



EAR, NOSE AND THROAT

(18) Airway Obstruction II

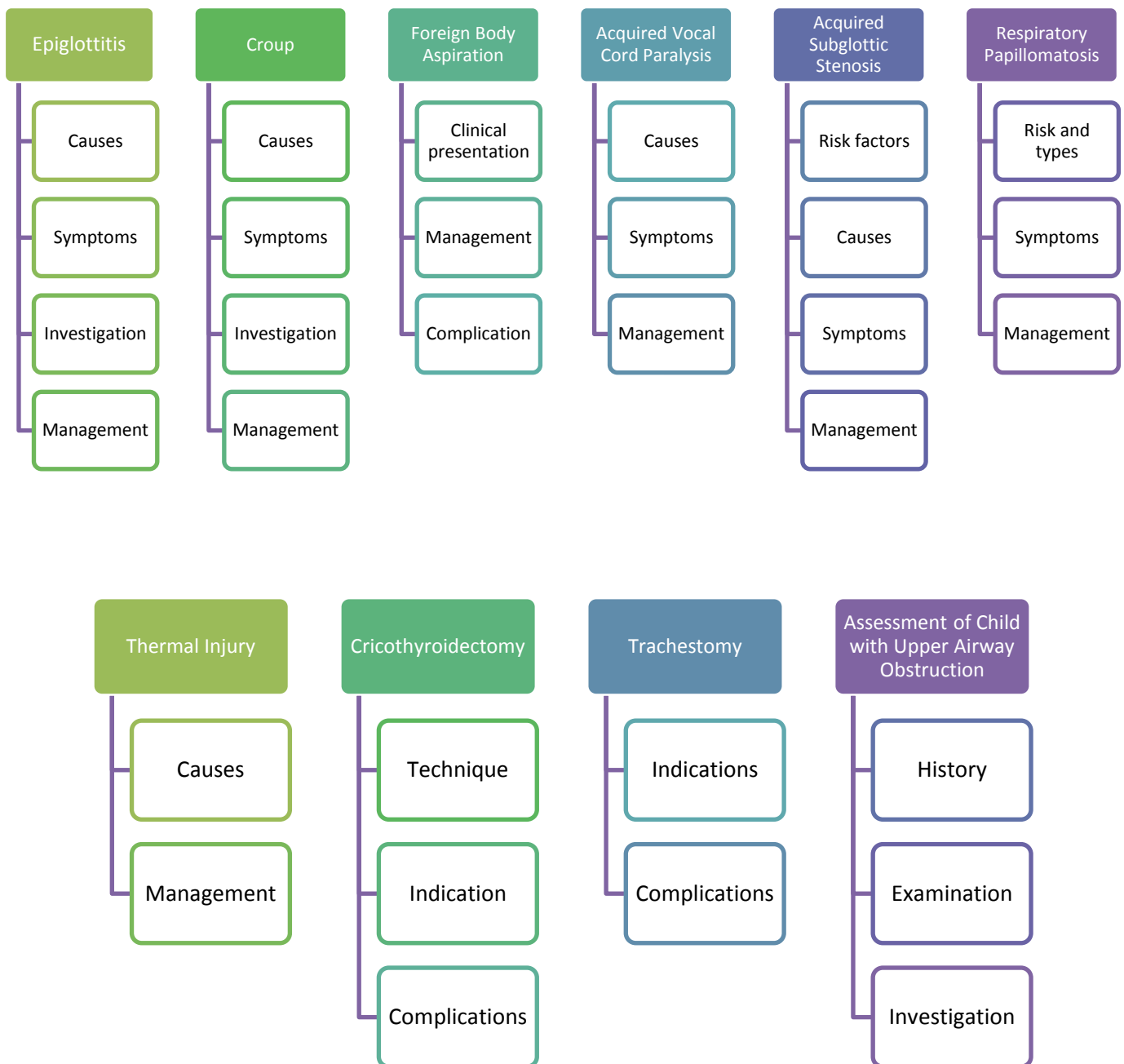
Leader: Maha Alhaidan

Done by: Ghadah Alharbi

Revised by: Amal Alsinan

Objectives:

1. Know the causes, signs and symptoms of airway obstruction.
2. Know how to investigate airway obstruction.
3. Know the management of airway obstruction and possible complications.



Not all the pictures were included, for more pictures go through the lecture.

Epiglottitis

Definition: It is an **acute inflammation in the supraglottic region of the oropharynx** with inflammation of the epiglottis, vallecula, arytenoids, and aryepiglottic folds ⁽¹⁾. It is a life threatening rapidly progressive condition.

Causes: *Haemophilus influenzae type B*. Age: 2-7 years.

Signs and Symptoms ⁽¹⁾:

- 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.

No examination should be done in the ER. (take to the OR and examine)

Investigation ⁽¹⁾:

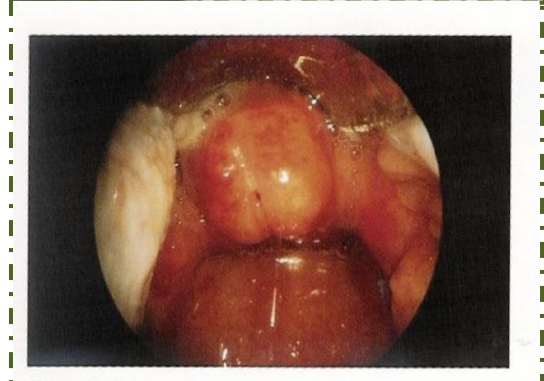
1. Airway management **“secure the airway!”**
2. Direct visualization of the epiglottis using nasopharyngoscopy/laryngoscopy after stabilizing the patient. **“the preferred method of diagnosis”**
3. Lateral neck soft-tissue x-ray. **“useful screening tool”**

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

Management:

1. Artificial airway “endotracheal intubation, tracheostomy, or cricothyrotomy”.
2. Empiric IV antimicrobial therapy.

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



Croup “Laryngotracheobronchitis”

Definition ⁽²⁾: 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)**

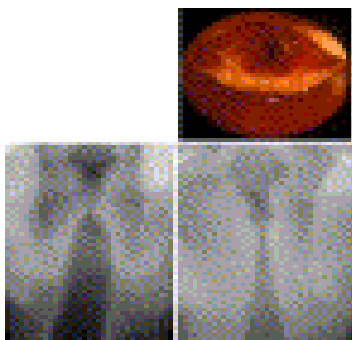
Symptoms:

- **Biphasic stridor** “stridor present during inspiration and expiration”
- **Hoarseness**
- Fever
- **Brassy cough** “loud metallic barking cough”
- No dysphagia

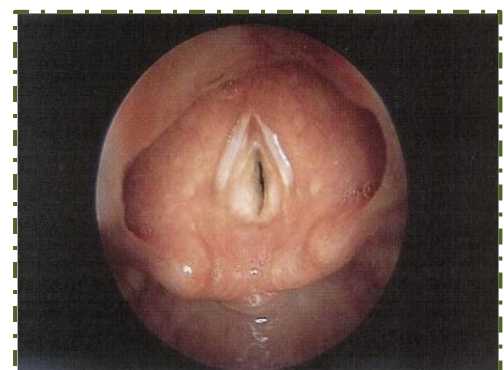
Investigation: It is mainly a **clinical diagnosis**, chest x-ray is only indicated when the diagnosis is suspicious, or the course is atypical. A posterior-anterior chest radiograph demonstrates subglottic narrowing commonly called **“steeple sign”**.

Management ⁽²⁾:

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



Steeple sign



Foreign Body Aspiration

Clinical presentation:

Acute episode: period of choking, gagging, wheezing, or hoarseness.

Asymptomatic period: cough or wheezing are possible.

Complications: pneumonia, obstructive emphysema and bronchiectasis.

Physical examination ⁽³⁾:

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

Investigation ⁽³⁾:

Radiography: 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.**

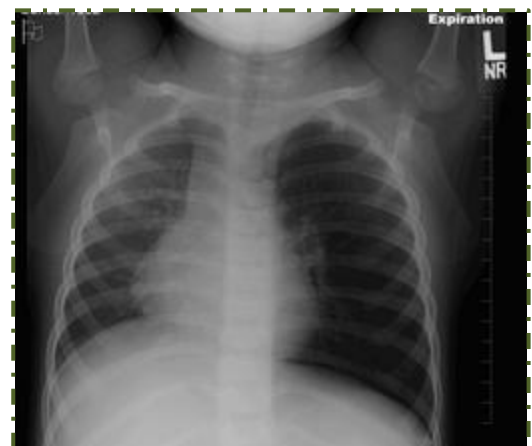
Fluoroscopy and CT scanning may be used as well. If the index of suspicion is high, we can proceed to bronchoscopy. (Bronchoscopy is the gold standard, because x-ray is normal most of the time because the majority of foreign bodies are plastic toys that can't be shown on x-ray)

Airway foreign bodies are removed most safely under general anesthesia using the ventilating rigid bronchoscope.

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

- comment on the picture:

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.



Acquired Vocal Cord Paralysis “AVCP”

Could be **unilateral** or **bilateral**.

Causes:

1. Birth trauma “forceps delivery”
2. Cardiac surgery “Patent ductus arteriosus repair”
3. Mediastinal or neck surgery
4. Tracheo-esophageal fistula repair

Bilateral Vocal Cords Paralysis “Abducted type”

Causes ⁽⁴⁾:

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

Physical examination ⁽⁴⁾:

- 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.**

- 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.

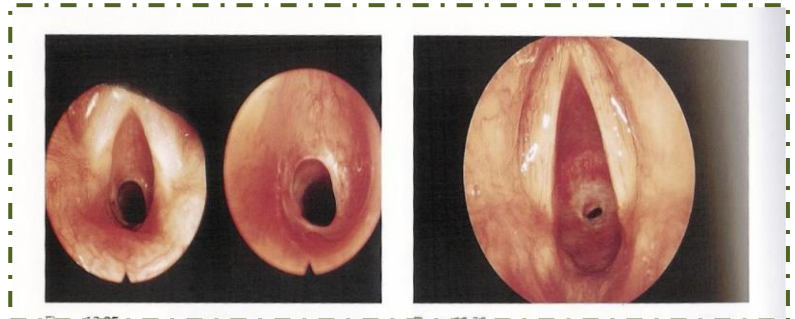


Acquired Subglottic Stenosis

Definition ⁽⁵⁾: It is a partial or complete narrowing of the subglottic area.

Risk factors: (imp)

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



Causes ⁽⁵⁾:

- **90%: trauma from endotracheal intubation.** The duration of intubation and the tube size are important.

- 10%: secondary to foreign body, infection, inflammation or irritation.

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 ⁽⁵⁾.

Symptoms ⁽⁵⁾:

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

Investigation ⁽⁵⁾:

- Chest x-ray
- MRI
- Videostrobolaryngoscopy
- Visualization of the larynx by flexible fiberoptic or rigid telescopic.

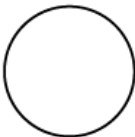





Cotton-Myer Grading of Subglottic Stenosis

Management of grade I and II:

- **Observation**
- **Balloon dilatation**
- **Laser excision**

Management of grade III and IV:

- **Tracheostomy**
- **Laryngotracheal reconstruction**
- **Cricotracheal resection**

Classification	From	To
Grade I	 No Obstruction	 50% Obstruction
Grade II	 51% Obstruction	 70% Obstruction
Grade III	 71% Obstruction	 99% Obstruction
Grade IV	No Detectable Lumen	

Source: Lalwani AK: *Current Diagnosis & Treatment in Otolaryngology – Head & Neck Surgery*, 2nd Edition: <http://www.accessmedicine.com>
Copyright © The McGraw-Hill Companies, Inc. All rights reserved.

Respiratory Papillomatosis

Definition ⁽⁶⁾: It is a disease caused by human papilloma virus (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”.**

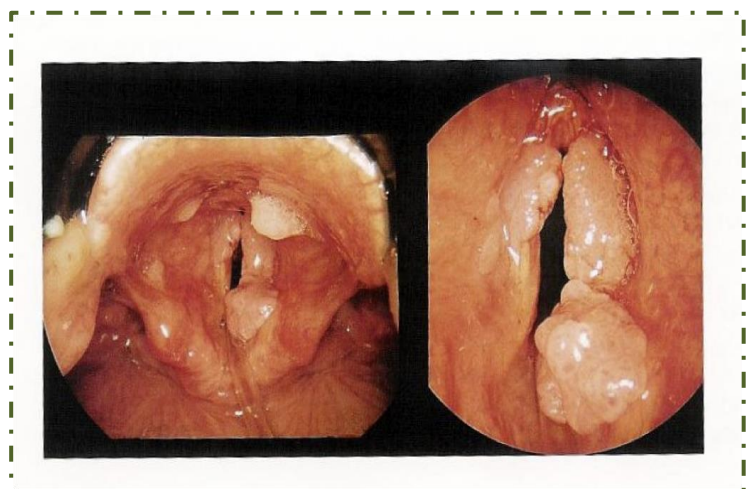
Symptoms ⁽⁶⁾: Symptoms of upper airway obstruction predominate because the larynx is usually affected in both types.

- **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 ⁽⁶⁾: **Laryngoscopy or bronchoscopy.**

Management:

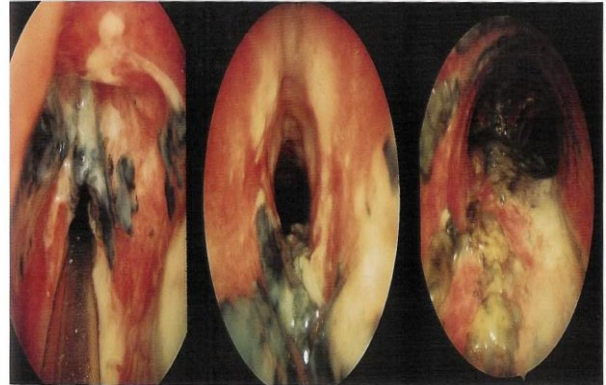
- ✓ **Laser excision or microdebrider**
- ✓ Adjuvant therapy: **Cidofovir, Acyclovir, Interferon**



Thermal Injury

It is caused by aspiration of hot liquid or caustic fluid. **Alkali is more dangerous of acids.**

The treatment starts with securing the airway “intubation”, tracheostomy and IV antibiotics.



Cricothyrotomy

Definition ⁽⁷⁾: 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 ⁽⁷⁾: Cricothyrotomy is indicated when an emergency airway is required and orotracheal or nasotracheal intubation is either unsuccessful or contraindicated.

- 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

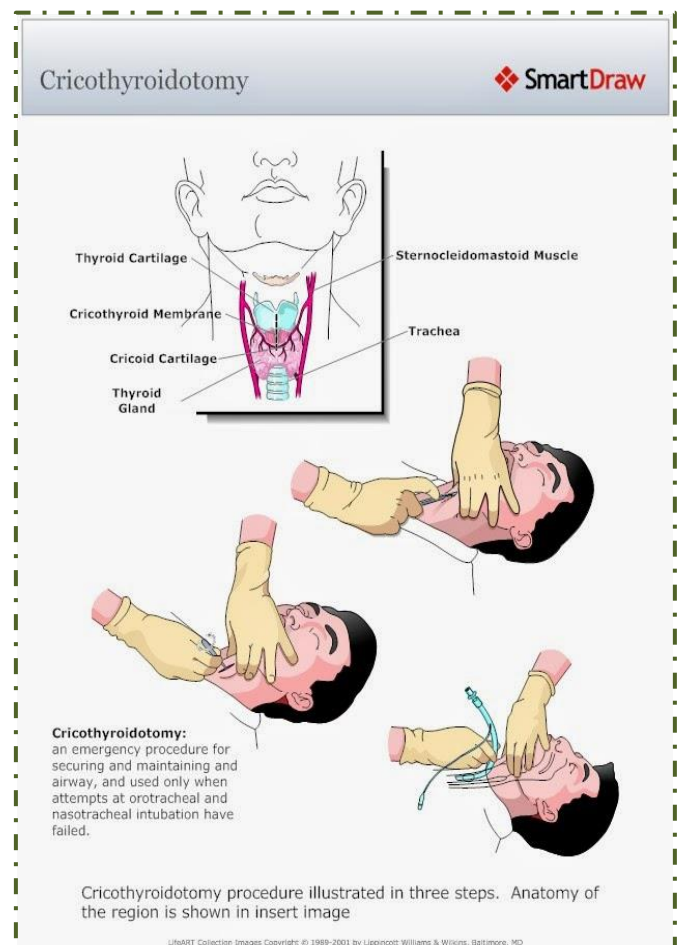
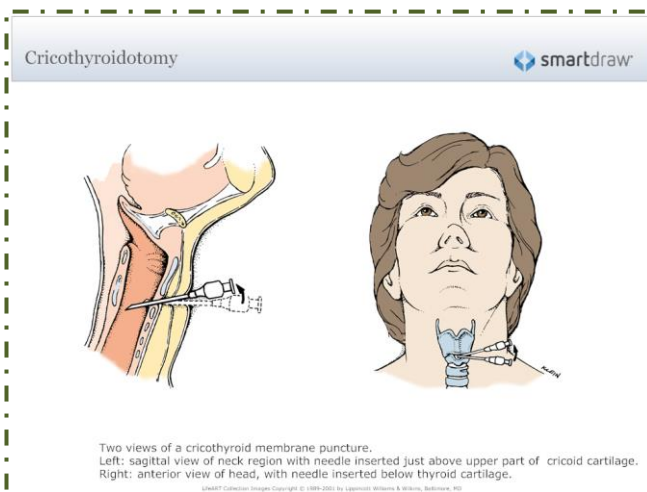
There are no absolute contraindications.

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

Complications ⁽⁷⁾:

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 extratracheal location (ie, false tract)
- Infection
 - **Intra/postoperative bleeding**
 - **Subglottic stenosis**
 - **Dysphonia/hoarseness**
 - **Pulmonary aspiration**
 - **Tracheal stenosis**
 - **Recurrent laryngeal nerve injury**



Tracheostomy

Definition ⁽⁸⁾: Tracheostomy is an operative procedure that creates a surgical airway in the cervical trachea.

Indications ⁽⁸⁾:

- 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.

Complications:

Immediate:

- **Hemorrhage, e.g. from thyroid isthmus**
- **Hypoxia**
- **Trauma to recurrent laryngeal nerve**
- **Damage to esophagus (dissection)**
- **Pneumothorax**
- Subcutaneous emphysema

Early:

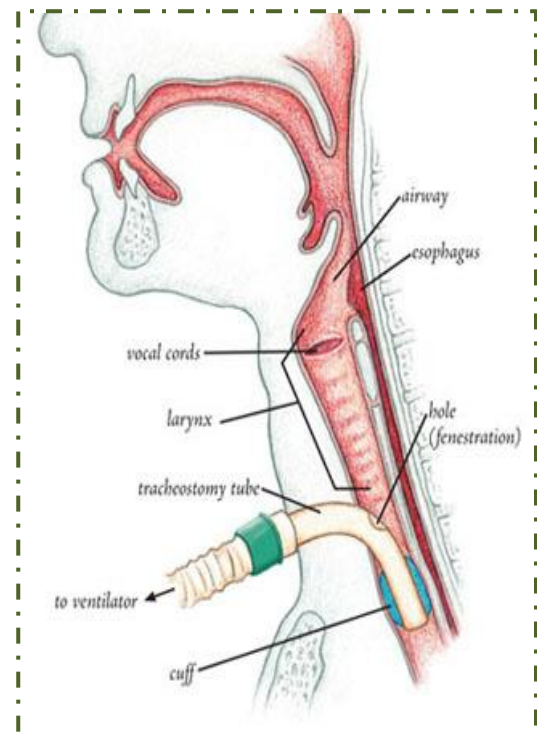
- Tube obstruction or displacement
- Aspiration
- Bleeding from tracheostomy site
- Infection

Late:

- **Airway obstruction with aspiration**
- **Tracheomalacia**
- **Aspiration and pneumonia**
- **Fistula formation, e.g. tracheo-cutaneous or tracheo-oesophageal**
- **Damage to larynx, e.g. stenosis**

- 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 ⁽⁹⁾

1. 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.

2. History:

- Age
- **Speed and onset of precipitating event**
- Associated symptoms (**fever**, drooling, hoarseness)
- Feeding difficulty
- Past medical history (birth trauma, intubation)

3. 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**

4. Physiological studies:

- ABG
- Spirometry

5. Imaging:

- Chest x-ray (foreign bodies)
- High kilovoltage imaging (subglottic stenosis)
- CT scan (Choanal atresia, retropharyngeal abscess, tumor)
- Barium swallow (vascular ring)

Summary

Epiglottitis:

Acute inflammation in the supraglottic region of the oropharynx

Causes: *Haemophilus influenzae type B*.

Signs and Symptoms:

- High fever
- Drooling
- Stridor
- Sore throat
- Odynophagia/dysphagia

Investigation: *bronchoscopy (no examination done in ER)*

2. Direct visualization of the epiglottis using nasopharyngoscopy/laryngoscopy after stabilizing the patient.
3. Lateral neck soft-tissue x-ray. **“useful screening tool”** The classic lateral neck radiograph findings are a swollen epiglottis (ie, a **thumb sign**).

Management:

1. Artificial airway “endotracheal intubation, tracheostomy, or cricothyrotomy”.
2. Empiric IV antimicrobial therapy.

Croup:

primarily **pediatric** viral respiratory tract illness generally affects the trachea and the larynx and may extend to the bronchi

Causes: **Parainfluenzae viruses (types 1, 2, 3)**

Symptoms:

- **Biphasic stridor** “stridor present during inspiration and expiration”
- **Hoarseness**
- Fever
- No dysphagia

Investigation: It is mainly a **clinical diagnosis**; a posterior-anterior chest radiograph demonstrates subglottic narrowing commonly called **“steeple sign”**.

Management:

- 100% humidified oxygen and ventilation support in case of severe respiratory distress.
- Steroids
- Nebulized racemic epinephrine

Foreign body aspiration:

Clinical presentation:

Acute episode: period of choking, gagging, wheezing, or hoarseness.

Asymptomatic period: cough or wheezing are possible.

Complications: pneumonia, obstructive emphysema and bronchiectasis.

Examination:

Abnormal airway sounds, such as wheezing, stridor, or decreased breath sounds.

Investigation: **bronchoscopy (goldstandard)**

Treatment: Airway foreign bodies are removed most safely under general anesthesia using the ventilating rigid bronchoscope.

Acquired vocal cord paralysis: (could be unilateral or bilateral)

Causes:

1. **Birth trauma "forceps delivery"**
2. Cardiac surgery "Patent ductus arteriosus repair"
3. Mediastinal or neck surgery
4. Tracheo-esophageal fistula repair

Management:

Tracheostomy

Posterior cordotomy (unilateral or bilateral)

Arytenoidectomy (endoscopic or external, partial or complete)

Cordopexy, lateralization of the vocal cords.

Acquired Subglottic Stenosis:

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

Risk factors:

- 1- **Intubation** (Prolonged, inappropriate size, inadequate care, high pressure cuffs tube, difficult intubation and multiple intubation)
- 2- GERD
- 3- Tracheobronchial infection

Causes:

90% is a result of traumatic endotracheal intubation and 10% is secondary to foreign body, infections, inflammation and irritation.

Symptoms:

Dyspnea, stridor, hoarseness, brassy cough, recurrent pneumonitis and cyanosis.

Investigation: XRAY, MRI, videostrobolaryngeoscopy, visualizing the larynx by fiberoptic or rigid telescope

Grading is done by Cotton-Myer grading

Management: **Grade I and II → (Observation, balloon dilation, laser excision)**

Grade 3 and 4 → (Tracheostomy, laryngotracheal reconstruction, cricotracheal resection)

Respiratory Papillomatosis:

It's a disease caused by HPV types 6-11 and has two types: Juvenile and Senile onset

Risk factors for juvenile onset papillomatosis:

Firstborn child, vaginally delivered, and the mother being younger than 20 y/o + the presence of genital warts "Condyloma Acuminata"

Symptoms:

Symptoms of upper airway obstruction predominate

Hoarseness, dysphonia, choking episodes, foreign body sensation, cough, dyspnea, inspiratory wheeze and stridor.

Investigation:

Laryngoscopy or bronchoscopy

Management:

Laser excision or microdebrider\adjuvant therapy: Cidofovir, Acyclovir Interferon

Thermal injury:

Caused by aspiration of hot liquid or caustic fluid. Alkali is more dangerous than acids. Treatment starts with securing the airway "intubation", tracheostomy and IV antibiotics.

Cricothyroidotomy:

A procedure that involves placing a tube through an incision in the cricothyroid membrane to establish an airway for oxygenation and ventilation.

Indications:

When an emergency airway is required and orotracheal or nasotracheal intubation is either unsuccessful or contraindicated.

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's no absolute contraindication, relative: possible or known traction of the trachea, laryngotracheal disruption with traction of the distal trachea into the mediastinum, and fractured larynx.

Complications: more in emergency than elective cricothyroidotomy

- Laceration of the thyroid cartilage, cricoid cartilage, or tracheal rings
- Perforation of the posterior trachea
- Unintentional tracheostomy
- Passage of the tube into an extratracheal location (ie, false tract)
- Infection -- Intra/postoperative bleeding
- Subglottic stenosis -- Dysphonia/hoarseness
- Pulmonary aspiration -- Tracheal stenosis
- Recurrent laryngeal nerve injury

Tracheostomy:

Tracheostomy is an operative procedure that creates a surgical airway in the cervical trachea.

Indications:

- 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.
- Facial fractures that may lead to upper airway obstruction.
- Upper airway edema from trauma, burns, or anaphylaxis.

Complications:

Immediate: (hemorrhage, hypoxia, trauma to RL nerve, esophageal dissection, pneumothorax and subcutaneous emphysema)

Early: (Tube obstruction or displacement, aspiration, bleeding from tracheostomy site and infection)

Late: (Airway obstruction with aspiration, tracheomalacia, aspiration pneumonia fistula formation, damage to larynx “stenosis”)

Assessment of child with upper airway obstruction:

1- Rapid airway assessment “to identify who needs resuscitation”

2- History:

Age, **speed and onset of precipitating event**, associated symptoms “**fever**”, feeding difficulty, past medical history “birth trauma, intubation”

3- Physical examination:

Vital signs, patient’s position, craniofacial anomalies, cutaneous hemangiomas, neck ma growth chart, complete ENT examination, flexible fiberoptic, endoscopy is the tool of examination

4. Physiological studies:

- ABG
- Spirometry

5. Imaging:

- Chest x-ray (foreign bodies)
- High kilovoltage imaging (subglottic stenosis)
- CT scan (Choanal atresia, retropharyngeal abscess, tumor)
- Barium swallow (vascular ring)

MCQ's:

1- 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) Microlaryngoscopy
- (c) Steroids
- (d) Antibiotics

2- 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

3- Steeple sign seen on posteroanterior view of neck in a child with stridor is indicative of:

- (a) Acute epiglottitis
- (b) Acute laryngotracheobronchitis
- (c) Laryngeal papillomatosis
- (d) Bilateral abductor paralysis

4- A 3-year-old boy came to the ER with abrupt onset of fever “40 degree”, 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

References

1. Epiglottitis: <http://emedicine.medscape.com/article/763612-overview#a3>
2. Croup: <http://emedicine.medscape.com/article/962972-overview>
3. Pediatric Airway Foreign Body: <http://emedicine.medscape.com/article/1001253-overview>
4. Bilateral Vocal Cords Paralysis: <http://emedicine.medscape.com/article/863885-overview#a5>
5. Subglottic Stenosis in Adults: <http://emedicine.medscape.com/article/865437-overview>
6. Recurrent Respiratory Papillomatosis: <http://emedicine.medscape.com/article/302648-overview>
7. Emergency Surgical Cricothyrotomy: <http://www.uptodate.com/contents/emergency-surgical-cricothyrotomy-cricothyroidotomy#H22>
8. Tracheostomy: <http://emedicine.medscape.com/article/865068-overview>
9. Emergency Evaluation of Acute Upper Airway Obstruction in Children: <http://www.uptodate.com/contents/emergency-evaluation-of-acute-upper-airway-obstruction-in-children#H21>

For mistakes or feedback

ENTteam432@gmail.com