

## Anatomy of Larynx

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### Objectives:

- To know the basic larynx anatomy and physiology.
- To recognize assessment and management of common laryngeal diseases, include ability to obtain patients' history, perform comprehensive physical and mental status assessment, interprets findings
- To know how to handle common laryngeal emergencies.
- To be aware of common laryngeal operations.

## Larynx I

- anatomy and physiology of the larynx
- gross anatomy , blood and nerve supply
- congenital diseases of the larynx ( in brief)
- (laryngomalacia, web, subglottic stenosis, and hemangioma)
- benign swelling of larynx (Singer's nodule, polyps, granuloma, J. L. papillomatosis)

**-Dysphonia:** is a **descriptive** medical term meaning disorder of voice.

**-Hoarseness:** is a **subjective** term, and usually refers to a weak or altered voice.

-voice changes are: *breathy, harsh, tremulous, weak, reduced to a whisper, or vocal fatigue (voice deteriorates with use).*

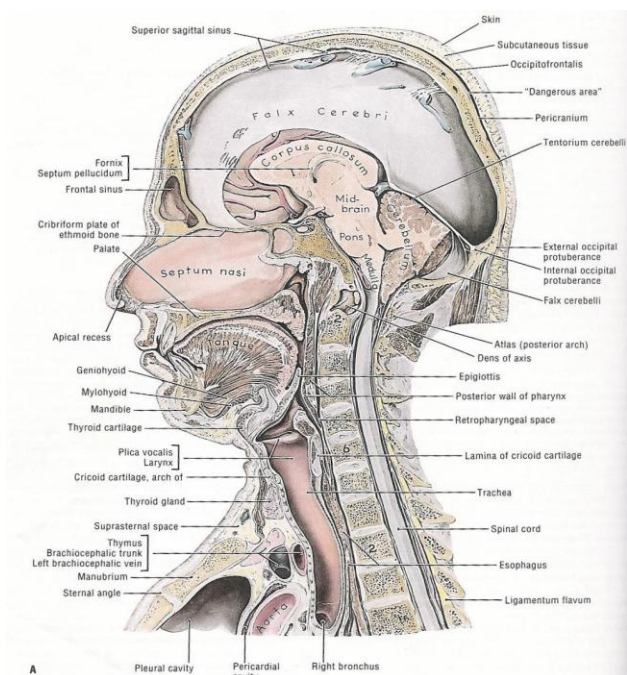
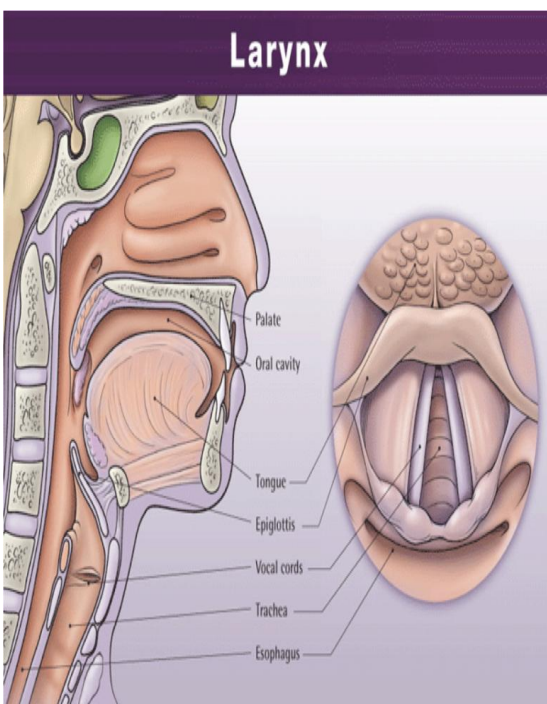
Dysphonia = Hoarseness

In OSCE ask about: onset, worsening, relating to any factor, URTI and previous surgery...

**Breathy : defect in closure of the airway , vocal cord paralysis .**

Normally person talks at end of respiration(you breath then talk and never breath in while talking without stopping, therefore while talking you are building up pressure causing the vocal cords to move and close during phonation.. (In breathy voice 1 of the vocal cords is not moving, so instead of saying 10 words in 1 sentence someone with a breathy voice will say around 3 words and stop for a breath)

- Spasmodic dysphonia: hyperadduction of vocal cords
- teachers have voice fatigue and pain at the end of the day.



## SKELETOMEMBRANOUS FRAMEWORK OF LARYNX:

- 1- Thyroid cartilage
- 2- Cricoid cartilage
- 3- Epiglottis

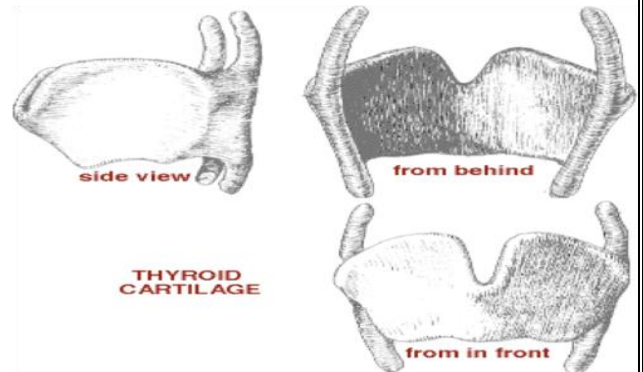
## 4- Paired arytenoids cartilage

## 5- Hyoid bone.

1, 2, and 3 are single cartilages while 4 is paired.

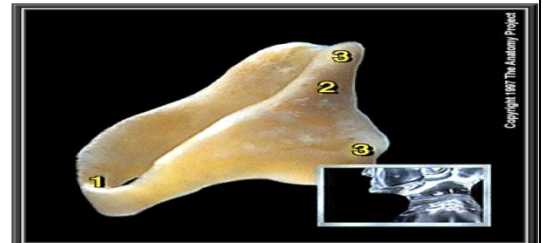
### 1. Thyroid Cartilage: Shield like.

Thyroid cartilage is opened posteriorly.  
In men it is noted as Adam's apple.  
It is attached to the cricoids.



### 2. Cricoid Cartilage:

- Signet ring shaped.
- The only **complete** skeletal ring in the air way.
- ♦ Both thyroid and cricoid cartilage ► hyaline ► **calcification** (seen on X-Ray)
  - Cricothyroid joint : Synovial joint ► hinge motion



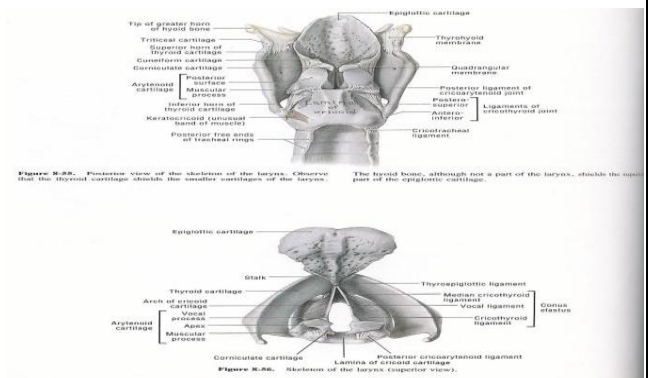
Cricoid Cartilage is the narrowest area where the airway obstruction usually happens because it is a complete ring.

Thyroid and cricoid might be seen like bones (calcified) in an X-Ray of a 40 year old patient.

### 3. Epiglottis cartilage:

Attached to the inner margin of the thyroid cartilage

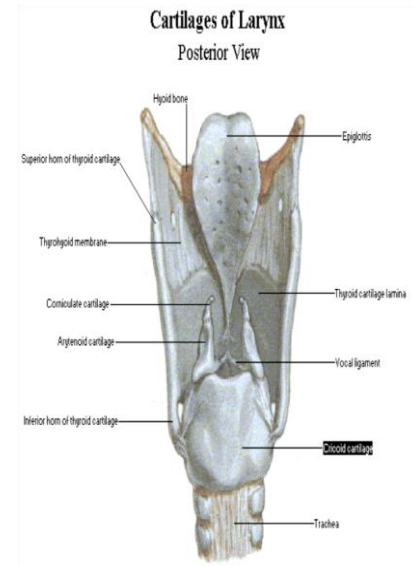
- Leaf like structure
- Elastic cartilage :
  - Thyroepiglottic ligament. to thyroid
  - Hyoepiglottic ligament attached to hyoid
  - Glossoepiglottic fold → Valleculae is the base of the tongue where the tongue is attached to the epiglottis.



#### 4. Arytenoid Cartilage:

- Pyramidal shaped
- Apex, vocal & muscular process.
- Cricothyroid joint
  - Synovial
  - rocking motion

Arytenoid :  
Vocal process (anteriorly)  
Muscular (posteriorly)



#### 5. Corniculate and cuneiform cartilage.

### LARYNGEAL MEMBRANES:

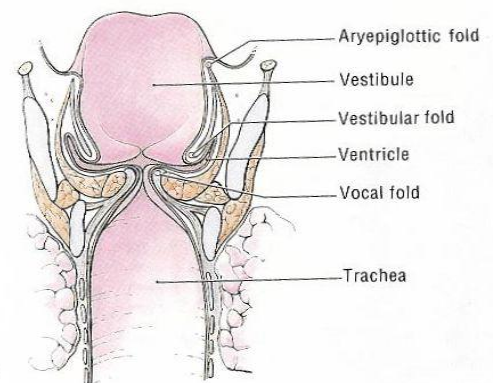
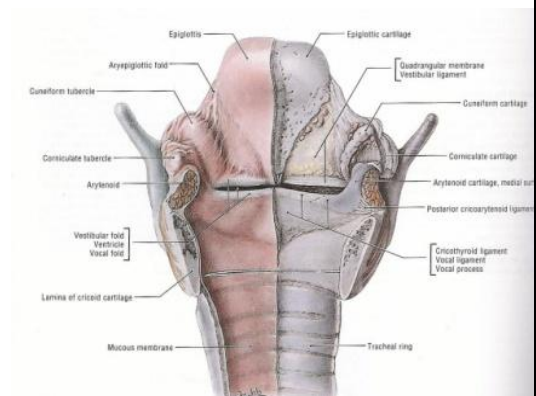
The cartilages are covered by membrane

#### 1. Quadrangular Membrane.

- Upper and lower border ► thickened
- **aryepiglottic fold**
- **Vestibular fold**

#### 2. Triangular Membrane (conus elasticus).

- Medial and lateral border is free ► thickened ► **vocal ligament**



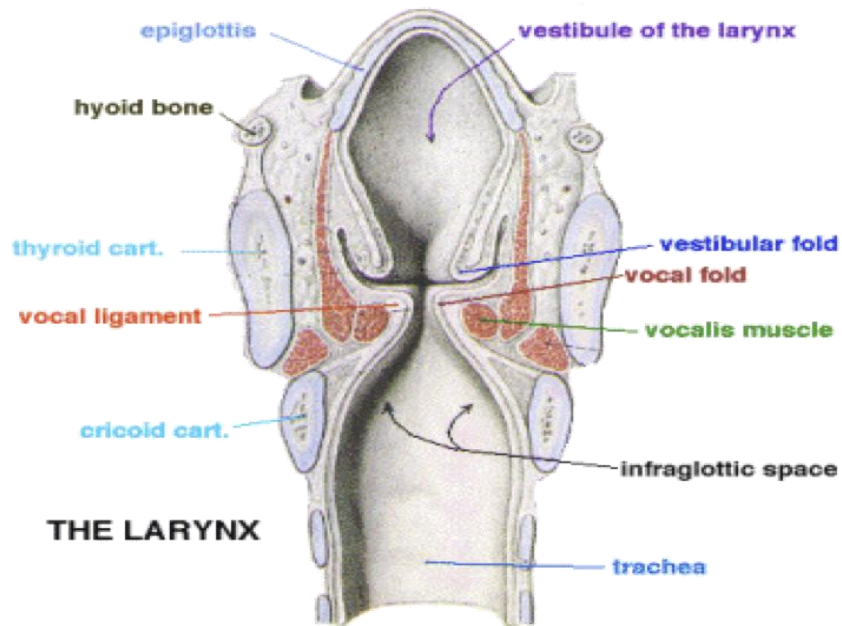
Between the upper membrane (quadrangular m ) and the lower membrane ( triangular m.) there is a very weak area which is not covered by any membrane we call it the **ventricle** .

### LARYNGEAL MUCOSA :

- All mucosa from trachea to aryepiglottic fold ► **ciliated columnar epithelium**.
- **Except** vocal cord and aryepiglottic fold ► **squamous epithelium**.
- **Commonest tumor in larynx: Squamous Cell Epithelium**



## Cavity of Larynx:



The area between the Vocal Cords is Glottis  
 The area above the Vocal Cords is Supraglottis or Epiglottis  
 The area below the vocal Cords is Subglottis

## LARYNGEAL MUSCULATURE:

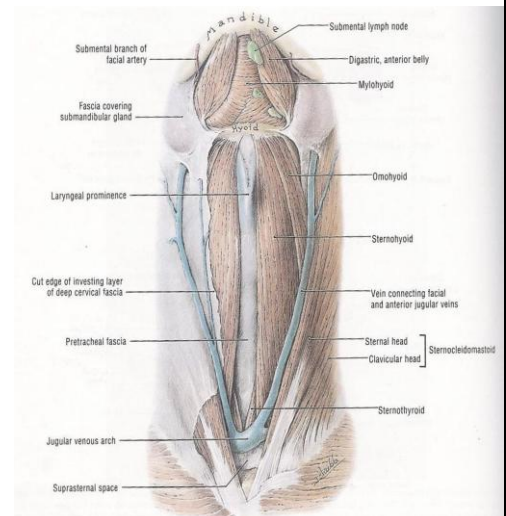
- **Extrinsic depressors: (C1-C3)** attachment to sternum

Sternohyoid sternothyroid thyrohyoid, omohyoid.

- **Extrinsic elevators:** attachment is above

Genohyoid (C1), digastric (CNV-CNVII) mylohyoid (v) stylohyoid (VII).

Used in swallowing.



## 3. Intrinsic musculature:

**Abductors:** (breathing)

posterior cricoarytenoid (PCA)

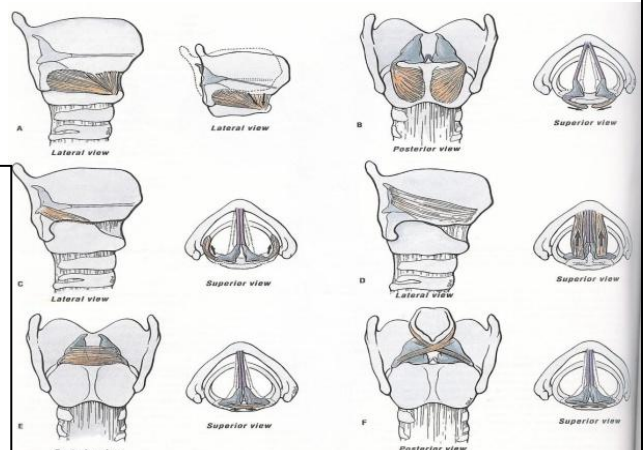
**Adductors:** (talking)

thyroarytenoid (TA), lateral cricoarytenoid (LCA), cricothyroid, interarytenoid.

**Vocal cords have 2 movements:**

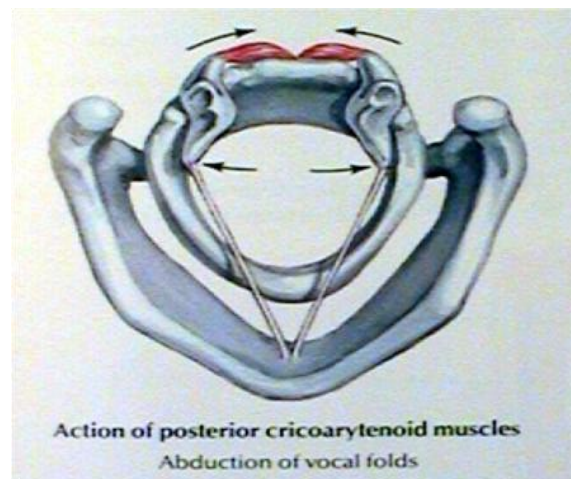
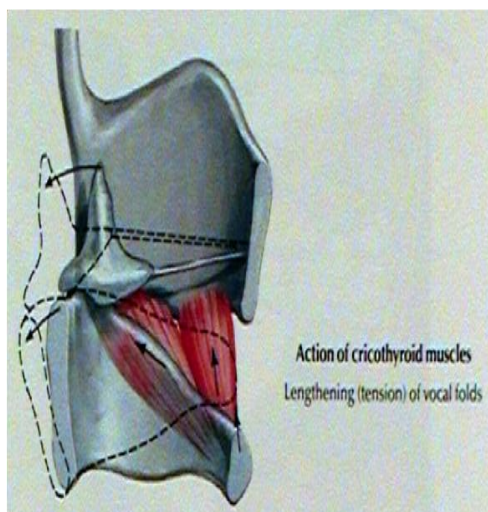
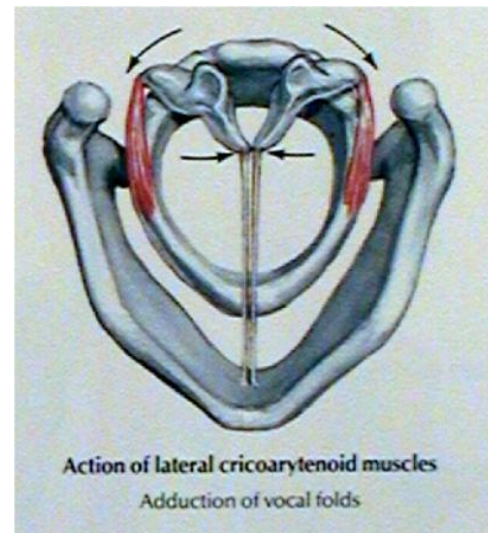
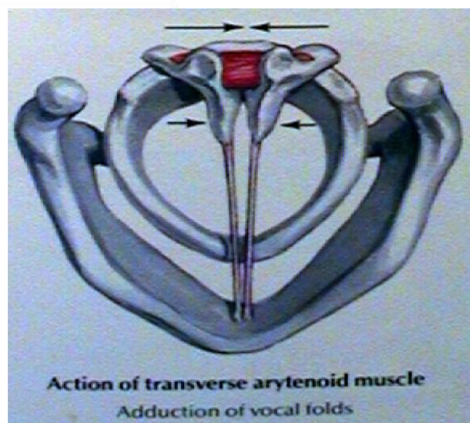
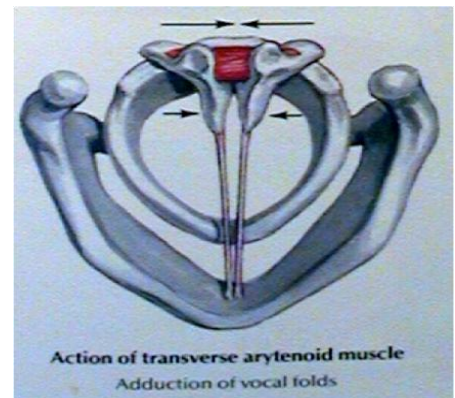
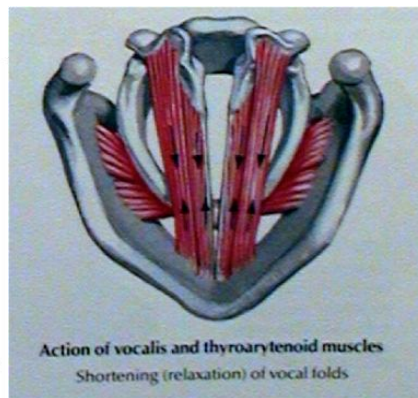
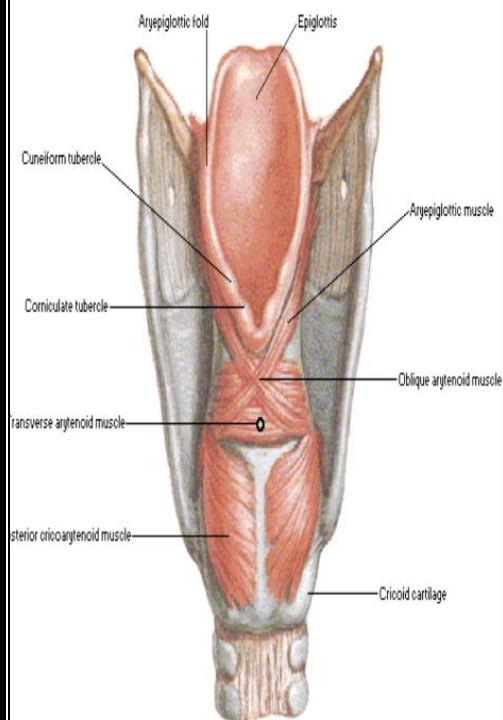
**Adductors (4 muscles)** are used for speaking. MCQ  
**Abductor (1 muscle)** used for breathing. Located Posteriorly MCQ.

Cricoidthyroid is an adductor ms. but mainly it is responsible for the Vocal Cord tension MCQ of the vocal cords and supplied by the Superior Laryngeal Nerve (SLN).



### Intrinsic Muscles of Larynx

#### Posterior View



## **HISTOPATHOLOGY:**

### **Vocal cord layers**

#### **Histology:**

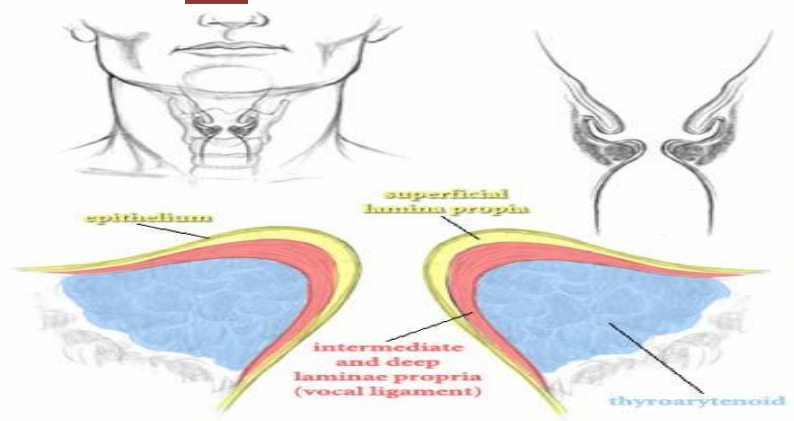
##### **1- Squamous epithelium**

##### **2- Lamina propria**

1. **superficial layer Reink's space:**  
little collagen, fibrous tissue and elastin
2. **Intermediate layer:** more fibers and elastin it gives the whitish color
3. **Deep layer.**

– **Intermediate + deep layers =vocal ligament** (the 2 layers are attached to each other)

##### **3- Vocalis (thyroarytenoid muscle)**



### **Blood Supply:**

- Superior and inferior laryngeal arteries and veins.

### **Lymphatic Drainage:**

- Above vocal cord ► Upper deep cervical lymph node.
- Below vocal cord lower ► lower deep cervical node

Vocal Cords have no lymphatic drainage, So when the patient has vocal cord carcinoma he won't have metastasis unless it goes supraglottic or subglottic he can start to have metastasis from there.

Any smoker should undergo vocal cord carcinoma screening.

Lymph nodes drain into cervical lymph nodes so any patient that comes with neck mass especially painless you should consider lymphoma.  
History: onset and duration, URTI, complete head and neck examination



## Nerve supply:

Vagus gives 2 branches:

### 1. Superior laryngeal nerve

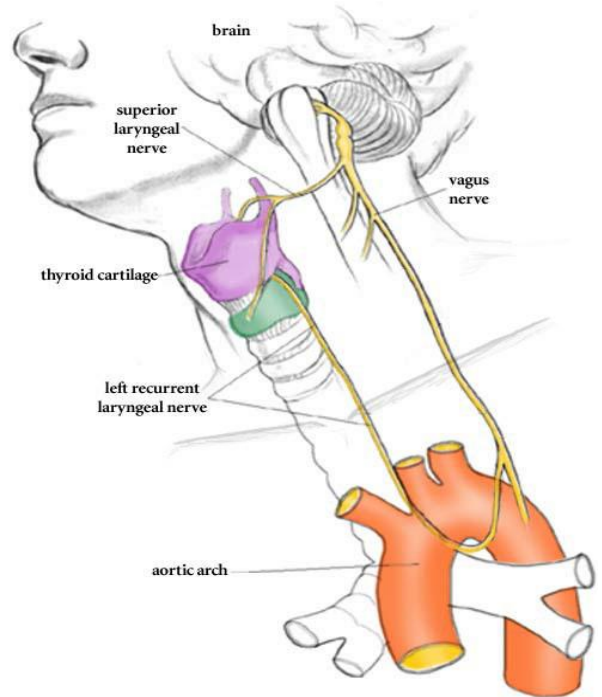
- Internal branch (sensory) + superior laryngeal artery.
- External branch (motor) ► **cricothyroid muscle only**

### 2. Recurrent laryngeal nerve

- RT side: crosses the subclavian artery
- LT side: arises on the arch of the aorta deep to ligamentum arteriosum (**left is longer**)

It is divided behind the cricothyroid joint

- Motor ► **all** the intrinsic muscles except the cricothyroid
- Sensory



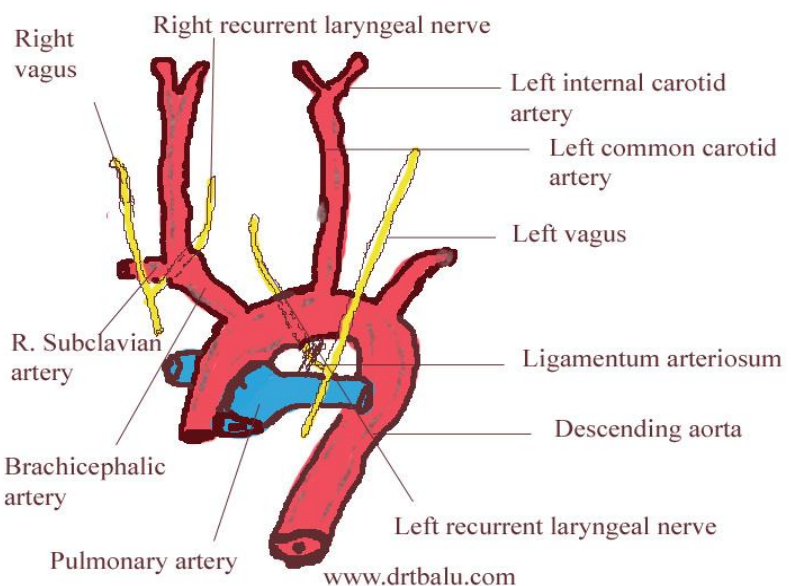
SLN: sensation above the vocal cords, chocking means (they are working well, good sensation).

RLN: sensation below the vocal cords. Left course is longer than the right course.

However, vocal cord paralysis might be caused by:

(**thyroidectomy is the most common**), brain tumor, vocal cord tumor, thyroid tumor, esophageal, mediastinal.. tumors compressing the nerve, Iatrogenic causes: cardiac thoracic surgery.. or idiopathic: waking up in the morning sounding weird. )

**Most common is to have left vocal cord paralysis due to the long course of the left recurrent laryngeal nerve.**



## Pediatric Airway Anatomy:

- The neonates are obligate nasal breathers until 2 months. (**they can't breathe from their mouth**)
- The epiglottis at birth is omega Ω shaped
- **The infants have high larynx C1-C4**



## APPLIED PHYSIOLOGY OF THE LARYNX:

1. Protection of the lower air passages
2. Respiration
3. Phonation

### 1. Protection of the lower air passages:

- Closure of the laryngeal inlet
- Closure of the glottis
- Cessation of respiration
- Cough reflex (forced expiration is made against a closed larynx)

Closure of the airways during swallowing the bolus.

### 2. Phonation:

- Voice is produced by vibration of the vocal cord
- Source of energy is the airflow (good lung --> good voice )
- Normal vocal fold vibration occurs vertically from inferior to superior
- The mouth ,pharynx ,nose ,chest (are resonating chambers)

COPD , Smoker  
→ low air  
amount → low  
vocal vibration  
→ dysphonia

We speak at the end of expiration so that air comes out of the lungs, through the trachea, and into the larynx. The air makes the vocal folds vibrate. So we need normal air and mucosa not thick secretions or masses or infections or allergic rhinitis closing the resonating chambers.

When the vocal folds vibrate, they alternately trap air and release it.

Each release sends a little puff of air into the pharynx; each puff of air is the beginning of a sound wave

The sound wave is enhanced as it travels through the pharynx; by the time it leaves the mouth, it sounds like a voice.

The mouth, pharynx, nose, and chest which all should also be normal.

Tongue is important for articulation of the voice.

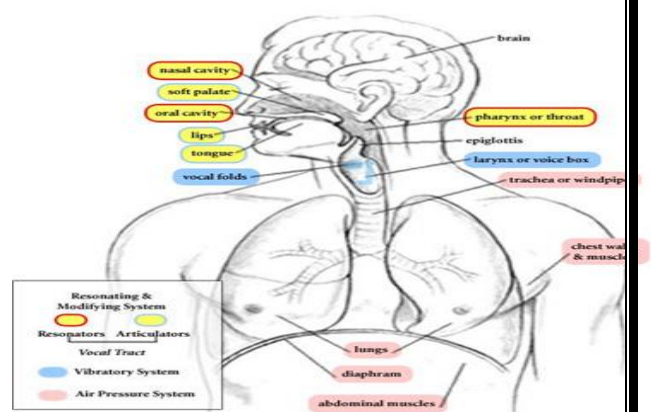
### 3. Respiration:

Vocal cord in abduction position

## VOICE MECHANISM:

Speaking involves a voice mechanism that is composed of three subsystems:

- Air pressure system
- Vibratory system
- Resonating system



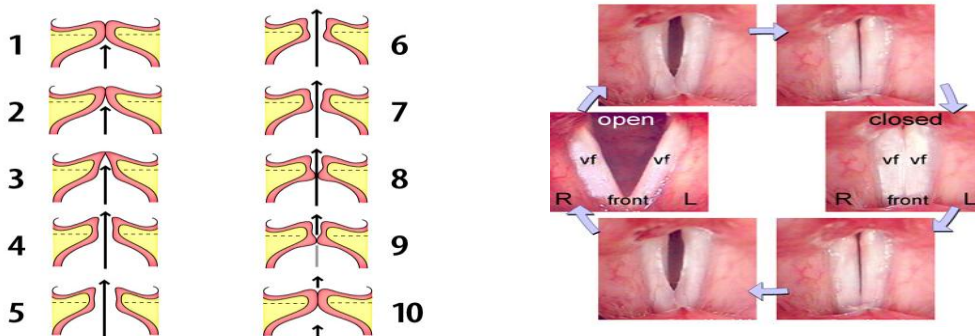
The “spoken word” result from three components of voice production:

❖ Voiced sound, resonance, and articulation

- **Voiced sound:** the basic sound produced by vocal fold vibration “buzzy sound”

- **Resonance:** voiced sound is amplified and modified by the vocal tract resonators (throat, mouth cavity, and nasal passages)
- **Articulation:** the vocal tract articulators (the tongue, soft palate, and lip) modify the voiced sound.
  - o Vocal fold vibrate rapidly in sequence of vibratory cycles with a speed of about:
  - o 110 cycles per second (men)= lower pitch
  - o 180 to 220 cycles per second (women)=medium pitch
  - o 300 cycles per second (children)= higher pitch
  - o Louder voice : increase in amplitude of vocal fold vibration

### Vocal cord vibration: Bernoulli Effect



Air comes from the lung opens the lower lip then the middle then the upper lip. Cannot be seen by direct visualization (very fast -300 cycle). Can be seen by stroboscope.

### Laryngeal sphincters:

- True vocal cord
- false vocal cord
- Aryepiglottic sphincter

Spasm during swallowing

Aryepiglottic fold is between the epiglottis and arytenoid. If it is short then the epiglottis will always be covering the airway.

## EVALUATION OF THE DYSPHONIC PATIENT:

### HISTORY

#### Dysphonia (hoarseness)

Onset , duration ,severity , URTI ,fever ,cough ,(voice abuse (job) ,tobacco or alcohol ), dysphagia ,aspiration , breathing difficulty(**stridor**) ,weight lost ,GERD ,trauma , previous surgery neck mass.

**laryngopharyngeal reflux (clearing your throat-it is very bad)** problem is posteriorly

(Occupation and medication are important)

**EXAMINATION:****Complete ENT examination****Laryngeal examination and voice assessments :**

4. Indirect laryngoscope (mirror)
5. Direct laryngoscope
6. Fibreoptic flexible scope
7. Stroboscopy
8. Acoustic analysis
9. **Cranial nerves** (tumors might be compressing the involved nerves )
10. neck examination

Always say in the OSCE that you want to examine the cranial nerves.

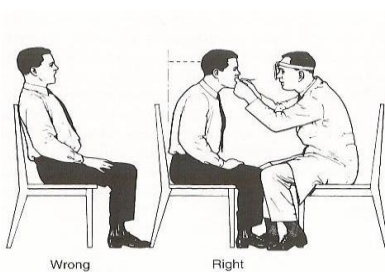
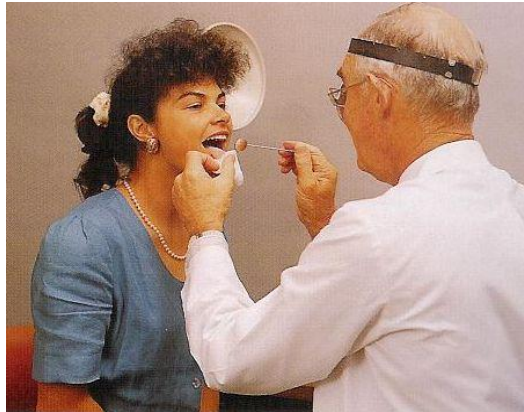
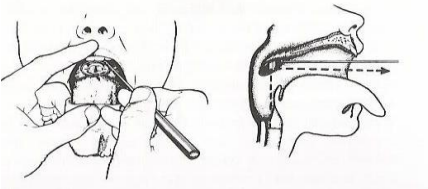


Figure 1.3  
Position of the patient's head and neck for indirect laryngoscopy to create the best angle for a comprehensive view of the laryngeal structures.



Indirect laryngoscope



Nasal polyp surgery → FESS  
Vocal Cord polyp nodule → microlaryngoscopy  
Deviated septum → septoplasty



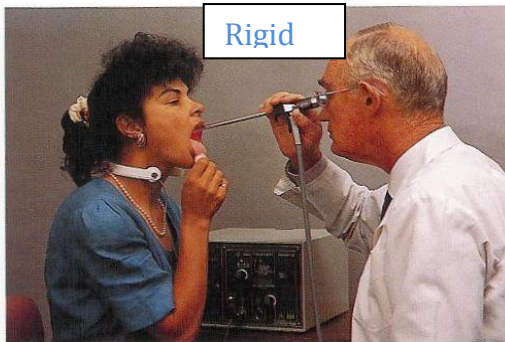


Figure 16

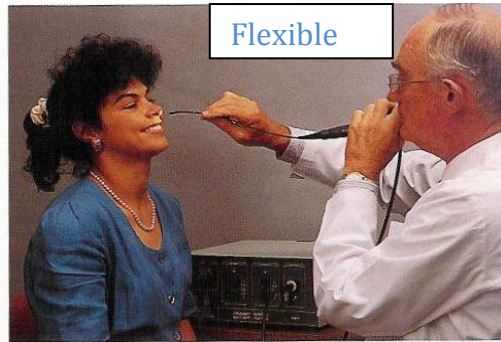
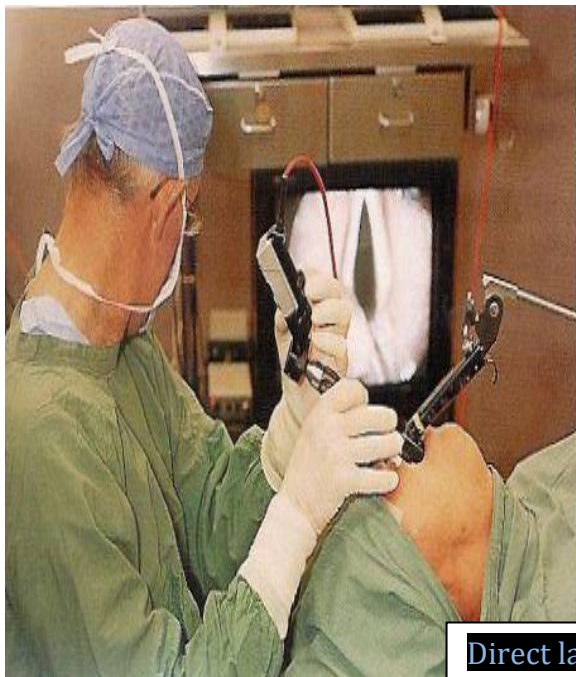


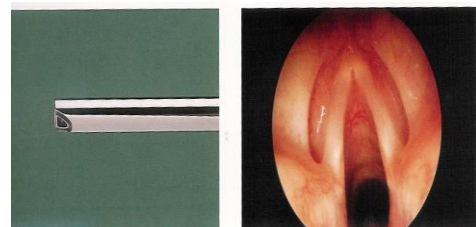
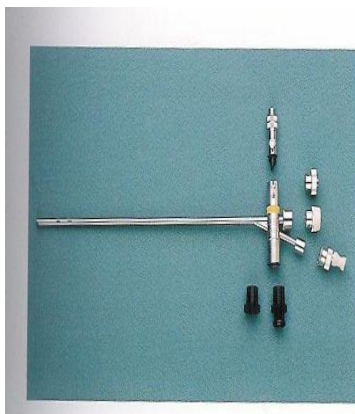
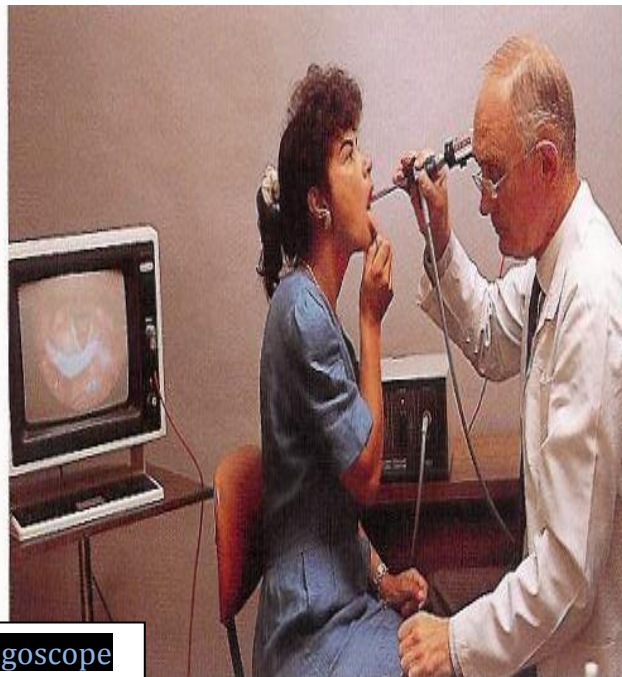
Figure 17

In Exam : mention 2 indications of the flexible fibre optic always:  
Children and Gag reflex (GERD)

In the rigid nasopharyngoscope :  
Nose use the angle of ( 0-30 ) degrees.  
Looking down use (70-90) degrees.



Direct laryngoscope



Long- horn is called bronchoscopy  
Indications: foreign body removal, biopsy, washing trachea  
and visualization.