Lecture 16,17

Editing File

# Larynx I-II

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## Lecture Objectives:

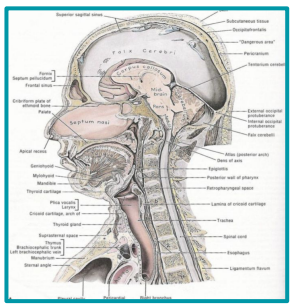
- ★ Larynx I:
  - ★ Anatomy and physiology of the larynx.
  - ★ Gross anatomy , blood and nerve supply.
  - ★ Congenital diseases of the larynx in brief: laryngomalacia, web, subglottic stenosis, and hemangioma.
  - ★ Benign swelling of larynx: Singer's nodule, polyps, granuloma, J. L.papillomatosis.
- ★ Larynx II:
  - ★ Acute and chronic laryngitis.
  - ★ Non-specific laryngitis.
  - ★ Specific laryngitis: acute epiglottitis, croup.
  - ★ Laryngeal paralysis: unilateral and bilateral.

Important Original content Doctor's notes
Gloden Notes Textbook Extra

# Larynx I: Anatomy of the larynx

- 35 years old female has dysphonia (hoarseness) ?
- The larynx or voice-box is part of the upper respiratory tract.
- It is lined with ciliated columnar epithelium except over the vocal folds or 'cords' which are covered with squamous epithelium. so when you take a sample from the larynx and you see that it's lined with squamous epithelium then you have to rule out cancer (metaplasia), and vica versa.
- It is made of a series of cartilages, the main ones being the epiglottis, the cricoid cartilage (a complete ring just above the trachea) and the thyroid cartilage, which you can palpate as the 'Adam's Apple' externally in the neck. between the thyroid cartilage and the cricoid cartilage is the cricothyroid membrane.
- Various membranes, muscles and ligaments complete the structure of the larynx
- The Larynx extends from the epiglottis to the cricoid cartilage.
- The epiglottis is on top behind the Arytenoid cartilages and the hyoid bone (436) .

## Definitions:



1. Dysphonia[1]:

   is a descriptive medical term meaning disorder of voice.

2. Hoarseness:

   is a subjective term, and usually refers to a weak or altered voice.

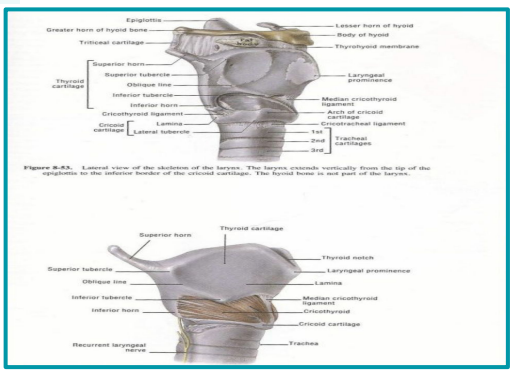
3. Voice changes:

   breathy, harsh, tremulous, weak, reduced to a whisper, or vocal fatigue (voice deteriorates with use common with teachers).

- spasmodic breathy voice occurs due to incomplete closure of the vocal cords causing air to escape (vocal cord paralysis)

## Skeleton Membranous Framework Of Larynx

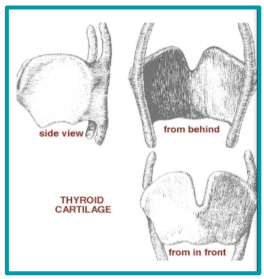
- Thyroid cartilage
- Cricoid cartilage commonest site of airway obstruction
- paired arytenoids cartilage
- Epiglottis
- Hyoid bone



1- when the patients say they have change in voice we have to ask them what do they mean by that exactly because there are different types of dysphonia. Is it breathy, harsh (mass of vocal cord), spastic. Also ask what time of the day it occurs, morning-> gerd.
2- Children: high-pitch voice. Female: medium. Male: low-pitch

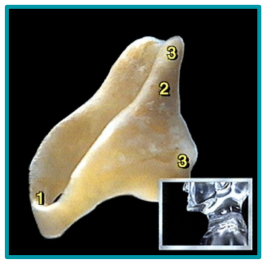
# Anatomy of the larynx

## Thyroid cartilage[1]




- Largest cartilage
- Shield like
- Protects the airway
- Point of attachment of vocal cord
- Thyroid cartilage is opened posteriorly and closed anteriorly. In men it is noted as Adam's apple. it's more prominent in men. It is attached to the cricoid.

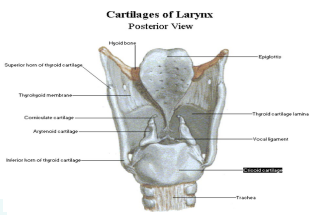
## Cricoid cartilage

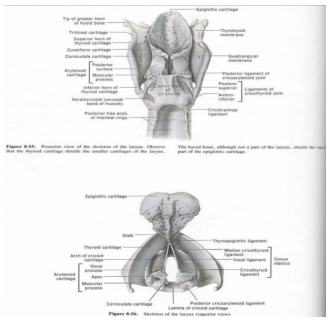



- Signet ring shaped.
- The only complete skeletal ring for the air way.
  it facilitates the opening and shunting of the airway
- Both thyroid and cricoid cartilage are hyaline (calcification)
- Cricothyroid joint is a Synovial joint (hinge motion)
- Cricoid Cartilage is the narrowest area and has a complete ring shape so the commonest site of airway obstruction is the subglottic area below the vocal cords where cricoid is located.
- Thyroid and cricoid might be seen as bones (calcified) in an X--Ray of a 40-- year old patient

## Arytenoid Cartilage important

- A pair of cartilages directly above the cricoid cartilage
- Pyramidal shaped > it has an anterior (vocal) process, and posterior/lateral (muscular) process.
- Apex (has corniculate and cuneiform cartilage attached to it) , vocal processes (anterior process) attached to the vocal ligaments & muscular processes (lateral/posterior process) attached to the muscles that moves the vocal cords. It facilitates the opening and closure of the vocal cords
- Cricoarytenoid joint: Synovial (Rocking motion). The only muscle that causes abduction to the vocal cords is posterior Cricoarytenoid muscle.



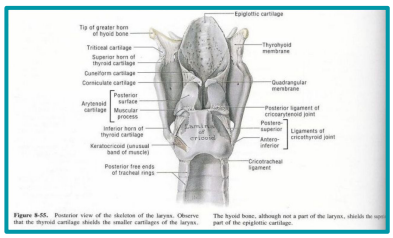
## Corniculate and Cuneiform Cartilage

- above the arytenoid cartilage is another two small cartilage called corniculate and cuneiform cartilage. it helps to prolong arytenoid cartilage posteriorly and medially. It has no significant function.

1- Hyoid bone is above thyroid cartilage and between them is thyrohyoid membrane, below to the thyroid cartilage we have cricoid cartilage and between them is cricothyroid membrane.

# Anatomy of the larynx

## Epiglottic Cartilage



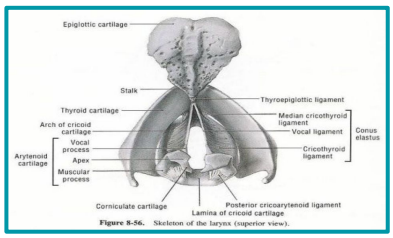


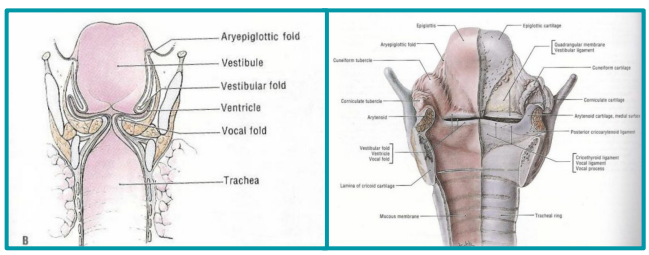
Figure 8-56. Skeleton of the larynx (superior view).

- It is elastic so unlike other cartilages it does not get calcified with age.
- Leaf like structure
- Elastic cartilage.
- Inner surface is attached to thyroid cartilage anteriorly
- Its ligaments and fold:
  - Thyroepiglottic ligament (to thyroid) anteriorly.
    It provides the stability to the epiglottis
  - Hyoepiglottic ligament (to hyoid bone).
  - Glossoepiglottic fold ➜ valleculae (Valleculae is the base of the tongue where the tongue is attached to the epiglottis). The one we see it during intubation.
- The epiglottis on top is attached to the thyroid cartilage midline, inner margin of thyroid, it's an elastic cartilage while swallowing it covers the airway and directs the food to cricopharaynegus. Its main function is to prevent food from passing down the trachea
- Thyroid, cricoid and epiglottis are all single cartilages unlike the others are paired.
- It is attached to the thyroid cartilage as well as to the tongue, thyroepiglottic ligament, hyoepiglottic ligament and glossiepiglottic.

## Laryngeal Membranes

- The cartilages are covered by membranes that form folds and ligaments.
- Quadrangular membrane[1]: upper and lower border ➜ thickened
  - Aryepiglottic fold (it goes up covering the epiglottis)
  - Vestibular fold (or ventricular fold inferiorly also called false vocal cord) ventricle is the area between the true and the false vocal cords
- Triangular membrane (conus elasticus): Medial and lateral border is free ➜ thickened ➜ vocal ligament

  Covers the trachea going up and ends at the level of vocal ligaments or fold "It become thickened at the level of vocal cord". Between the upper membrane (quadrangular m) and the lower membrane (triangular m) there is a very weak area[2] (in the larynx) which is not covered by any membrane we call it the ventricle or vestibule or saccule.




1-It extends up from the epiglottis to arytenoid and gives "aryepiglottic fold", then ends on the false vocal cords.
2- It's located between true and false vocal cord, in this weak area we can have saccular cyst or herniation.
3- other names for false vocal cords: vestibular or ventriclular folds.

# Anatomy of the larynx

## Laryngeal Mucosa

- All mucosa from trachea to aryepiglottic fold: ciliated columnar epithelium with goblet cells.
    - Common tumor is Adenocarcinoma
- Except vocal cord and aryepiglottic fold: squamous epithelium. There is a lot of content and tension that's why it's squamous
    - Commonest tumor in larynx is Squamous Cell Carcinoma. Most common tumor of vocal cords is squamous cell carcinoma
- Due to movement in vocal cords a more robust epithelium is needed

## Cavity of Larynx (another way of dividing the larynx) Important

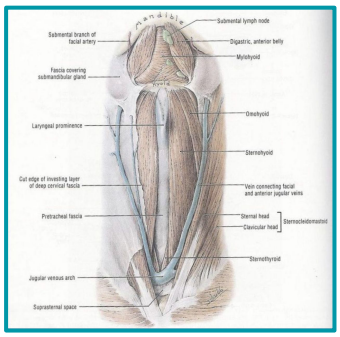
- Glottic → area in-between the vocal cords
- Infra\Subglottic → area below the vocal cords
- Supraglottic → Area above the vocal cords

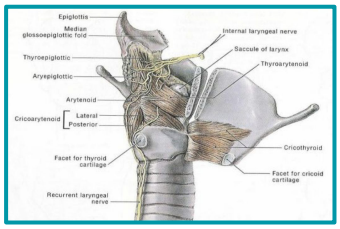
## Laryngeal Musculature

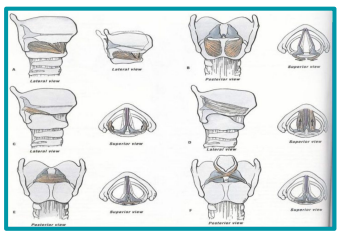
- Extrinsic: they only move the larynx up and down during swallowing
    - Extrinsic depressors "attachment is down with the sternum": (C1-C3) (Sternohyoid, sternothyroid, thyrohyoid, omohyoid.)
    - Extrinsic elevators "attachment is up": above the hyoid bone (Genohyoid (C1), diagastric (CNV--CNVII) mylohyoid (v) stylohyoid (VII) Used in swallowing.
- Intrinsic: responsible for vocal cord movement (Important Exam Q)
    - Abductors (breathing: open the airway): Posterior cricoarytenoid (PCA) (the only muscle that abducts the vocal cord 'MCQ') when the two muscles move laterally the vocal cords open.
    - Adductors (talking: phonation): 4 muscles Thyroarytenoid (TA4 ), lateral cricoarytenoid (LCA), interarytenoid, cricothyroid gives more tension and tone when talking (Important Exam Q)

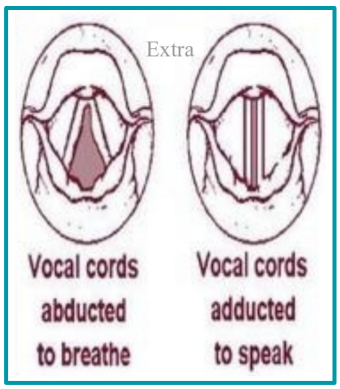
Vocal cords have 2 movements: (Important for MCQs)

- Adductors (4 muscles) are used for speaking, Abductor (1 muscle) used for breathing and located Posteriorly.
- Cricothyroid is an adductor muscle. But mainly it is responsible for the Vocal Cord tension of the vocal cords and the only muscle supplied by the Superior Laryngeal Nerve (SLN).



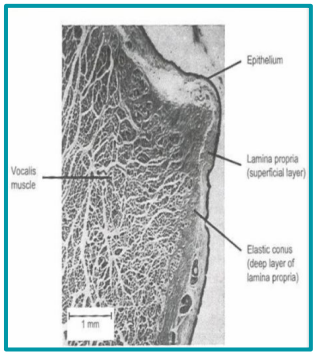






# Anatomy of the larynx

## Vocal cord layers (Histology):




01

- Squamous epithelium no lymphoid tissue.

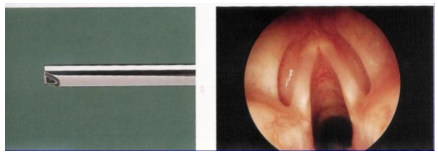
02

- Lamina propria:
  it helps to provide elasticity and protection to the vocal cords, the squamous epithelium glides on it to produce sound
  - superficial layer (Reinke's space) Gelatinous layer. Reinke's edema is the collection of fluid within the Reinke's space below the epithelium that causes heavy voice in smoker
  - Intermediate layer
  - Deep layer

  Intermediate + deep layers = vocal ligament, the two layers are attached to each other

03

- Vocalis muscle (thyroarytenoid muscle)



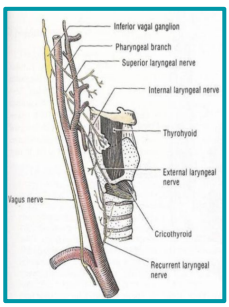
## Blood Supply

- Superior and inferior laryngeal artery and veins.

## Lymphatic Drainage

- Above vocal cord > upper deep cervical lymph node.
- Below vocal cord > lower deep cervical lymph 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 through the cervical lymph nodes.

## Nerve Supply




Vagus gives 2 branches: from the right side

1. Superior laryngeal nerve (SLN)
   - Internal branch (sensory) + superior laryngeal artery
     all sensation above vocal cords "cough reflux in case of blockage to protect the airway"
   - External branch (motor) > cricothyroid muscle only
     the one that gets contracted while shouting. (Only muscle that is not supplied by RLN)
2. Recurrent laryngeal nerve (RLN). Important exam Q. Know the pathway.
   - RT side: crosses the subclavian artery
   - LT side: arises on the arch of the aorta deep to ligamentum arteriosum (left is longer because it loops around the arch of aorta) more prone to trauma due to longer trajectory
   - Know the difference between Right and Left side paralysis.
   - It is divided behind the cricothyroid joint
   - Motor > all the intrinsic muscles except the cricothyroid.
   - Sensory: vocal cords and below.

Things that affect the nerves that supply the vocal cords based on anatomy:

1) Brain surgery
2) Thyroid surgery
3) Aneurysm in the aorta
4) Cardiac surgery
5) Patent ductus arteriosus repair surgery in babies (breathy cry after surgery)
6) Tracheal\esophageal surgery (tracheoesophageal fistula repair in babies
7) Lung/ mediastinum surgery
8) Mass

# Anatomy of the larynx

**Management:**

How to manage vocal cord paralysis? Wait for 6 months it might resolve by its own. If it didn't or the patient count on his voice for living, you interfere earlier. by injecting materials absorbable within six months to close the vocal cord temporary.
SLN: sensation above the vocal cords, choking means (they are working well, good sensation).
RLN: sensation of vocal cords and below. Left course is longer than the right course. However, vocal cord paralysis might be caused by: thyroidectomy - most common, brain tumor, vocal cord tumor, esophageal, mediastinal. Tumors compressing the nerve, iatrogenic causes: in cardiothoracic 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 first when they are born. they have high larynx and epiglottis so the soft palate will cover the central side (mouth airway) which will guide the milk to move to the lateral sides. that's why they can eat and breath at the same time.
- Any airway obstruction → cyanosis
- The epiglottis at birth is omega Ω shaped. Its very high and descends with age
- The infants have high larynx C1-C4. (you can see epiglottis using a tongue depressor)

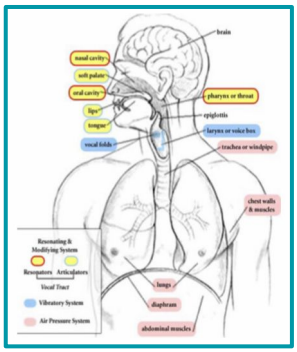
## Physiology Of The Larynx Important exam Q

- Protection of the lower airway passage from aspiration:
  - Closure of the laryngeal inlet
  - Closure of the glottis.
  - Cessation of respiration. (with swallowing process)
  - Cough reflex (forced expiration is made against a closed larynx). A protective reflex when the larynx is irritated.[1]
  - Vocal cords in adduction position
  - Ventricular folds close
  - Closure of the airways during swallowing the bolus, the food will go back to the Cricopharangues which is the upper sphincter of esophagus.
  - Patient with CVA or neurological problem have loss of sensation so all the time they aspirate or choke.
- Phonation:
  - Voice is produced by vibration of the vocal cord. Resonance is caused by mouth, nose and sinuses
  - Source of energy is the airflow (good lung ➜ good voice)
  - good vocal cord mobility, no polyps or cyst ➜ good voice.
  - Normal vocal fold vibration occurs vertically from inferior to superior.
  - The mouth, pharynx, nose, chest (are resonating chambers). We talk during expiration (we take deep breath that builds pressure in subglottic area this pressure help in pushing the air between the vocal cords and start vibrating them). If I have bronchial asthma it means that the amount of air is little, I won't be able to talk for long time because the pressure was so little. COPD, Smoker ➜ low air amount ➜ low vocal vibration ➜ dysphonia.
- Respiration:
  - Vocal cord in abduction position

1- old patients with Parkinson's disease for example, should be given small amounts of semi solid food followed by spoon of water to reduce aspiration

# Anatomy of the larynx

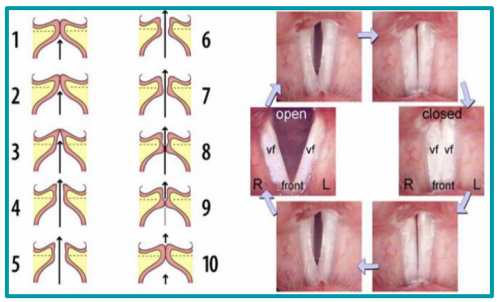
## Voice Mechanism



- Speaking involve 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: 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

## Vocal Cord Vibration

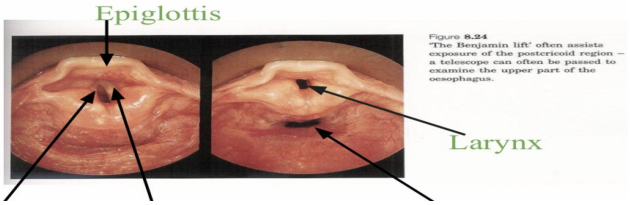
- Vocal fold vibrate rapidly in sequence of vibratory cycles with a speed of about:
  - 110 cycles per second (men)= lower pitch
  - 180 to 220 cycles per second (women)=medium pitch
  - 300 cycles per second (children)= higher pitch
- Louder voice: increase in amplitude of vocal fold vibration
- Bernoulli effect:




Reflux types: gastroesophageal reflux (heartburn). laryngopharyngeal reflux, throat clearance is a symptom of Laryngopharyngeal reflex "LPR" when the acidity reach the pharynx, it is not like GERD when acid reach the esophagus only. Other LPR symptoms include hoarseness, foreign body sensation. When examining LPR patient we see signs of irritation, redness, erythema.

## Laryngeal Sphincters:

- True vocal cord
- False vocal cord. Helps protect the airways, located above the true vocal cord.
- Aryepiglottic sphincter.
- Aryepiglottic fold is between the epiglottis and arytenoid. If it is short, then the epiglottis will always be covering the airway (air obstruction)



# Evaluation of dysphonic patients (Important)

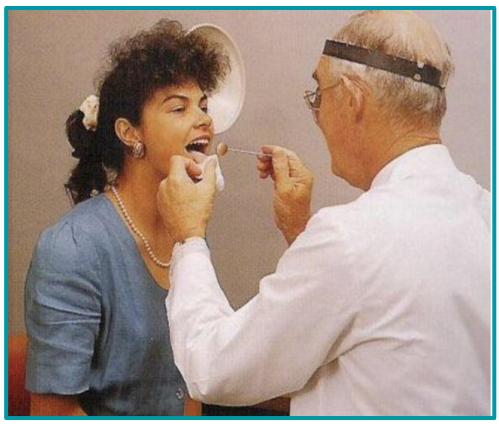
## History of Dysphonia (hoarseness): Any change in voice quality

- Onset sudden or gradual, duration for days? Months?, severity progressive?
- URTI after urti, fever (laryngitis)
- Cough (Ask about asthma) causes forced adduction between 2 vocal cords
- Voice abuse (job) like teachers, singers, lawyers, housewives, field workers (advice them to talk in normal volume), tobacco or alcohol, very important to ask about smoking (lung or laryngeal cancer + laryngeal edema)
- Dysphagia (mass in the esophagus which is posterior to larynx)
- Aspiration[1] (Paralysis of vocal cords > choking > aspiration)
- Breathing difficulty (stridor) In case of stenosis it's important to know the phase of sound of stridor
- Weight loss. think about cancer
- GERD (heartburn) commonest cause nowadays
- Trauma cartilage framework fracture
- Previous surgery two mechanisms of injury:
  1- injury of nerves that supply the functions adduction during phonation and abduction during breathing like injury to recurrent laryngeal nerve in thyroidectomy, or after patent ductus arteriosus ligation surgery of aorta.
  2- intubation (paralysis - dislocation of arytenoid)
- Neck mass
- Laryngopharyngeal reflux (throat clearance - coughing or choking at night - hoarseness - change of voice - foreign body sensation)
- Occupation and medication are important

## Examination "complet ENT examination"

- **Laryngeal examination and voice assessments:**
  - Indirect laryngoscopy (using mirror in old days). Used in clinic.
  - Direct laryngoscope. Done in the OR
  - Fibreoptic flexible scope (MCQ: indications are examination of nose, nasopharynx, larynx). small scope that goes inside the nose all the way to the larynx looking for large adenoid, nasopharyngeal cancer and taking biopsy.
  - Stroboscopy for vocal cord vibration assessment. to check if there is any scars or cysts. done for patients with voice problems.
  - Acoustic analysis
  - Cranial nerves (tumors might be compressing the involved nerves)
  - Neck examination
- You always have to examine the patient nose, throat and vocal cords the difference between laryngoscopy and bronchoscopy is that bronchoscopy has an opening for breathing so you can ventilate at the same time.
- You always have to examine the patient nose,throat,and vocal cords and always mention in the exam you need to examine the cranial nerves

In the exam we'll be given a picture of a device and asked to identify it.



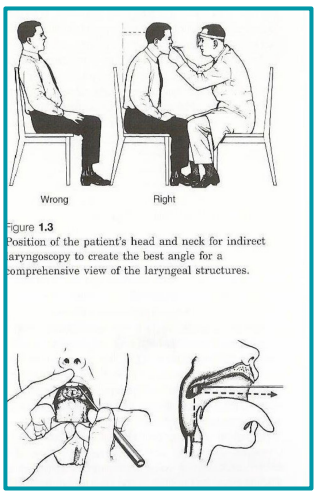
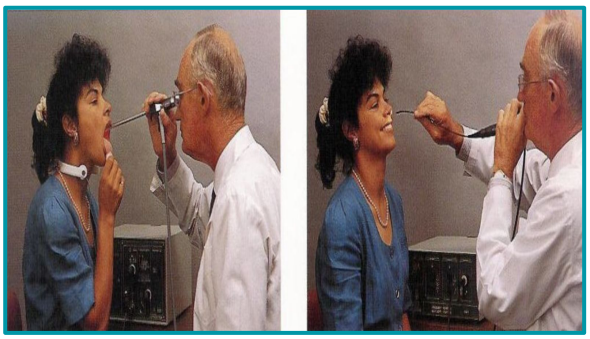
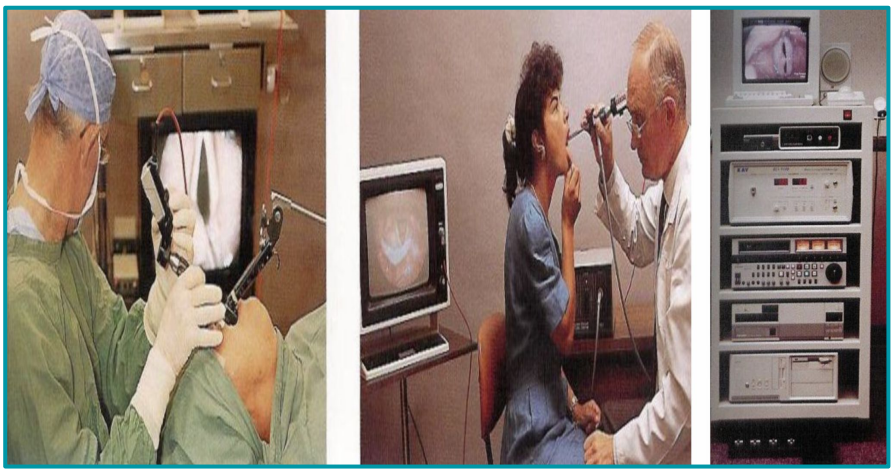



Figure 1.3
Position of the patient's head and neck for indirect laryngoscopy to create the best angle for a comprehensive view of the laryngeal structures.

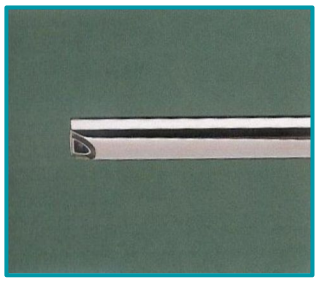
Indirect Laryngoscope
The flexible scope is most used Used in clinic

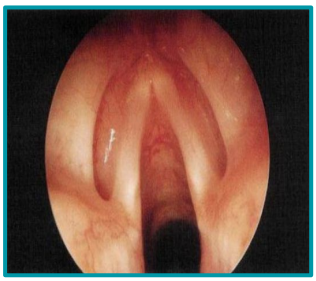


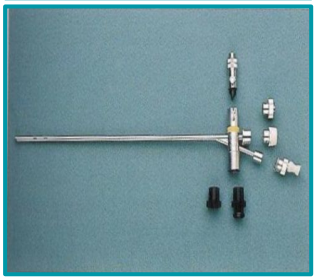
Direct Laryngoscope
Used in surgery



Right bronchoscope long and has hole for ventilation used for examination of trachea and bronchi and removal of foreign bodies, biopsy







Laryngoscope

Rigid bronchoscopy
Indications: foreign body removal, biopsy, balloon dilatation, diagnostic.

# Larynx II: Diseases of the larynx

There are notes and scenarios about each disease at the end of this lecture

**Introduction**

signs and Symptoms of laryngeal disease:

- Lesions on or around the vocal cords cause hoarseness.
- Failure of the laryngeal inlet to close on swallowing causes aspiration; the patient will cough and splutter on swallowing – food 'going down the wrong way'.
- The most dangerous laryngeal pathology is narrowing of the airway. This causes reduced air entry and turbulent flow so that the patient makes a high-pitched noise when breathing (stridor).
- Increasing difficulty causes a rise in respiratory rate (tachypnoea), and the patient will struggle to breathe and become distressed as he uses the accessory muscles of respiration to maintain airflow.
- In severe cases there may be cyanosis, cessation of air entry (apnoea) and death.

## Congenital abnormalities:

### 1 Laryngomalacia:

Omega shaped epiglottis.

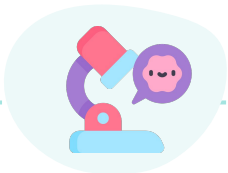
Normally in inspiration: the epiglottis is open and vocal cords are abducted.

- Most common cause of stridor (high pitched sound) in neonate and infants (MCQ).
- **Laryngeal findings:**
  - Inward collapse of aryepiglottic fold (short) into laryngeal inlet during inspiration **(inspirational stridor)**.(supraglottic collapse)
  - Epiglottis collapses into laryngeal inlet.*cartilage الـ رخاوة في* immature cartilage

#### Symptoms

- Intermittent **inspiratory** stridor that improves in prone position.**(IMP)**

#### Diagnosis



- History and endoscopy. "flexible endoscope through the nose while baby is awake" it can't be diagnosed in the OR when the patient is sedated

#### Treatment

- Observation if mild Usually it improves with time
- Supraglottoplasty in severe cases when you see signs of growth retardation and airway obstruction like: cyanosis, sleep apnea, and desaturation, it Involves cutting the Aryepiglottic fold to relieve the epiglottis and trimming of aryetenoid mucosa.
- Tracheostomy. old method, we do it if child is still not improving after supraglottoplasty.
- The percentage of children with laryngomalacia that will need surgical intervention is only 10% .

### Case scenario

10-months baby, his mother noticed noisy voice when breathing, (it gets better when he sleeps on his stomach and worsen when he lies on his back) on laryngoscope there was an omega shaped epiglottis and short aryepiglottic fold.

What is the diagnosis? Laryngomalacia.

What is the most appropriate management? If no signs of growth retardation or airway obstruction Reassurance, if there is then do Supraglottoplasty.

# Congenital abnormalities (cont.):

## 2 Subglottic stenosis:

- Incomplete recanalization of subglottic area, small cricoid ring. (stridor is noticed since birth)
- Can be acquired or congenital, acquired due to prolonged intubation (Failure of intubation again due to a history of prolonged intubation results in subglottic stenosis >**SAQ**)
- The most common is acquired subglottic stenosis post intubation

### Types:

1 Membranous

2 Cartilaginous
Most of the time cartilaginous

3 Mixed

### Grades: Cotton-Myer grading system (IMPSAQ)

- **Grade I:** < 50% obstructed.
- **Grade II:** 51-70%.
- **Grade III:** 71-99%.
- **Grade IV:** complete obstruction (no detectable lumen).

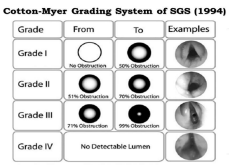



Table 60.1 The Myer-Cotton grading system for subglottic stenosis

| Grade | Reduction in proportion of cross-section area of subglottis |
|---|---|
| 1 | 0–50 per cent |
| 2 | 51–70 per cent |
| 3 | 71–99 per cent |
| 4 | No lumen |

**BOOK**

### Symptoms

- Biphasic stridor. during inspiration and expiration, because of a fixed stenosis unlike laryngomalacia which is dynamic
- Failure to thrive.

### Diagnosis

- Chest and neck X-ray.
- Flexible endoscope. while baby is awake (to exclude other causes)

### Treatment

- Tracheostomy in severe cases, or rural areas. to secure the airway (one of the indications of tracheostomy is airway obstruction, it's used until surgery is performed)
- Grade 1-2: endoscope (CO2 or excision with dilation using a balloon), cut stenotic area and inflate balloon to dilate it. more commonly done nowadays, esophageal atresia is more common than laryngeal atresia, both same concept of treatment.
- Grade 3-4: open procedure. first secure the airway by tracheostomy & treat by LTR
  - LTR (Laryngotracheal reconstruction) or CTR (cricotracheal resection)
  - -Ant. cricoid split

Grade 2 stenosis, the redness underneath the opening is a wound

Grade 3 stenosis

Question that commonly come in the exam: can the phase of the stridor help you know the level of obstruction? Yes , if it's inspiratory-> glottic & supraglottic
If it's biphasic-> subglottic. And if only expiratory -> chest part of trachea.

# Congenital abnormalities (cont.):

## 3 Laryngeal web (vocal cord web):

- Incomplete decanalization (could cause subglottic stenosis)
- Could be membranous or cartilaginous.

Here the cartilages and membranes are attached to each other congenital

The vocal cords are still attached to each other

### Types:

1 Supraglottic

2 Glottic

3 Subglottic

**Symptoms**

- Weak cry at birth.
- Variable degrees of respiratory obstruction depending on the grade.
- On and off stridor.
- Anterior laryngeal web: dysphonia
- Posterior laryngeal web: dysphonia and stridor

**Diagnosis**

- Flexible endoscope. while baby is awake

**treatment**

- No treatment (in small web)
- Laser excision (in large web)
- Open procedure + tracheostomy (if there is difficulty in breathing)

### Case scenario

3 month baby came with abnormal noisy breath (stridor), no airway obstruction, no cyanosis, no history of previous intubation, other things are normal.

The most likely diagnosis is: Laryngeal Web.

## 4 Subglottic hemangioma: The most common congenital vascular tumor

- Most common in subglottic space. It is the most common congenital pediatric tumor.
- It has two types: 1- Capillary (typically resolve) 2- Cavernous.
- 50% of subglottic hemangiomas are associated with cutaneous involvement (وحمه). (4 months baby crying with stridor and cutaneous hemangioma)

**Symptoms:**

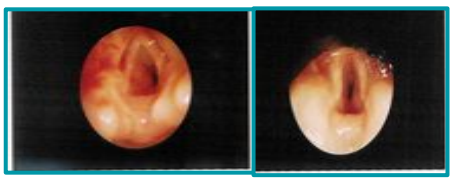
- Biphasic stridor

**Diagnosis:**

- Endoscope

**Treatment:**

- **Propranolol** (this is what's used now, forget about the rest)
- Observation
- Corticosteroid
- CO2 Laser




From 436, what are the commonest causes of stridor in pediatrics?
1-Laryngomalacia
2- Subglottic stenosis
3- Bilateral Vocal cord paralysis

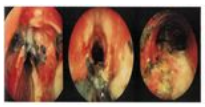
# Traumatic Conditions of the Larynx:

1. Direct injuries (blows). common in RTA
2. Penetration (open) knife
3. Inhalation of foreign bodies, common in pediatric usually vegetables in pediatrics.
4. Intubation injuries:

   -Prolonged intubation (more than 2 weeks in adults "risk of subglottic stenosis", more than 3 weeks in pediatrics). If intubation is needed for a longer time use tracheostomy

   -Blind intubation.

   -Too large tube.
5. Inhalation of "sloughing and carbonized tissue": give steroid, antibiotic and Anti-Reflux Drugs
6. Burns (inhalation, corrosive fluids).



Burn injury (black is smoke)

## Pathology:

- Abrasion (injury to the mucosa) > granulomatous formation > subglottic stenosis due to scaring.

## Signs & Symptoms:

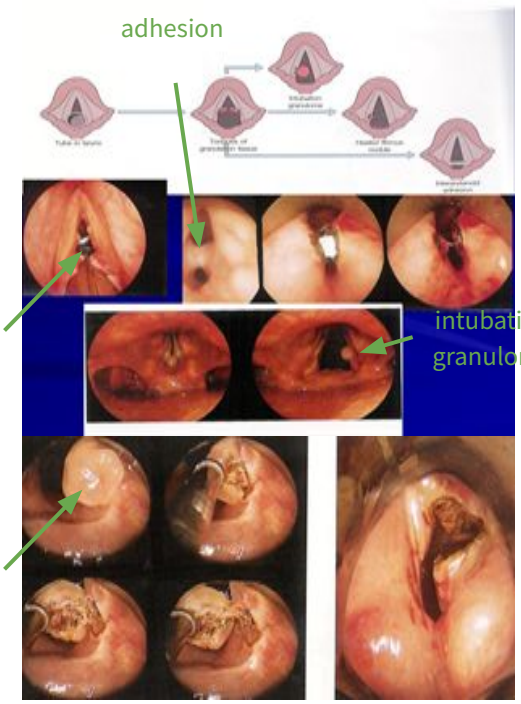
- hoarseness, dyspnea

## Treatment:

- Voice rest, Endoscopic removal, Prevention

- The safest time to keep the Intubation tube is from 2-3 weeks maximum, after that time it has to be removed and instead put the pt on tracheostomy, because if longer than that it will cause granulation tissue, granuloma around it and scars and at the level of subglottic area it will cause narrowing and stenosis. E.g. When a comatose pt admitted after an RTA, they intubate him for long time. So, the most common cause of subglottic stenosis is iatrogenic (Prolonged intubation). Another scenario when the pt intubated with improper technique due to bad ventilators or improper size of tubes or bad tubes, etc.

Important



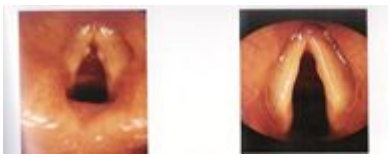
# Vocal Fold Lesions Secondary To Vocal Abuse & Trauma:

## 1 Vocal nodules (singer's nodules): Seen in teachers, kids and singers

At junction of ant ⅓ or mid ⅓. (Ant ⅓ and post ⅔)

**Treatment:** *Remove? No*

- Voice therapy refer to speech therapy to learn how to not stress on voice.
- Surgical excision (microlaryngoscopy), if large but therapy is usually effective, rarely done.
- Drink lots of water, rest your voice.



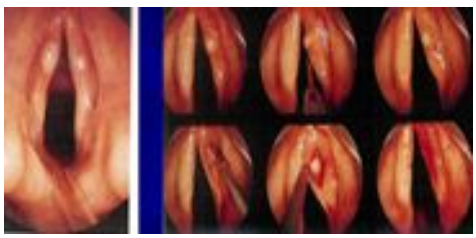

## 2 Vocal fold polyp:

- Middle and ant 1/3, free edge, unilateral, usually anterior.
- Mucoid, hemorrhagic (Vocal cord hemorrhagic polyp).
- Can occur after trauma or irritation. like concert or long speech.
- They may present with dysphonia.
- **Treatment:** surgical excision (microlaryngoscopy polyp removal).
- Complication: dysphonia, pain while talking, aphonia.

Don't miss it in the exam, they'll bring a case of acute voice injury and then they will describe a lesion on the vocal cord focus on the lesion b/c the treatment depends on it. If Tiny mass, voice therapy. If it's large mass, then the treatment is surgical excision.

## 3 Vocal fold cyst: Collection, congenital or acquired

- Congenital dermoid cyst.
- Mucus retention cyst: due to blockade of mucus drainage.
- **Treatment:** surgical excision dissection.



## 4 Reinke's edema: (al pacino's voice)

Caused by smoking and acid reflux

Accumulation of fluid in Reinke's space, common in smokers

Spot dx in women who smoke (thick voice)

**Treatment:**

- Voice rest.
- Stop smoking.
- Anti-reflux therapy.
- Surgical excision.


Thickened vocal cords

## Laryngocele:

Don't worry about it

- Air filled dilation of the appendix of the ventricle, communicates with laryngeal lumen.
- Congenital or acquired.
- Common site: ventricle.
- It could close the airway if happened congenital in children and may even cause dysphagia or discomfort.

**Types:**

- External: through thyrohyoid membrane.
- Internal.
- Combined
- **Treatment:** Marsupialization "partial removal of the mass" (we have to remove it)

laryngocele
(Air filled sac)

## Vocal cord paralysis "Vocal Cord Immobility":

Important

- Vocal cord paralysis occurs when the nerve impulses to your voice box (larynx) are disrupted. This results in paralysis of the vocal cord muscles. Detected early due to voice change.
- Vocal cord paralysis can affect your ability to speak and even breathe. That's because your vocal cords, sometimes called vocal folds, do more than just produce sound. They also protect your airway by preventing food, drink and even your saliva from entering your windpipe (trachea) and causing you to choke.
- It occurs to the left recurrent laryngeal nerve more due to its anatomical location(pass behind aortic arch).*we wait for 6 months to 1 year no improvement we then decide that it's permanent paralysis *

### Causes:

**Adults:**

- Iatrogenic the most common cause (Cervical surgery anterior approach, Thoracic surgery, Thyroidectomy, Skull base surgery, Other medical procedure) & non iatrogenic.
- Neoplastic: tumor in brain, thyroid, esophagus, trachea.
- Systemic disease: (CVD, Developmental abnormalities, Drug neurotoxicity, Granulomatous disease).
- Trauma
- Neurological
- Idiopathic (We do CT Scan +MRI for the brain, neck and chest to exclude all causes like hidden tumors. If CT scan is normal, we label it as idiopathic).
- Infectious & Toxins facial neuritis, vestibular neuritis

**Children:**

- Arnold chiari malformation: if a baby is born normally but has a breathy cry we have to do MRI for posterior fossa to rule out arnold chiari malformation.
- Birth trauma: "Forceps delivery" they put it on the side of the neck and hit the RLN.

### Signs & Symptoms:

- Dysphonia (unilateral paralysis).
- Choking in recurrent laryngeal nerve injury.
- Stridor in pediatric patients or if there's bilateral paralysis.

In unilateral we have one cord that's moving and the other is not and that usually gives us voice problems (breathy voice), but if it was bilateral it will lead to respiratory problem (stridor).

# Vocal cord Position:

- Median, paramedian, cadaveric
- **Treatment:** Self-limiting or permanent paralysis

**For medialization:** we perform it if we have a problem in the voice "dysphonia"

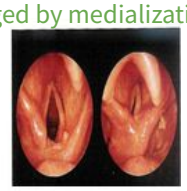
- Vocal cord injections: gelfoam, fat, collagen, teflon
- Thyroplasty type 1 (Silicon Block "Permanent") in case of permanent paralysis

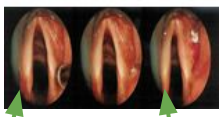
**For lateralization:** if the problem is respiratory "stridor". if we have bilateral vocal cord paralysis (when the patient breaths the cords are adducted, no abduction movement)

- Cordotomy
- Thyroplasty
- Tracheotomy

- Vocal cord paralysis can be unilateral or bilateral:
- ➔ Unilateral: one cord work and the other is paralyzed, with gap in between affects voice (Breathy voice)
  - Treatment: medialization "inject the paralyzed cord to inflate it closure of the gap.
- ➔ Bilateral: Adduction of the cords while breathing can't open and it will cause stridor, and dyspnea, voice is fine
  - Treatment: lateralization (cordotomy)

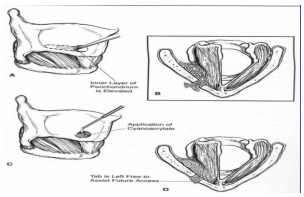
gap in addiction, it supposed to be completely closed, managed by medialization.

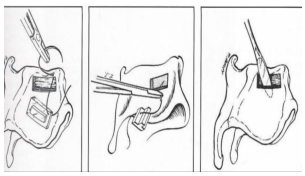


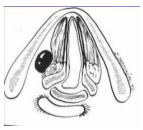


Thin, paralyzed and atrophic cord.

Material is injected to push cord inward.







Arytenoidectomy

# Inflammation of the larynx:

## 1 Acute Epiglottitis:

- Used to be a threatening infection but now due to vaccinations it is seen less.
- **Caused by Haemophilus influenza B** most commonly
- Vaccine (2-6 year).

Epiglottis is inflamed and airway is obstructed

### Symptoms

- Dysphonia, No cough, Normal voice, Fever, Drooling, Dyspnea.
- Sniffing position(The child presented to ER binding forward), Dysphagia.

### Diagnosis

- X-ray (thumbprint sign)

### Treatment

- Do not examine the child in the ER. (Don't use tongue depressor the child may collapse because he lost the airway) tongue depressor will create stress because the patient is trying to bring the epiglottis anteriorly just to breath
- Intubate in the OR
- IV Antibiotics
- Corticosteroids (For the Edema)

# Inflammation of the larynx (cont.):

## 2 Acute Viral Laryngitis:

**Caused by** Rhinovirus - Parainfluenza

- **Signs & symptoms:** Dysphonia - Fever - Cough
- **Treatment:** Conservative - Steroids

## 3 Croup (Laryngotracheobronchitis):

- Primarily involves the subglottic region. Edema in glottis/subglottis and vocal co
- **Cause:** parainfluenza 1-3
- 1-5 years pediatric

### Symptoms

- Biphasic stridor, Fever, Brassy cough.
- No Dysphagia, Hoarseness.

### Diagnosis

- X-ray: Steeple sign (sharp edge like a pencil).

### Treatment

- Humidified oxygen.
- Racmic Epinephrine (IMP)(vasoconstriction)
- Steroids To resolve edema quickly.

skipped by doctor

## 4 Diphtheric Laryngitis: rare due to vaccination

- **Cause:** corynebacterium diphtheriae
- **Signs & Symptoms:** cough, stridor (suggests the spread of the membrane to the larynx and trachea), dysphonia, fever, Greyish –white membrane "dirty membrane"
- **Treatment:**
  - Antitoxin injection.
  - Systemic penicillin.
  - Oxygen.
  - Tracheostomy.

skipped by doctor

## 5 Fungal Laryngitis: 50 year old asthmatic patient using inhaled corticosteroids (patient has to gargle with water after using it to avoid fungal infections)

- Seen in diabetics and Immunocompromised patients, chemotherapy
- **Causes:** candidiasis, aspergillosis, steroid inhalers, patients taking steroid inhalers have to wash their mouth and adjust the dose otherwise they'll get fungal infection not only in oral cavity but also in larynx.
- **Signs & symptoms:** Dysphonia, Cough, Odynophagia, dirty white/gray membrane.
- **Treatment:** Antifungal regimen.

# Inflammation of the larynx (cont.):

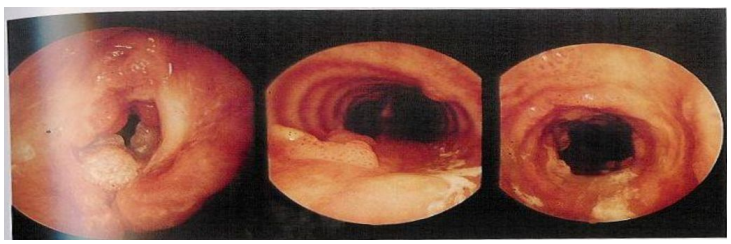
## 6 Recurrent Respiratory Papillomatosis:

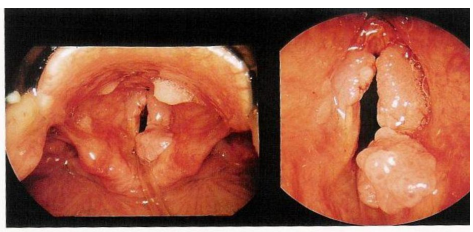
- 2/3 before age 15 (juvenile). During delivery the child get the infection from the mother.
- Rarely malignant change.
- **HPV 6-11 (common)**
- **HPV 16-18 (malignancy)**
- **Types:** ○Juvenile "affect children and it's very aggressive". ○ Senile.
- **Signs & symptoms:** Hoarseness, stridor.
- **Treatment:**
  - Laser excision, microdebrider.
  - Adjunctive therapy: Cidofovir, acyclovir, interferon (new treatment :Avastin)

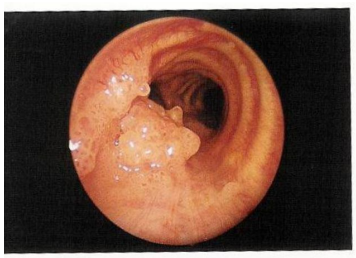
**Risks**

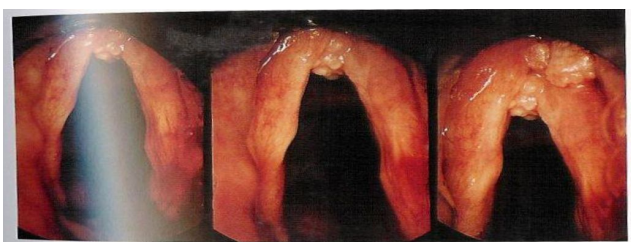
○ Younger first time mother (condyloma acuminata)

○ Lesions: wart like (cluster of grapes), in genital area.



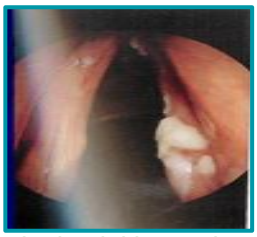




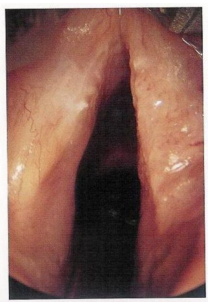


# Malignant Neoplasm Of The Larynx:

- 50 year old male, smoker, presents with worsening dysphonia, on examination we see leukoplakia→ biopsy.
- Smokers should come to the clinic regularly for screening, because early cancer is easier to treat with laser or radiotherapy.
- 1-5 % of all malignancies of head and neck.
- All are squamous cell carcinomas.



leukoplakia patch



## Signs & Symptoms:

- Hoarseness, aspiration, dysphagia (functional issue).
- Stridor, weight loss.

## Risks:

- Smoking, alcohol.
- Radiation exposure.

## Treatment:

- Radiotherapy. chemotherapy and surgery
- Hemi Laryngectomy.
- Total Laryngectomy + Neck dissection (lymphadenectomy).

## Classification:

1

### Supraglottic:

- 30-40% of Laryngeal Ca
- 25-75% Nodal metastasis

2

### Glottic:

- 50-75%. Commonest because it has squamous cells
- Limited regional metastasis

3

### Subglottic:

- Rare
- 20% regional metastasis

# Notes from 437

**1) Laryngomalacia notes:**

***Case scenario:***

- 2 month old child started to have noisy breathing 1 month ago, sound coming during inspiration, no abnormal sound during expiration he has a normal delivery.
- Most common cause of this sound (stridor): Laryngomalacia
- During breathing, vocal cords are abducted and epiglottis goes anteriorly. But in laryngomalacia, there is immature cartilage and the epiglottis is omega in shape, arytenoid is covered in mucosa that goes inward forward closing the airway, but during expiration the airway is open this is why no abnormal sound is heard during expiration. Surgery is done by cutting the short aryepiglottic fold on each side allowing it to come more anteriorly, we can also do trimming of the redundant mucosa on the arytenoid.
- This disease can be resolved on its own within 1 year (4-5 months), more neurological maturity
- In pediatric population use flexible fiberoptic through the nose and let the baby cry and swallow so we can check the mobility of vocal cords and the movement of the epiglottis anteriorly.
- If the child has no cyanosis, and he is feeding well ( follow up on the growth chart).. then we can wait.
- If not then surgical intervention is done. if baby did not improve tracheostomy is done till the baby recovers.

**2) Subglottic stenosis notes:**

***Case Scenario:***

- Baby since birth has stridor that is biphasic (during inspiration and expiration).
- when we have biphasic stridor this means that the obstruction is not supraglottic like in laryngomalacia but subglottic.
- Subglottic stenosis can be congenital, but the commonest cause is: Acquired (Prolonged intubation).
- Subglottic area is the narrowest area
- If subglottic stenosis is diagnosed while the mom is still pregnant with the fetus, C\S is done and they remove only the baby's head and perform tracheostomy, after that the rest of the body can be delivered (exit procedure). Because if the whole baby is removed and the umbilical cord is cut before tracheostomy asphyxia may occur.
- How is the open procedure performed? (laryngotracheal reconstruction) we open the trachea and take rib graft (small cartilage) and put it in-between the 2 sides, therefore, increasing the diameter of the trachea.

**3) Laryngeal web notes:**

- Glottic web may be grade 1,2,3,4.
- The more the web is extended more posteriorly the baby will start to have not only dysphonia but start to have inspiratory stridor as well.
- Surgery: we cut the web with laser or cold knife and put stent and leave it for 6wks and then remove it.

**4) Subglottic hemangioma notes:**

***Case scenario:***

- Baby born and after 1 month the mother noticed a big birthmark(وحمة) on his face and he started to have biphasic stridor: Subglottic hemangioma
- Hemangioma in subglottic area has 3 phases (grows acutely and then starts regressing)

**5) Reinke's edema notes:**

- Lining of the vocal cords is squamous epithelium and the space underneath that is called reinke's space.
- In reinke's edema, the space becomes filled with fluid.
- It occurs mainly with smokers this is why they have a harsh voice
- During surgery the fluid is removed and the redundant mucosa as well and send to histopathology.

# Notes from 437

**6) Laryngocele notes:**

- Occurs in people who use musical instruments that involve blowing, or in glass blowers.
- After valsalva maneuver the patient feels swelling in the neck.
- Internal laryngocele may present with difficulty in breathing, it occurs in the weak vestibular area that is not covered by any membrane.

**7) Vocal cord paralysis:**

***Case scenario:***

- Patient came with no history of surgery or intubation and on examination there is one vocal cord that is immobile, this patient cant be labeled as idiopathic.. we have to do CT neck and chest first because vocal cord paralysis may be the first symptom of a thyroid mass or he may have aortic aneurysm or lung tumor
- If CT scan chest and neck is normal → we can label as idiopathic.
- Nerve may be compressed after surgery (neuropraxia) so we have to give it time (6 months) for spontaneous recovery.
- In patients who have only one of the vocal cords paralyzed the vocal cords don't close completely so the quality of the voice will become breathy and they will choke on water.. we don't wait for 6 months in this case and we perform medialization surgery (inject material)
- Unilateral vocal cord paralysis → dysphonia
- Bilateral vocal cord paralysis → stridor (no abduction movement)

**8) Acute Epiglottitis:**

***Case scenario:***

- 7 year old child came to the emergency room with head bending forward and an open mouth and drooling saliva, he can't swallow or talk and has a fever: Epiglottitis
- Epiglottis is red and congested and closing the airway, the child bends forward to bring the epiglottis more anteriorly to breath and its very painful for him to swallow because he is moving an inflammatory structure.
- Manage by intubating the patient in the OR and IV antibiotics and steroids to reduce edema.
- DO NOT EXAMINE THE PATIENT IN THE ER

**9) Recurrent Respiratory Papillomatosis:**

***Case scenario:***

- Mom with HPV delivered baby and the baby got the virus. The child after 1 year presented with dysphonia (change of voice) after examination we found a wart on the vocal cord (papilloma). Another scenario: history of a mother complaining about change of voice of her child with repeated surgeries for polyps removal.
- The child may present with stridor.
- Very aggressive
- Treatment is done by excision of the wart with microdebrider and then injection of an antiviral (not a cure but it reduces the recurrence)

# Extra

**Vocal Cord Paralysis:**

Unilateral: affected cord lies in the paramedian position, inadequate glottic closure during phonation > weak, breathy voice.

Usually medializes with time whereby phonation and aspiration improve.

Treatment options include voice therapy, injection laryngoplasty (Radiesse), medialization using silastic block.

Bilateral: cords rest in midline therefore voice remains good but respiratory function is compromised and may present as stridor.

If no respiratory issues, may monitor closely and wait for improvement. If respiratory issues, intubate and will likely require a tracheotomy.

**Benign Laryngeal Papillomas (from Toronto notes):**

Etiology HPV types 6, 11

❏ possible hormonal influence, possibly acquired during delivery

Epidemiology Biphasic distribution:

❏ Birth to puberty (most common laryngeal tumour) and adulthood

Clinical Features

❏ hoarseness and airway obstruction

❏ can seed into tracheobronchial tree

❏ highly resistant to complete removal

❏ some juvenile papillomas resolve spontaneously at puberty

❏ may undergo malignant transformation

❏ laryngoscopy shows wart--like lesions in supraglottic larynx and trachea

Treatment:

❏ microdebridement or CO2 laser

❏ adjuvants under investigation: interferon, cidofovir, acyclovir

❏ HPV vaccine may prevent/decrease the incidence but more research is needed

**Laryngeal Carcinoma (from Toronto notes):**

Etiology:

SCC most common 3 sites: 1. Supraglottic (30 to 35%) 2. Glottic (60 to 65%) 3. Subglottic (1%)

Mean age: 45 to 75 M:F = 10:1

Risk factors:

❏ Smoking/EtOH

❏ HPV 16 infection strongly associated with the risk of laryngeal squamous cell cancers Clinical Features:

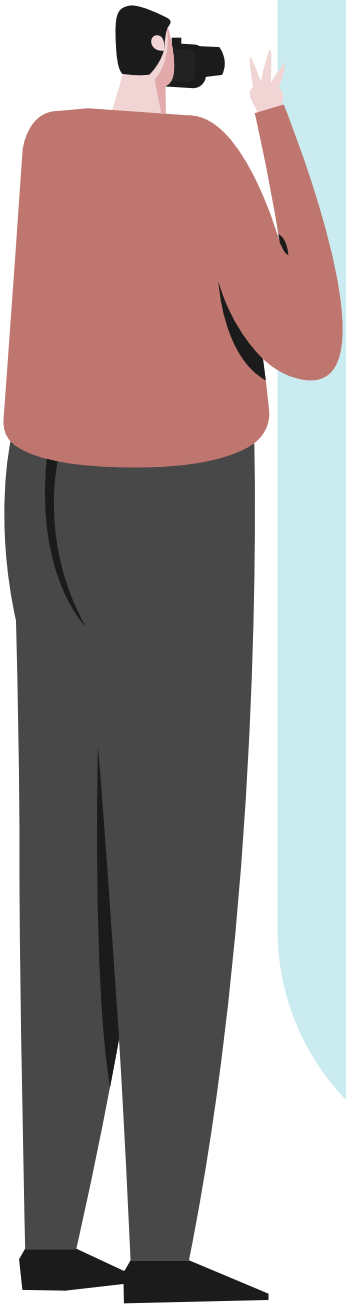
❏ Dysphagia, odynophagia, globus Otalgia, hoarseness, Dyspnea/stridor Cough/hemoptysis

Cervical nodes: rare w/glottic CA

Diagnosis: Laryngoscopy CT/MRI

Treatment: 1ry radiation -2ry surgery -1ry surgery for bulky T4 disease.

# THANK YOU!

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