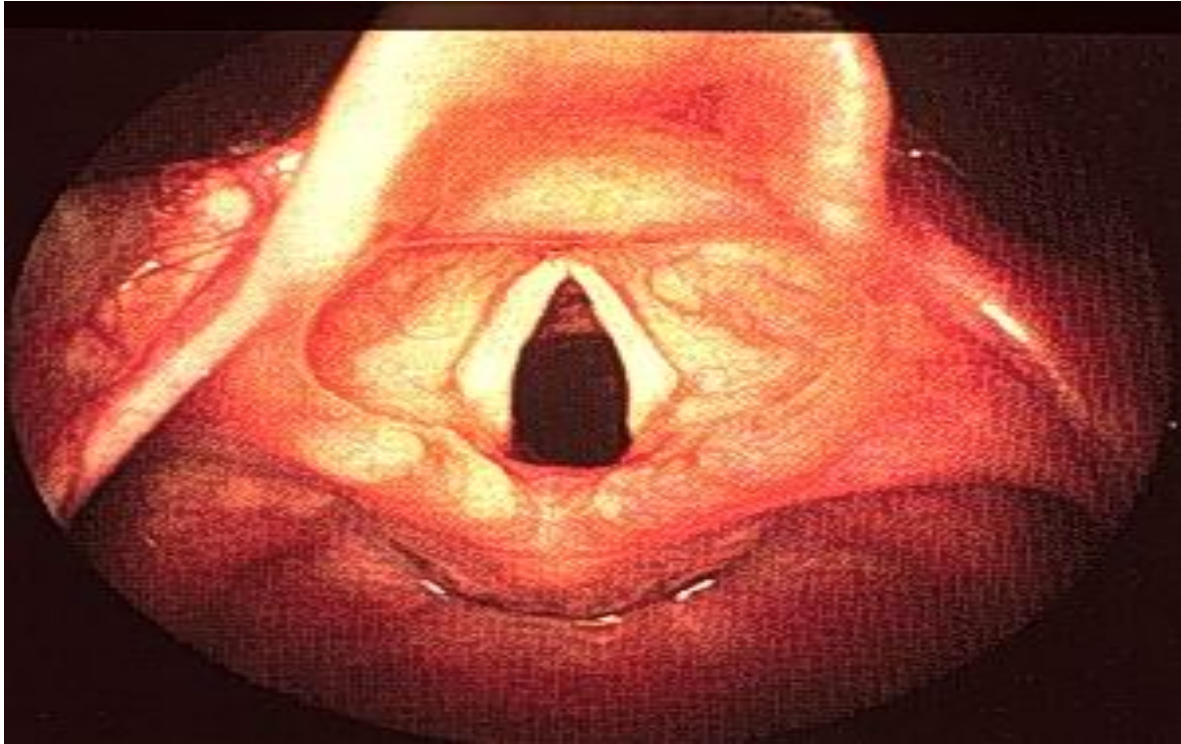


Upper airway Obstruction I

Sources: Lecture Notes, Slides, 427 Team



Anatomy of the Larynx

- **We divide the Larynx to Three Regions:**

- 1- Glottic Region: Between the Vocal Cords
- 2- Supra glottic Region:
- 3- Sub Glottic Region:

- **The laryngeal framework is composed of a cartilage:**

- 1- three unpaired cartilages:**

- Cricoid: the **only complete ring in the airway**. Unable to expand. The narrowest part of airways in children. Liable to injury.
- Thyroid: the biggest.
- Epiglottis.

- 2- three paired cartilages:**

- Arytenoids: pyramid shape. Base on the cricoids lamin. Attached anterior to the vocal ligament. Posterior to crycoarytenoid muscle. Most important as it's responsible for movement of vocal cord. **MOST IMPORTANT**
- Corniculate. ----> **Less Important**
- Curiform. ---->
- Trieceaus.

- **laryngeal membranes and ligaments:**

1. intrinsic: between the laryngeal cartilage.
2. extrinsic: attach the larynx to other structures
3. thyrohyoid membrane.
4. coricthyroid membrane: part of conus elasticus.
5. coricothyroidectomy: (easiest approach to emergency airway obstruction) but not in children
6. Tracheostomy which done in 2nd, or 4th tracheal ring.
7. quadrangular membrane

- **Muscles:**

1. extrinsic.
2. Intrinsic: all Muscles are supplied by: Recurrent Laryngeal Nerve, Except
the Cricothyroid Muscle supplied by External Laryngeal Nerve

Infant and pediatric larynx:

- Position is higher at birth. In adult from 2C to 3C.
- Epiglottis lying at the nasopharynx makes the neonate an obligate nasal breather, for 4-6 months.
- Cartilage and soft tissues are softer.
- Soft tissues are less adherent to the underlying cartilage ---> susceptible to collapse, and less resistance to develop submucosal edema.
- Subglottis is the narrowest part of airway in children. It's surrounded by cricoid cartilage.
- **In adults the narrowest part of glottis.**
- Omega Shape Epiglottis.

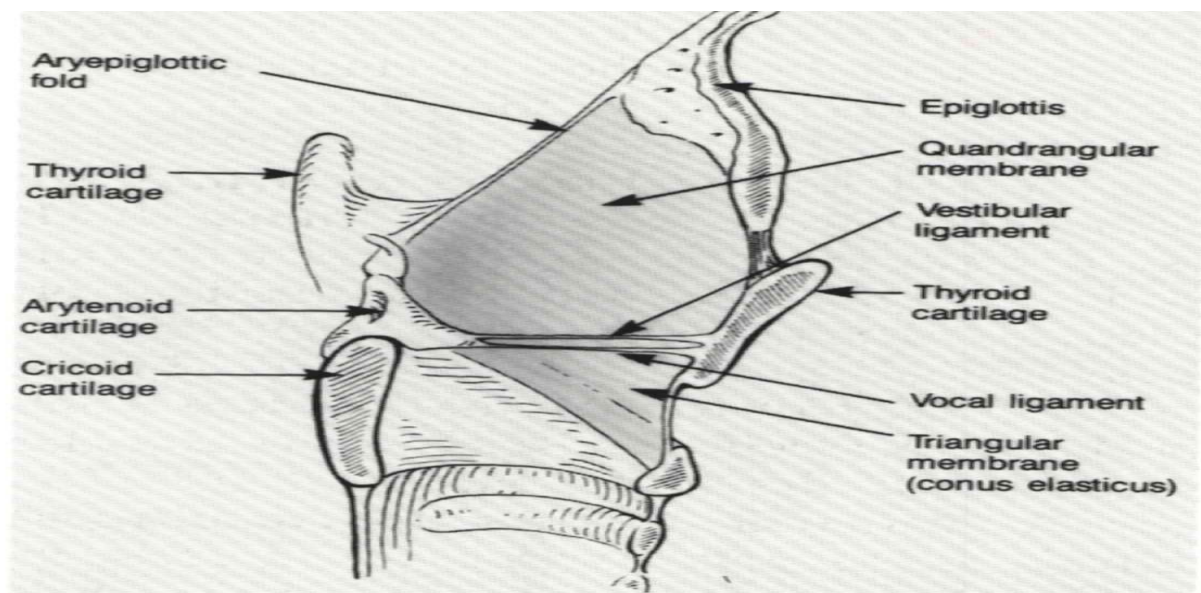


Figure 1-3. Midsagittal cut of the larynx showing the fibroelastic membrane attachments.

Anatomy of The Trachea

- Consists of 16-20 incomplete cartilaginous ring, the posterior wall is a membranous part. (Its Function: Expand, and allow the bolus to pass)
- Diameter: 19 mm in males, 16 mm in females
- Length is approximately 11 cm.



Pediatric trachea:

- Diameter:

At birth- 6 mm

At 6 months- 7.2 mm

At 1 years- 7.8 mm

- significance of knowing these diameter: in case of intubation and use of bronchoscopy.
- Beyond Two years (below) you need to know how to calculate !

TABLE 91-2. APPROXIMATE SIZE OF ENDOTRACHEAL AND TRACHEOSTOMY TUBES FOR INFANTS AND CHILDREN

Age	ID Size (mm)
Premature	
< 1000 gm	2.5
1000-2500 gm	3.0
Neonate-6 months	3.0-3.5
6 months-1 year	3.5-4.0
1-2 years	4.0-5.0
Beyond 2 years	$\text{Age in years} + 16$

*** ID: inner diameter**

Signs of Airway Obstruction

1- Stridor:

- **Stridor:** is harsh high pitched musical sound produced by turbulence of air flow through partial obstruction of AW. It can be inspiratory or expiratory depends on: site and degree of obstruction.

Stridor indicates:

1. pathologic narrowing of AW.
2. potential respiratory obstruction.
3. even death.

Usually:

1. supra-glottic (above the vocal Cord) is inspiratory.
2. Glottis and Sub-Glottic is biphasic.
3. Lower trachea (Intra thoracic) is Expiratory

Other signs of upper airway obstruction:

- flaring of nasal alae.
- retraction of the neck, intercostals and abdominal muscles
- dyspnoea.
- tachypnea.
- restlessness.
- cyanosis.
- Subcutaneous emphysema (Air under the Skin)

Diagnostic Assessment:

1- History:

- Time of onset.
- Characteristic of cry. (will reflex Integrity and Mobility of vocal Cords)
- Possible trauma.
- Hx of previous intubation.
- Relation of airway to problem to feeding, position.
- Question about possible aspiration of foreign body. (you have to have a high suspicion of that) - Use Bronchoscopy !
- **If stridor present since birth:**
 - I. congenital laryngo malacia
 - II. sub-glottic stenosis.
 - III. vocal cord paralysis.
 - IV. vascular rings.
- **If stridor is gradual and progressing:**
 - I. Sub-glottic hemangioma appear between 1-3 months of age.
 - II. Papilloma of the larynx appear at 6 months of age.

2- Evaluation of UAO:

A- Radiologic Evaluation:

- Indicated for patients **without** respiratory distress.
- 1. Plain view soft tissue of the neck: A.P , lateral . chest (inspiratory + expiratory)
- 2. Mobile pharyngeal tissue may bulge during expiration in normal infants.
- 3. High kilovoltage techniques (crowp series) AP view assesses sub-glottis region. You can see the contrast between the air and soft tissue (One of the quickest techniques
- 4. Fluoroscopy : dynamic airway changes (it's video x-ray , without contrast)
- 5. Barium swallow: (Why) ?
 - Assess swallowing (slow swallowing can lead to aspiration)
 - Rule out : presence of vascular rings --> can affect the airway

Note That:

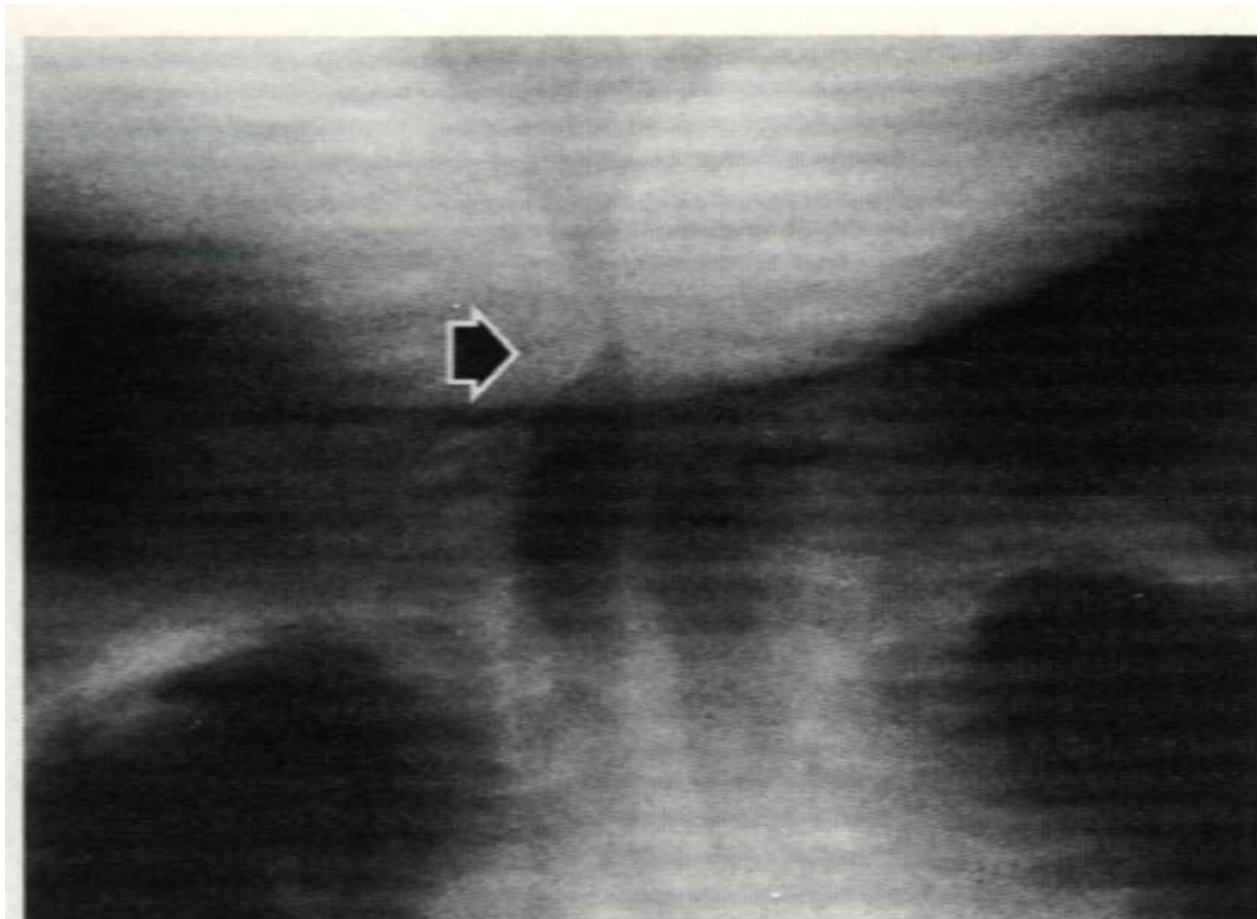
MRI ,CT scan -> ARE GOOD IN EVALUATING MEDIASTINUM, statement of the cartilage, Extend of the Narrowing.

Case:

- Child 2 years old with a Mass, for 1 year in the sub glottic region.
what is could be ?

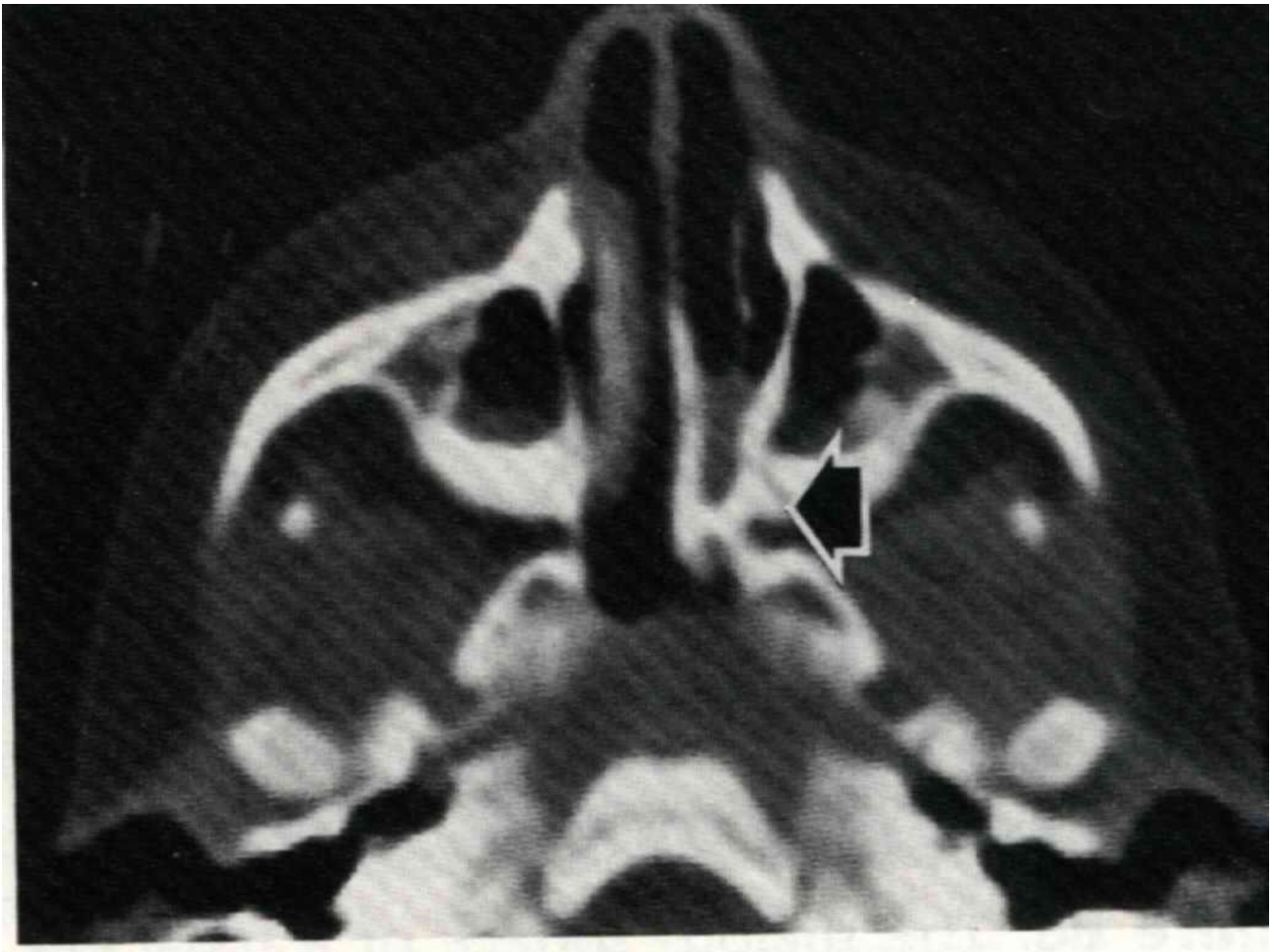
Sub-glottic hemangioma, you confirm that by Bronchoscope

- What techniques was used, based on the Radiological Picture?
High kilovoltage techniques; because you can see the Lumen, tissue and Mass.



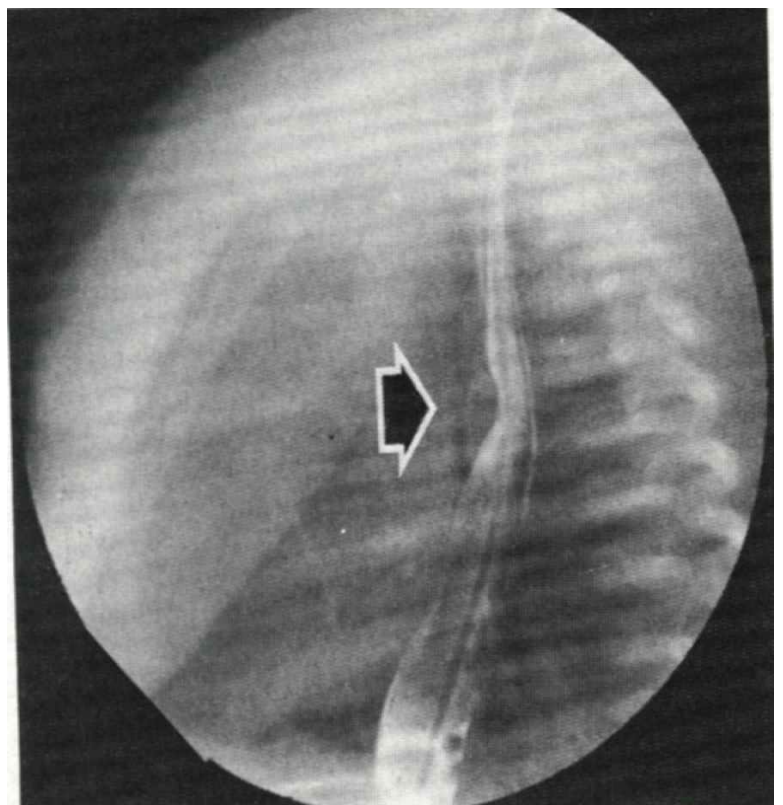
Case 2:

this is a CT scan Axial Cut, the abnormality is: Unilateral Qiuana-Atresia



Case 3:

Barium Swallow showing:
Vascular Compression



B- Endoscopic Evaluation:

- Mirror examination : is not endoscopic in older children + adults Can provide information about hypo pharynx and larynx.
- Telescopic examination: Fiberoptic endoscopy: excellent to assess the movement of vocal cords.
- Rigid bronchoscopy:
 1. done under GA
 2. may enable removal of foreign body.
 3. assess the AW down to the main stem bronchi.

Continue on Diagnostic Assessment

- 3- Flow volume loop
- 4- ABG
 - late indicator of AWO
 - should not be used routinely to assess degree of obstruction

THERAPEUTIC OPTIONS

1. Observation/Medical Support

- a. ICU
- b. Airway team availability
- c. Oxygenation
- d. Steroids
- e. Antibiotics

2. Heimlich maneuver

3. N. P. Airway

4. Oral Airway

5. Esophageal airway

6. Transoral intubation

7. Nasal intubation

8. Flexible fibroptic intubation

9. Transtracheal jet ventilation

10. Cricothyroidotomy

11. Tracheostomy

Read it only**Table 131-1.** Advantages and disadvantages of various types of airways

Airway	Indications	Advantages	Disadvantages
Nasopharyngeal	Obtundation with mandibular retrusion or pharyngeal collapse	Simple Maintains airway Facilitates suctioning Well-tolerated in alert patients	Requires normal ventilatory drive Can cause epistaxis
Oral	Obtundation	Simple	Easily dislodged
	Obstructed or injured nasal airway	Maintains airway Facilitates suctioning	Requires normal ventilatory drive Poorly tolerated by alert patients
Oral intubation	Need for controlled ventilation	Allows full control of ventilation Prevents aspiration	Requires expertise and proper equipment Potential injury to larynx and pharynx
	Failure of simple measures		
	Aspiration control		
Blind nasal	Potential cervical spine injury with need for airway control	Can be performed without hyperextending neck Eliminates need for laryngeal visualization	May aggravate airway problem if poorly executed May cause epistaxis Requires prior experience
	Massive oral cavity injury precluding oral intubation		
Fiberoptic nasal	General airway control	Allows laryngeal visualization and placement of tube under direct visualization	Difficult to see if excess secretions or bleeding present
	Potential cervical spine injury	Less chance for error compared with blind nasal intubation	Requires added equipment and expertise
	Massive oral cavity injury		
Transtacheal (jet ventilation)	Failure of above methods	Very rapid control of oxygenation	Requires special equipment Requires training
		Easily performed	Potential submucosal inflation
Cricothyroidotomy	Failure of intubation	More rapid than tracheotomy	Surgical procedure
	No laryngeal injury	Good airway control	Can cause both acute and chronic laryngeal injury
Tracheostomy	Laryngeal trauma	Avoids entry into larynx	Time consuming
	Oropharyngeal obstruction not controlled by intubation		Anatomically more complex than cricothyroidotomy Numerous potential complications

Surgical Techniques**1. Trans tracheal needle ventilation (For short time is ER)**

- 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

- failure to establish an AW
- misplaced catheter in soft tissue of the neck (esp. in children because the cartilage is soft normally and it will be compressed not penetrated) which can lead to :

1. pneumo mediastinum

2. pneumothorax

- total obstruction of the airway prevents adequate ventilation.

2- Cricothyroidotomy:

- Generally for ER UAWO (if intubation has failed or it's contraindications)
- Elective for head & neck & c.v.s procedures.
- Also used where access to tracheal rings in limited (e.g kyphosis)

• **Procedures :**

1. May use horizontal or vertical incision.
2. Use small tracheal tube or endotracheal tube

• **Complications:**

1. Injury to int. Jugular vein (great vessels)
2. Injury to recurrent laryngeal nerve
3. Subglottic or laryngeal stenosis (esp. in child)

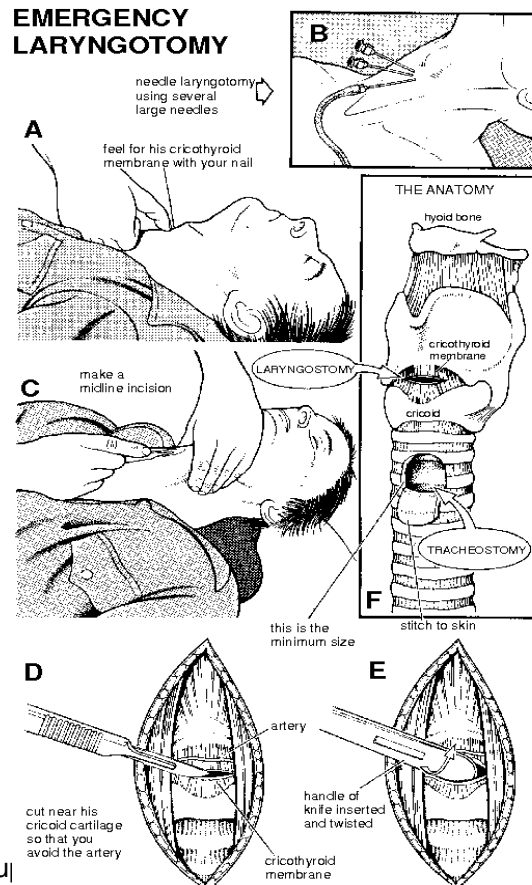
3- tracheostomy:

- For ER or elective upper airway obstruction , also for acute or chronic u
- In ER:

A- vertical incision is preferred

B- Maintain homeostasis after establishing airw

EMERGENCY LARYNGOTOMY



Advantages

Vertical incision	Horizontal incision
limit injury of vascular and neural structure	improve cosmetic appearance
improve access of trachea (easy retraction of soft tissue)	may avoid neck dissection wound

Disadvantages

Vertical Incision	Horizontal Incision
potential scar formation	risk of neurovascular injury
risk of communication with neck wounds (e.g. apron flap)	may limit tracheal elevation during swallowing

Note That:

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

4- Percutaneous Tracheostomy

- Passing --> needle --> guide wire --> series of dilators --> the tube

Complications

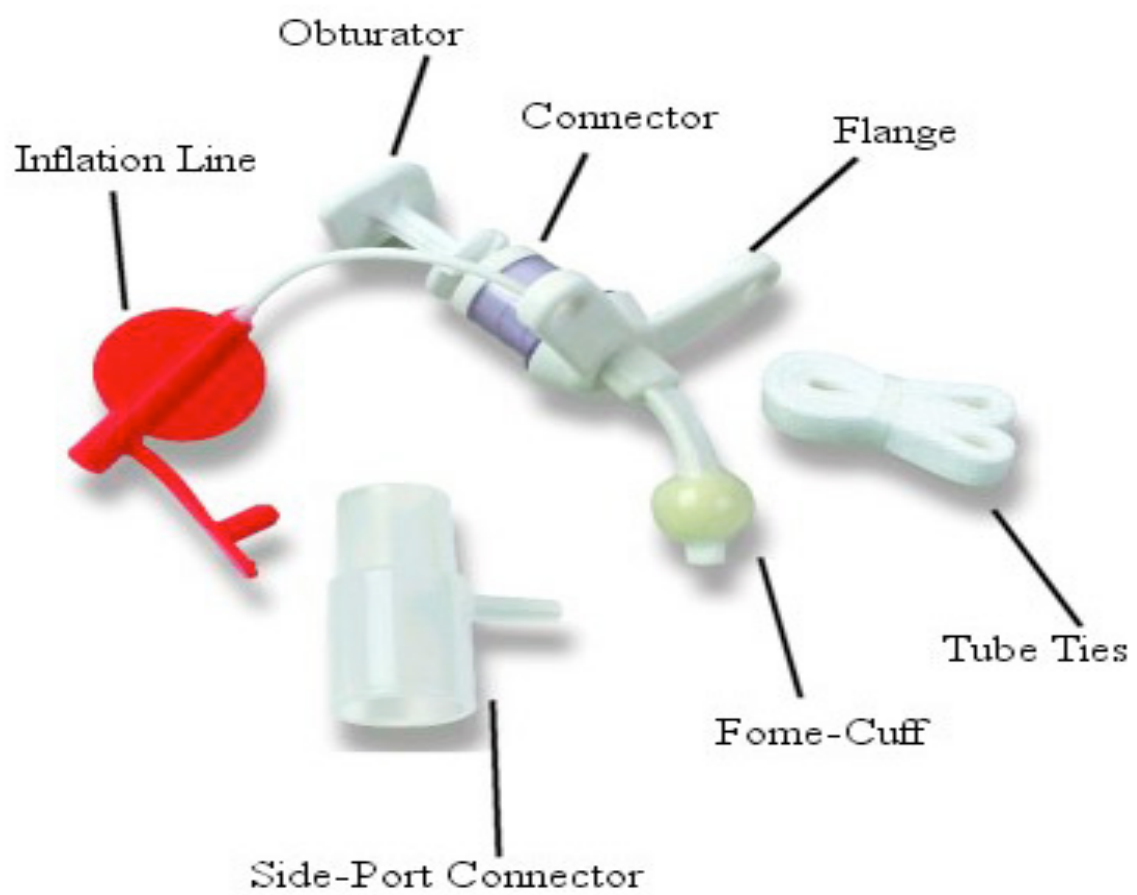
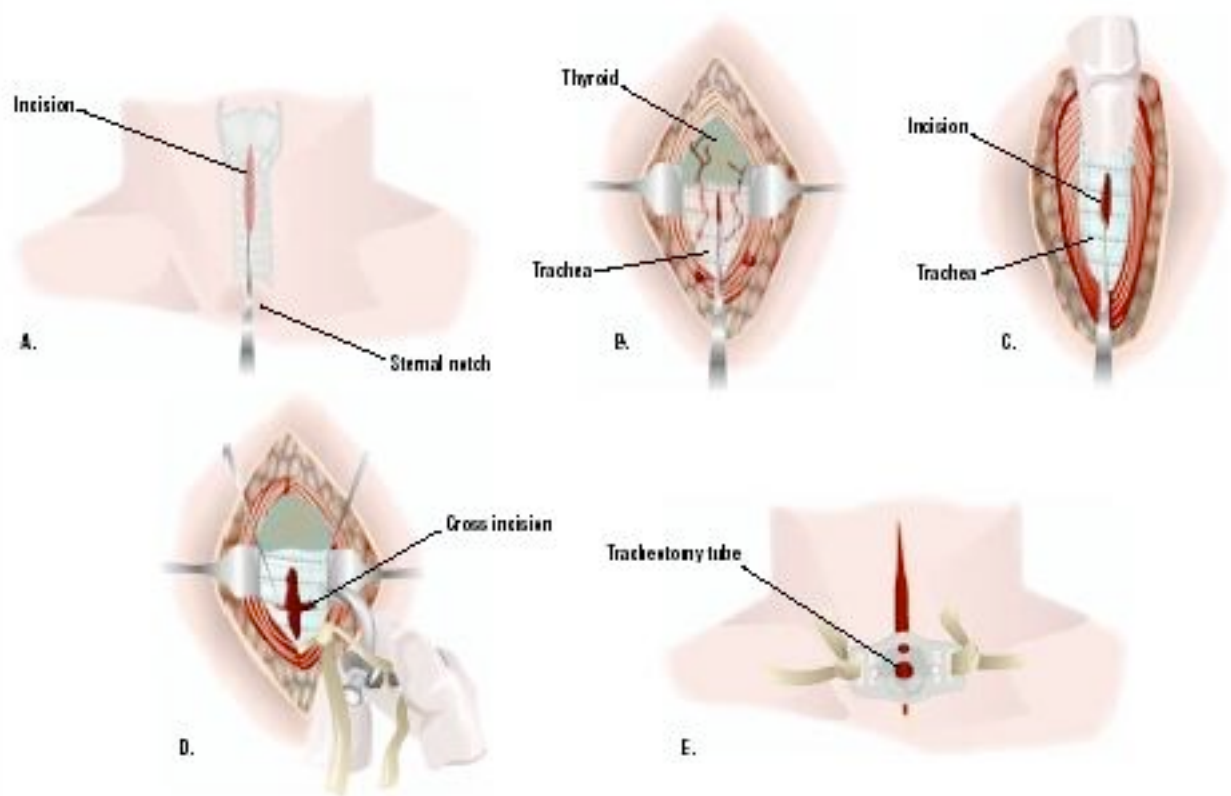
- difficulty with dilatation
- failed intubation
- excessive bleeding
- pneumothorax
- false passage of the tube
- accidental decannulation
- tracheoesophageal fistula

Other diagnostic test :

1. flow volume loop.
2. ABG (arterial blood gases).

late indicator of upper airway obstruction , that's why it shouldn't be used routinely or in ER to asses the degree of obstruction .

Tracheotomy



Differential diagnosis of upper airway obstruction:

1. Congenital:

- a. laryngeal web.
- b. laryngomalasia.
- c. subglottic haemangioma.

2. acquired:

- a. inflammatory: e.g. epiglottitis, laryngobronchitis.
- b. infectious: laryngeal diphtheria.
- c. traumatic: corrosive inhalation.
- d. neoplastic: papillomatosis, laryngeal cancer.
- e. foreign body.

Done !