Airway Obstruction I-II

Objectives:

- **To recognize assessment and management of common airway obstruction diseases, include ability to obtain patients' history, perform comprehensive physical and mental status assessment, interprets findings.**
- **To know how to handle common airway emergencies.**
- **To be aware of common airway obstruction operations.**
- **Know the causes, signs and symptoms of airway obstruction.**
- **Know how to investigate airway obstruction.**
- **Know the management of airway obstruction and possible.**

Resources: **Team 435, Slides, Dr. notes.**
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Basic Anatomy (FROM 433)

Infant & Pediatric larynx

- Position is higher at birth compared to adults. (what the benefit? to suck and breath at the same time)
- Epiglottis lying at the nasopharynx: makes the neonate an obligate nasal breather for 4-6 months
- Cartilage & soft tissue are softer.
- **Soft tissue:**

➢ less adherent to the underlying cartilage "mild trauma leads to large edema"

➢ susceptible to collapse

➢ less resistant to develop submucosal edema

- Omega shaped Epiglottis "curved"
- Subglottis is the narrowest part of AW in children and non-expandable. In adult's glottis is the narrowest. **MCQ**

TRACHEA

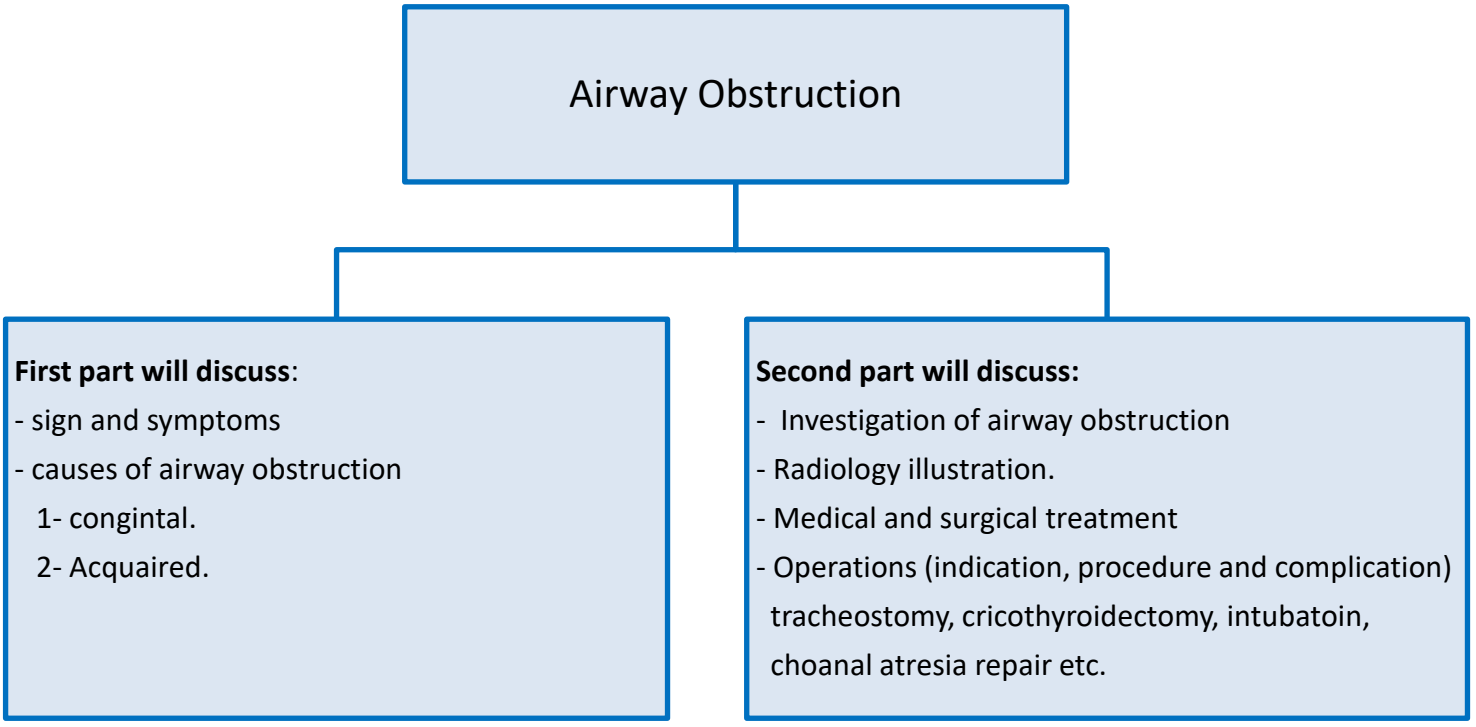
- Consists of 16 to 20 incomplete cartilaginous rings. "complete in pediatric "
- The posterior wall is a membranous part. "helps expanding in swallowing "
- Length is approximately 11 cm.
- Diameter 19 mm male, 16 mm female.

Pediatric trachea:

Diameter: **At Birth**:6 mm, **6 months**:7.2 mm, **1 year**: 7.8 mm, **4 years**: 11 mm. You just need to understand that you need a smaller tube in children.

Size of the selected tube in patient older than 2 years $\frac{age+16}{4}$ mm

1. Airway Obstruction:



PART 1:

Signs & Symptoms of (Upper Airway Obstruction):

- Upper airway extends from the nares and lip to the subglottic area.

1. Stridor imp
2. Flaring of the nasal alae
3. Retraction of the neck, intercostal and abdominal muscles
4. Dyspnea
5. Tachypnea
6. Restlessness
7. Cyanosis imp
8. Subcutaneous emphysema "Escaped air from the lumen of the airway"

- If a patient presented with most of these sign and symptoms then **he is mostly in Respiratory Distress** which require medical intervention immediately and do not wait for investigation.

What is Stridor?

-Stridor is harsh **high-pitched** musical sound produced by turbulence of air flow through a partial obstruction of the airway (AW)
-Audible sound produce during breathing due to air-flow change within the larynx
-It's very important because it indicate pathological narrowing and possibly AWO (airway obstruction).
-it indicates pathologic narrowing of air way, potential respiratory obstruction , even death.
-The most common cause of stridor in pediatrics is **Laryngomalacia**

Types of stridor?

- **Inspiratory stridor:** the obstruction is supraglottic, (glottis the area between the two vocal cords) e.g: Laryngomalacia the vocal cords and above (supraglottic)
- **Expiratory stridor:** the obstruction is in the trachea (lower) (in the intrathoracic trachea)
- **Biphasic stridor:** the obstruction is between the two areas: **subglottic obstruction** (below the vocal cord or upper trachea) the most dangerous

If stridor is present since birth:

- ➢ congenital laryngomalacia 60%
- ➢ subglottic stenosis
- ➢ vocal cord paralysis
- ➢ vascular rings

If onset of stridor is gradual and progressing:

- ➢ subglottic hemangioma appears between 1-3 months of age
- ➢ papilloma of the larynx appears at 6 months of age (treated medically by beta-blocker)

Congenital Upper Airway Obstruction:

From birth to the first few weeks:

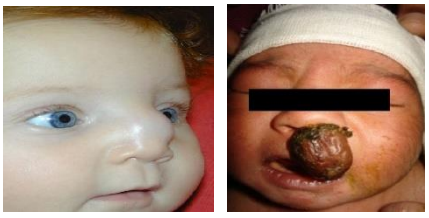
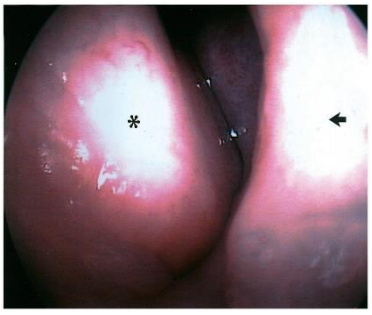
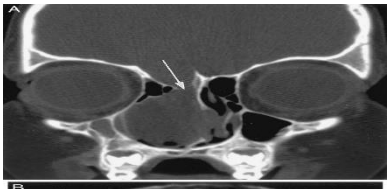
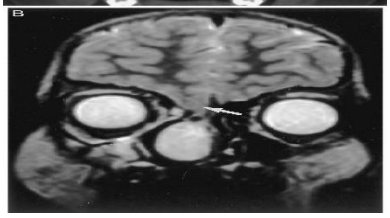
1.Nasal obstruction
2.Nasal masses
3.Choanal atresia and stenosis
4.Pyriform aperture stenosis
5.Pharyngeal
6.Craniofacial anomalies
7.Laryngeal
8.Laryngomalacia (no.1 cause of UAW postreaction)
9. Vocal cord paralysis (no.2 cause of UAW obstruction)
10. Subglottic haemangioma
11. Subglottic stenosis
12. Laryngeal web
13. Laryngeal lymphangioma
14. Saccular cyst

1.Nasal Obstruction (Not in Dr. slides of 436 A2):

- Neonates in the first 3 months are obligatory nasal breathers (can't breathe through the mouth).
- This is the typical scenario Cyanosed neonates with nasal obstruction will improve with crying, because when they are crying, they will breathe through their mouths. **In neonate's cyanosis improves with crying and worsens on feeding (cyclic cyanosis)**

Types	
Cystic	**Solid**
• Meningoencephalocele • Meningocele • Dermoid cyst • Epidermoid cyst	• Haemangioma • Neurofibroma • Glioma • Lymphangioma • Neuroblastoma • Craniopharyngioma • Rhabdomyosarcoma • Chordoma

432 Notes:

		A  B 
•In OSCE you would describe site, size,..etc. •**DDX:** Meningoencephalocele; Dermoid cyst and Epidermoid cyst •For diagnosis do imaging then scope. •Dermoid cyst is a differential diagnosis	When you scope and see any mass you shouldn't grasp because it could be meningoencephalocele attached to the brain. So, in pediatrics it's important to do CT and MRI. Grasping the mass risks the development of meningitis	•★ **A:** coronal CT scans showing homogenous mass in the right nostrils (arrow). •**B:** MRI shows communication (homogenous= all the same color)

★If you see a brain connection do an MRI:

- Homogenous opacification of sinus →fluid, polyp
- Heterogeneous with spiking →fungal, "calcium and minerals" or malignancy).
- MRI is good for soft tissue and neurological tissue gives more details.
- Remember in imaging: Bone: white, soft tissue: grey, Air: black
- 4 sinuses: above the eye frontal, below the eye maxillary, between the eyes ethmoid and behind the eye sphenoid. So, when you see the CT scan and you don't see the eyes its sphenoid NOT nasopharynx
- Lamina papyracea is a thin bone plate between the orbit and ethmoid.
- On CT scan you should look for the extension of the disease and the complication on orbit or brain. **Also look for anatomical variations**
- Rx: functional endoscopic sinus surgery (FESS) NOT fibrotic Endoscopic Evaluation of Swallowing (FEES).
- In vocal cord polyp if you write polypectomy zero! The correct answer: Micro laryngoscopy polyp excision.

2.Choanal Atresia very important

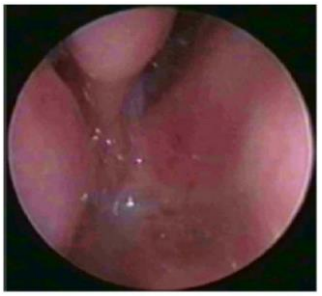
- Lack of patency of posterior nasal aperture (complete closure)
- **Bilateral atresia(imp)** presents soon after birth with severe respiratory distress *"because neonates are obligate nasal breathers"* (Top emergency Rx: oral tube) The first thing to do is oral tube then do a CT scan and any other thing you would like to do <emergency>.
- Unilateral atresia may be undiagnosed until later in childhood (rhinorrhea) (diagnosis at 1-2 year with one side nasal discharge)

Note 431: The commonest cause for unilateral obstruction is foreign body (purulent, foul smelling discharge).

Could be associated with other anomalies in 20-50% of cases:
- CHARGE "Coloboma (a hole in one of the structures of the eye, such as the iris, retina, choroid, or optic disc), Heart anomalies, choanal Atresia, Retardation of growth and development, Genital and/or urinary abnormalities and Ear anomalies"

- VATER "VACTERL" "Vertebral anomalies, Anal atresia, Cardiac defects, Tracheoesophageal fistula and/or Esophageal atresia, Renal & Radial anomalies and Limb defects "

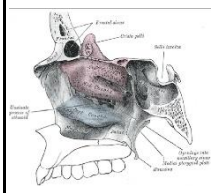
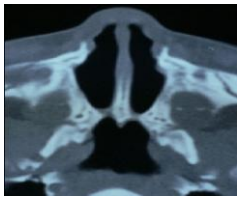
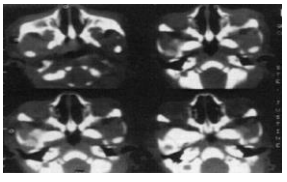
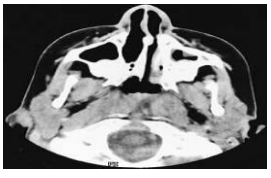
-Craniofacial anomalies



Types: (Do CT to differentiate between the types)
➢ Membranous 10%
➢ Bony
➢ Mixed

Dx:
➢Cyanosis **improves with crying**
➢Inability to pass size 6 French catheter (In small hospital where they don't have scope)

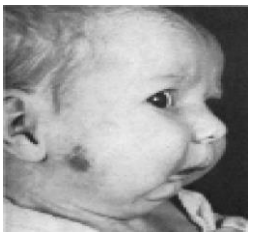
70% of choanal atresia associated with CHARGE syndrome: **'Important MCQ'**
C-coloboma (a hole in one of the structures of the eye, such as the iris, retina, choroid, or optic disc.)
H-heart disease A-atresia R-retarded growth G-genital hypoplasia E-ear deformity This is why we need to do a **chromosomal analysis** to look for everything.

				
	Axial CT that shows bilateral membranous choanal atresia Membranous = grey Bone = white		**Axial CT showing mixed Choanal Atresia**	Axial Unilateral Bony Choanal Atresia CHARGE Syndrome

Treatment:

- Emergency treatment is by insertion of oral tube
- Surgical treatment is by either transnasal or transpalatal choanal atresia repair
  With the scope if it is membranous →cut it. if it is bony →drill it
  (Pharyngeal Obstruction not in Dr slides 436 A2)

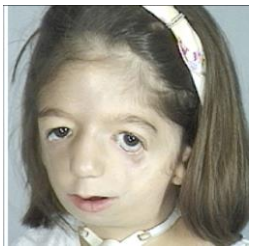
3. Pharyngeal Obstruction Craniofacial anomalies:



1. **Pierre–Robin syndrome** (These patients sometimes need tracheostomy) →
   - Glossoptosis[1]: Airway obstruction caused by backflow displacement of the tongue base
   - **Micrognathia:** Small narrow mandible, causes narrow airway, cleft palate

2. **Treacher- Collins syndrome** (Mandibulofacial; dysostosis)
   - Disorder of bone development, affecting ossification, narrow nose high arched palate

Note 432: These patients have retrognathia, tongue is big, cleft palate and they might have pharyngeal obstruction and need tracheostomy.



4. Laryngomalacia

- Due to flaccidity or incoordination of supra laryngeal cartilages which are pulled inside the lumen during inspiration leading to Upper Airway (UAW) obstruction.
- The most common cause of congenital airway obstruction. The most common cause of inspiratory stridor in infancy (2nd is Bilateral vocal cord paralysis and 3rd subglottic stenosis)
- In laryngomalacia, the epiglottis or the arytenoids that are soft and floppy. This floppy tissue gets pulled into the airway during inspiration, causing temporary partial blockage of the airway. This tissue is pushed back out when the infant exhales, opening the airway again.

Symptoms:

- **Snoring:** is low pitch sound caused by tissue vibration of the nasopharynx pharynx and soft palate due to obstruction above the larynx.
- Stridor in the first weeks of life.
- Inspiratory phase.
- Worse with crying, feeding and respiratory tract infection.
- Improved in prone position.
- DX: flexible fiberoptic endoscopy.

Complication:

- feeding difficulty and failure to thrive.

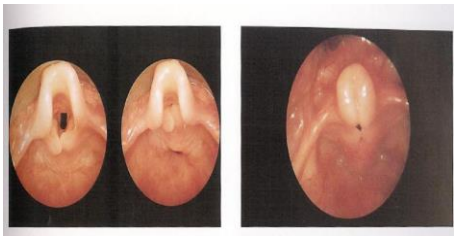
The most important prognosis for the child's case in regards to whether or not they should be managed surgical intervention or observed is their growth chart, if it is less than 50% you have to intervene.so if he child grow and gain weight don't interfere because it will go away when he growing

Best way of diagnosing is fiberoptic endoscopy imp

Note 431: While the child is awake to visualize the pattern of breathing.

[1] **Glossoptosis** is a medical condition and abnormality which involves the downward displacement or retraction of the tongue.

Endoscopic finding:



- Tall, omega shaped epiglottis arytenoid mucosa (epiglottis is collapsing)
- Inward forward movement of (sucked)
- Short aryepiglottic fold

Treatment:

- Any airway abnormality we need to evaluate how bad it's affecting the child's feeding and measuring the child on growth chart

1. *Reassurance* "mostly self limited"
2. *Infant can outgrow this problem* They could reach 6 month- 1 year and their problem would resolve
3. *Mild cases* :(no cyanosis not affecting the child growth): Observation (it can improve with time by 12-18 months in 90% of cases)
4. *Sever cases:* if the mother complains of bad oral intake, cyanotic child
   - Supraglottoplasty 'the best' (cut of the aryepiglottic fold and trimming of arytenoid mucosa)
   - Tracheostomy 'can't be used continuously' This only done if we did the supraglottoplasty and the child is cyanotic, so we perform the tracheostomy and leave it temporarily until the child gets better.

5. Vocal cord paralysis (not in dr slide 436 A2)

Note 432: All the muscles all supplied by recurrent laryngeal nerve except Cricothyroid muscle. Diagnose by fiberoptic endoscopy. Vocal cord not abducting Do CT brain to exclude Arnold Chiari Syndrome. Look back to the history to see if the child was delivered by forceps and had a vagal compression Child has weak cry (weeping)

- Can be unilateral or bilateral, congenital or acquired.
- The Congenital form may associate with abnormality of the central nervous system **(Arnold Chiari syndrome)** or cardiovascular anomalies
- The acquired causes: Birth trauma "forceps delivery", cardiac surgery "Patent ductus arteriosus repair", mediastinal or neck surgery, tracheo-esophageal fistula repair. Bilateral Vocal Cords Paralysis "Abducted type".
- **This is the second most common cause of stridor in children**
- You want to do an MRI of the brain to check for Arnold Chiari Malformation

Symptoms:

High pitched inspiratory stridor

Treatment:

- Tracheostomy in severe cases (e.g. affect the growth).
- Spontaneous recovery occurs in half patients (Congenital have a chance of spontaneous recovery within **5 years**) Surgical intervention postponed until the patient become old.
- Vocal cord **lateralization.**
- Arytenoidectomy and laser cordotomy.

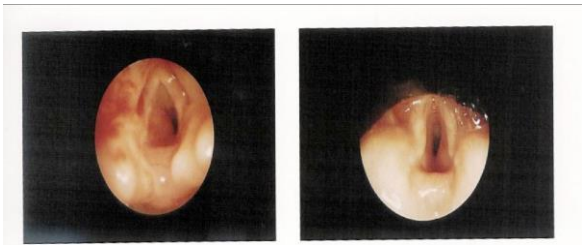
6. Subglottic Haemangioma

Congenital vascular lesion Not present at birth but grow rapidly over the first few months of life.
Hemangioma is the most common tumor in the pediatric can be anywhere in the body

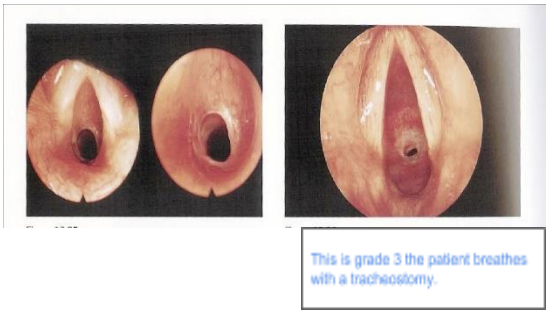
Symptoms:

- Biphasic stridor. You want to insert a scope, and it is inserted while the child is awake because you want to observe the dynamic movement which will help you with the diagnosis. so you will see the vocal cords moving ok but there is a mass that is reddish or purplish in color.
- Tend to involute slowly after **one** year.
- 50% of the patients have cutaneous haemangioma in the head and neck
- Present at age of 3 moth with progressive dysphonia

Treatment: Systemic steroid, intralesional steroid, Propranolol, laser ablation tracheostomy. The first line treatment is Propranolol(beta blocker) but it needs to be administered under the guidance of a pediatric cardiologist.



7.Congenital Subglottic Stenosis



Subglottic area is the narrowest area in the airway, stenosis if the diameter less than 4 mm in term infant.
We rarely see Congenital Subglottic Stenosis, it is mostly acquired **due to prolonged intubation (and post truma). (EXAM)**
Symptoms: depend on the degree of stenosis

- Biphasic stridor.
- Recurrent croup.

Diagnosis: Bronchoscopy, plain x--ray, HKV.
(check a picture of the rigid bronchoscope they love to bring it in the exam)
Treatment: Depend on the degree of stenosis
Grades 1 and 2: **We love to bring the grades in the exam!**

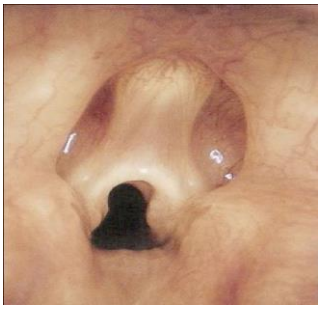
- Tracheostomy.
- Laser excision.
- Endoscopic Balloon dilation.

Grades 3 and 4:

- Laryngotracheal Reconstruction (LTR).
- Cricotracheal Resection (CTR).

- The maximum percentage of airway obstruction is determined and assigned a grade:
- Grade I <50% obstruction
- Grade II 51-70% obstruction
- Grade III 71-99% obstruction
- Grade IV no detectable lumen

8.Laryngeal web



Small web just has dysphonia.

- Weak cry
- Stridor (more common with **posterior** webs)

Treatment:

- Laser excisions
- Tracheostomy (any air way obstruction first thing to do is secure the airway)

(Extra-tracheal Compression not in dr slide 436 A2)

9.Extra-tracheal Compression Cystic hygroma:

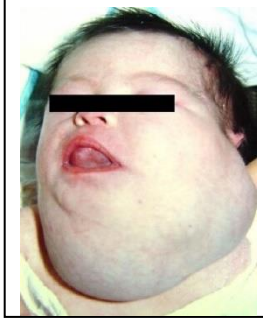
- Born with it diagnosed by antenatal US and emergency debunking surgery after delivery.
- **Difficult to intubate** sometimes to maintain the airway by oxygenate through the blood.

Definition: Lymphatic malformation arising from the vestigial lymph channels of neck.

Clinical features:
- Usually presents by age 2
- Thin walled cyst extending from floor of mouth to mediastinum, in posterior triangle or supraclavicular area.
- Painless, soft, compressible

Diagnoses:
- intra-natally by ultrasound

Treatment:
- **Surgical excision (debulking)** if it fails to regress- difficult dissection due to numerous cyst extensions.
- Cystic h ygroma is consisting of lobulated masses when they open one another one appears.



-**Mass compressing the floor of the mouth, tongue.**

- This baby is born with difficult breathing and you can't intubate him.
- both intubation and tracheostomy are difficult, so you ventilate this baby **through the blood**

- you could perform a tracheostomy and intubate this baby.

Acquired Upper Airway Obstruction:

Acquired upper airway obstructions are **more common** than congenital type. Subglottic area is the narrowest area.

Infectious Causes:

1. Peritonsillar abscess
2. Retropharyngeal abscess
3. Epiglottis
4. Croup
5. Bacterial Tracheitis

Non-Infectious Causes:

1. Foreign body aspiration
2. Acquired vocal cord paralysis
3. Acquired subglottic stenosis
4. Adenotonsillar enlargement.
5. Respiratory papillomatosis.
6. Malignancy.
7. Angioedema.
8. Caustic ingestion.
9. Trauma.
10. Laryngospasm

1.Peritonsillar abscess (not in Dr slide 436 A2)

- Common deep infection in late childhood

Symptoms:

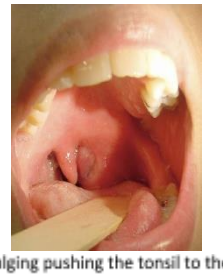
low grade fever severe sore throat, muffled voice, drooling, trismus

Diagnosis:

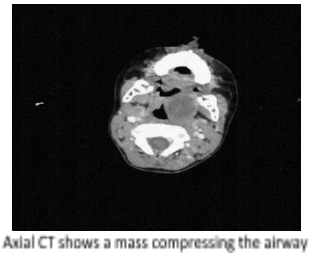
- Clinical diagnosis.
- CT scan.

Treatment:

- Aspiration
- Excision and drainage
- Later tonsillectomy
- IV ABX



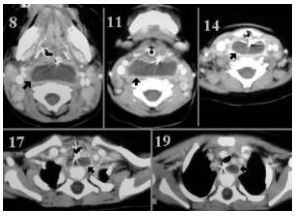
Bulging pushing the tonsil to the other side



Axial CT shows a mass compressing the airway

Case: child had tonsillitis and treated with antibiotic for 3 days then stopped, after 2 days he started getting worse drooling of saliva, can't open the mouth (trismus) and hot potato voice?

- Peritonsillar abscess (quinsy) (one of the indications of tonsillectomy)



2.Retropharyngeal abscess (not in Dr slide 436 A2)

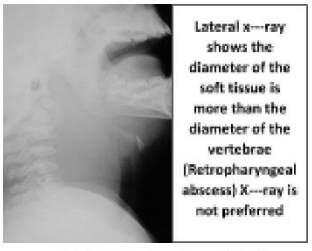
Symptoms:

Fever, cervical adenopathy, stridor torticollis, drooling.

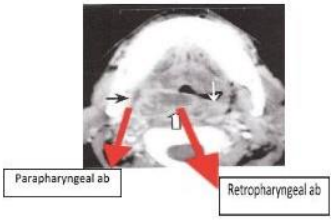
Causes: Progressive pharyngitis S.aureus, Haemophilus, group A beta haemolytic streptococcus, bacteroides.

Treatment: Intraoperative to reduce risk of swallowing and aspiration.

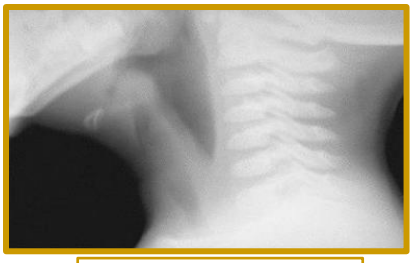
- Transoral excision and drainage.
- IV ABX.
- INTUBATION.
- Tracheotomy.



Lateral x---ray shows the diameter of the soft tissue is more than the diameter of the vertebrae (Retropharyngeal abscess) X---ray is not preferred



3.Epiglottitis (not in Dr slide 436 A2)



Thumb sign

Definition: It is an acute inflammation in the supraglottic region of the oropharynx (less acute in adults) with inflammation of the epiglottis, vallecula, arytenoids, and aryepiglottic folds. It is a life threatening rapidly progressive condition.
Causes: Haemophilus influenzae Type B. Age: 2-7 years.

Signs and Symptoms:

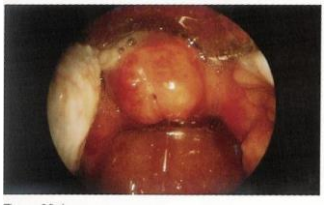
- High fever.
- **Drooling.**
- Stridor.
- Sore throat.
- Odynophagia/dysphagia.
- Muffled voice.
- "Hot potato voice", as If the patient is struggling with a mouthful of hot food.
- Adults may have preceding upper respiratory tract infection (URTI) symptoms.

Fever, sore throat, drooling, leaning forward, the child looks sick!
No examination should be done in the ER. (take to the OR and examine).

Investigation:

- Airway management. **"secure the airway!".**
- Direct visualization of the epiglottis using nasopharyngoscopy/laryngoscopy after stabilizing the patient. **"the preferred method of diagnosis".**
- Lateral neck soft-tissue x-ray. **"useful screening tool".**

The classic lateral neck radiographic findings are a swollen epiglottis (i.e., a **thumb sign**), thickened aryepiglottic folds, and obliteration of the vallecula (vallecula sign).

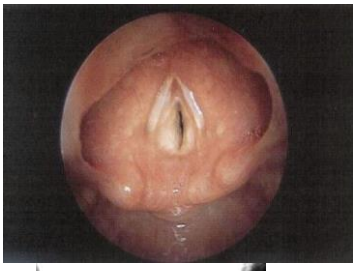


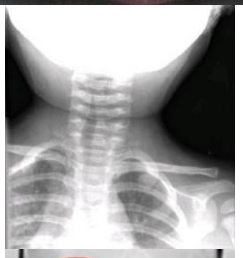
Management:

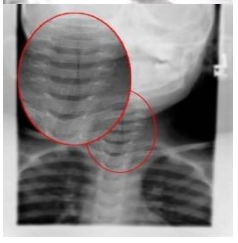
- Artificial airway "endotracheal intubation, tracheostomy, or cricothyrotomy".
- Empiric IV antimicrobial therapy.

We don't see it now because vaccination reduced the incidence of epiglottitis.

4.Croup (Laryngotracheobronchitis) (not in Dr slide 436 A2)







Steeple sign

Definition: It is a common, primarily pediatric viral respiratory tract illness generally affects the trachea and the larynx and may extend to the bronchi. Morbidity is secondary to narrowing of the larynx and trachea below the level of the glottis (subglottic area), causing the characteristic audible inspiratory stridor.
Causes: Parainfluenzae viruses (types 1, 2, 3)
Symptoms:

- Biphasic stridor. (stridor present during inspiration and expiration).
- Hoarseness.
- Fever.
- Brassy cough (loud metallic barking cough).
- No dysphagia.

Investigation: It is mainly a clinical diagnosis, chest x-ray is only indicated when the diagnosis is suspicious, or the course is atypical. A posterior-anterior chest radiograph demonstrates subglottic narrowing commonly called **"steeple sign"**.

Management:

- Vital signs assessment.
- 100% humidified oxygen and ventilation support in case of severe respiratory distress.
- Steroids.
- Nebulized racmic epinephrine.

5.Foreign Body Aspiration more in the right

Complete AW obstruction may be recognized in the conscious child as sudden respiratory distress, inability to speak or cough. "do Heimlich maneuver as ABC"

Clinical presentation:

➢ **Acute episode**: period of sudden choking, gagging, wheezing, or hoarseness.
➢ **Asymptomatic period**: cough or wheezing are possible.
➢ **Subacute stage:** Mimic different acute or chronic disease of lungs e.g. croups, bronchial asthma.
➢ **Complications**: pneumonia, obstructive emphysema and bronchiectasis

Physical examination:

Major findings include new abnormal airway sounds, such as wheezing, stridor, or decreased breath sounds. These sounds are often, but not always, bilateral.

A lack of findings upon physical examination does not preclude the possibility of an airway foreign body.

- The most common objects aspirated by young children are food products (peanuts, seeds,Corn ، فصفص).

Most imp thing is vegetable matter because if it stay there, it will cause infections.

- Beans and seeds absorb water over time.
- Inert FB (Pieces of toys causes less reaction).

Location of FB in the AW:

- Commonly the final destination is one of the main bronchi →right bronchus affected more commonly than left bronchus (the right is shorter, wider and more vertical)
- Larynx in case of sharp objects
- Trachea is there is narrowing in it.

The most feared Complication is atelectasis and in order to avoid it, PERFORM A BRONCHOSCOPY FROM THE START!

Investigations:

Radiography:

✓ Extended soft tissue neck
✓ PA, lateral chest most efficacious
✓ It can demonstrate FB, Emphysema, atelectasis of the lung
✓ A lack of findings upon physical examination does not preclude the possibility of an airway foreign body.

A ***plain x-ray*** can reveal an area of focal overinflation or an area of atelectasis, depending on the degree of obstruction.

If the plain radiography findings are not diagnostic, remember that an affected lung portion does not completely empty.

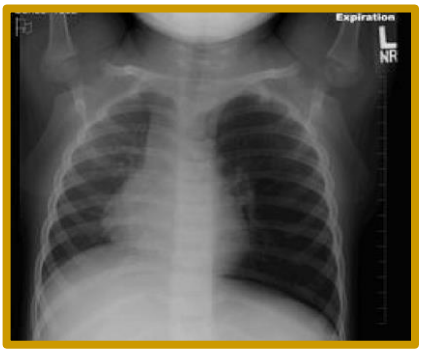
If the child cooperates, an anteroposterior expiratory radiograph may reveal trapped air in the affected portion of the lung.

In those children who cannot cooperate with the maneuver, lateral decubitus radiographs may reveal the trapped air.

Fluoroscopy and CT scanning may be used as well. If the index of suspicion is high, we can proceed to bronchoscopy. ***(Bronchoscopy is the gold standard***, because x-ray is normal most of the time because the majority of foreign bodies are plastic toys that can't be shown on x-ray)

Airway foreign bodies are removed most safely under general anesthesia using the ventilating rigid bronchoscope. (Diagnostic and therapeutic)

- (Optical) Telescopic forceps can be used for foreign bodies removal and biopsy.
- Medical history is the key for diagnosing.



- X-Ray:
  - **hyperinflation of the left lung which is clearly more lucent than the right.**
  - Shift of mediastinum and flattening of the hemidiaphragm are signs secondary to air trapping.

6.Acquired Vocal Cord Paralysis (AVCP) (not in Dr slide 436 A2)

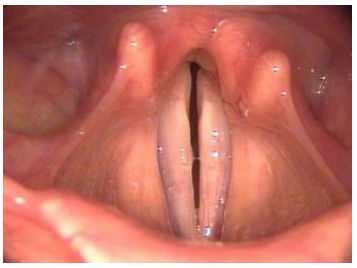
Could be unilateral or bilateral. if its unilateral it will cause dysphonia. if its bilateral, it will cause stridor.

Causes:

- Birth trauma (forceps delivery).
- Cardiac surgery (Patent ductus arteriosus repair).
- Mediastinal or neck surgery.
- Tracheoesophageal fistula repair.

Bilateral Vocal Cords Paralysis (Adducted type)

Causes:



- Surgical trauma
- Malignancies
- Endotracheal intubation
- Neurological diseases
- Idiopathic

Physical examination:

- The voice can be breathy or normal.
- Airway findings arrange from biphasic stridor to normal.

Management:

- Tracheostomy
- Posterior cordotomy (unilateral or bilateral)
- Arytenoidectomy (endoscopic or external, partial or complete)
- Cordopexy, lateralization of the vocal cords.

Note 432:

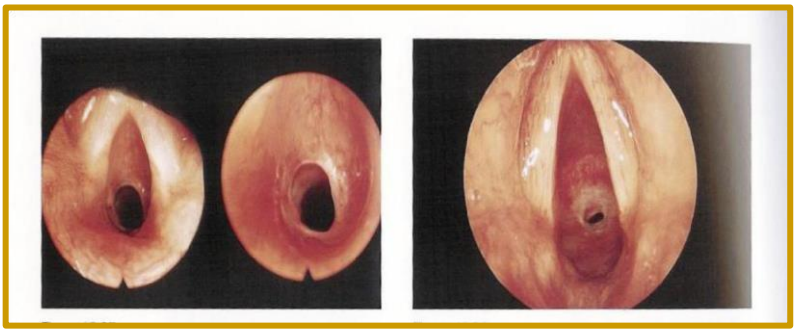
- Arytenoidectomy: partial removal of the arytenoid cartilage.
- Cordotomy: removal of the entire membranous vocal fold with the vocalis muscle.
- Bilateral vocal cords paralysis will cause obstruction, whereas unilateral paralysis will affect the voice.
- Any lesion along the course of the recurrent laryngeal nerve could cause AVCP.

7.Acquired Subglottic Stenosis

Definition: It is a partial or complete narrowing of the subglottic area.

Risk factors: (imp)

- Prolong / incorrect intubation.
- Size of the tube.
- Care of intubated patient.
- High pressure cuffs tube.
- Difficult intubations.
- Multiple intubation.
- GERD.
- Tracheobronchial infection.



Causes:

- 90%: trauma from endotracheal intubation.
- The duration of intubation and the tube size are important.
- 10%: secondary to foreign body, infection, inflammation or irritation.

432 Explanation: Usually, injury is caused by endotracheal intubation or high tracheostomy tube placement. If irritation persists, the original edema and inflammation progress to ulceration and granulation tissue formation.

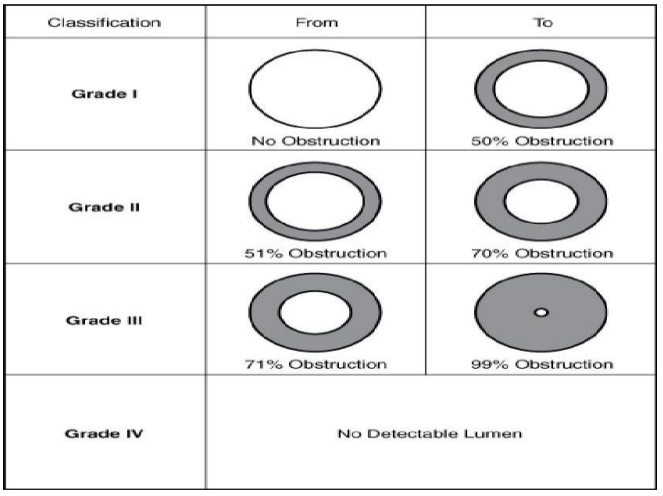
When the source of irritation is removed, healing occurs with fibroblast proliferation, scar formation, and contracture, leading to stenosis or complete occlusion of the airway.

Symptoms:

- Dyspnea (may be on exertion or rest depending on the degree of stenosis)
- Stridor
- Hoarseness
- Brassy Cough
- Recurrent pneumonitis
- Cyanosis

Investigations:

- Chest x-ray
- MRI
- Videostrobolaryngoscopy.
- Visualization of the larynx by **flexible** fiberoptic or rigid telescopic.
- Cotton-Myer Grading of Subglottic Stenosis



Management of grade I and II:

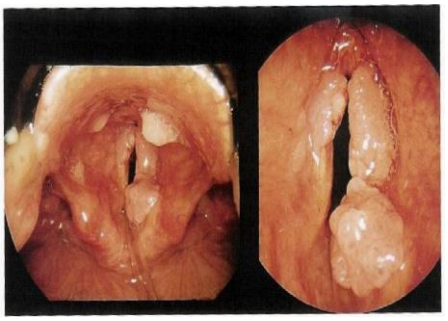
- Observation
- Balloon dilatation
- Laser excision

Management of grade III and IV:

- Tracheostomy.
- Laryngotracheal reconstruction.
- Cricotracheal resection.

8.Respiratory Papillomatosis

Definition: It is a disease caused by human papillomavirus (HPV) types 6-11. The commonest 16 and 18, associated with malignancies. Two-thirds before the age of 15 years. **Has two types juvenile and senile.**
Risk factors: of juvenile-onset respiratory papillomatosis are firstborn child, vaginal delivery, and the mother being younger than 20 years + the presence of genital warts "condyloma acuminata".



Symptoms: Symptoms of upper airway obstruction predominate because the larynx is usually affected in both types.

- Hoarseness.
- Voice changes (dysphonia). initially they come with only dysphonia when obstruction happens the other symptoms starts to appear.
- Choking episodes.
- Foreign body sensation in the throat.
- Cough.
- Dyspnea.
- Inspiratory wheeze.
- Stridor.

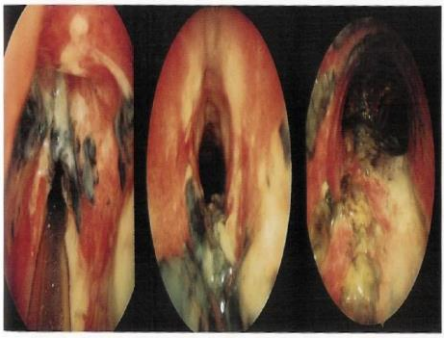
Investigation: Laryngoscopy or bronchoscopy.

Management:

- Laser excision or microdebrider
- Adjuvant therapy: Cidofovir, Acyclovir, Interferon

9.Thermal injury (not in dr slide 436 A2 but there is burn injury in **Airway Emergency)**

It is caused by aspiration of hot liquid or caustic fluid. Alkali is more dangerous of acids.
Because of the risk of rapidly developing airway edema, the patient's airway and mental status should be immediately assessed and continually monitored.



The treatment starts with securing the airway "intubation", tracheostomy ***(below in grey)*** and IV antibiotics.

Tracheostomy (433)

❖ Reported to have higher mortality rate as a result of infectious complication (pulmonary sepsis, necrotizing tracheitis, mediastinitis)
❖ Bleeding, pneumothorax, tracheal stenosis
❖ Edema of the neck results in
➢ difficult procedure
➢ inadvertent removal of the tube

Cricothryroidotomy, may establish the airway more easily

Stabilization of airway is indicated for:

I. thermal injury of trachea, and extensive burns of the face or oropharynx. Where **impending UAWO** necessitates intubation
II. Intubation for assisted ventilation is required for **inhalation injury** with changes in ABG, O2 sat, and increase CO

Once decision of intubation is made:

1) ET "endotracheal tube" should be attempted initially
2) if necessary, leave it for 3-4 wks
3) utilize this time for grafting neck burns
4) shift to tracheostomy after that if necessary

- **Airway Emergency**

A. Tumor: (most common adult laryngeal tumor is SSC) كررها اكثر من مرة

- Commonly tumors of aerodigestive tract or thyroid
- typically present with gradual airway obstruction
- initial management 0_2 humidification steroids and IV antibiotics.

- Airway stabilization:
- organization between Surgeon and Anasthatist
- avoid blind attempt of intubation
- if available, fiberoptic intubation (experience)
- percutaneous jet ventilation to stabilize patient not common procedure

-elective awake tracheostomy under local anesthesia is the safest method to secure the airway
-precipitation of complete obstruction necessitates emergent cricothyroidotomy or tracheostomy

B. TRAUMA

- Presenting SX
- Hoarseness (means at the level of vocal cord)
- Pain tenderness
- Hemoptysis
- Dysphagia
- SC emphysema IMP (it is air in subcutaneous tissue)
- Impaired respiration
- Haematoma

- **Classification of Laryngeal Trauma & Treatment:** (CALLED SCAFER CLASSIFICATION)

-Type I ما يحتاجوا شيء كثير
-minor endolaryngeal haematoma or laceration absence of detectable fracture of laryngeal skeleton

Management:
-24 / 48 hours observation in ICU
-head of bed elevated
-humidification & systemic steroids

-Type II
-edema, haematoma, mucosal disruption no exposed cartilage, no displaced fracture

Management:
- tracheostomy under local anaesthesia
- CT scan to R/O displaced fracture اذا ما شفت في الاشعة كسر و متحرك العظم لا تسوي لهم شيء

-TYPE III
-massive edema with large mucosal laceration, exposed cartilage, displaced fracture رجعه مكانه اذا متحرك العظم
V.C. motion impairment

Management:
- tracheostomy
- laryngoscopy
- exploration and repair

-TYPE IV
-same as III but more severe

Management:
- explore and repair
- require endolaryngeal stent

C. BURN PATIENT

- airway management is controversial
- considering the choice of airway
- Oral or nasal endotracheal tube
  - Mayexacerbate existing thermal injury
  - Inadvertent extubation is a potential disaster
  - When facial grafting is necessary tube and ties will limit the access
  - Tube obstruction occur more frequent

- Tracheostomy Reported to have higher mortality rate as a result of infectious complication (pulmonary sepsis, necrotizing tracheitis, mediastinitis steroid)
- Bleeding, pneumothorax, trancheal stenosis
- Edema of the neck results in
  - difficult procedure
  - inadvertent removal of the tube

-Cricothryroidotomy, may establish the airway more easily

- Stabilization of airway is indicated for thermal injury of trachea, and extensive burns of the face or oropharynx. Where impending UAWO necessitates intubation
- Intubation for assisted ventilation is required for inhilation injury with:
- changes in ABG, O_2 sat, and increase CO_1

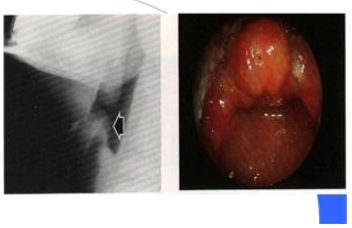
- Once decision of intubation is made:
- ET should be attempted initially
- if necessary, leave X 3-4 wks
- utilize this time for grafting neck burns
- shift to tracheostomy after that if necessary

D. SUPRAGLOTTITIS / EPIGLOTTITIS: دايم تجي في الاختبارات

-Paediatric: by H. influenza
- sudden onset
- rapidly progressive course
- high fever, respiratory distress
- drooling, painful swallowing

-ADULT: by staph auras
- dysphagia, severe sore throat
- fever, stridor, voice change

If u see child with this pic don't examin him and take hime to OR >>he may loss the airway



PART 2:

Surgical Technique بصراحة ما نسالكم عن تفاصيلها كثير، نسال عنها الريزيدنت و اهم ثنتين هم كريكوثيرودتمي و تارقيوتومي ()

1. Trans-tracheal needle ventilation (not do it any more)

where immediate ventilation is required, can support ventilation for several hours Technique: 12, 14- or 16-gauge cannula
& high press ventilation system (50 p.s.I) attached Complications:

1. failure to establish an AW
2. Misplaced catheter in soft tissue of the neck (esp. in children) "high mobile and soft "
3. pneumo-mediastinum
4. pneumothorax

Total obstruction of the airway prevents adequate ventilation

2. Cricothyroidotomy imp

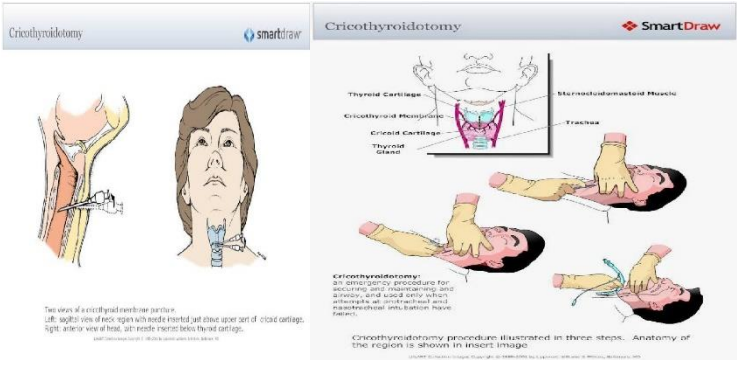
Definition:

Cricothyrotomy (also called cricothyroidotomy) is a procedure that involves placing a tube through an incision in the cricothyroid membrane to establish an airway for oxygenation and ventilation

Indications:

Cricothyrotomy is indicated when an ***emergency*** upper airway obstruction is required and orotracheal or nasotracheal intubation is either unsuccessful or contraindicated. ***Elective*** for head & neck or cardiovascular procedures where access to the tracheal rings is limited *"you can't do tracheostomy"*
المستشفيات لانها تسبب epiglottis stenosis(اغلب اللي يسوونها هم الجنود اللي ساحة الحرب لانها اسرع ، لكن حنا ما نحبها في)

- Intubation is not possible (difficult intubation).
- Need to avoid neck manipulation.
- Severe maxillofacial trauma.
- Edema of throat.
- Severe oropharyngeal/tracheobronchial hemorrhage.
- Foreign body in upper airway.
- Lack of equipment for endotracheal intubation.
- Technical failure of intubation.



There are no absolute contraindications.

Relative contraindications: possible or known traction of the trachea, laryngotracheal disruption with traction of the distal trachea into the mediastinum, and fractured larynx.

Complications:

Emergency surgical cricothyrotomy has a much higher complication rate than elective cricothyrotomy. This is likely because emergency cricothyrotomy is performed on critically ill patients with difficult airways under emergency conditions.

• Laceration of the thyroid cartilage, cricoid cartilage, or tracheal rings. • Perforation of the posterior trachea. • Unintentional tracheostomy. • Passage of the tube into an extra-tracheal location (ie, false tract). • Infection. • **Intra/postoperative bleeding.**	• **Subglottic/ laryngeal stenosis.** (especially in children) • **Dysphonia/hoarseness.** • **Pulmonary aspiration.** • **Tracheal stenosis.** • **Recurrent laryngeal nerve injury.** • Injury of anterior jugular vein, great vessels

3. Tracheostomy very imp

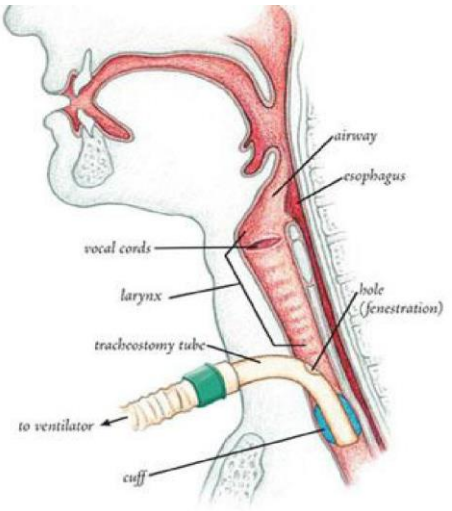
Definition:

Tracheostomy is an operative procedure that creates a surgical airway in the cervical trachea. **In emergency tracheostomy** vertical incision is preferred (اسرع و اسهل لكنها تسوي ندبة كبيرة) . (hyperextension then done between the second and third tracheal ring or third and fourth)

HORIZONTAL INCISION (نسويها اذا كان عندنا الوقت الادوات المناسبة لان فيه رسك)

Advantages: improve cosmetic appearance and may avoid neck dissection wound

Disadvantages: risk of neurovascular injury AND may limit tracheal elevation during swallowing



Indications: (Every exam includes the indications and complications 435dr notes)

- Congenital anomalies like laryngeal hypoplasia.
- Upper airway foreign body.
- Supraglottic or glottis pathology like infection, neoplasm, bilateral vocal cord paralysis.
- Neck trauma results in severe injury to the thyroid or cricoid cartilages.
- Subcutaneous emphysema.
- Facial fractures that may lead to upper airway obstruction.
- Upper airway edema from trauma, burns, or anaphylaxis.
- Vertical vs horizontal tracheostomy incision,
  vertical advantage: limited injury of vascular and neural structure, improve access of trachea (easy retraction of soft tissue) disadvantage potential scar formation, risk of communication with neck wound (apron flap). Horizontal advantage: improve cosmetic appearance, may avoid neck dissection wound, disadvantage: risk of neurovascular injury, may limit tracheal elevation during swallowing

Complications:

Immediate	Early	Late
• Hemorrhage, e.g. from thyroid isthmus. • Hypoxia • Trauma to recurrent laryngeal nerve.(through lateral dissection) • Damage to esophagus (dissection). • Pneumothorax. • Subcutaneous emphysema.	• Tube obstruction or displacement. • Aspiration. • Bleeding from tracheostomy site. • Infection.	• Airway obstruction with aspiration. • Tracheomalacia. • Aspiration and pneumonia. • Fistula formation, e.g. tracheocutaneous or tracheoesophageal. • Damage to larynx, e.g. stenosis.

432 notes:

- Imperfect positioning and suturing could lead to the development of subcutaneous emphysema and pneumothorax. So, you should suture the trachea from outside.
- Big skin incision + big tracheal incision = increased risk of emphysema.Also, strong ambu bagging could cause pneumothorax.

Assessment of Child with Upper Airway Obstruction

- Rapid airway assessment: to identify those who needs resuscitation depending on the presenting signs and symptoms of: complete upper airway obstruction, rapidly progressing partial airway obstruction, or respiratory failure.
- **History:**
  - Age.
  - Speed and onset of precipitating event. "immediately after birth or not"
  - Associated symptoms (fever, drooling, hoarseness).
  - Feeding difficulty. Relation of airway problem to feeding and position. this is very important for treatment decision.
  - Past medical history (birth trauma, intubation).
  - Characteristic of cry "reflects the status of vocal cords"
  - History of previous intubation.
  - Questions about possible aspiration of FB "high index of suspicion"
- **Physical examination:**
  - Vital signs
  - The patient's position. (sniffing position in significant airway obstruction).
  - Craniofacial anomalies.
  - Cutaneous hemangiomas.
  - Neck mass.
  - Growth chart.
  - Complete ENT examination.
  - Flexible fiberoptic examination.
  - Endoscopy is the tool of examination.
- **Physiological studies:**
  - ABG: late indicator of AWO, should not be used routinely to assess degree of obstruction
  - Spirometry.
  - Flow volume loop
- **Imaging:**
  - Radiological evaluation indicated for patient without respiratory distress
  - Plain views -soft tissue neck -chest
  - Mobile pharyngeal tissue may bulge during expiration in normal infant
  - High kilovoltage technique (croup series) AP view assesses subglottic region
  - Fluoroscopy: dynamic air way change
  - Chest x-ray (foreign bodies).
  - High kilovoltage imaging (subglottic stenosis).
  - CT scan (Choanal atresia, retropharyngeal abscess, tumor), good in assess mediastinum.
  - Barium swallow (vascular ring) and assess swallowing
  - MRI
    - Shallow rapid breathing >>>patient about to collapse.
    - The characteristic of cry reflects the integrity of vocal cord.
    - ABG usually is for chronic conditions.
    - Epiglottitis and subglottis caused by H.influenzae type B.
    - Dynamic obstruction >>> use fibrotic endoscopy.
- **Endoscopic evaluation:**
  - Mirror examination: is not endoscopic, in older children and adult can provide information about hypopharynx and larynx
  - Telescopic examination: 1-fibroeptic endoscope: excellent to assess the movement of vocal cord 2-rigid bronchoscopy: done under GA, may enable removal of FB, assess the air way down to the main stem bronchi

- **Therapeutic options:**
  - Observation/medical support: ICU, airway team availability, oxygenation, steroid, antibiotic
  - Heimlich maneuver
  - N.P.airway
  - Oral airway
  - Esophageal airway
  - Transoral intubation
  - Nasal intubation
  - Flexible fibroptic intubation
  - Transtracheal jet ventilation
  - Cricothyroidotomy
  - tracheostomy

MCQs

1- A 12--year--old girl is complaining of left unilateral nasal obstruction worse on expiration for 5 months. Examination of the nose showed a single pale grayish glistening pedicled mass in the posterior part of the left nasal cavity. A CT showed pacification of the left nasal cavity, maxillary sinus and the nasopharynx.
What is the most likely diagnosis?
A. Antro--choanal polyp
B. Inferior turbinate enlargement
C. Mucocele

2- A 4-years-old child presented in the ER with mild respiratory distress. On laryngoscopy, she was diagnosed with multiple juvenile papillomatosis of the larynx.
Next line of management is:
A. Tracheostomy
B. Microlarynoscopy
C. Steroids
D. Antibiotics

3- A patient presented with stridor and dyspnea which he developed after attack of upper respiratory tract infection. On examination he was found to have a 3-mm glottis opening. All of the following are used in the management except:
A. Tracheostomy
B. Arytenoidectomy
C. Teflon injection
D. Cordectomy

4- Steeple sign seen on posteroanterior view of neck in a child with stridor is indicative of:
A. Acute epiglottitis
B. Acute laryngotrachacheobronchitis
C. Laryngeal papillomatosis
D. Bilateral abductor paralysis

5- A 3-year-old boy came to the ER with abrupt onset of fever "40 degrees", respiratory distress and stridor. On examination, the boy appears actually ill. He is sitting, leaning forward with her mouth open and drooling.
What's the most likely diagnosis?
A. Epiglottitis
B. Pneumonia
C. Adenoiditis
D. Asthma

Answers:

1.	A
2.	A
3.	C
4.	B
5.	A

Golden NOTES
MCQs

1-A child was playing with his toys when he suddenly started chocking and coughing and cyanosed. His airway is patent. His parents took him to the hospital. What is the best management?

A- Bronchoscope.
B- Cricthyroidotomy.
C- Tracheostomy.
D- Observe

The Answer: C

2-27-years old male had rod traffic accident with history of intubation at that time in the ICU for two months. Multiple trails of extubation were done but they failed. A tracheostomy was done for him. What is the most likely underlying cause for failure of intubation?

A- Laryngeomlacia.
B- Subglottic stenosis.
C- Tracheomalacia.
D- Vocal cord paralysis.

The Answer:B

3- A New born child had cyanosis and difficulty breathing immediately after delivery. The cyanosis improves with crying. Which of the following is the most likely diagnosis?

A.Enlarged Adenoid
B.Laryngomalecia
C.Laryngeal web
D.Bilateral coanal atresia

Answer: D

4- 3 months old baby brought to the emergency department by his parents because of noisy breath (stridor) which is not effected by position. No cyanosis, no history of previous intubation and the voice is normal. Systemic review revealed cerebral palsy. What's most likely diagnosis?

A- Laryngeal web
B- laryngomalacia
C- subglottic stenosis
D- Bilateral vocal cords paralysis.

Answer: A (not sure)

5-A young patient presented with sore throat for which he took antibiotics and it did not work. Examination showed temperature of 38.9c and swollen tonsillar lymph nodes. CBC showed lymphocytosis.
What is the diagnosis?

A- Infectious mononucleosis B- Acute diphtheria
C- Vincent's angina D- Quinsy abscess

Answer: A

6-A 28 y.o female complaining of right neck mass. Clinically euthyroid, on examination 4 cm right solid nodule, 3 cm left nodule. FNA shows follicular carcinoma, Wthat is the recommended treatment?

A- thyroid replacement therapy
B- thyroidectomy
C- repated aspiration

Answer: B

SAQs

1-Case: picture of baby with skin rash "hemangioma" and history of stridor?

Q: what is the diagnosis?
Q: how would you investigate it?

2-picture of tracheostomy tube:

Q: identify it?
Q: indications?

3-foreign body (dysphagia, odynophagia)

site in the pic? management?

4-bilateral choanal atresia

diagnosis? management?