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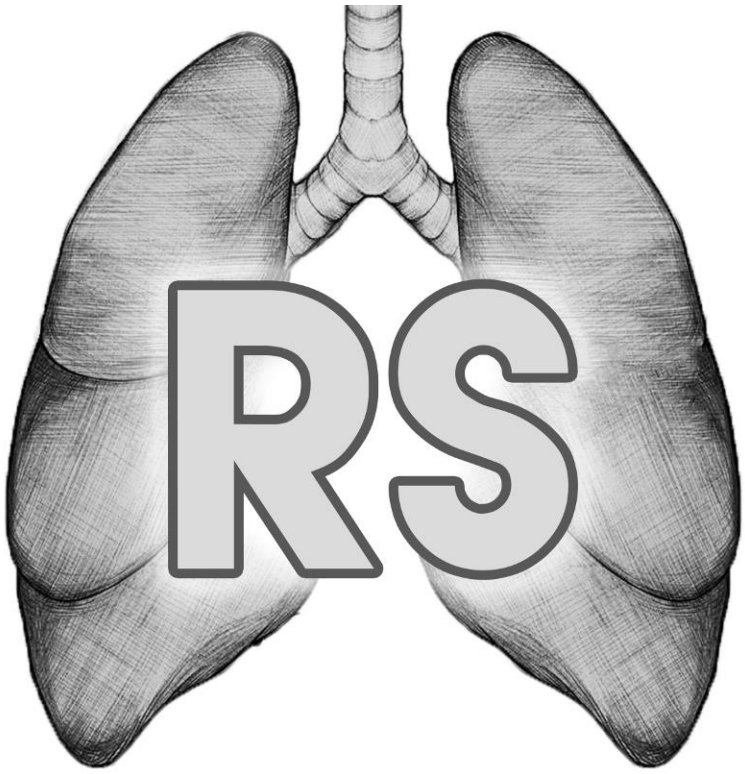


ANATOMY / HISTOLOGY

☑ Sheet ☐ Slide ☐ Handout

Number

٣

Subject

Larynx

Done By

Maryam Ali Al-Jammal

Corrected by

Abdallah S. Sulaiman

Doctor

Mohammad Hisham Al-Mohtaseb

Date: ٢٦/١١/٢٠١٦

Price:

The larynx

- It is a box of cartilage, formed of:
  ١. Single cartilage :
    a) Epiglottis
    b) Thyroid
    c) Cricoid
  ٢. Paired cartilage:
    i. Arytenoid
    ii. Cuneiform
    iii. Corniculate

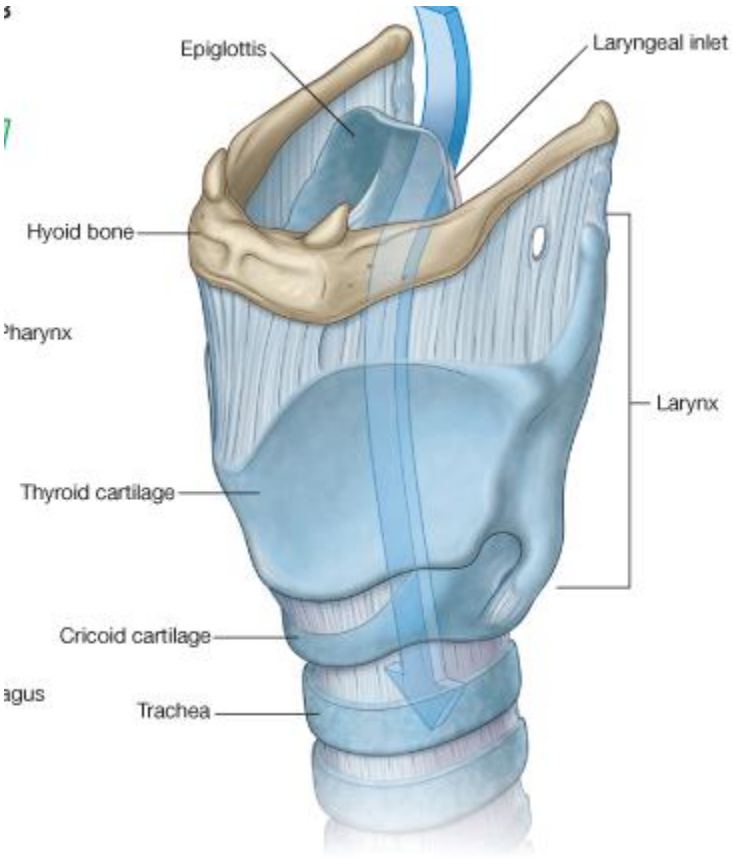
❖ **Location**:

- It extends from the ٣rd cervical vertebra to the lower border of the ٦th cervical vertebra. (the ٦th cervical vertebra is considered the lower border of cricoid cartilage (the most inferior cartilage in the larynx))
- It lies between the laryngopharynx and the trachea (starts from the laryngopharynx and continues as trachea)

In this image, notice:

❖ The inlet of the larynx. (one of the inlet's boundaries is the free edge of epiglottis (the most superior cartilage in the larynx))

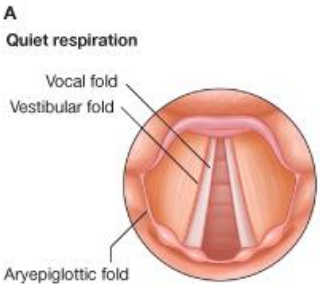
❖ The hyoid bone which is located on the upper border of the larynx, and it is considered to be outside the larynx (not a part of the larynx).



The function of the larynx: (the function depends on its status) (٤ points)

١. Opened valve : for respiration

During respiration the larynx is always opened so the air can pass from the nasopharynx to the larynx then to the trachea, to reach the lungs and cause inflation of the two lungs.



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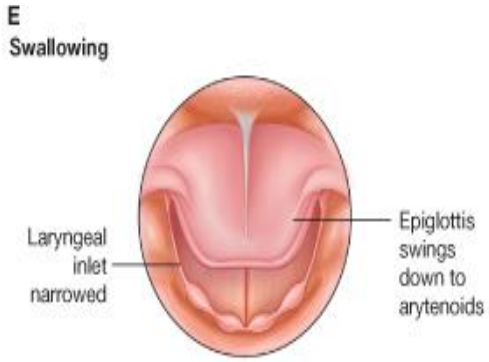
(Nasopharynx ⟹ larynx ⟹ trachea ⟹ lungs)

٢. Closed valve: in deglutition

During swallowing the inlet of the larynx is closed, so that the food bolus can pass through the esophagus.

How does the closure of the inlet occur?

I. The epiglottis moves downwards.
II. The larynx moves upwards.
III. Contraction of two muscles (**aryepiglottic** muscles)



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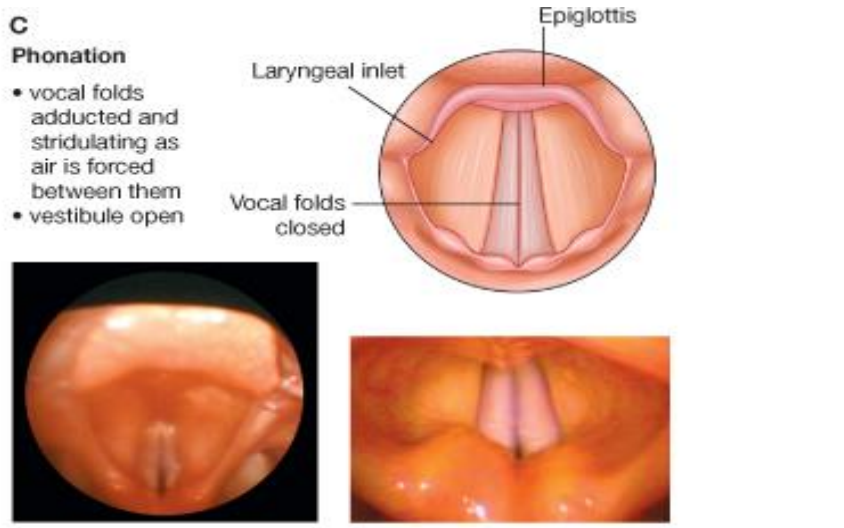
❖ When we eat, sometimes small particles pass to the larynx (food, water). As a reflex, we will start coughing till these particles get out of the larynx. (this reflex of coughing is for protection)

٣. Partially closed valve: for production of voice (phonation)

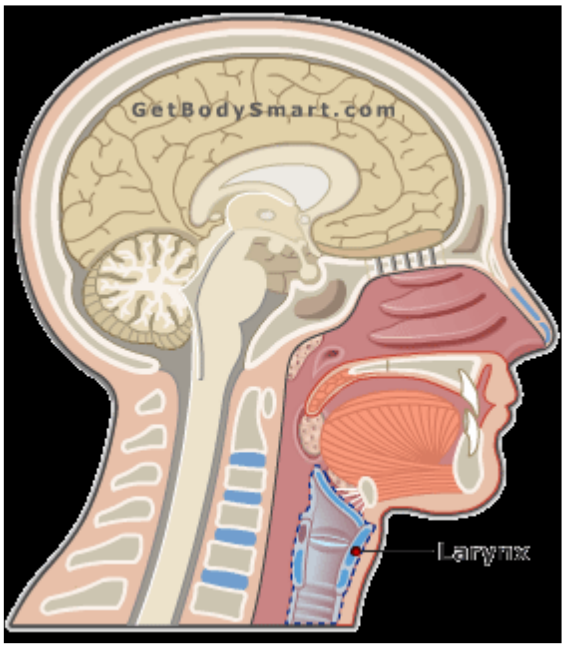
(The air in phonation is forced through the closed Rima glottides, and that will cause the vibration of the vocal folds against each other to produce the voice) *this is mentioned in the slides and not in the record.*

Inside the larynx, we have true vocal cord (white in the picture) which vibrates to produce the voice.

The vibration is done by abduction and adduction, how? During expiration, the air is moving from the lungs upwards through the trachea to go outside, when it reaches the vocal cord; it causes vibration of the true vocal cord and produce the voice.



٤. During coughing: a complete closure of vocal cord (adduction), followed by a sudden opening (abduction).
   - complete closure : the complete adduction will cause the vocal cord to get closed; that will prevent the expired air to go out, producing a compressed column of air.
   - With the sudden opening, the air will get out causing the 'coughing'.



As mentioned before, this reflex is used for protection; by coughing we can get rid of bacteria and foreign bodies that enter the larynx.

(Coughing: is an adduction followed by a sudden opening).

❖ **The larynx is composed of :**

١. **Cartilage :** There are ٩ cartilages:

- ٣ singles
- ٣ pairs

٢. **Mucosa**

The larynx is covered from inside by the mucosa, and the lining epithelium is **pseudo-stratified ciliated columnar** epithelium, except at the level of the true vocal cord, the lining epithelium is **stratified squamous non-keratinized**; that is important for regeneration as that area (vocal cord) is repeatedly injured.

٣. **Ligaments and membranes:**

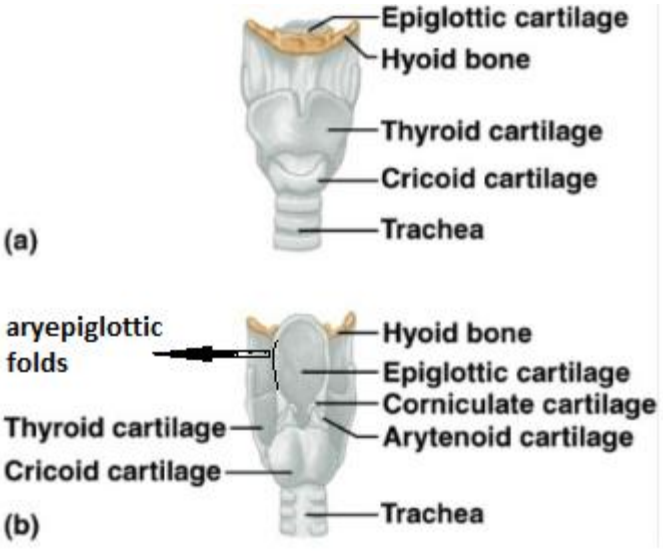
These are located between the cartilages, and responsible for the connections between them.

٤. **Muscles:**

All of the muscles in the larynx are intrinsic muscles (inside the larynx), except one muscle located outside the larynx and called **cricothyroid** muscle.

Cricothyroid muscle is responsible for the pitch of the voice; as it causes tense of the vocal cord.

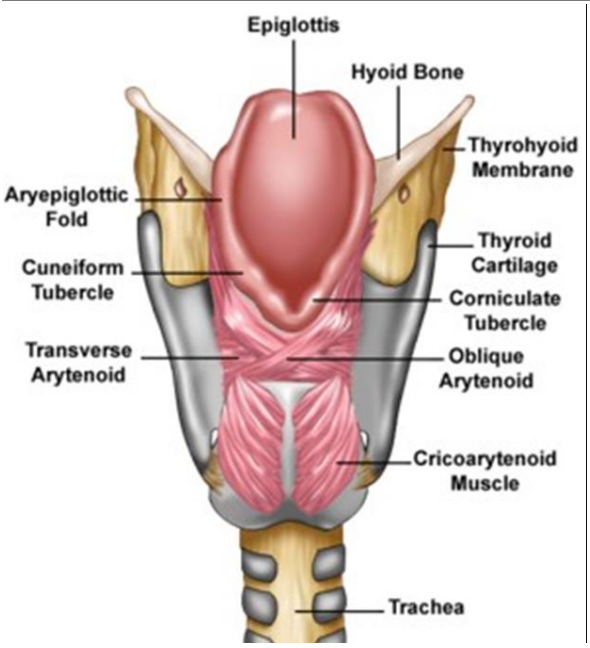
- **Cartilage:** As mentioned before, we have ٣ single cartilages and ٣ paired cartilages (total of ٩).
  - **Single: (a)**
    ١. **Epiglottis** (located at the beginning of the larynx, upward)
    ٢. **Thyroid**
    ٣. **Cricoid** (at the end of the larynx, downward)

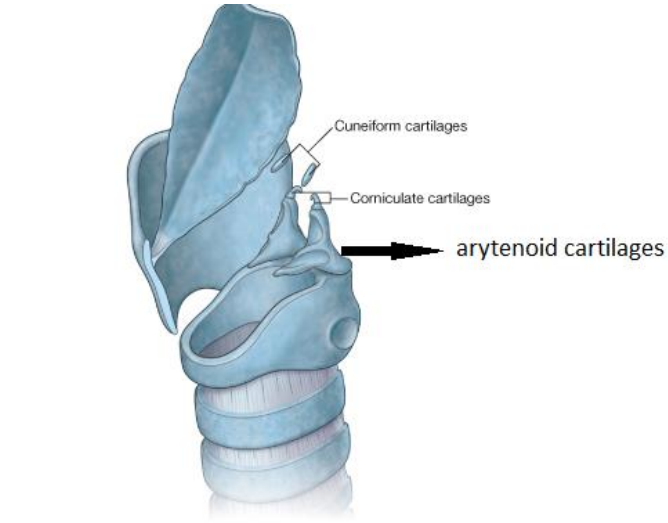


- **Pairs: (b)**
  - **I. Cuneiform**
  - **II. Corniculate**
  - **III. Arytenoid**

- **Picture (a): anterior view of the larynx ------ notice the ٣ single cartilages.**
- **Notice the hyoid bone (outside the larynx)**

- **Picture (b): posterior view of the larynx.**
- **Notice:**
  - ✓ The epiglottis and the free edge of epiglottis.
  - ✓ The lamina of cricoid.
  - ✓ The thyroid cartilage is opened posteriorly.
  - ✓ The arytenoid cartilages (paired) --- one on the right and one on the left.
  - ✓ The corniclate cartilages (paired) --- articulated on the apex of arytenoid.
  - ✓ Cuneiform cartilages (paired) --- see them in the next picture (on the right), they are clearer there.
  - ✓ Aryepiglottic folds (laterally). ---- see the folds in the next picture on the left.





- **Notice the ٣ paired cartilages.**

- There is a muscle called oblique arytenoid that helps in the closure of the inlet of the larynx.
- As mentioned, the epiglottis moves downwards, the larynx moves upwards, and the muscle (oblique arytenoid) contracts.

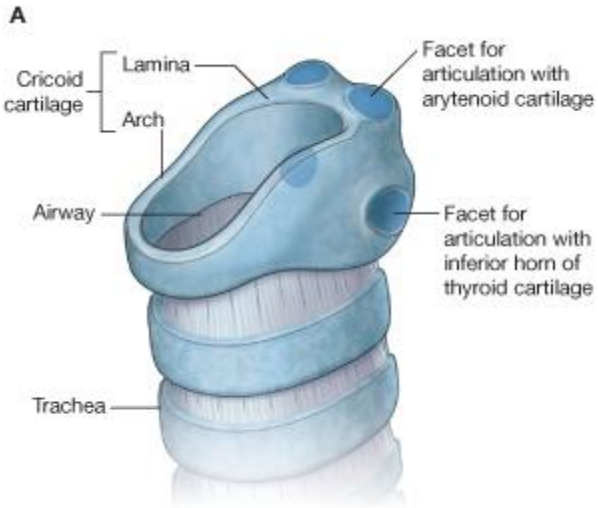
Let's talk about the cartilages in details:

١. **Cricoid cartilage:** (The most inferior cartilage ---- shaped like a "**signet ring**")

- Anteriorly: it has an arch.
- Posteriorly: it has a lamina.
- Inside: the air moves inside it. (opened from inside) ---- it encircles the airway.
- The lower border of cricoid is the end of the larynx and the beginning of trachea. (at the level of the lower border of C٦)

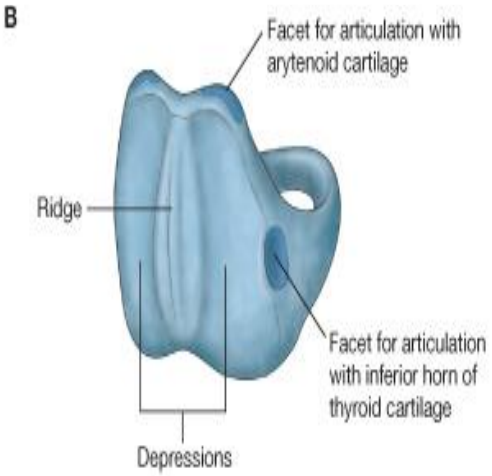
Notice:

- the tracheal rings
- the arch
- the lamina
- the airway



Posteriorly: it has:

١. **Two depressions**: for the attachment of two posterior crico-arytenoid muscles. (which are responsible for the **abduction** of the vocal cord)
٢. **A ridge**: for attachment with the esophagus. ----- (the esophagus lies behind the trachea)
٣. **Articular facet:** located superiorly above the upper border of the lamina. ---- for articulation with arytenoid, and as we know we have two arytenoids (right and left) --- there are two facets.



- The arytenoid is very important in the movement (rotatory movement), which means that all the joints in the larynx are **synovial joints** (for rotation)
- **Lateral wall:**

There is a facet for articulation (another joint), this facet is for articulation with the **inferior** horn of thyroid cartilage.

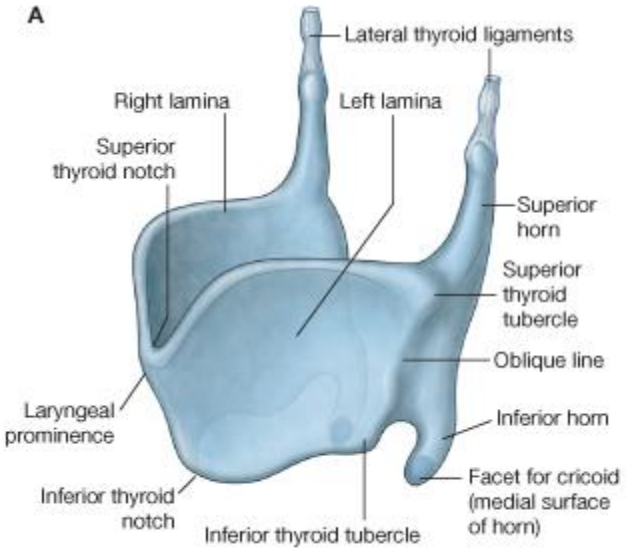
٢. **Thyroid cartilage :** (the largest cartilage in the larynx)
- Formed by two lamina (right and left)
- Anteriorly, the two lamina form an angle, the highest point of the angle is **the laryngeal prominence**
  (or it is called superior thyroid notch) ---- **Adam's apple.**

Adam's apple is more prominent in males. Why?

The vocal cords are attached to the angle of thyroid.

The cause is hormonal:

- ✓ In adult males, there is testosterone secretion; which will cause thickening in the bones and cartilages, and that will form **acute angle** in the thyroid cartilage, forming longer vocal cords; which will cause having a low pitch voice in men.
  (To understand the angle see the next figures)
- ✓ In adult females, there are secretions of estrogen and progesterone, which will cause lightening of bones and muscles and forming an obtuse angle; and that means short cords and high pitch in women.



The thyroid cartilage has:

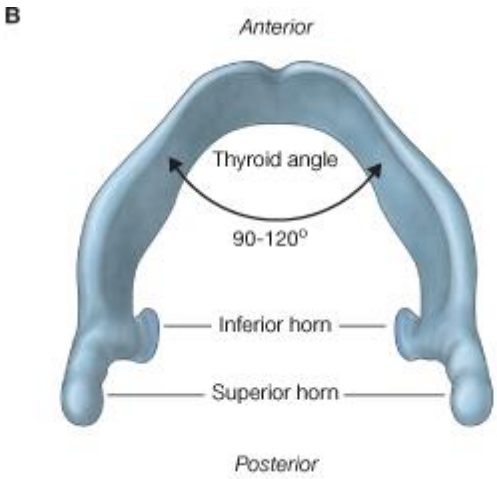
١. Oblique line: for muscle attachment.{ from the slide: attachment for the **extrinsic muscles of the larynx (sternothyroid, thyrohyoid, and inferior constrictor)** }

٢. Superior horn: articulation with the hyoid.
٣. Inferior horn: for articulation with cricoid cartilage.
٤. Superior and inferior thyroid tubercles. (at the ends of the oblique line)

- **The thyroid is opened posteriorly** (as the two lamina are separated posteriorly).
- **The thyroid cartilage is related laterally with the lateral lobe of the thyroid.**

Notice the angle **(٩٠-١٢٠)**

- Acute in males
- Obtuse in females
- The superior thyroid notch is prominent in males.



➢ **One of the important muscles is the cricothyroid muscle.**
✓ Originated from the cricoid cartilage and inserted into the thyroid cartilage.
✓ Nerve supply: external laryngeal nerve (branch of the vagus)
✓ Function: responsible for the pitch of the voice. (shortening of the vocal cords ---- high pitch)
➢ **Vocalis muscle:**

- It is a part of the true vocal cord
- Function: the opposite of cricothyroid ---- relaxation/ elongation of the vocal cord --- low pitch

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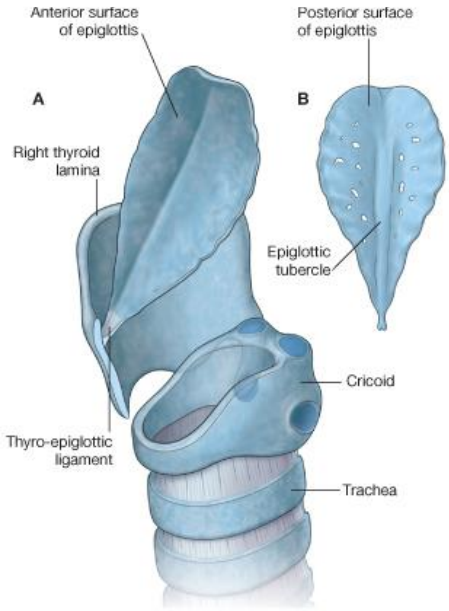
٣. **Epiglottis cartilage:** (leaf-shaped)

- It has a free upper border.
- The apex is attached to the angle of thyroid by a ligament called thyro-epiglottic ligament.

- It has two surfaces:
  ١. Superior anterior surface.
  ٢. Posterior inferior surface. (which has a tubercle (ridge) on it, called epiglottic tubercle).

☞ These two surfaces are different from each other by the lining epithelium:
  ١. Superior anterior surface: it is like the oral cavity ---- stratified squamous non-keratinized.
  ٢. Posterior inferior surface: it is like the larynx ---- psuedostratified ciliated columnar.



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Epiglottis has a very important rule in closure of the inlet of the larynx ---- it is moved downwards by the bolus.

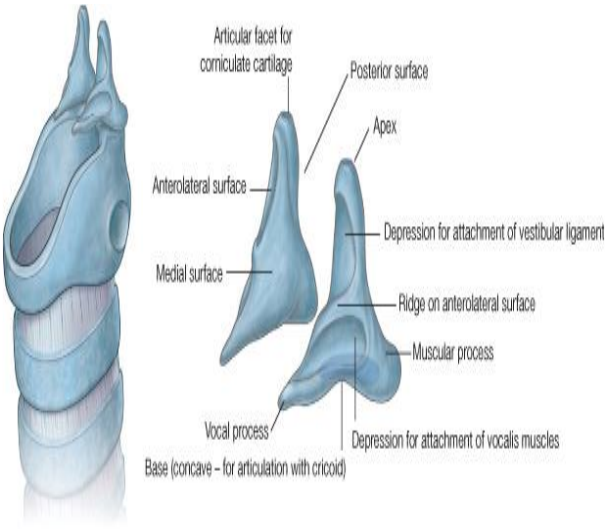
And as mentioned, the larynx will move upwards, and there will be muscle contraction.

Paired cartilage:

١. **Arytenoid**
(inferior to the other two paired cartilages) (pyramid-shaped)

It has:

- Apex: This has a facet for articulation with corniculate cartilage.
- Base: it has a depression for articulation with the upper border of cricoid cartilage.
- Medial surface: (smooth)



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- Lateral surface: it has two depressions separated by a ridge.

I. Depression above the ridge: that is attached to the vestibular ligament of the **false** vocal cord.

II. Depression below the ridge: that is attached to the vocalis muscle which is a part of the **true** vocal cord --- responsible for relaxation/elongation of the vocal cord.

- Arytenoid has two processes:

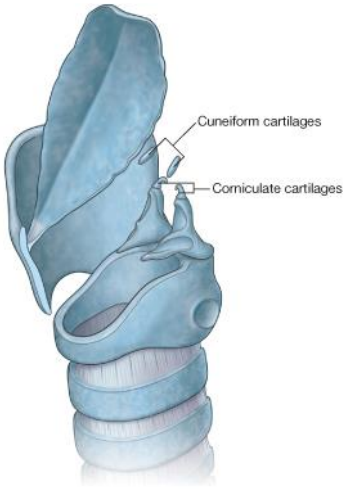
a) Vocal process: for attachment with the true vocal cord (vocal ligament)

b) Muscular process: for attachment of muscles:

١. **P**osterior crico-arytenoid (a**B**duction)

٢. **L**ateral crico-arytenoid (adduction)

These two muscles are responsible for abduction and adduction of the true vocal cord.



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٢. corniculate cartilages:

Each one is articulated with the apex of arytenoid.

٣. Cuneiform cartilage :

- It is located in the fold (aryepiglottic fold).
- Function: it is located in the fold to strengthen the contraction of the muscles during the closure of the inlet.

Ligaments and membranes:

- They lie between the cartilages.
- There are two types of ligaments:

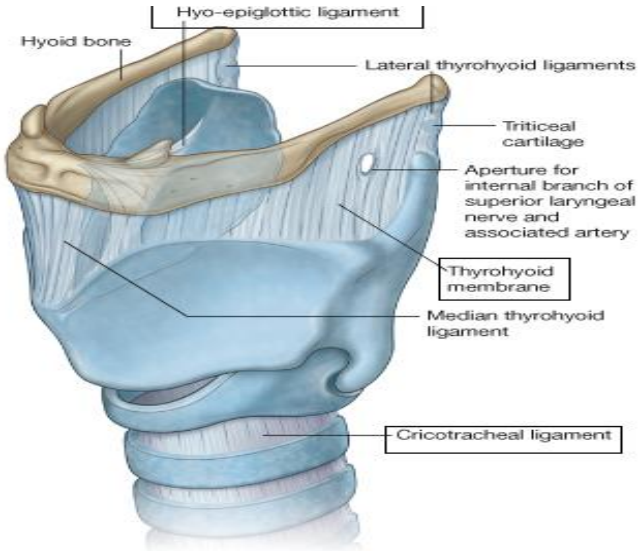
١. Extrinsic

٢. Intrinsic

- There are some differences between the membrane and the ligament:
  - The membrane is thinner than the ligament --- the ligament is a thick membrane.
  - The ligament is located at the midline (median) or laterally. While the membrane is in between.

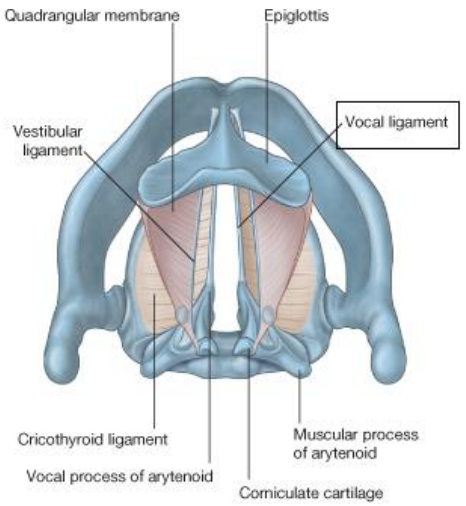
Extrinsic ligaments and membranes:

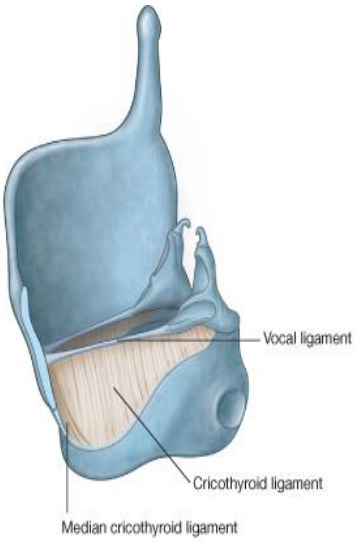
١. Thyrohyoid **membrane** (between the thyroid and the hyoid bone)
٢. Hyoepiglottic ligament (between the hyoid and the epiglottis)
٣. Cricotracheal ligament (between the cricoid and the trachea)



Intrinsic ligaments: (located inside the larynx --- very important and essential)

١. Lower cricothyroid ligament
٢. Upper quadrangular membrane





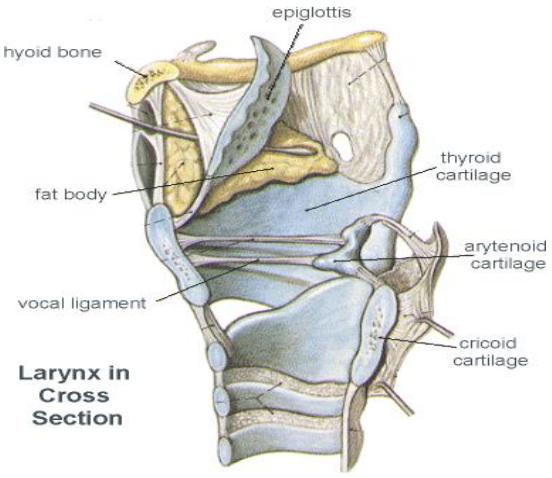
- **Cricothyroid ligament or membrane**
  - It is also called cricovacal or **conuselasticus** (it is used in hospital)
  - This membrane/ligament starts from the upper border of cricoid upwards to the thyroid to attach to the **vocal process of arytenoid** and extends to the **angle of thyroid**.
  - The upper free edge (attached to the process) forms the vocal ligament (part of the true vocal cord).

The true vocal cord is formed by the upper free edge of conuselasticus

(The part that is attached to the vocal process of arytenoid from one side and the angle of thyroid cartilage from the other side)

The vocal cord is composed of:

١. Vocal ligament
٢. Vocalis muscle
٣. Covered by mucosa



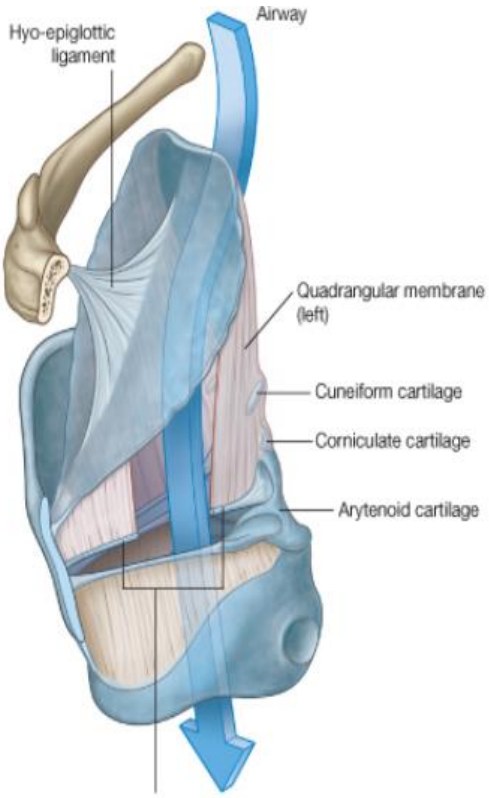
- **Quadrangular membrane: (**the opposite of cricothyroid ligament)

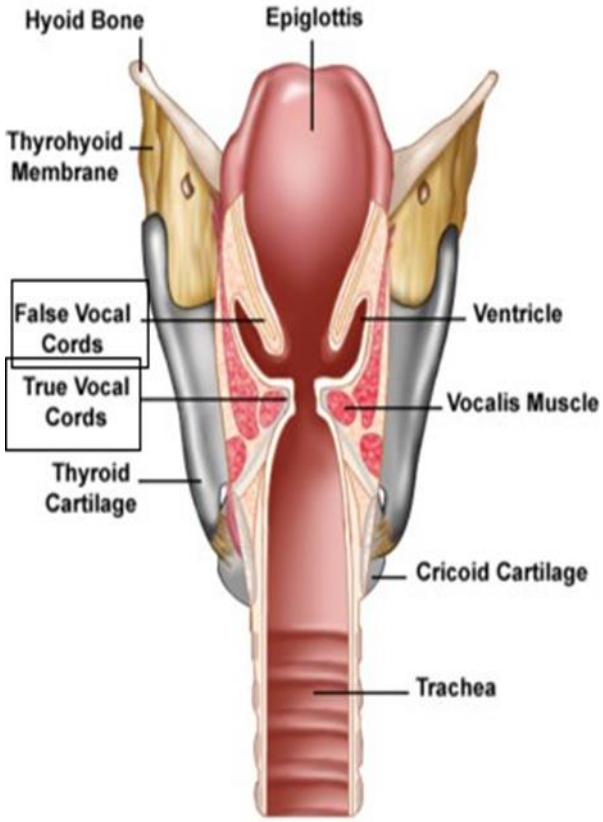
It descends downwards from the edge of epiglottis till it reaches the thyroid cartilage from inside, to reach the upper depression of arytenoid and forms **false vocal ligament (vestibular ligament).**

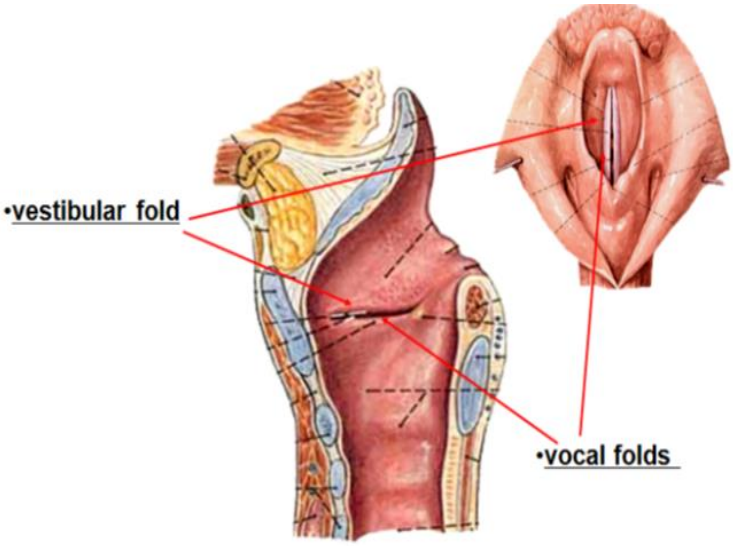
(The vestibular ligament is from the lower free edge of quadrangular membrane)

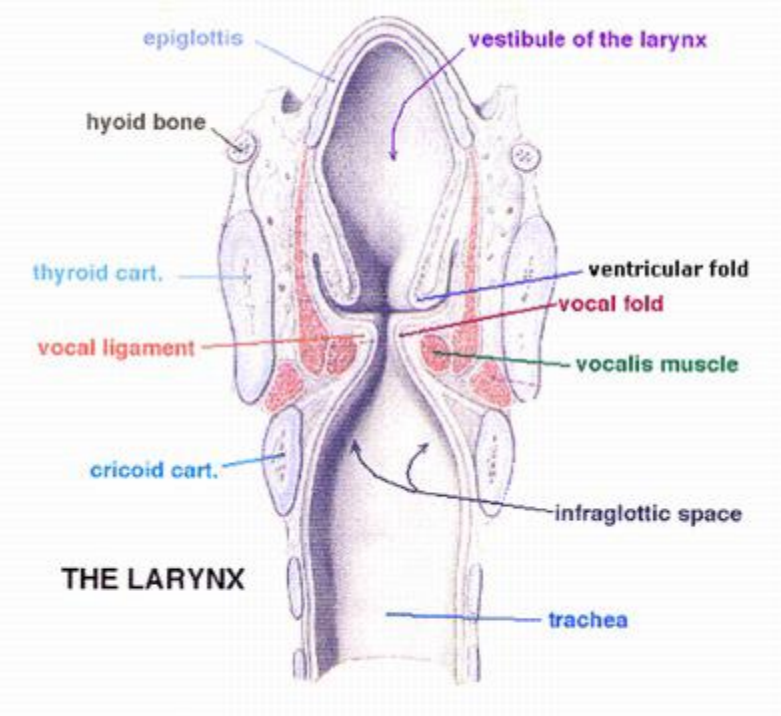
Notice:

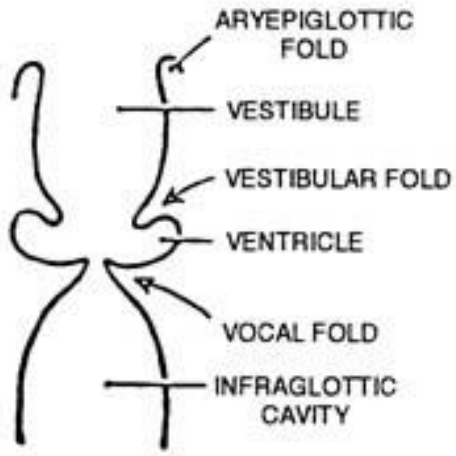
- ✓ The inlet of the larynx
- ✓ Epiglottis
- ✓ Thyroid cartilage
- ✓ Cricoid (anterior—arch. Posterior---- lamina)
- ✓ Arytenoid.
- ✓ Corniculate
- ✓ Cuneiform
- ✓ Aryepiglottic fold (forms the boundary of the inlet)











- We can divide the larynx into:
  ١. Vestibule (from the inlet to the false vocal cord--- vestibular fold)

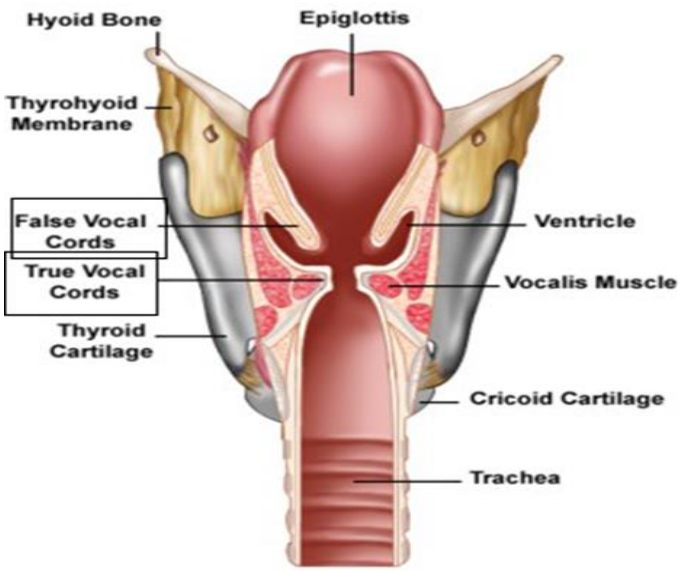
  ٢. Glottis part (middle chamber) located between the false and the true cords.

  It contains a ventricle (space) that forms a saccule (like a pocket), this saccule contains glands that produce secretions for lubrication of the true vocal cord.

  ٣. Infra-glottic part (below the true vocal cord).

The true vocal cord: characterized by:

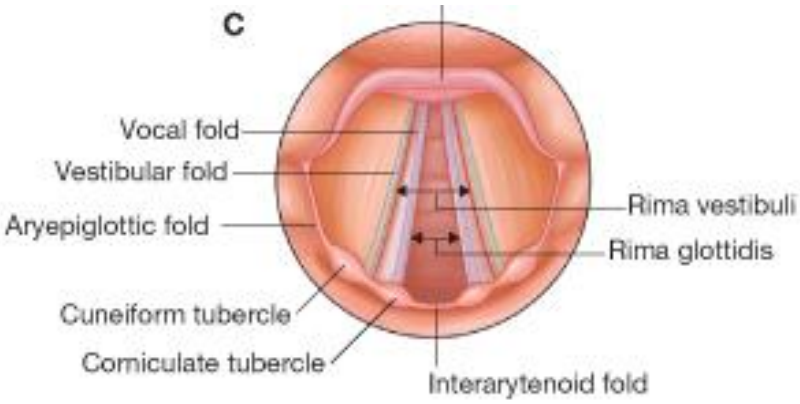
١. It contains vocal ligament (upper free edge of conuselasticus)
٢. Covered by mucosa (stratified squamous non- keratinized epithelium)



This part of the larynx is exposed to injury (absence of voice), and this type of epithelium can regenerate (mitosis) ---- the voice is back.

Notice that the lining epithelium is different from the other parts of the larynx.

٣. Vocalis muscle: responsible for elongation/relaxation of the true vocal cord.
٤. No submucosa: because the submucosa is exposed to fluid accumulation and edema, so if this happens it will cause adduction of the vocal cord causing suffocation.
٥. No blood vessels:
It receives blood by diffusion ---- that is why it is white in color, while the false vocal cord (vestibular fold) is red in color; because it is rich in blood vessels.
٦. It has lymphatic.
٧. Longer in males ---- difference of the pitch.



During anesthesia, it is a must to have a view of the area in the picture. When the patient is getting prepared for a surgery, we have to pass an endotracheal tube; from the oral cavity and it must pass between the true vocal cords toward the trachea.

That is important to prevent adduction of the true vocal cords during operation.

Notice the Rima vestibuli and Rima glottidis

(rima vestibuli is at the entrance of the middle chamber)

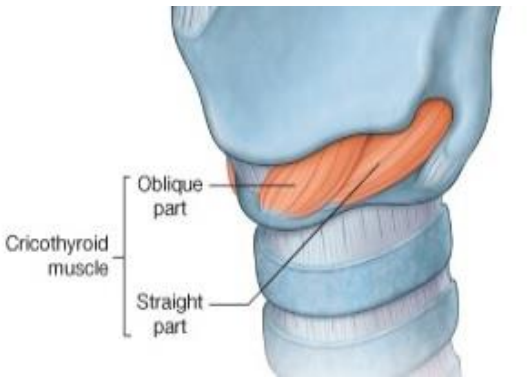
(rima glottidis separates the middle chamber from the infra-glottic cavity)

- Rima glottides: it is a space between the true vocal cords.
- Rima vestibule: it is a space between the false vocal cords.

➢ The rima glottidis is narrower and it is very important.

➢ When abduction and adduction occur in the vocal cord there will be widening and narrowing of the rima glottides.

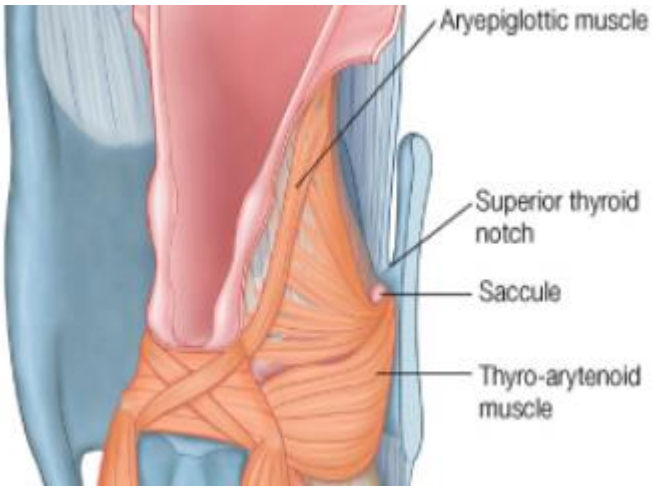
Muscles of the larynx:



١. Cricothyroid : responsible for shortening (tense) of the vocal cord.

It is the only laryngeal muscle present outside the larynx, and the only muscle supplied by the external laryngeal nerve.

(The other muscles are inside the larynx and supplied by the recurrent laryngeal nerve.

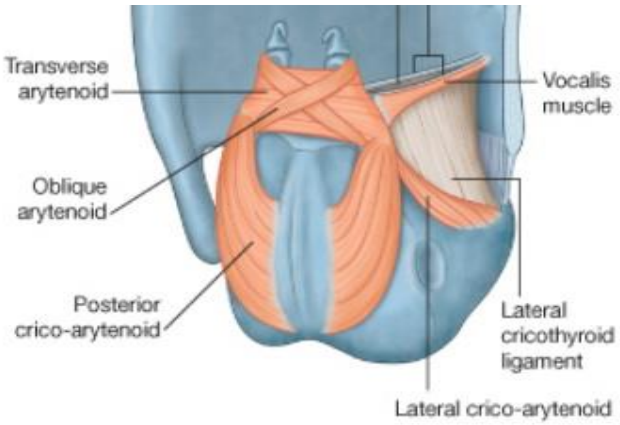


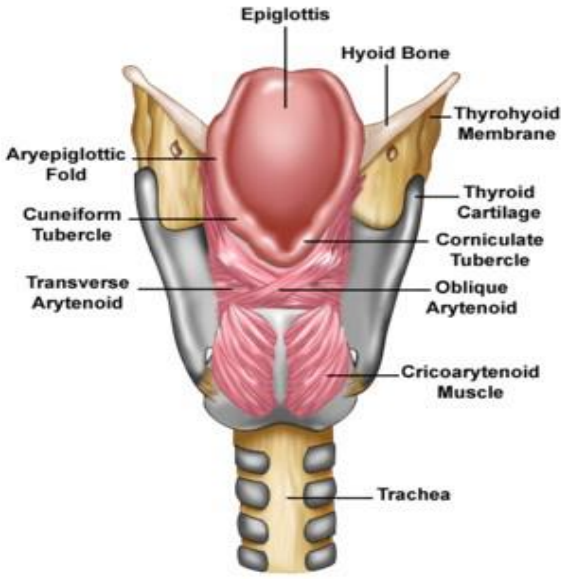
٢. Thyroarytenoid muscle (vocalis muscle): responsible for elongation/relaxation of the vocal cord.

٣. Posterior cricoarytenoid (abduction)

٤. Lateral cricoarytenoid (adduction)

The posterior and lateral cricoarytenoid are attached to the **muscular process** of arytenoid from one side and to the **cricoid** from the other side.





٥. Transverse arytenoid (adduction posteriorly ---- narrowing the rima glottidis posteriorly.)

It is originated from one arytenoid and inserted into the opposite arytenoid.

٦. Oblique arytenoid (narrowing the inlet)

It transports obliquely from arytenoid to cricoid on both sides (paired) –*in slides and Snell text book:* ***from the muscular process of arytenoid to the apex of the opposite arytenoid*** *--- (the same location.)*

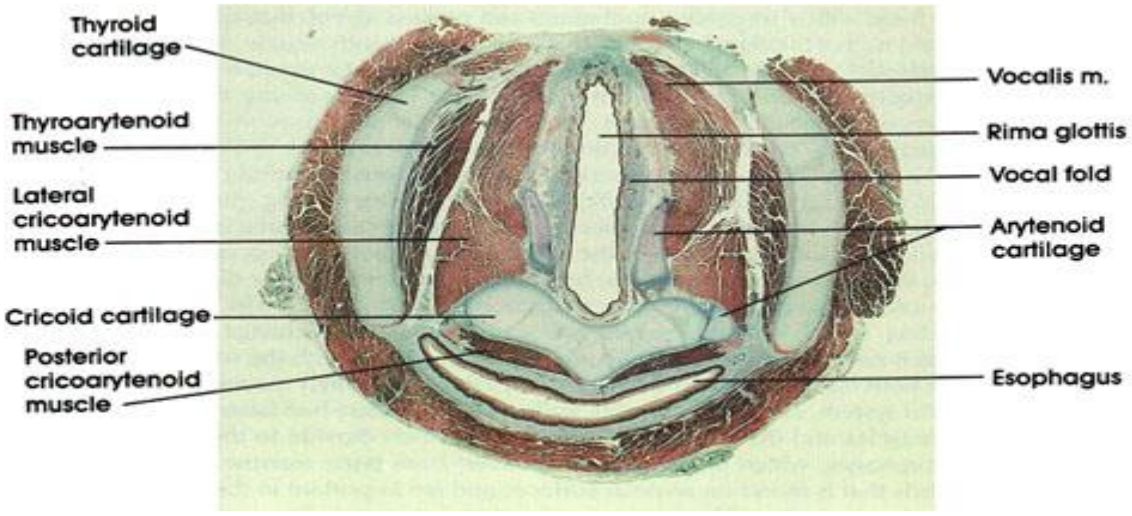
٧. thyroepiglottic muscle (**aryepiglottic** muscle): widens the inlet, and is originated from the thyroid to the epiglottis and aryepiglottic fold.

The table below shows the origin, insertion, innervation, and action of the laryngeal muscles:
To make is easy: there are:

- ✦ Two muscles for shortening and elongation of the vocal cords
- ✦ Two muscles to control the inlet
- ✦ Two muscles for widening and narrowing (abduction and adduction)
- ✦ One muscle for the posterior part of the rima glottidis (closure)
- All the muscles are supplied by the recurrent laryngeal nerve except for one muscle (cricothyroid) that is supplied by the external laryngeal nerve.
- The cricothyroid is the only muscle outside the larynx.
- The origin and insertion can be known from the names of the muscles.

Intrinsic muscles of the larynx: (Snell text book, Page ٦٤٨)

muscle	origin	Insertion	Nerve supply	Action
Muscles	**Controlling the**	**laryngeal inlet**		
Oblique arytenoid	Muscular process of arytenoid cartilage	Apex of opposite arytenoid cartilage	Recurrent laryngeal nerve	Narrows the inlet by bringing the aryepiglottic folds together
thyroepiglottic	Medial surface of thyroid cartilage	Lateral margin of epiglottis and aryepiglottic fold	Recurrent laryngeal nerve	Widens the inlet by pulling the aryepiglottic folds apart
Muscles	**Controlling the**	**Movement of**	**The vocal**	**Folds(cords)**
Cricothyroid	Side of cricoid cartilage	Lower border and inferior cornu of thyroid cartilage	External laryngeal nerve	Tenses vocal cords
Thyroarytenoid (vocalis)	Inner surface of thyroid cartilage	Arytenoid cartilage	Recurrent laryngeal nerve	Relaxes vocal cords
Lateral cricoarytenoid	Upper border of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Adducts the vocal cords by rotating arytenoid cartilage
Posterior cricoarytenoid	Back of cricoid cartilage	Muscular process of arytenoid cartilage	Recurrent laryngeal nerve	Abducts the vocal cords by rotating arytenoid cartilage
Transverse arytenoid	Back and medial surface of arytenoid cartilage	Back and medial surface of opposite arytenoid cartilage	Recurrent laryngeal nerve	Closes posterior part of rima glottidis by approximating arytenoid cartilages



This is the true vocal cord.

- ✓ Adduction: lateral cricothyroid
- ✓ Abduction: posterior cricothyroid
- ✓ White in color
- ✓ Adduction is very dangerous; it stops respiration and cause suffocation

That's why we put endotracheal tube during operations --- to prevent adduction (suffocation) during operation, and preserve normal respiration.

These muscles were not mentioned by the doctor, but mentioned in the slides:

Extrinsic muscles

- Elevators of the larynx:
- ١. Digastric muscle
- ٢. Stylohyoid
- ٣. Myelohyoid
- ٤. Geniohyoid
- The larynx moves up in swallowing by these muscles assisted by :
- Stylopharngeus, Salpingo-pharngeus, And Palatopharngeus.
- Depressors of the larynx :
- ١. Sternothyroid
- ٢. Sternohyoid
- ٣. Omohyoid

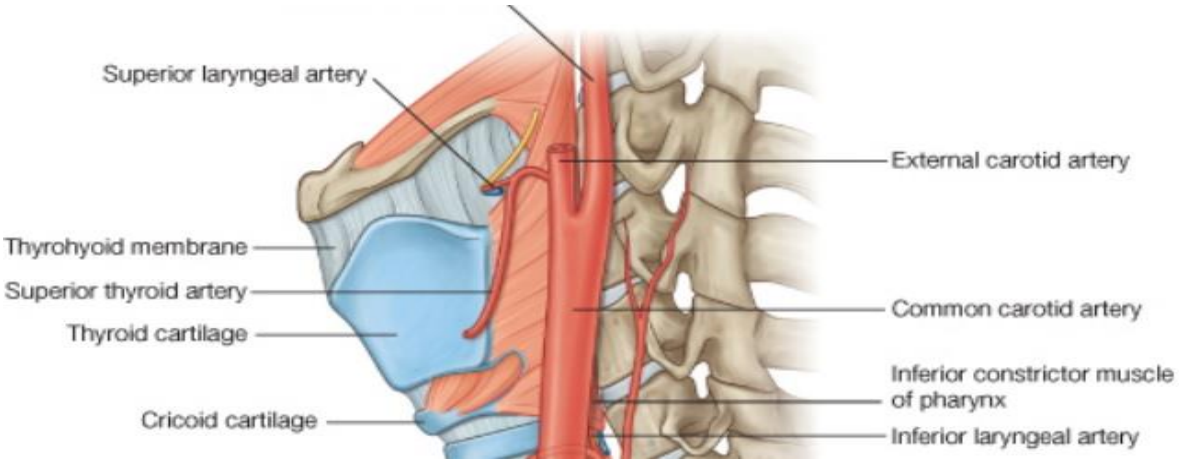
(The doctor said that blood and nerve supply and the clinical cases are very important)

Blood supply:

١. Superior laryngeal artery:

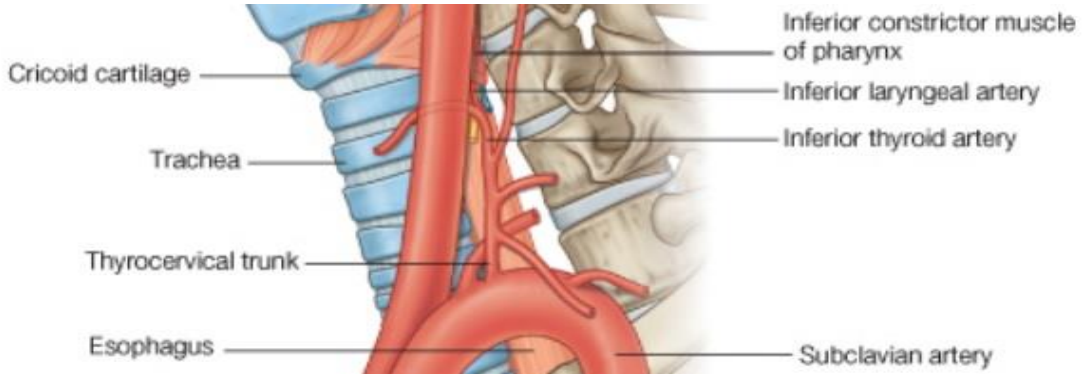
It is a branch from the superior thyroid artery, which is a branch from the external carotid artery.

External carotid ⟹ superior thyroid artery ⟹ superior laryngeal artery



- ❖ The superior laryngeal artery is accompanied with a nerve (internal laryngeal nerve, a branch from the vagus)
- ❖ The internal laryngeal nerve is responsible for **sensation** above the true vocal cords (the mucosa of the larynx above the vocal cords)
- ❖ The area below the true vocal cords is supplied by the recurrent laryngeal nerve.

٢. Inferior laryngeal artery:



Inferior laryngeal artery:

It is a branch from the inferior thyroid artery, which is a branch from the thyrocervical trunk of the subclavian.

Subclavian ⟹ thyrocervical trunk ⟹ inferior thyroid ⟹ inferior laryngeal

- To sum up the blood supply:
  ١. Superior laryngeal artery
  ٢. Inferior laryngeal artery

☞ The nerve that are running along with the artery : We have to know them, so that when we need to do ligation of the artery to be careful not to cause any injury to the nerve.

١. With the superior **thyroid** artery, there is the external laryngeal nerve (which supplies the cricothyroid muscle---- the only muscle located outside the larynx and is responsible for the tense of the vocal cord – high pitch)

During ligation of the superior thyroid artery, if the nerve was injured, that will cause paralysis to the supplied muscle, and that will result in weakness/**hoarseness** of the voice. Especially, if the injury occurred on both sides.

٢. Inferior thyroid artery:

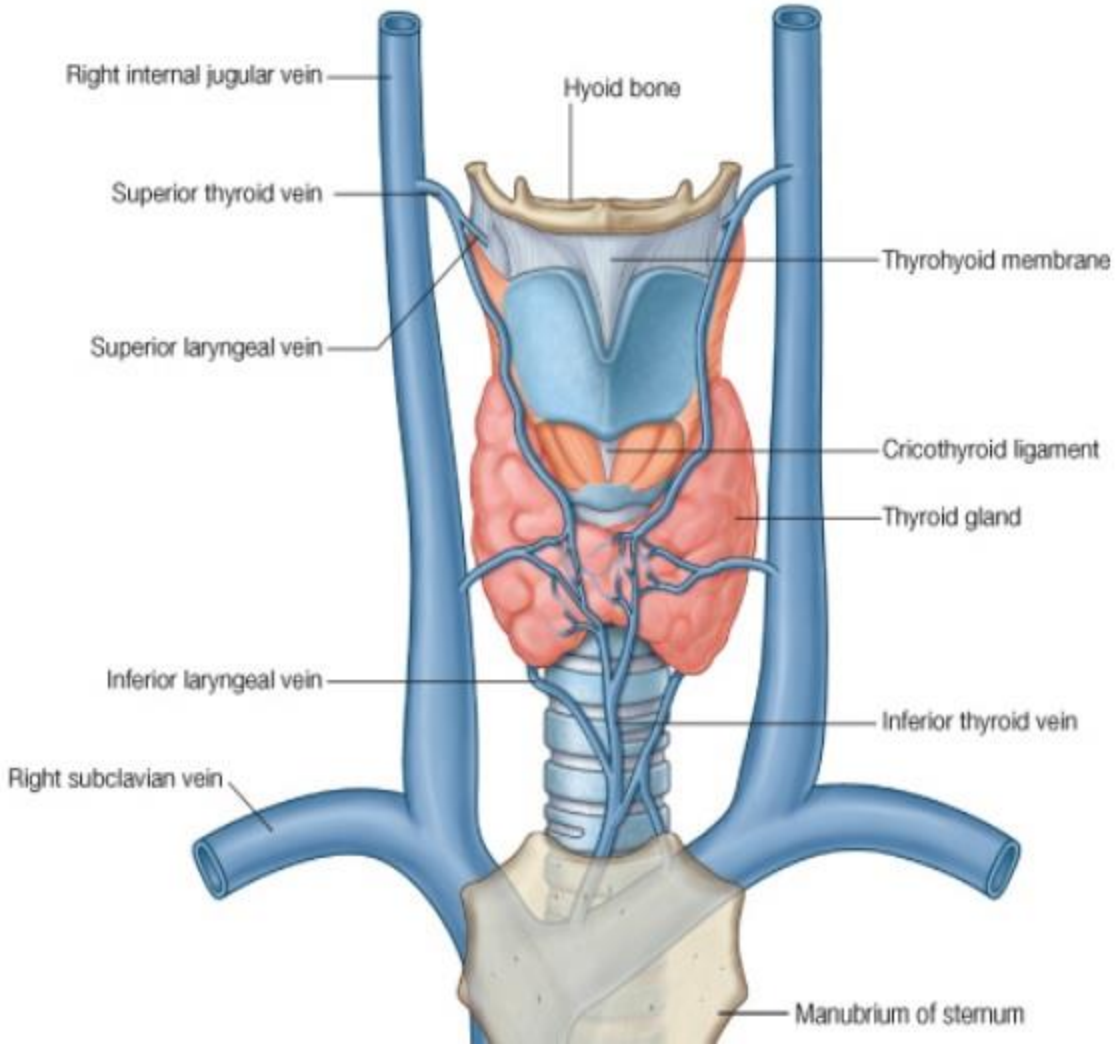
With the recurrent laryngeal nerve, this supplies all the laryngeal muscles except the cricothyroid muscle.

During ligation of the inferior thyroid artery or its branches (mainly the inferior laryngeal artery), the recurrent laryngeal nerve can be injured.

Venous drainage of the larynx:

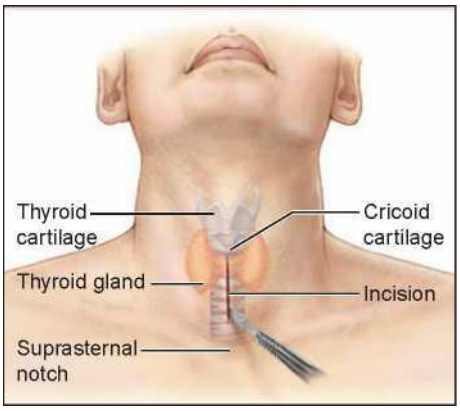
١. Superior thyroid vein
٢. Middle thyroid vein
٣. Inferior thyroid vein

- The superior and the middle receive blood from the upper part of the larynx, and drain into the internal jugular artery.
- The inferior thyroid vein receives blood from the lower part of the larynx and ends in the **left** brachiocephalic.



- The inferior thyroid vein is located in the suprasternal region.
- When there is a need for tracheostomy (emergency), it is done in the suprasternal region, so the vein can be injured.
- Tracheostomy is an operative procedure that creates a surgical airway in the cervical trachea.
- What are the organs that are exposed to injury during **<u>suprasternal (low) tracheostomy</u>** ?

١. Thyroid ima artery (if present)
٢. Inferior thyroid vein
٣. Jugular arch
٤. Anterior jugular vein



- When is tracheostomy done?

If there is an obstruction in the airway passage, specially above the vocal cord.

So, we need an opening in the trachea (located below the vocal cord)

The trachea is always opened, because it is composed of c-shaped hyaline cartilage, and in emergencies (if there is a person who can't breathe), we open at the suprasternal region (tracheostomy)

- How is it done?

  By palpating the ring of the trachea with your finger, and open there; so that the air can enter into the lungs.

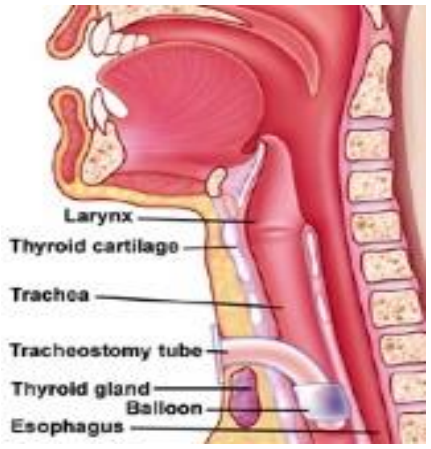
This procedure protects from brain damage, because brain cells are damaged after ٢-٣ minutes of stopping oxygen delivery.

❖ **<u>High tracheostomy:</u>**

- It is done during operations when the patient has a sudden stop of breathing.

(for example, the recurrent laryngeal nerve was cut on both sides)

- It is done below the cricoid cartilage and between the first and the second tracheal rings. ---- It should be done above the ٢nd ring, why?



Because the thyroid gland is located there (the two lateral lobes are connected by the isthmus, that is located in front of ٢nd, ٣rd , and ٤th tracheal rings. ----- so we can't open at its level, it should be above the ٢nd ring.

❖ The lymphatic run with the vessels.

This was not mentioned by the doctor, but was mentioned in the slides:

Lymphatics

• Lymphatics drain regions above and below the vocal folds:

• Those above the vocal folds follow the superior laryngeal artery and terminate in deep cervical nodes

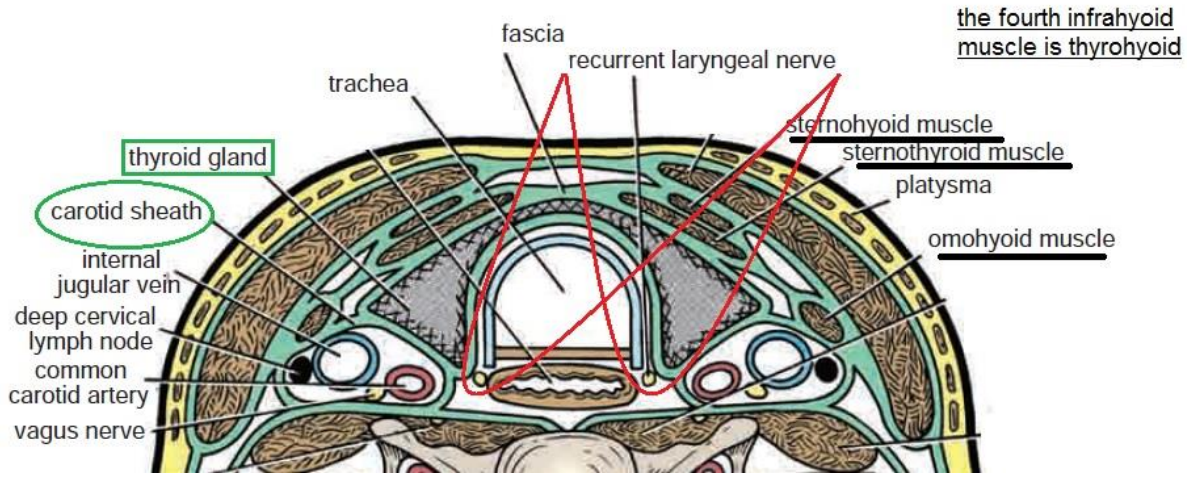
• Those below the vocal folds drain into deep nodes associated with the inferior thyroid artery

• Or with nodes associated with the front of the cricothyroid ligament or upper trachea.

Relations of the larynx:

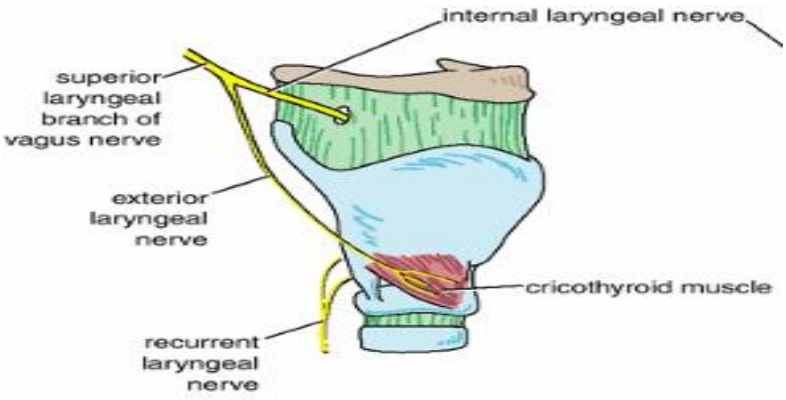
- On both sides:
  1. Carotid sheath, which contains:
     - I. Common carotid artery
     - II. Internal jugular vein
     - III. Vagus nerve
  2. Lateral lobes of the thyroid gland.
- Posteriorly:
  - A. Recurrent laryngeal nerve (in slides it's mentioned as only Right recurrent, which is wrong)
  - B. Pharynx
- Anteriorly :

Skin, fascia, and ٤ infrahyoid muscles .



Nerve supply:

1. Recurrent laryngeal nerve
2. External laryngeal nerve
3. Internal laryngeal nerve



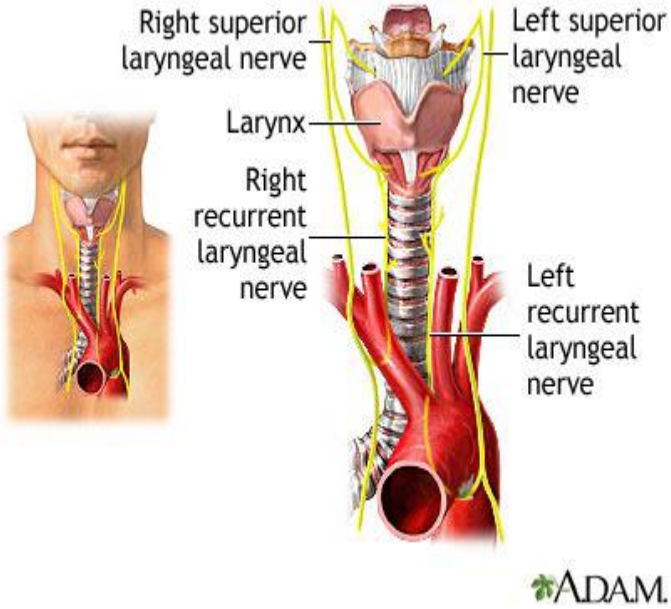
- Sensory:
- Above the true vocal cord : internal laryngeal nerve.
- Below the true vocal cord : recurrent laryngeal nerve.
- Motor:
- All muscles are supplied by the recurrent laryngeal nerve, except one muscle (cricothyroid) which is supplied by the external laryngeal nerve.

- Right and left recurrent laryngeal nerves:

The difference between them is in their origin:

- ✓ Left: in the chest (thorax)
- ✓ Right: at the root of the neck

- Look at the picture:
  - Right: it is below the subclavian artery, at the root of the neck, it ascends between the trachea and the esophagus
  - Left: in the chest, below the arch of the aorta, and it ascends upwards between the trachea and the esophagus.



Nerve injury: (clinical notes)

- The external laryngeal nerve: during thyroidectomy, for example if there is a tumor in the thyroid gland and it must be removed. ------ in this case the normal anatomy is changed due to the tumor(the thyroid is enlarged), and we can't recognize the locations of the arteries and nerves.

If there is a cut in the superior thyroid artery and the nerve running with it (external laryngeal nerve), there will be weakness/hoarseness of the voice.

Note: the internal laryngeal nerve is far in this case as it enters into the thyrohyoid membrane.

❖ The recurrent laryngeal nerve:

It supplies most of the muscles (especially the muscles responsible for adduction and abduction of the larynx---- posterior and lateral cricoarytenoid muscle)

There are four cases:

١. Unilateral complete injury (one side)
٢. Bilateral complete injury (two sides)
٣. Unilateral partial injury
٤. Bilateral partial injury.

- Complete: the whole section is cut.
- Partial: the nerve is not cut, but the superficial fibers and the manipulations are injured.

The **su<u>P</u>erficial fibers mainly supply the a<u>B</u>ductor** muscles, so if there is injury in them there will be paralysis in the abductors ---- that *<u>will cause the adductor to work.</u>*

The adductor will cause the vocal cords to get closer to each other.

(**<u>The partial is more dangerous than the complete</u>**. And the bilateral more than the unilateral)

❖ bilateral partial injury (The most dangerous case)

The two vocal cords are adducted (the abductors are paralyzed)

We are concerned about two main points:

١. Breathing (more important)
٢. Speech

In this case we will have:

I. Dyspnea (difficulty in breathing)
II. Stridor شخير
III. Suffocation (adduction of the vocal cords)

This means that it is a very dangerous case, and tracheostomy must be carried on.

The loss of speech because the injury is on both sides.

❖ Unilateral partial injury:

Hoarseness, but the other vocal fold will compensate the action

❖ Bilateral complete injury:

Impaired breathing (rima glottidis is partially closed)

Loss of speech.

❖ Unilateral complete injury:

The other side will compensate for speech.

The breathing is not affected; as there is a space between the vocal cords.
