433 Teams

ENT

22 & 23

Airway Obstruction I & II

Color index:

432 Team – **Important** – **433 Notes** – **Not important**

ent433team@gmail.com

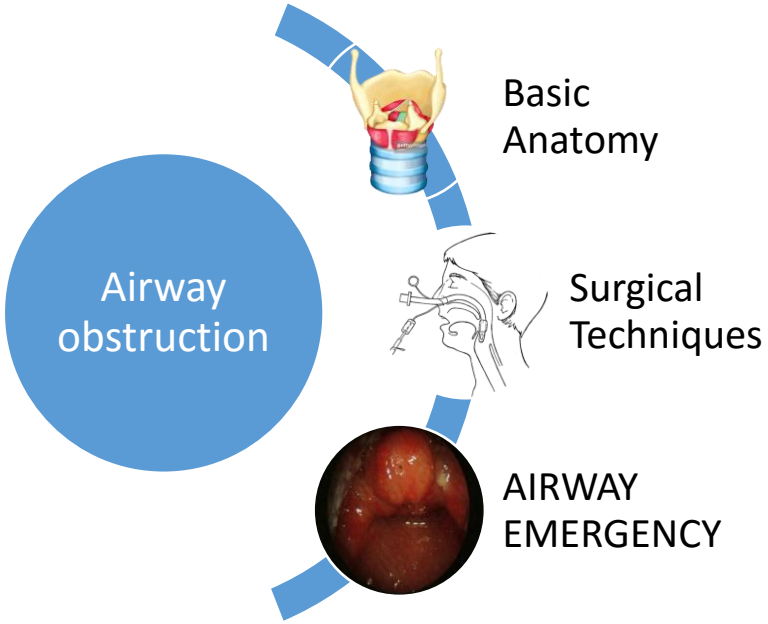
Objectives

- 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 complications.

Warning

This work is based on dr.Alammar's lecture and group A1 and A2 notes only

We also recommend reading larynx lecture before this lecture for better understanding of anatomy and physiology .



AW = Airway

Basic Anatomy

Infant & Pediatric larynx

- position is higher at birth compered to adults .
- epiglottis lying at the nasopharynx: make neonate an obligate nasal breather 4-6 months
- cartilage & soft tissue are more soft .
- **Soft tissue :**
  - less adherent to the underlying cartilage "mild trauma leads to large edema"
  - susceptible to collapse
  - less resistant to develop submucosal edema
- Omega shape Epiglottis "curved"
- Subglottis is the narrowest part of AW in children and non expandable. In adults glottis is the narrowest. **MCQ**

TRACHEA

- consists of 16 to 20 incomplete cartilaginous rings . "complete in pediatric "
- the posterior wall is a membranous part . "help expanding in swallowing"
- length is approximately 11 cm .
- diameter 19 mm male , 16 mm female .

Pediatric trachea:

Diameter: At Birth 6 , 6 mons 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

Notice the incomplete rings

Signs of Airway Obstruction

1. **Stridor**: is harsh high pitched musical sound produced by turbulence of air flow through a partial obstruction of the AW .
   - Stridor is a very important sign of UAW "upper airway" obstruction
   - It indicates: pathologic narrowing of AW, potential respiratory obstruction, even death
   - If inspiratory, the obstruction is supraglottic , e.g : laryngomalacia
   - If expiratory, the obstruction is in the infra-thoracic trachea
   - If biphasic , the obstruction is between the two areas , most dangerous
2. flaring of the nasal alae
3. retraction of the neck, intercostal and abdominal muscles
4. Dyspnea
5. Tachypnea
6. Restlessness
7. Cyanosis
8. Subcutaneous emphysema "escaped air from the lumen of the airway"

Diagnostic assessment

HISTORY

Before taking history you must do "ABC" to make sure that the patient is stable , if not you must give priority to secure the airway , like shallow and rapid breathing in children

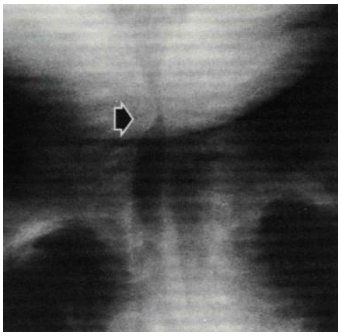
- ✓ Time of onset "immediately after birth or not"
- ✓ Possible trauma
- ✓ Characteristic of cry "reflect the status of vocal cords"
- ✓ Relation of airway problem to feeding and position
- ✓ History of previous intubation
- ✓ Questions about possible aspiration of FB "high index of suspicion"

❖ **If stridor is present since birth:**
- ➢ congenital laryngomalacia 60%
- ➢ subglottic stenosis
- ➢ vocal cord paralysis
- ➢ vascular rings

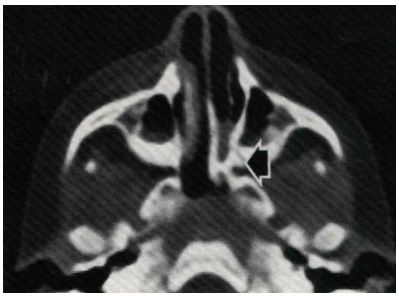
❖ **If onset of stridor is gradual and progressing**:
- ➢ subglottic hemangioma appears between 1-3 months of age
- ➢ papilloma of the larynx appears at 6 months of age

RADIOLOGIC EVALUATION

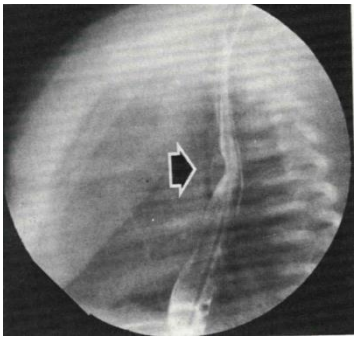
- Indicated for patient **without** respiratory distress "don't waste time"
- In case of respiratory distress, it is an emergency and you have to intervene
- **Plain views :** soft tissue neck A.P. lateral and chest
  - Mobile pharyngeal tissue may bulge during expiration in normal infants
- High-kilovoltage technique (croup series) AP view assesses subglottic region
- **Flouroscopy**: dynamic AW changes "real time"
- **Barium swallow :**
  - Assess swallowing
  - R/O "roll out" presence of vascular rings
- CT scan : good in evaluating mediastinum
- MRI



High-kilovoltage technique
shows signs of obstruction
hemangioma



CT scan
shows signs of obstruction
Choanal atresia



Barium swallow
shows signs of obstruction
apparent pulmonary artery

ENDOSCOPIC EVALUATION

Mirror Examination: is not endoscopic. Used In older children and adults .

can provide information about hypopharynx and larynx and movement of vocal cords.

Telescopic Examinations:

- **Fibroeptic Endoscopy "flexible":**

  excellent to assess the movement of vocal cords. "nose, pharynx, larynx and trachea"

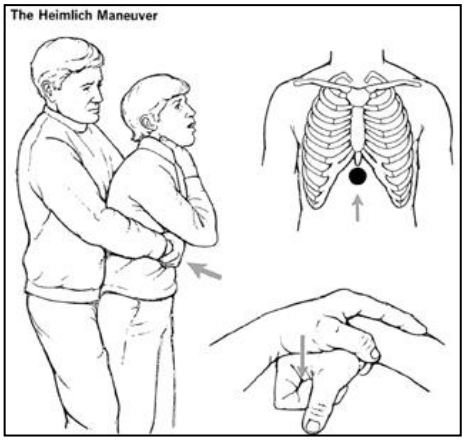
- **Rigid bronchoscopy :**
  - ✓ done under GA "general anesthesia"
  - ✓ may enable removal of FB "foreign body" "and taking biopsy"
  - ✓ assess the AW down to the main stem bronchi

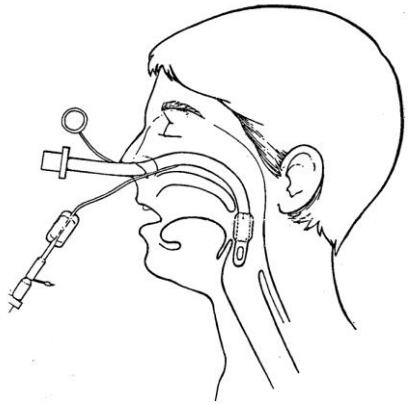
OTHER DIAGNOSTIC MEASURES

- **Flow volume loop** "part of pulmonary function test"
- **ABG** "arterial blood gasses"
  - late indicator of AWO
  - should not be used routinely to assess degree of obstruction

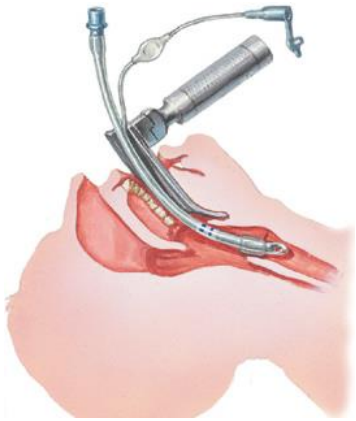
THERAPEUTIC OPTIONS

1. Observation/Medical Support
   - ✓ ICU
   - ✓ Airway team availability
   - ✓ Oxygenation
   - ✓ Steroids "reduce edema"
   - ✓ Antibiotics
2. Heimlich maneuver
3. N. P. Airway
4. Oral Airway
5. Esophageal airway
6. Trans-oral intubation
7. Nasal intubation "more natural, good in case of cervical neck injury "
8. Flexible fibroptic intubation
9. Trans-tracheal jet ventilation "Trans-tracheal needle ventilation "
10. Cricothyroidotomy
11. Tracheostomy





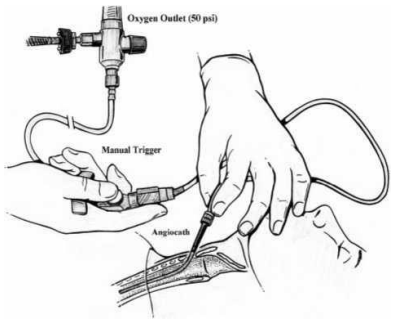
Nasal intubation



Trans-oral intubation

Surgical Techniques

Trans-tracheal needle ventilation



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

Complication :

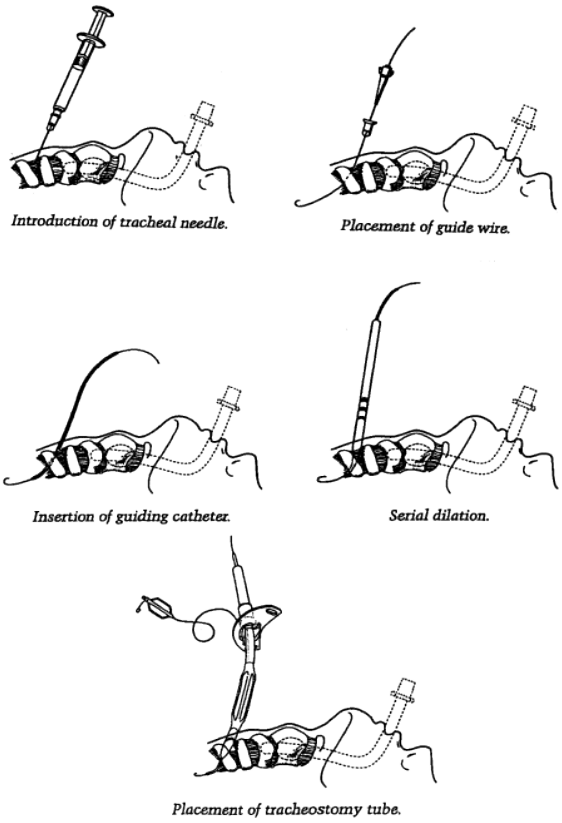
A. failure to establish an AW
B. misplaced catheter in soft tissue of the neck (esp. in children) "high mobile and soft"
    - pneumo mediastinum
    - pneumothorax
C. total obstruction of the airway prevents adequate ventilation

Percutaneous Tracheostomy "skipped by doctor"

Passing needle, guide wire, series of dilators and the tube

Complications :

I. difficulty with dilatation
II. failed intubation
III. excessive bleeding
IV. pneumothorax
V. false passage of the tube
VI. accidental decannulation
VII. tracheoesophageal fistula



Cricothyroidotomy "laryngectomy"

Indications:

generally, for emergency UAO (failed or contraindication intubation)

elective for head and neck or cardiovascular procedures

where access to tracheal rings is limited "you can't do tracheostomy"

Procedure :

may utilize horizontal or vertical incision

use small trach. tube or endotracheal tube

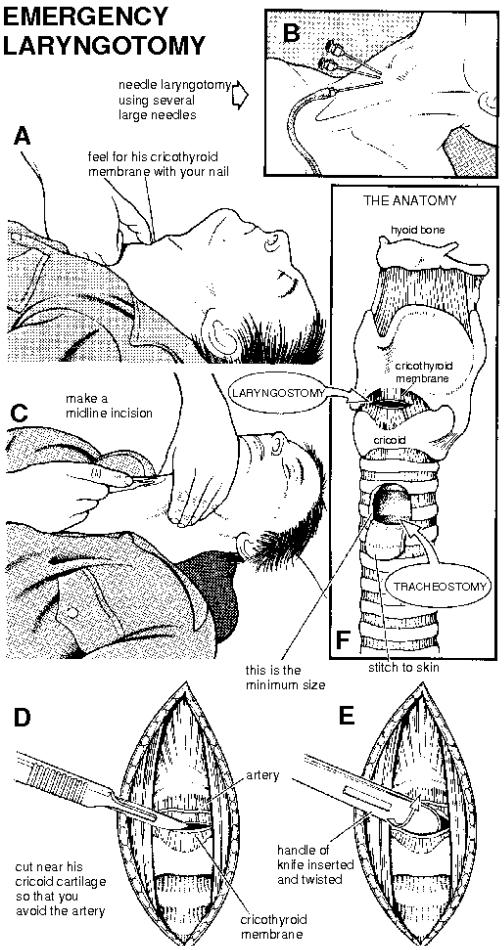
Complications :

injury of anterior jugular vein, great vessels

injury of recurrent laryngeal nerve

subglottic and laryngeal stenosis (especially in children)

"because the cricothyroid membrane not fully developed"

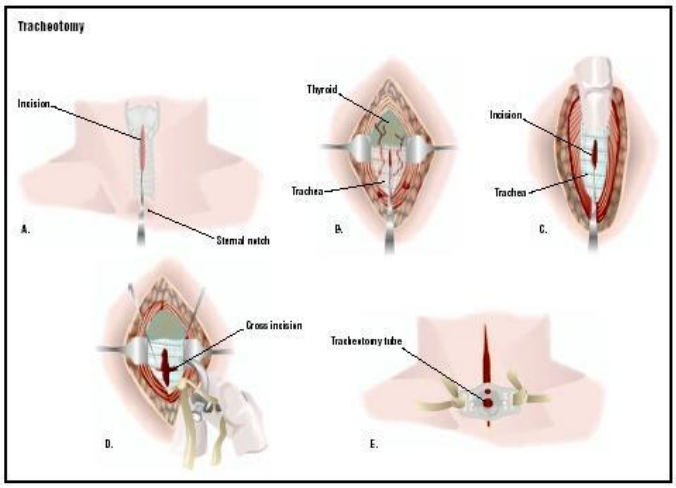


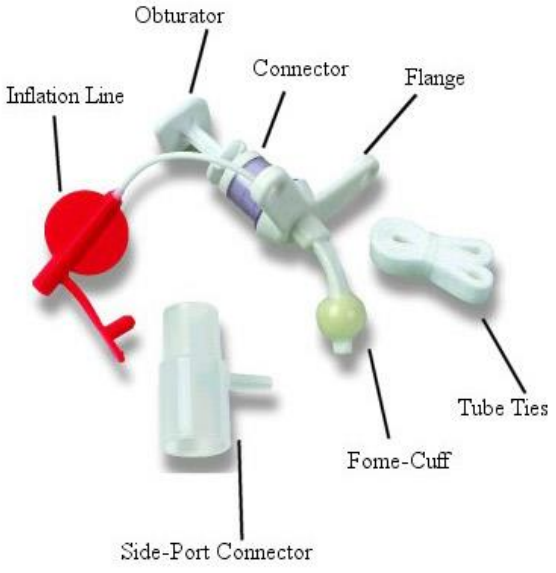
Tracheostomy

Indications :

for emergency or elective-airway obstruction acute or chronic-airway obstruction "main surgical way"

in emergency tracheostomy: vertical incision is preferred





Vertical Vs Horizontal Tracheostomy "skipped by doctor"

I. **VERTICAL**
   - Advantages :
     - limit injury of vascular and neural structure
     - improve access of trachea (easy retraction of soft tissue)
   - Disadvantages :
     - potential scar formation
     - risk of communication with neck wounds (e.g. apron flap)

II. **HORIZONTAL**
   - Advantages :
     - improve cosmetic appearance
     - may avoid neck dissection wound
   - Disadvantages :
     - risk of neurovascular injury
     - may limit tracheal elevation during swallowing

All these considerations are theoretical, No sound evidence to support one incision over the other

AIRWAY EMERGENCY

Tumor

commonly tumors of aero-digestive tract or thyroid

typically present with gradual airway obstruction

initial management :

O_2, humidification, steroids "for edema" and IV antibiotics "secondary infections"

Airway stabilization :

- organization between Surgeon and Anesthetist "make a plan"
- avoid **blind** attempt of intubation "it will make it worse"
- if available, fiber-optic intubation (experience)
- percutaneous jet ventilation to stabilize patient "might be used"
- **elective** awake tracheostomy under local anesthesia is the safest method to secure the airway
- precipitation of complete obstruction necessitates emergent cricothyroidotomy or tracheostomy

TRAUMA

Presenting signs and symptoms :

a. Hoarseness
b. Pain tenderness
c. Hemoptysis
d. Dysphagia
e. Sub-cutaneous emphysema
f. Impaired respiration
g. Haematoma

Classification of Laryngeal Trauma & Treatment: "you don't need to memorize it"

	Type I	Type II	Type III	Type IV
Definition	• Minor endolaryngeal haematoma or laceration • absence of detectable fracture of laryngeal skeleton	• edema, haematoma, mucosal disruption • no exposed cartilage, no displaced fracture	• massive edema with large mucosal laceration, exposed cartilage, displaced fracture • vocal cords motion impairment	• same as III but more severe
Management	1. 24 / 48 hours observation in ICU 2. head of bed elevated 3. humidification & systemic steroids	1. tracheostomy under local anesthesia 2. CT scan to R/O displaced fracture	1. Tracheostomy 2. Laryngoscopy 3. exploration and repair	1. explore and repair 2. require endolaryngeal stent

BURN PATIENT

airway management is controversial considering the choice of airway .

Oral or nasal endotracheal tube :

- May exacerbate existing thermal injury
- Inadvertent extubation is a potential disaster "because possible of edema"
- When facial grafting is necessary, tube and ties will limit the access
- Tube obstruction occur more frequent "because of thick secretions"

Tracheostomy

- 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

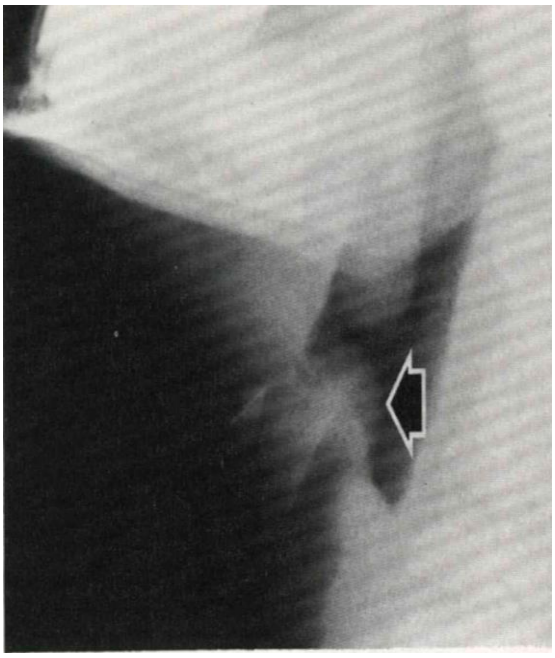
SUPRAGLOTTITIS / EPIGLOTTITIS

Pediatric :

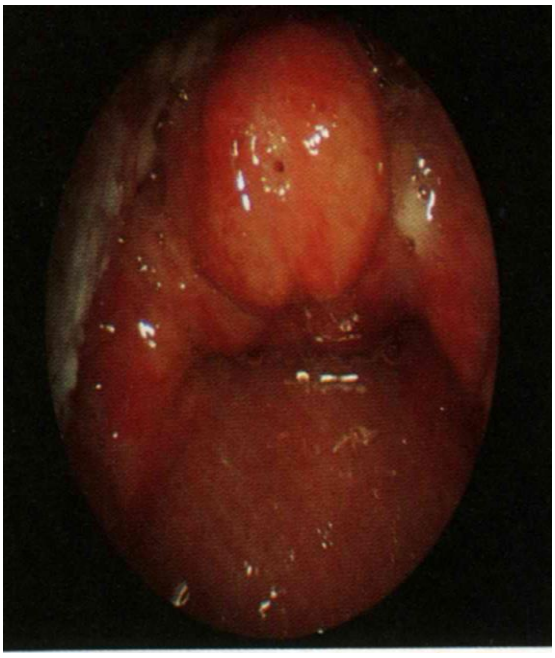
- H.influenzae type B is the commonest cause "common MCQ"
- sudden onset
- rapidly progressive course
- high fever, respiratory distress
- drooling, painful swallowing
- don't examine the patient in uncontrolled environment nor send him to X-ray if you suspect epiglottitis , secure the airway first
- **Management:**
  - secure airway (ET tube , tracheostomy)

ADULT :

- dysphagia, severe sore throat
- fever, stridor, voice change
- **Management :**
  - frequently observed in an ICU
  - may need intubation
  - 2nd generation cephalosporin as empirical treatment



X – ray
shows signs of epiglottitis
thump sign



endoscopy
shows signs of epiglottitis

FOREIGN BODY

Death from FB aspiration in USA is about 3000 per year for all ages

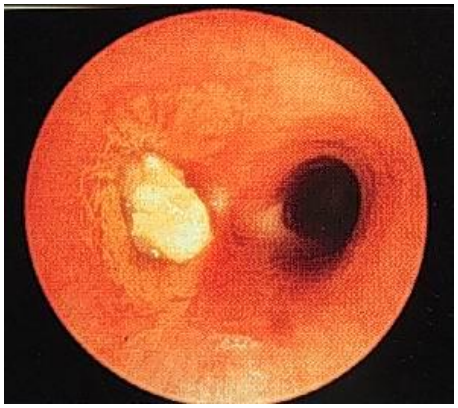
Complete AW obstruction may be recognized in the conscious child as sudden respiratory distress, inability to speak or cough . "do Heimlich maneuver as ABC"

Types of Foreign Bodies "FB": "affect diagnosis and treatment "

- vegetable matters are the most common in the children's AW
- metal
- plastic

Location of FB in the AW :

- commonly the final destination is one of the main bronchi right more common than left "more vertical and wider"
- Larynx in case of sharp objects
- Trachea if there is narrowing in the trachea



Foreign body in the main bronchi

PRESENTATION

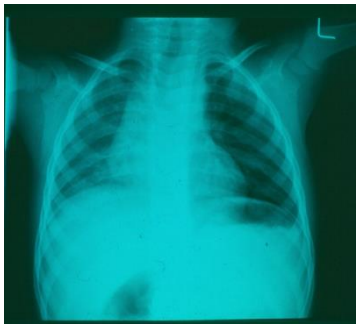
- **Acute:** Usually coughing, choking, gaging and wheezing
- No symptoms or signs "incidental"
- **Subacute stage:** Mimic different acute or chronic disease of lungs e.g. croups, bronchial asthma.
- **Stage of complications** "abscess or perforation"

Chest X-ray inspiratory phase Shows normal lungs

DIAGNOSIS

Radiologic:

- ✓ extended soft tissue neck
- ✓ PA, lateral chest most efficacious
- ✓ It can demonstrate FB, Emphysema, atelectasis of the lung



Chest X-ray expiratory phase Shows entrapped air in L lung FB in the L main bronchi

Management "gold standard"

Endoscopic removal is both diagnostic and therapeutic

That is why you must take two x-rays inspiratory and expiratory

LARYNGOMALACIA

Accounts for 60% of laryngeal problems in newborn

Due to flaccidity or incoordination of supra laryngeal cartilages which are pulled inside the lumen during inspiration leading to UAW obstruction

Characterized by stridor in the first few weeks "inspiratory stridor"

Cause is unknown, possible causes : "skipped by doctor"

- edema of the Aryepiglottic folds and loose suspension of the epiglottis.
- Embryologically, rapid growth of the third branchial arch causes the epiglottis to curl open itself forming an omega shape.
- Neurologic immaturity of Brainstem & vagus lead to infolding of the arytenoids in the AW

Diagnosis

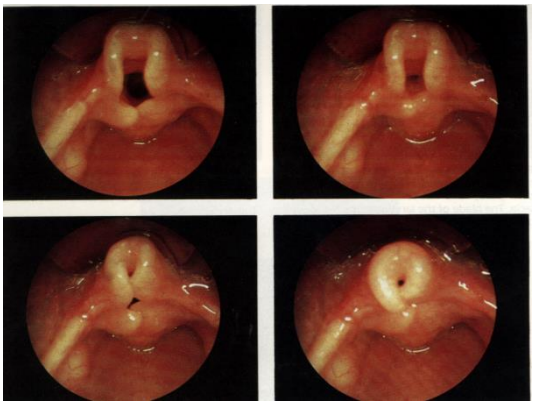
- ✓ can only be confirmed by direct observation of movement of supraglottis during respiration
- ✓ fibroeptic evaluation is the most appropriate method of visualization
- ✓ Radiologic evaluation by (high voltage X-ray PA lateral) may help in excluding the presence of associated AW problem: e.g. SGS , Innominate artery compression.

Complication

1) Feeding difficulty
2) Failure to thrive "most sensitive"

Treatment

- ❖ Reassurance "mostly self-limited"
- ❖ Infant can outgrow this problem
- ❖ Tracheostomy for severe cases "but high mortality"
- ❖ Epiglottoplasty for severe cases "best"



One photo will not be enough to mimic real time inspiration

SUBGLOTTIC STENOSIS

It is a narrowing of the subglottis "SG"

in newborn SG diameter of less than 3.5 mm "narrow"

Types of Subglottic Stenosis :

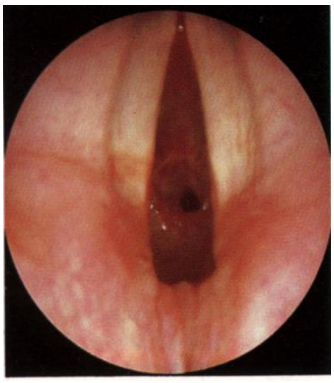
- Congenital
- Acquired - the commonest "caused by intubation"

Presentation

- Mild cases may present as recurrent croup secondary to URTI
- Generally present with symptoms and signs of UAW obstruction.

EVALUATION

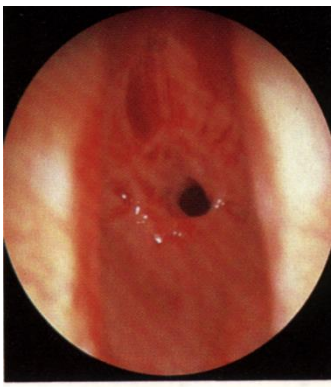
- Plain film of the neck (high KV) "X-ray"
- MRI - for difficult cases
- confirm the diagnosis by endoscopy



Endoscopic view

MANAGEMENT

- Endotracheal intubation
- Tracheotomy "best for kwon cases in ER" "below the stenosis"
- Cricothyroidotomy
- **Endoscopic Techniques :**
  A. dilatation
  B. laser
- **Open Surgical Technique :** "severe cases"
  I. Cricoid split
  II. Laryngotracheoplasty + Rib graft + stent
  III. Resection and primary anastomosis



Choanal atresia

Uncommon anomaly 1/ 5000- 8000

Unilateral: present late

Bilateral: birth emergency "because neonates are obligate nasal breather"

Mixed bone-membranous Choanal atresia "CA" account for 90% , Remaining bony CA

CA may be associated with other anomalies in 20-50% of cases :

- **CHARGE** "**C**oloboma, **H**eart anomalies, choanal **A**tresia, **R**etardation of growth and development, **G**enital and/or urinary abnormalities and **E**ar anomalies"
- **VATER** "**VACTERL**" "**V**ertebral anomalies, **A**nal atresia, **C**ardiac defects, **T**racheoesophageal fistula and/or Esophageal atresia, **R**enal & Radial anomalies and **L**imb defects "
- **craniofacial anomalies**

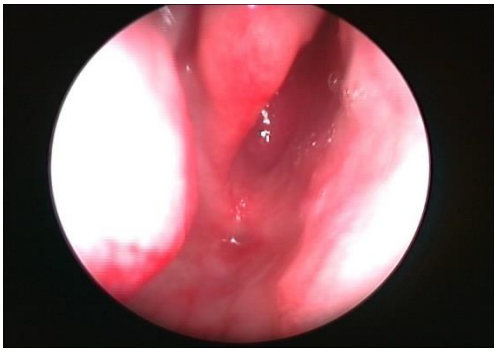
Examination

Infants : failure to pass # 6- 8 catheter ,pyriform aperture stenosis (1 CM), choanal atresia (3.5 cm) "measuring from the opining of the nose"

Fiberoptic nasoscope

Surgical repair of CA

- **Many approaches :**
  - Transpalatal
  - Transnasal
  - transantral
  - trans-septal
- **Endoscopic repair**
  - outcome is variable
  - Success rates reported to range between 20-80%



Nasoscope shows Choanal atresia

Respiratory Papillomatosis

Caused by human papilloma virus (HPV) types 6 and 11

vary from hoarsens and breathing difficulty to AWO

Management:

Laser excision or microdebrider

Adjuvant therapy: Cidofovir

Laryngeal web "glottic web"

Patient born with hoarsens and breathing difficulty

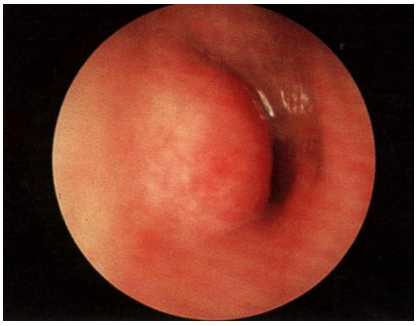
Less than 35% = hoarsens only

More than 35% = breathing difficulty

Diagnosis by laryngoscope

Treatment by surgical deviation

Subglottic heamangioma



Treatment is Beta blockers like propranolol

Done By:

Abdulmalek AlQahtani