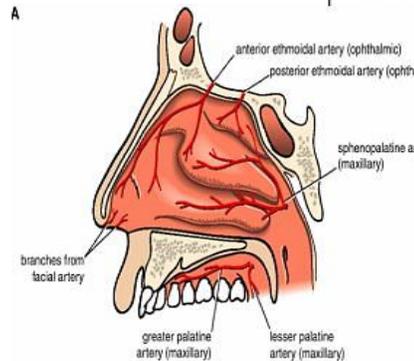
5. Sphenopalatine arteries (long & short).

### POST SUP ALVEOLAR Artery

- Originates from the maxillary artery as it passes through the pterygomaxillary fissure
- Meets the posterior superior alveolar nerve,
- Accompanies it through the alveolar foramen on the infratemporal surface of the maxilla
- Supplies the molar and premolar teeth, adjacent gingiva, and the maxillary sinus.

### Sphenopalatine artery

- The terminal branch of the maxillary artery
- Leaves the pterygopalatine fossa medially through the sphenopalatine foramen
- Accompanies the nasal nerves, giving off:
  1. Posterior lateral nasal arteries, which supply the lateral wall of the nasal cavity and contribute to supply of the paranasal sinuses;
  2. Posterior septal branches, which supply the nasal septum-the largest of these branches passes anteriorly down the septum to anastomose with the end of the greater palatine artery.



### Infra-orbital artery

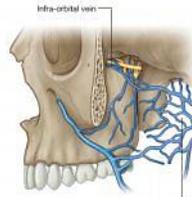
- Passes forward with the infra-orbital nerve and leaves the pterygopalatine fossa through the inferior orbital fissure
- With the infra-orbital nerve, it lies in the infra-orbital groove and infra-orbital canal
- Emerges through the infra-orbital foramen to supply parts of the face.
- In the orbital canal gives :
  1. Branches that contribute to the blood supply of structures near the floor of the orbit-the inferior rectus and inferior oblique muscles, and the lacrimal sac;
  2. **Anterior superior alveolar arteries**, which supply the incisor and canine teeth and the maxillary sinus.

6. The artery of the pterygoid canal: Passes posteriorly into the pterygoid canal and supplies surrounding tissues. Passing inferiorly through the cartilage filling the foramen lacerum and terminates in the mucosa of the nasopharynx.

The maxillary artery ends by infraorbital artery and enters to the infraorbital foramen with the nerve.

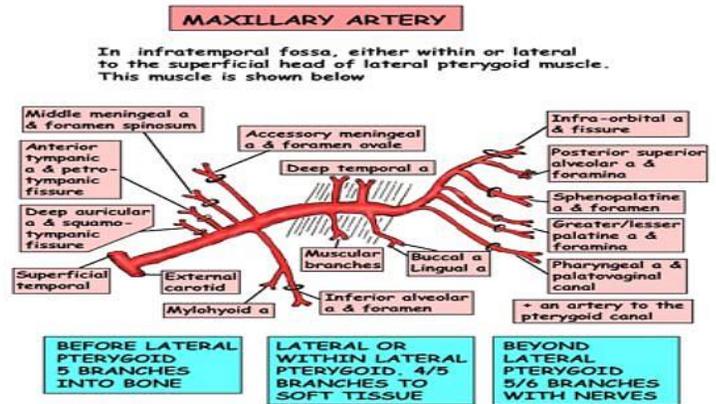
## Veins

- Drain areas supplied by branches of the terminal part of the maxillary artery
- Generally travel with these branches back into the pterygopalatine fossa.
- The veins coalesce in the fossa and then pass laterally through the pterygomaxillary fissure to join the pterygoid plexus of veins in the infratemporal fossa
- The infra-orbital vein, drains the inferior aspect of the orbit,
- May pass directly into the infratemporal fossa, so bypassing the pterygopalatine fossa



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## Maxillary artery



### Venous drainage:

Facial vein drains pterygoid and Ant. part of the face (especially from infraorbital vein).

Lateral pterygoid plexus drains the posterior aspect, this plexus drained by the maxillary vein that joins the superficial temporal vein in the parotid gland to make the retromandibular vein.

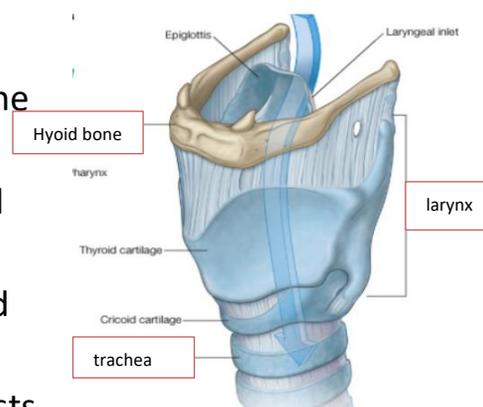
Helloooo, in this sheet we're gonna study about larynx. In this link, you'll find some extra pictures I collected from Kenhub to help you throughout this lecture.

<https://drive.google.com/file/d/1g8C6txbyvZw0o1CDf9sg-mDyf3y-F-gO/view?usp=sharing>

رح تحسوا حالكم ضايعين باول صفحتين لأنه المصطلحات جديدة، بس عادي كل ما مشيتوا بالشيت رح تفهموا أكثر و تصير الصورة أوضح، ف ما في داعي اول ما تقرأوا مصطلح جديد تروحوا عجوجل 😊

## Larynx

- Extends from the third cervical vertebra C3 to the lower border of the sixth cervical vertebra C6 (at the level of the lower border of the cricoid cartilage).
- The larynx begins with the **laryngopharynx opening** and ends with the **trachea**.
- It is suspended from the hyoid bone above and attached to the trachea below by membranes and ligaments.
- You can think of the larynx as a box of cartilage; it consists of layers that are arranged according to the following:

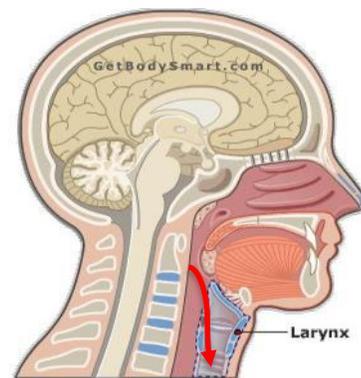


### Histology corner:

1. **Mucosa:** The larynx is covered from the inside with respiratory mucosa (pseudostratified ciliated columnar epithelium) except for the true vocal cords and the anterior (upper) surface of the epiglottis, which are both lined with stratified squamous non-keratinized epithelium.
2. **Submucosa:** Connective tissue
3. **Membranes, ligaments and joints:** To connect the cartilaginous parts together.
4. **Cartilage:** The skeleton of the larynx.
5. **Muscles:** Intrinsic laryngeal muscles and one extrinsic.
6. **Adventitia**

### Functions of the larynx: (recommended animation: <https://www.youtube.com/watch?v=IUvfAsBnn9g>)

1. **Acts as an open valve in respiration:** It needs to be open for the passage of air into and out of the lungs.
2. **Acts as a closed valve in deglutition:** When we swallow food, the bolus goes from the oral cavity through the oropharynx and to the esophagus. So, to prevent food from entering the inlet of the larynx, the epiglottis moves downward (contracts) and the larynx moves upward to completely close the inlet of the larynx.



3. **Acts as a partially closed valve in the production of voice (speech):** The production of voice happens during expiration due to vibration of the true vocal cord. So, during

expiration, the true vocal cord adducts (moves towards the midline), forming a column of compressed air below it. This compressed air vibrates the true vocal cord in order to produce voice (speech). <https://www.youtube.com/watch?v=b89RSYCaUBo>

4. **During cough, it is first closed and then opens suddenly to release compressed air.** Coughing happens to expel foreign bodies and dust entering the trachea. This process basically is the closure of the true vocal cord, forming below it a column of compressed air. When it opens suddenly, it causes the compressed air to exit suddenly.

### – Cartilage of the larynx

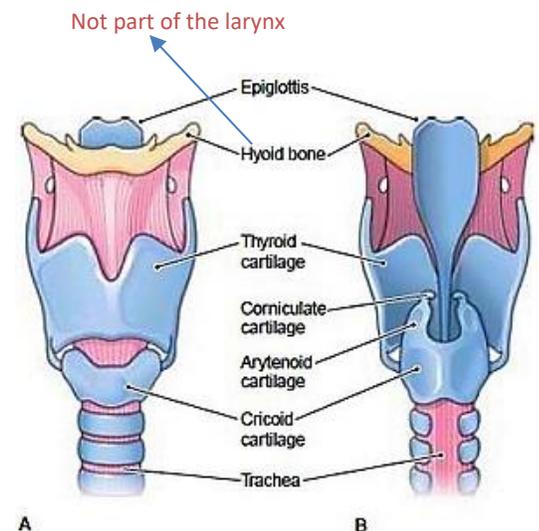
We said that the larynx is a box of cartilage. It contains single and paired cartilages:

a. **3 Single cartilage pieces:**

- Thyroid
- Cricoid
- Epiglottis

b. **3 Pairs:**

- **Arytenoid:** The most important, there is one on the right and one on the left. They connect to the upper border of the lamina of the cricoid cartilage.
- **Cuneiform**
- **Corniculate:** Connect with the apex of arytenoid. Together they form a joint.

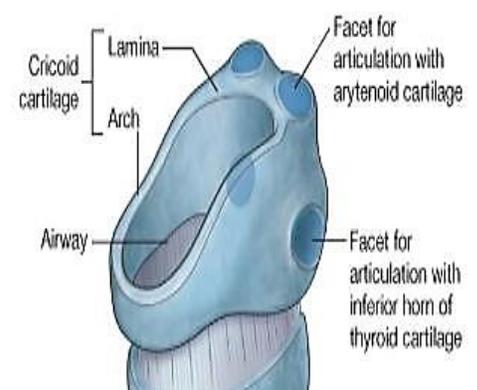


### 1. Cricoid cartilage:

- The most inferior of the laryngeal cartilages.
- Shaped like a 'signet ring.'
- It has a narrow **arch anteriorly** and a broad **lamina posteriorly**. [completely encircles the airway].

– **Facets: 2 facets on each side:**

- a. One on the lateral surface near the base and is for articulation with the inferior horn of thyroid cartilage.
- b. One facet is on the sloping superolateral surface and articulates with the base of an arytenoid cartilage.

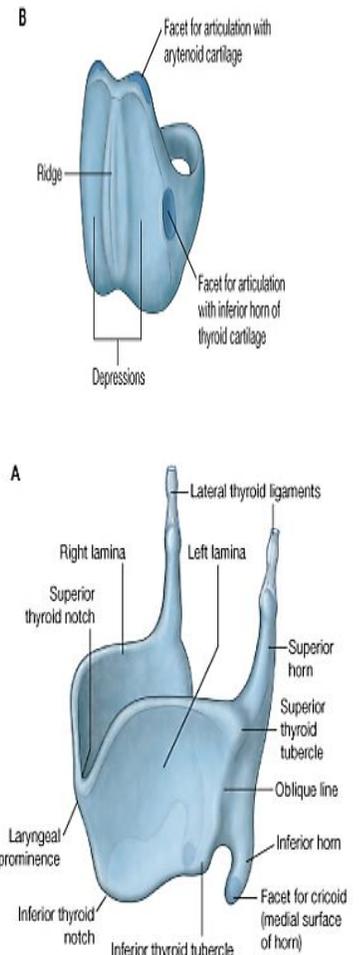


In other words, we have 4 facets. The upper two articulate with arytenoid cartilage, and the lower lateral two articulate with the inferior horn of thyroid cartilage.

- The posterior surface of the lamina has two oval depressions for attachment of the posterior crico-arytenoid muscle. They are separated by a ridge, which is for the attachment of the esophagus.

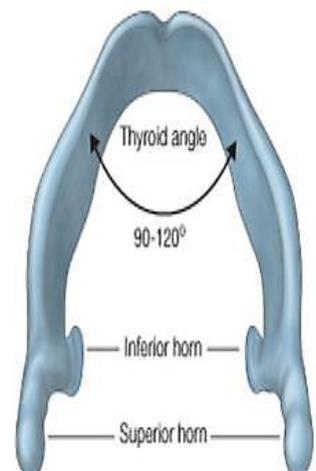
## 2. Thyroid cartilage

- The largest of the laryngeal cartilages. It has a relation with the lateral lobes of the thyroid gland.
- It is formed by a right and a left lamina:
  - ✓ **Anteriorly** they converge forming the laryngeal prominence.
  - ✓ **Posteriorly** they are widely separated.
- Superior to the laryngeal prominence, the **superior thyroid notch** separates the two laminae. The superior thyroid notch and the laryngeal prominence are palpable landmarks in the neck.
- The less distinct **inferior thyroid notch** is in the midline along the base of the thyroid cartilage.
- The posterior margin of each lamina is elongated to form a superior horn and an inferior horn:
  - ✓ **The inferior horn:** The medial surface articulates with the cricoid cartilage.
  - ✓ **The superior horn** connects with the greater horn of the hyoid bone by the thyrohyoid ligament.
- The lateral surface of lamina is marked by a ridge (**the oblique line**) which curves anteriorly from the base of the superior horn to the inferior margin of the lamina. The ends of the oblique line are expanded to form the **superior and inferior thyroid tubercles**.
- The oblique line is important for the attachment of the strap muscles of the



**Laryngeal Prominence (Adam's apple):** It is prominent in males and less prominent in females, as the angle between the two laminae is more acute in men ( $90^\circ$ ) than in women ( $120^\circ$ ). This difference is due to hormonal secretions; in males testosterone is secreted which causes the bones to be heavy and bulky and the muscles are large and strong so this leads to the formation of an acute angle that causes the voice to be low pitched (the true vocal cord is **longer** in males than in females).

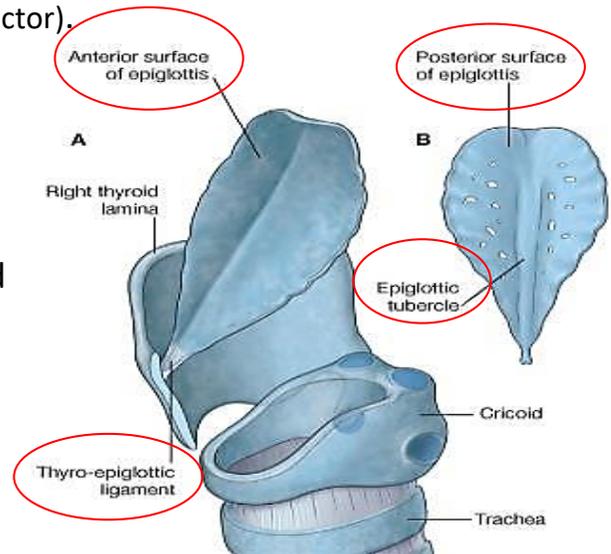
In contrast, in females estrogen and progesterone are secreted, which cause the muscles and bones to be smooth and light, so the muscles do not affect the angle of the thyroid and it stays obtuse, and the voice in females becomes high pitched (the true vocal cord is shorter in females than in males).



neck (sternothyroid, thyrohyoid, and inferior constrictor).

### 3. Epiglottis

- It is a 'leaf-shaped' cartilage.
- It has a superior free edge and an apex that attaches in the midline between the laryngeal prominence and the inferior thyroid notch internally through the thyro-epiglottic ligament.
- It has two surfaces:
  - a. **Superoanterior** surface
  - b. **Posteroinferior** surface: Contains the epiglottic tubercle and ridge.

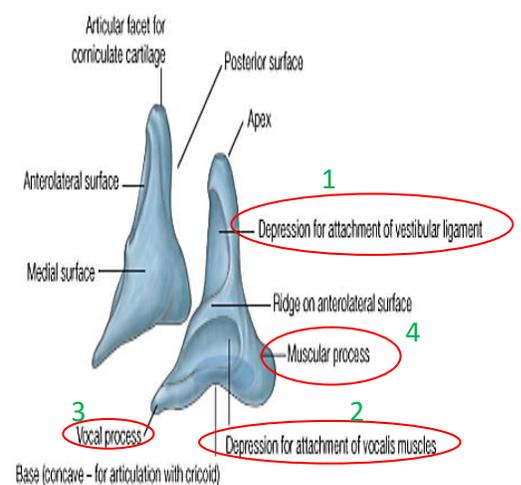
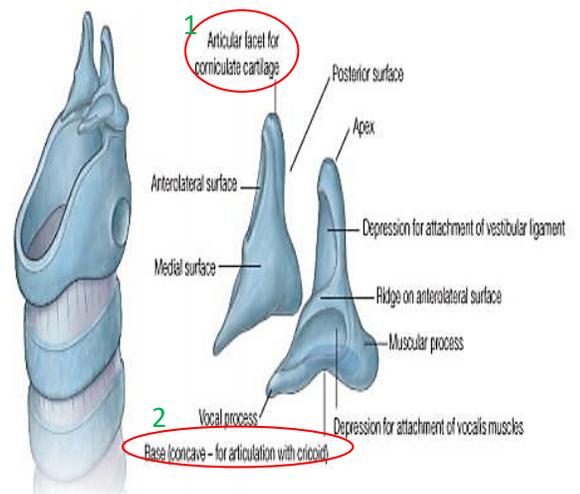


#### Histology corner:

The superoanterior surface has the same epithelium as the oral cavity: stratified squamous nonkeratinized epithelium (as it's located behind the pharyngeal part of the tongue). On the other hand, the posteroinferior surface has respiratory epithelium: pseudo...

### 4. Arytenoid cartilage:

- The two arytenoid cartilages are pyramid-shaped, each one has an apex and a base:
  - a. The **apex** of arytenoid cartilage has a facet<sup>1</sup> that articulates with **corniculate cartilage**.
  - b. The **base** of arytenoid cartilage is concave (has a depression<sup>2</sup>) that articulates with the facet on the superolateral surface of the cricoid cartilage.
- Each arytenoid cartilage has **three** surfaces:
  - a. **Medial surface**: Smooth
  - b. **Anterolateral surface**: Has a ridge separating two depressions. The **upper depression**<sup>1</sup> is for the attachment of the vestibular vocal cord (false vocal cord) by the vestibular ligament (false vocal ligament) and the **lower depression**<sup>2</sup> is for the attachment of the vocalis muscle, which is a part of the true vocal cord.
  - c. **Posterior surface**
- The base of arytenoid cartilage has:
  - a. **A vocal process anteriorly**<sup>3</sup> to which the vocal ligament of true vocal cord is



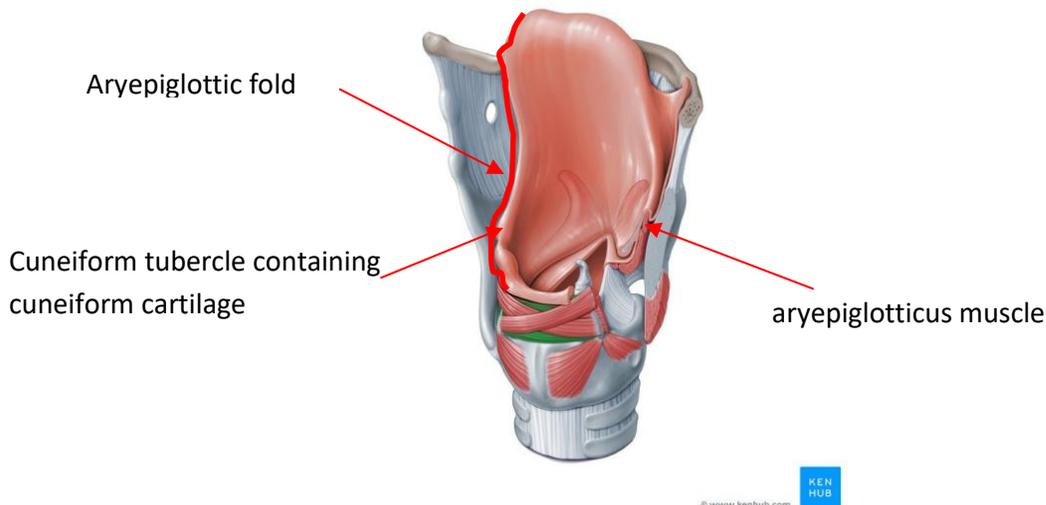
attached.

- b. **A muscular process posterolaterally**<sup>4</sup> for the attachment of the posterior and lateral cricoarytenoid muscles.

– Between the arytenoid and the epiglottis, there is a fold of fibroelastic membrane, called the **aryepiglottic fold** because it extends from the arytenoid to the epiglottis.

This fold is very important because:

- ✓ It contains the aryepiglotticus muscle, which helps the inlet close backward and downward.
- ✓ It contains the pair of cuneiform cartilages.



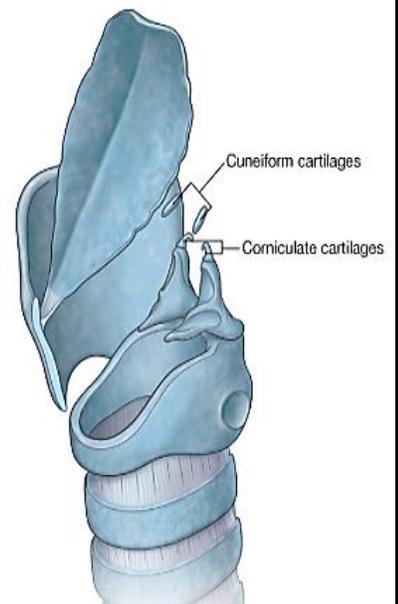
## 5. Corniculate and Cuneiform Cartilages:

### a. Corniculate cartilages:

Two small conical cartilages that articulate with the apex of the arytenoids and mark the end of the aryepiglottic fold (membrane). Their apices project posteromedially towards each other.

### b. Cuneiform cartilages:

Two small club-shaped cartilages that lie anterior to the corniculate cartilage. They are suspended in the aryepiglottic fold to add a bony strength to help in closure of the laryngeal inlet.



## – Membranes and ligaments of the larynx

We can divide them into extrinsic and intrinsic membranes or ligaments. And from the

name of the ligament we can know its attachments.

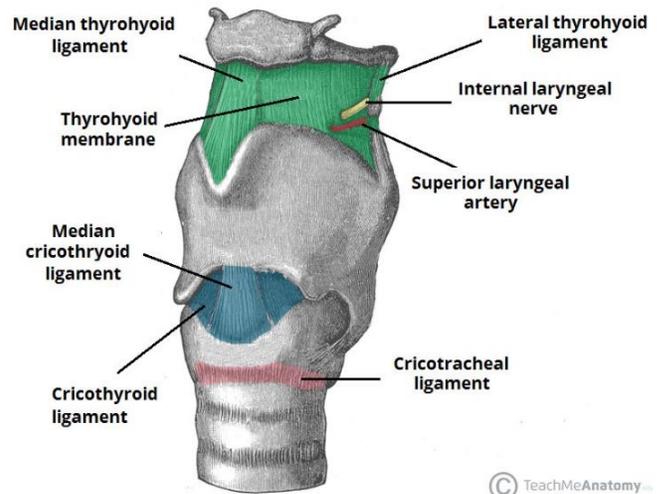
### Extrinsic ligaments:

1. Thyrohyoid membrane
2. Hyo-epiglottic ligament
3. Cricotracheal ligament

**\*\*A membrane is a sheet of fibrous tissue. A ligament is a folded membrane, making it a double-layer band of fibrous tissue.**

### 1. Thyrohyoid membrane:

- A tough fibroelastic ligament that spans between the superior margin of the thyroid cartilage below and the hyoid bone above. It is attached to the thyroid laminae and adjacent anterior margins of **the superior horns, then** ascends medial to the greater horns and posterior to the body of the hyoid bone to attach to the superior margins of these structures.
- The **posterior** borders of the thyrohyoid membrane are thickened to form the lateral thyrohyoid ligaments. They are also thickened **anteriorly** in the midline to form the median thyrohyoid ligament.
- There is an opening<sup>1</sup> in the lateral part of the thyrohyoid membrane on each side for the passage of:
  - a. **Superior laryngeal artery**
  - b. **Internal laryngeal nerve**
  - c. **Lymphatic vessels.**
- Occasionally, there is a small cartilage (triticeal cartilage<sup>2</sup>) in each lateral thyrohyoid ligament to give strength to the ligament.



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### 2. Cricotracheal ligament<sup>3</sup>

Runs from the lower border of the cricoid cartilage to the adjacent upper border of the first tracheal cartilage.

### 3. The hyo-epiglottic ligament<sup>4</sup>

Extends from the midline of the epiglottis anterosuperiorly to the body of the hyoid bone.

