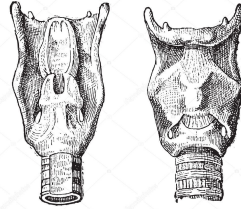




Larynx I-II



Objectives:

- **Larynx 1: Anatomy Of The Larynx**
 - 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 2: Diseases Of The Larynx**
 - Acute and chronic laryngitis
 - Non-specific laryngitis
 - Specific laryngitis: acute epiglottitis, croup.
 - Laryngeal paralysis: unilateral and bilateral.

Resources: Doctor Slides, 436

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Color index: **Important** | **Notes** | Extra

Larynx I: Anatomy Of The Larynx

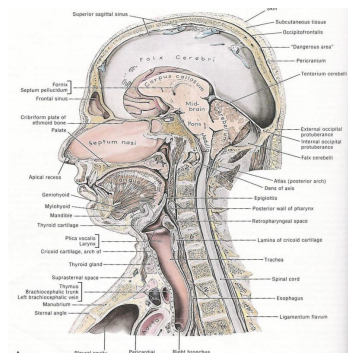
- 35 years old female has dysphonia (hoarseness) ?
- The larynx or voice-box is part of the upper respiratory tract.
- It is lined with ciliated columnar epithelium except over the vocal folds or ‘cords’ which are covered with squamous epithelium. so when you take a sample from the larynx and you see 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

- **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 **common with teachers**). **spasmodic**
- **Breathy voice occurs due incomplete closure of the vocal cords causing air to escape (vocal cord paralysis)**

Skeleton Membranous Framework Of Larynx

- Thyroid cartilage
- Cricoid cartilage
- paired arytenoids cartilage
- Epiglottis
- Hyoid bone



- **Thyroid cartilage**

- Shield like
- Thyroid cartilage is opened posteriorly. 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 shutting 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 where the airway obstruction usually happens because it is a complete ring
- Thyroid and cricoid might be seen as bones (calcified) in an X--Ray of a 40-- year old patient

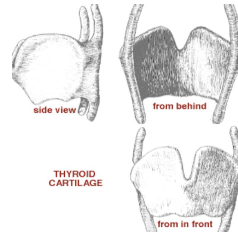
- **Arytenoid Cartilage:** important

- 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 cords & 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 small cartilage called corniculate cartilage. it helps to prolong arytenoid cartilage posteriorly and medially. It has no significant function

Thyroid Cartilage



Cricoid Cartilage

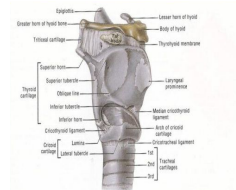
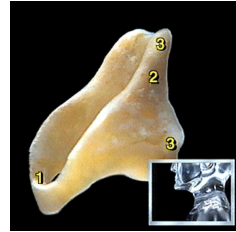
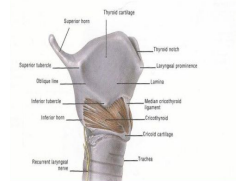
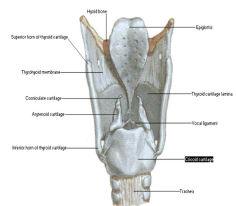


Figure 8.15. Lateral view of the skeleton of the larynx. The larynx consists essentially from two sets of the cartilages in the anterior border of the cricoid cartilage. The thyroid horn is a part of the hyoid.



Cartilages of Larynx
Posterior View



- **Epiglottic Cartilage:** It is elastic so unlike other cartilages it does not get calcified with age. لسان المزمار

- 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 cricopharynx. 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 glossepiglottic.

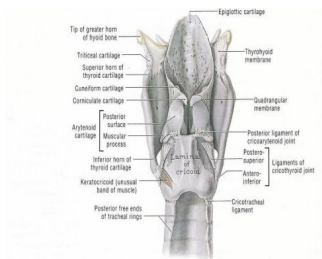


Figure 8-55. Anterior view of the larynx. Observe that the thyroid cartilage shields the smaller cartilages of the larynx. The hyoid bone, although not a part of the larynx, is part of the epiglottic cartilage.

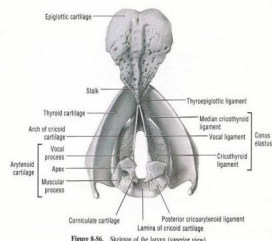
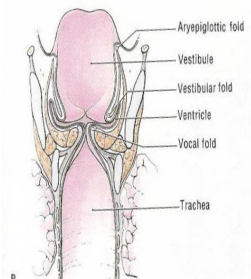
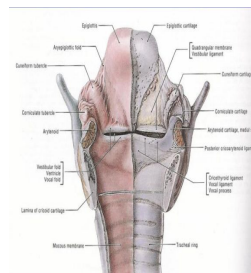


Figure 8-56. Superior view of the larynx (superior view).

- **Laryngeal Membranes:**

- The cartilages are covered by membranes that form folds and ligaments.
- Quadrangular membrane: 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. Between the upper membrane (quadrangular m) and the lower membrane (triangular m) there is a very weak area (in the larynx) which is not covered by any membrane we call it the **ventricle or vestibule or sacculus**.

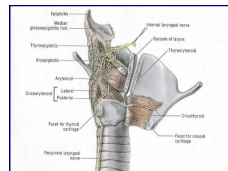


● Laryngeal Mucosa:

- 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.
 - * 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

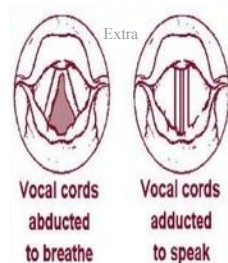
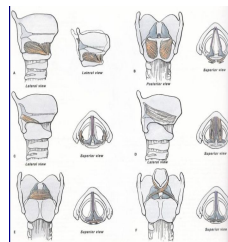
● Cavity of Larynx (another way of dividing the larynx)

- 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: (C1-C3) (Sternohyoid, sternothyroid, thyrohyoid, omohyoid.) attachment is down with the sternum
 - * Extrinsic elevators: above the hyoid bone (Genohyoid (C1), diagastric (CNV--CNVII) mylohyoid (v) stylohyoid (VII) Used in swallowing. attachment is up
- **Intrinsic:** responsible for vocal cord movement
 - * **Abductors** (breathing: open the airway): Posterior cricoarytenoid (PCA) when the two muscles move laterally the vocal cords open.(supplied by superior laryngeal)
 - * **Adductors** (talking: phonation): 4 muscles Thyroarytenoid (TA4), lateral cricoarytenoid (LCA), cricothyroid, interarytenoid



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).

● **Vocal cord layers:**

1. Squamous epithelium no lymphoid tissue.
2. 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) **Reinke's edema is the collection of fluid within the Reinke's space below epithelium that causes heavy voice in smoker**
 - * Intermediate layer
 - * Deep layerIntermediate + deep layers = vocal ligament, the two layers are attached to each other
3. Vocalis muscle (thyroarytenoid muscle)

● **Blood Supply:**

- Superior and inferior laryngeal artery and veins.

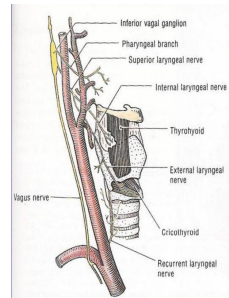
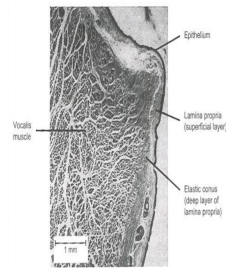
● **Lymphatic Drainage:**

- 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 reflex"
 - * External branch (motor) > **cricothyroid muscle only** the one that gets contracted while shouting.
2. **Recurrent laryngeal nerve (RLN)**
 - * 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
 - It is divided behind the **cricothyroid joint**
 - * Motor > **all the intrinsic muscles except the cricothyroid.**
 - * Sensory, below the vocal cords



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)

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 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 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:**

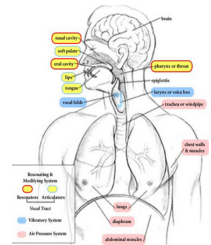
- **Protection of the lower airway passage from aspiration**
 - * Closure of the laryngeal inlet
 - * Closure of the glottis.
 - * Cessation of respiration.
 - * Cough reflex (forced expiration is made against a closed larynx).
 - * Vocal cords in adduction position
 - * Ventricular folds close
 - * Closure of the airways during swallowing the bolus.
 - * 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)
 - * 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

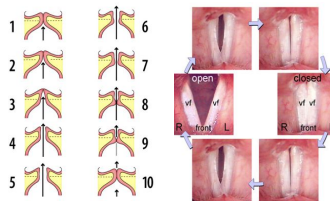
● Voice Mechanism

- 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



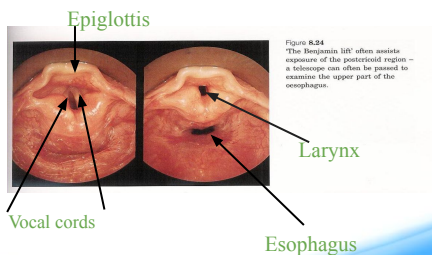
● Vocal Cord Vibration

- 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:



● 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)



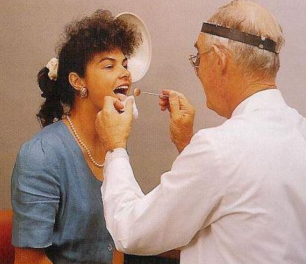
● Evaluation of dysphonic patients

● History of Dysphonia (hoarseness):

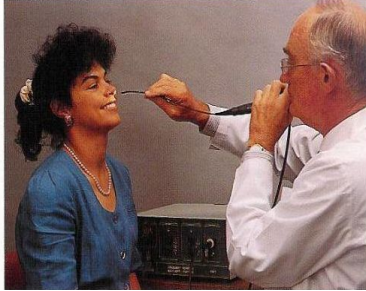
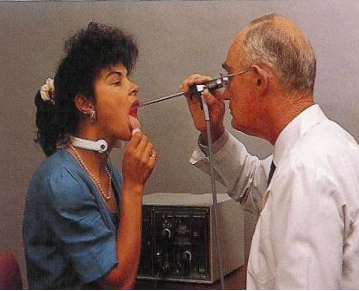
- Onset, duration, severity **progress**
- URTI, fever (**laryngitis**)
- Cough (Ask about asthma) **causes forced adduction between 2 vocal cords**
- Voice abuse (job), tobacco or alcohol, **very important to ask about smoking (lung or laryngeal cancer)**
- Dysphagia (**mass in the esophagus which is posterior to larynx**),
- Aspiration
- Breathing difficulty (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 thyroidectomy, 2-intubation (paralysis - dislocation of arytenoid)**
- Neck mass
- Laryngopharyngeal reflux (**throat clearance - coughing or choking at night - hoarseness - change of voice**)
- Occupation and medication are important

● Examination “**complet ENT examination**”

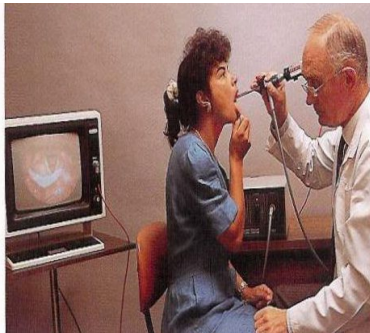
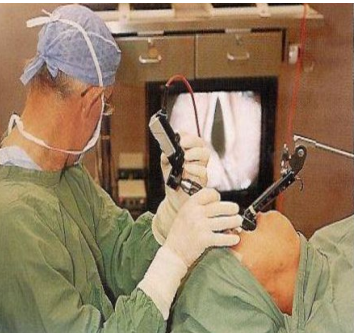
- Laryngeal examination and voice assessments:
 - * Indirect laryngoscopy (using mirror in old days)
 - * Direct laryngoscope **done in the OR**
 - * **Fibreoptic flexible scope** (MCQ: indications are **examination of nose, nasopharynx, larynx**) **small scope that goes inside the nose all the way to 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 OSCE you need to examine the cranial nerves



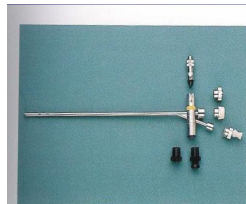
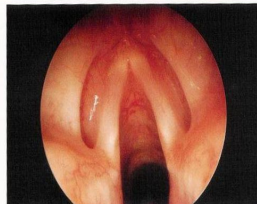
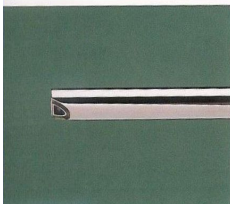
Indirect
Laryngoscope the flexible
scope is most used



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

Introduction

Symptoms and signs 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:

- Most common cause of stridor (high pitched sound) in neonate and infants.

- Laryngeal finding:

* Inward collapse of aryepiglottic fold (short) into laryngeal inlet during inspiration (inspirational stridor).

* Epiglottis collapses into laryngeal inlet. *رخاوه في ال cartilage*

* Omega shaped epiglottis with short aryepiglottic fold

- Signs & symptoms: Intermittent inspiratory stridor that improve in prone position.

- 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 most of the time cause the condition will improve with time.

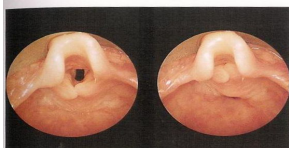
* Supraglottoplasty (we will consider this surgery in case of severe laryngomalacia, when there is signs of growth retardation, signs of airway obstruction like: cyanosis, sleep apnea, and desaturation).

*Epiglottoplasty

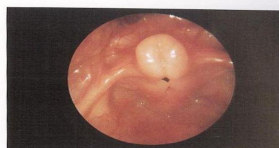
* Tracheostomy old method

* 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. 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 .



Omega shaped epiglottis



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

2. Subglottic stenosis stridor is noticed since birth

- Incomplete recanalization of subglottic area, small cricoid ring
- Can be acquired or congenital, **acquired due to prolonged intubation** and it's more common than the congenital.

-Types:

- *Membranous
- *Cartilaginous
- *Mixed

- Failure of intubation again due to a history of prolonged intubation that result as subglottic stenosis. (SAQ)

- Grades: important

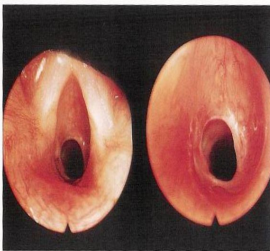
- * I < 50%.
- * II 51-70%.
- * III 71-99%
- * IV complete obstruction (no detectable lumen)

Cotton-Myer Grading System of SGS (1994)

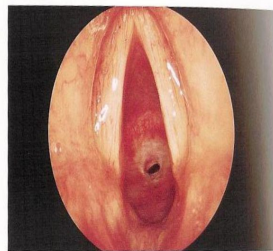
Grade	From	To	Examples
Grade I			
Grade II			
Grade III			
Grade IV	No Detectable Lumen		

Cotton
Myer
grading
system
Group A

- **Signs & symptoms:** **biphasic** stridor during inspiration and expiration, because of a fixed stenosis unlike laryngomalacia which is dynamic, and failure to thrive.
- **Diagnosis:** chest and neck X-ray, flexible endoscope **while baby is awake (to exclude other causes)** نخليه بصايح لازم يكون صاحي
- **Treatment:** **tracheostomy** to secure the airway (one of the indications of tracheostomy is airway obstruction, it's used until surgery is performed) in severe cases, or rural areas
 - *Grade 1-2: endoscope (CO2 or excision with dilation **using a balloon**), **cut stenotic area and inflate balloon to dilate stenotic area.** 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

The vocal cords are still attached to each other

3. Laryngeal web (vocal cord web)

- Incomplete decanalization. (didn't open completely)

- **Types:**

- Supraglottic
- Glottis
- Subglottic

-**Signs & symptoms:** 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

- Weak cry at birth
- Variable degrees of respiratory obstruction depending on the grade
- On and off 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)

★ Patient with Anterior laryngeal web: dysphonia

★ Patient with Posterior laryngeal web: **dysphonia and stridor**

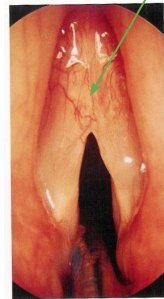


Figure 14.6
Vocal fold adhesion. Simultaneous removal of vocal nodules caused synechiae of moderate thickness. The voice was worse than before treatment.



Here the cartilages and membranes are attached to each other **congenital**

4. Subglottic hemangioma:

Most common in subglottic space. It is the most common congenital pediatric tumor.

-50% of subglottic hemangiomas associated with **cutaneous involvement**. *4 months baby crying with stridor and cutaneous hemangioma *

-**Types:**

- Capillary (typically resolve)
- Cavernous.

-**Signs & symptoms:** biphasic stridor.

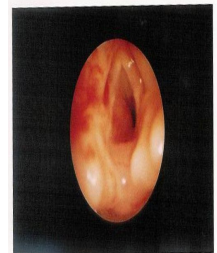
-**Diagnosis:** endoscope.

-**Treatment:**

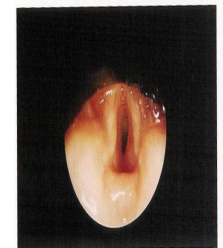
- **Observation**. *small/ asymptomatic*
- Corticosteroid (old treatment). *dramatic improvement *
- **Propranolol** (to decrease neovascularization*decrease the size*).very effective but needs follow up with cardiology
- CO2 Laser **risk of scar formation**

From 436, what are the commonest causes of stridor in pediatrics?

- 1- Laryngomalacia
- 2- Subglottic stenosis
- 3- Bilateral Vocal cord paralysis



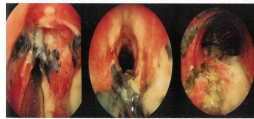
Unilateral



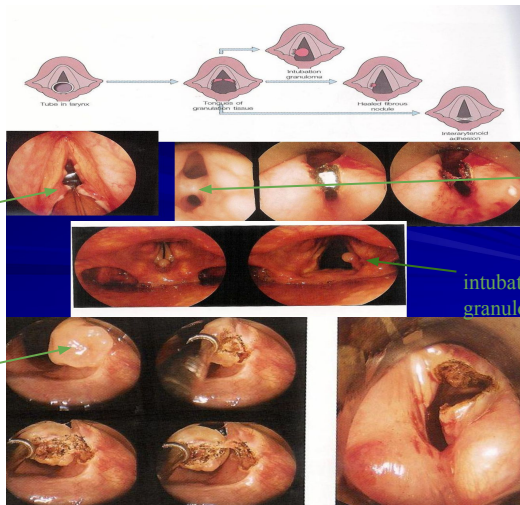
Bilateral

● Traumatic Conditions of the Larynx:

- Direct injuries (blows) **common in RTA**
- Penetration (open) knife
- Burns (inhalation, corrosive fluids).
- Inhalation foreign bodies, common in pediatric **usually vegetables in pediatrics**
- Inhalation “sloughing and carbonized tissue”: give steroid, antibiotic and Anti-Reflux Drugs
- Intubations 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.
- **Pathology:** Abrasion (injury to the mucosa) > granulomatous formation > subglottic stenosis due to scarring.
- **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.



Burn injury
(black is smoke)



Open wound
Granulation
tissue later it
will form
adhesion scar

adhesion

intubation
granuloma

Granuloma

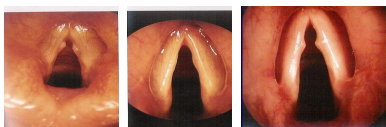
● Vocal Fold Lesions Secondary To Vocal Abuse & Trauma

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

- At junction of ant 1/3 or mid 1/3. (Ant 1/3 and post 2/3)

- **Treatment:** *Remove? No*

- Voice therapy refer to speech therapy to learn who 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. 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 dermoid cyst

- Mucus retention cyst: due to blockade of mucus drainage

- Treatment: surgical excision dissection



4. Reinke's edema (al pacino's voice).

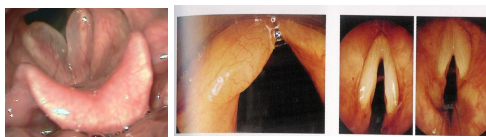
- Caused by smoking and acid reflux

- 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** air filled cyst

- Air filled dilation of the appendix of the ventricle, communicates with laryngeal lumen.

- Congenital or acquired*عند الأشخاص اللي ينفخون في الآلات الموسيقية*

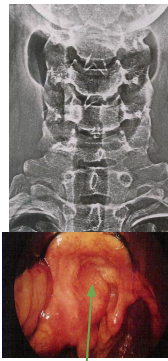
- Common site: ventricle.

- 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

- **Vocal cord paralysis “Vocal Cord Immobility”**

- Vocal cord paralysis occurs when the nerve impulses to your voice box (larynx) are disrupted. This results in paralysis of the vocal cord muscles.

- 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**

Adult:

* Trauma: iatrogenic (Cervical surgery **anterior approach**, **Thoracic surgery**, **Thyroidectomy**, Skull base surgery, Other medical procedure) & non iatrogenic.

* Tumor: **tumor in brain, thyroid, esophagus, trachea**

* Medical disease: (CVD, Neurological, Developmental abnormalities, Drug neurotoxicity, Granulomatous disease)

*Idiopathic * Infection *Toxins

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.

Children:

* Arnold chiari malformation: if a baby is born normally but has a breathy cry we have to do MRI to rule out arnold chiari malformation

* Birth trauma: “Forceps delivery” they put it on the side of the neck and hit the nerve

- **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 one not and that's usually give us voice problems, but if bilateral usually respiratory problem.

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”

- o Vocal cord injections: gelfoam, fat, collagen, teflon
- o 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 breathes the cords are adducted, no abduction movement)

- o Cordotomy
- o Arytenoidectomy
- o Tracheotomy

-Vocal cord paralysis can be unilateral or bilateral:

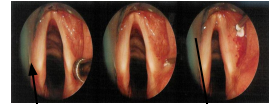
→ **Unilateral:** one cord work and the other is paralyzed, with gap in between affects voice (Breathy)

- o 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

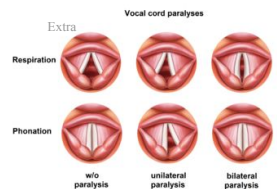
- o Treatment: **lateralization**

gap in addition, 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 Viral Laryngitis: الخناق

- Rhinovirus - Parainfluenza

- **Signs & symptoms:** Dysphonia - Fever - Cough

- **Treatment:** Conservative - Steroids

2. Acute Epiglottitis

- Used to be a threatening infection but now due to vaccinations it is seen less.

- **Haemophilus influenzae B most common**

- Vaccine (2-6 year).

- **Signs & 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. (if you use tongue depressor, child may collapse because he lost the airway)

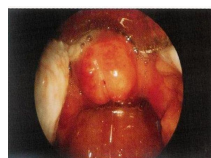
- Intubate in the OR

- IV Antibiotics

- Corticosteroids (For the Edema)



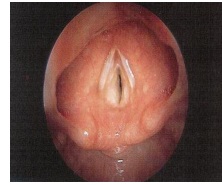
X-ray (Thumbprint sign)



Epiglottitis is inflamed and airway is obstructed

3. Croup (Laryngotracheobronchitis)

- Primarily involves the subglottic region. **Edema in subglottis and vocal cord**
- **Cause:** parainfluenza 1-3
- 1-5 years pediatric
- **Signs & symptoms:** Biphasic stridor, Fever, Brassy cough, No Dysphagia, Hoarseness.
- **Diagnosis:** X-ray “**Steeple sign**” زي قلم الرصاص حافظه حادة
- **Treatment:**
 - * Humidified O2.
 - * **Racemic Epinephrine (IMP).**
 - * Steroids **To resolve edema quickly**



4. Diphtheric Laryngitis **rare due to vaccination**

- **Causes:** 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.

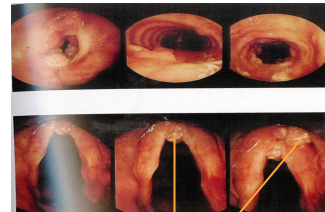
5. Fungal Laryngitis **50 year old asthmatic patient using inhaled corticosteroids (patient has to gargle with water after using it to avoid fungal infections)**

- seen in diabetics and Immunocompromised patients
- **Causes:** candidiasis, aspergillosis
- **Signs & symptoms:** Dysphonia, Cough, Odynophagia, **dirty white/gray membrane**
- **Treatment:** Antifungal regimen



6. Recurrent Respiratory Papillomatosis

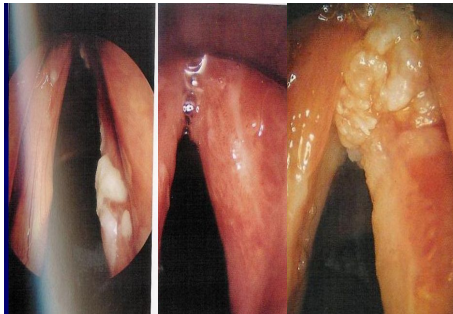
- 2/3 before age 15 (juvenile).
- Rarely malignant change.
- **HPV 6-11 (common)**
- **HPV 16-18 (malignancy)**
- **Risks:** *حتى لو انولد قيصري فيه احتماليه بجهيه*
 - o Younger first time mother (condyloma acuminata)
 - o Lesions: wart like (cluster of grapes), in genital area.
- **Types:**
 - o Juvenile “affect children and it’s very aggressive”.
 - o Senile.
- **Signs & symptoms:** Hoarseness, stridor.
- **Treatment:**
 - o Laser excision, microdebrider.
 - o Adjunctive therapy: **Cidofovir**, acyclovir, interferon (new treatment :Avastin)



Papilloma

● 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**
- **Signs & symptoms:** Hoarseness, aspiration, dysphagia(functional issue), stridor, weight loss.
- **Risks:** **Smoking**, alcohol, radiation exposure.
- **Classifications:**
 1. Supraglottic:
 - * 30-40% of Laryngeal Ca
 - * 25-75% Nodal metastasis
 2. Glottic:
 - * 50-75%. commonest
 - * Limited regional metastasis
 3. Subglottic:
 - * Rare
 - * 20% regional metastasis
- **Treatment:**
 - **Radiotherapy**
 - Hemi Laryngectomy.
 - Total Laryngectomy + Neck dissection (lymphadenectomy).



leukoplakia patch

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 lazer 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.

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 dont 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 after examination we found a wart on the vocal cord (papilloma)
- 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 Notes

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 Otagia, 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