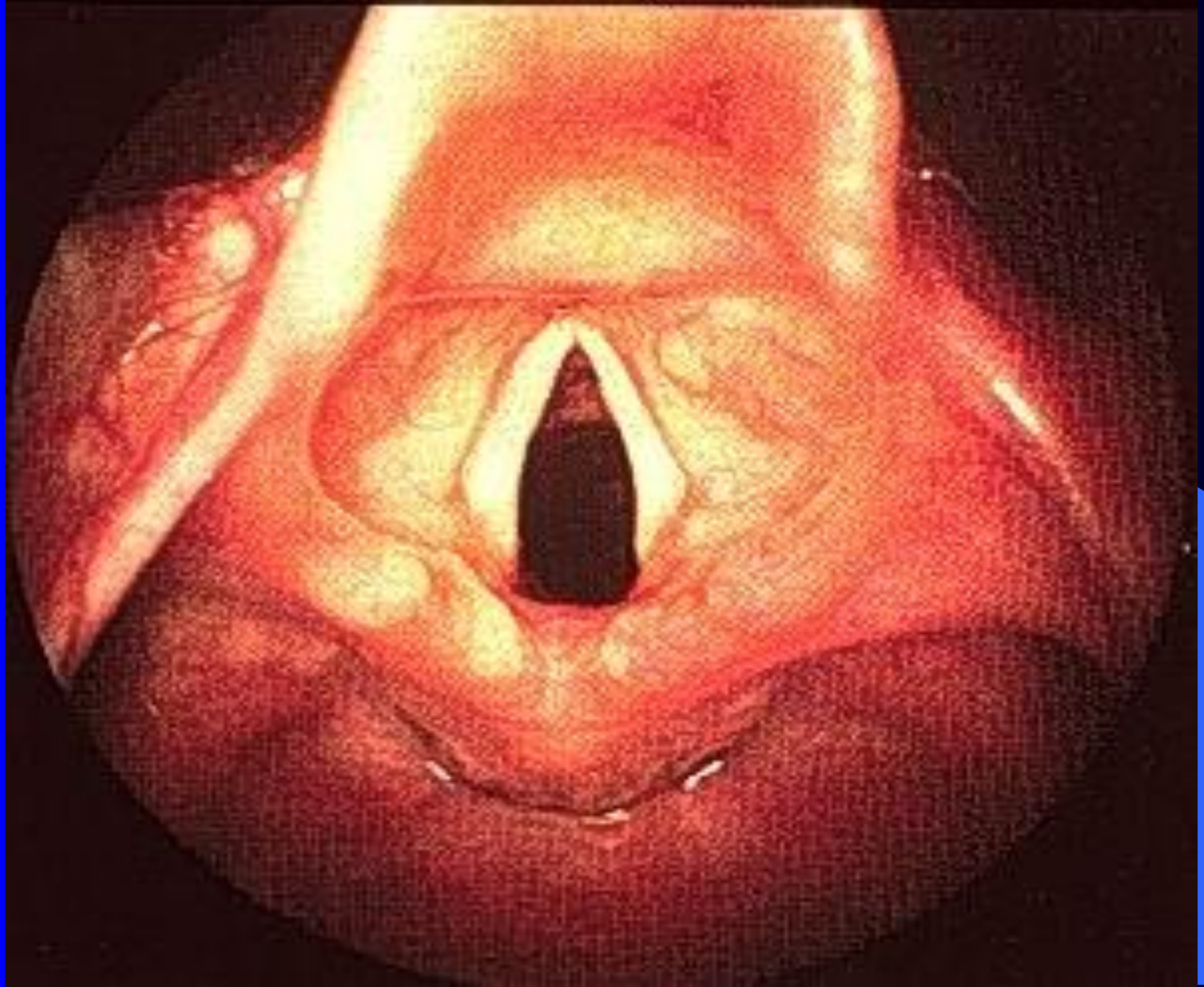


# UPPER AIRWAY OBSTRUCTION

By

prof. Ahmed Al-Ammar



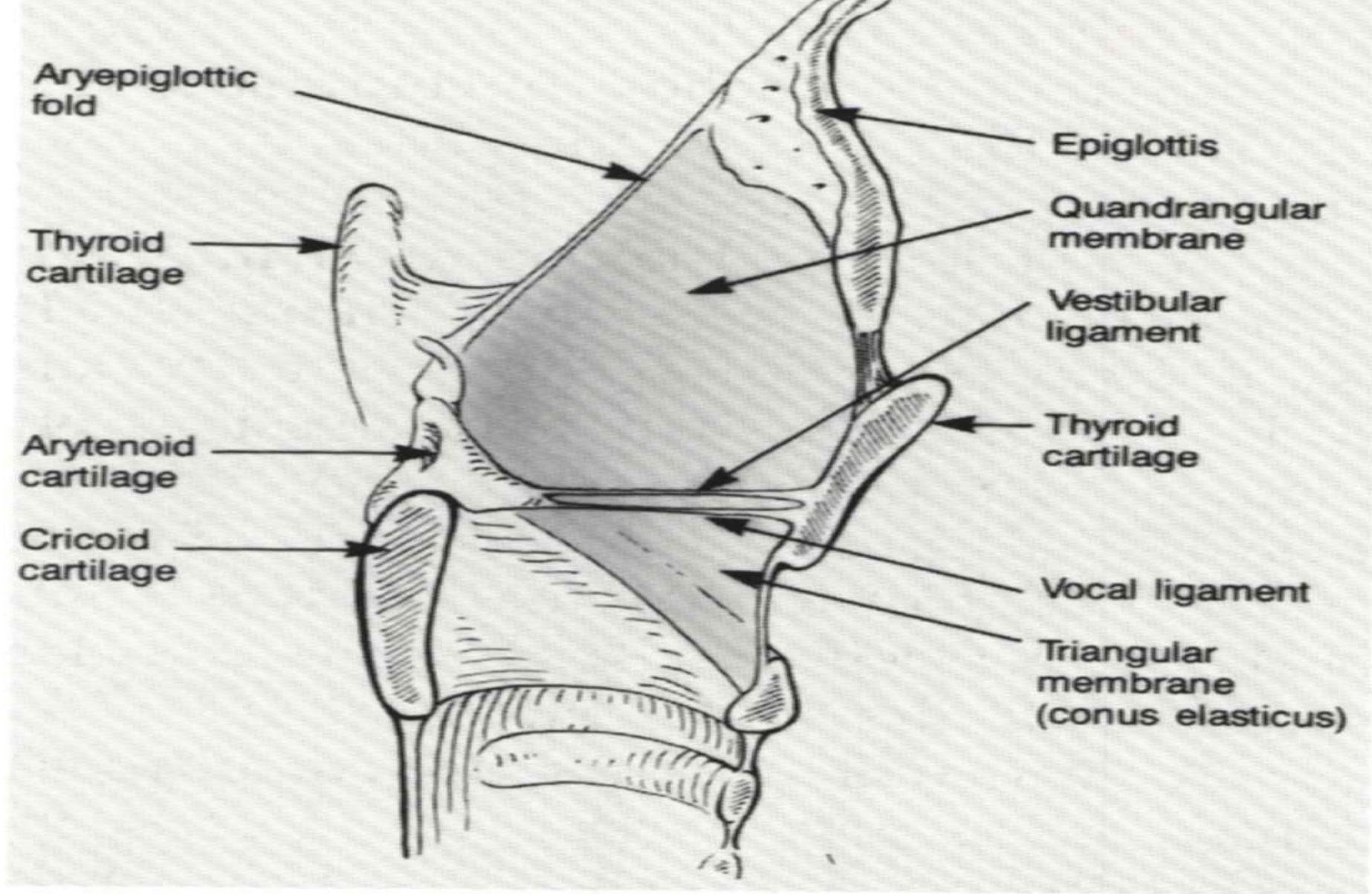


Figure 1-3. Midsagittal cut of the larynx showing the fibroelastic membrane attachments.

# *ANATOMY*



## \* Infant & Pediatric larynx

- position is higher at birth
- epiglottis lying at the nasopharynx  
make the neonate an obligate nasal breather  
x 4-6 months
- cartilage & soft tissue are more soft

# *LARYNGEAL ANATOMY*

## *in pediatric (cont.)*

Soft tissue - are less adherent to the underlying cartilage

- susceptible to collapse

- less resistant to develop submucosal edema

Omega shape Epiglottis

Subglottis is the narrowest part of AW in children.

In adults glottis is the narrowest.

# *TRACHEAL ANATOMY*

- consists of 16 to 20 incomplete cartilaginous rings
- the post wall is a membranous part
- length is approximately 11 cm
- diameter 19 mm male  
16 mm female



# *TRACHEAL ANATOMY*

## *( cont.)*

Pediatric trachea:

Diameter:	At Birth	6 mm
	6 mons	7.2 mm
	1 year	7.8 mm
	4 years	11 mm



**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	<u>Age in years + 16</u>

## *Signs of Airway Obstruction*

- Stridor is harsh high pitched musical sound produced by turbulence of air flow through a partial obstruction of the AW
- Stridor is a vary important sign of UAW obstruction

It indicates - pathologic narrowing of AW

- potential resp obstruction
- even death

## *Other signs of UAW obstruction*

- flaring of the nasal alae
- retraction of the neck, intercostal and abdominal muscles
- Dyspnea
- Tachypnea
- Restlessness
- Cyanosis
- Subcutaneous emphysema

**TABLE 79-1. CAUSES OF STRIDOR AND RESPIRATORY DISTRESS ORIGINATING WITHIN UPPER RESPIRATORY TRACT IN CHILDREN**

<b>Supralaryngeal</b>	<b>Glottic and Subglottic Corinoid</b>
<b>Congenital</b>	<b>Inflammatory</b>
Nasal obstruction, e.g., choanal atresia, encephalocele	Viral croup
Micrognathia, e.g., cleft lip, hypoglossoma, hemangioma	Bacterial laryngotracheitis, including diphtheria
Facial skeletal anomalies—Pierre Robin anomaly	Tuberculosis*
Cleft palate	Sarcoid**
Treacher Collins syndrome	Fungal, e.g., coccidioidomycosis**
Menigeocele	Allergic edema
Facial edema (face presentation)	Erythema multiforme*
Congenital cysts—Thyroglossal duct	Eosinophilia, e.g., measles, whooping cough**
Desmoid of base of tongue	<b>Neoplastic</b>
Ramula	Benign—Hemangioma
Lingual thyroid	Granular cell myoblastoma*
Pharyngeal tumors, e.g., dermoid**	Neurofibroma
<b>Inflammatory</b>	Hematomas
Retropharyngeal abscess	Recurrent respiratory papillomatosis
Infectious mononucleosis	<b>Malignant—Rhabdomyosarcoma</b>
Adenomatoid hypertrophy	Lymphomatoid granulomatosis
Laryng angina	Fungus
Severe orofacial trauma	Weysser granulomatosis
<b>Neoplastic</b>	Lymphomas
e.g., rhabdomyosarcoma	Fibrosarcoma**
<b>Neurologic</b>	<b>Neurogenic</b>
Subacute sclerosing panencephalitis (Dawson disease)	Vocal cord paralysis, e.g., syringomyelia**
<b>Postoperative</b>	Unilateral, e.g., post ductus ligation pneumonia**
Tongue obstruction	Bilateral, e.g., meningococcal meningitis, hydrocephalus, ventriculoperitoneal shunt failure
<b>Supraglottic</b>	arthrogryposis multiplex congenita*
<b>Congenital</b>	laryngeal abductor vocal cord paralysis**
Atresia	<b>Neuroma*</b>
Web	<b>Traumatic</b>
Laryngomalacia	Foreign body**
Cleft larynx—Cleft arytenoid	Intubation—Evacuation of ventricle
Extension cleft	Granulation tissue
Interarytenoid fixation*	Stenosis
Ventricular band hypertrophy**	Edema
Bilid epiglottis**	<b>Fracture</b>
Internal thyroglossal duct cyst	Post-intubation
Coarctation syndrome*	<b>Miscellaneous</b>
Cyst of epiglottis**	Tetanus
Secular cysts—Anterior*	Tibias secondary to hypocalcemia
Lateral	<b>Tracheal</b>
<b>Inflammatory</b>	<b>Congenital</b>
Epiglottitis—Primary infection	Ageneis or atresia
Secondary to trauma	Stenosis
Abcess*	Fibrous structures—Web**
<b>Traumatic</b>	Fibrous stenosis of tracheal segments
Dislocated arytenoid	Stenosis associated with tracheocephalic fistula
Edema—Suctioning trauma	Stenosis
Allergic	Abence or deformity of tracheal cartilage
Inhalation burn	Tracheomalacia
Caustic ingestion	Cartilage ring abnormalities (segmental malacia)
Fracture	Calcification of tracheal cartilages**
Foreign body**	<b>Tracheogenic cysts</b>
<b>Neoplastic</b>	<b>Inflammatory</b>
Hemangioma	Membranous laryngotracheitis
Lymphangioma	<b>Neoplastic</b>
Cystic hygroma	Fibrous histiocytoma
Recurrent respiratory papillomatosis	<b>Traumatic</b>
Chondroma	Foreign body*
<b>Glottic and Subglottic</b>	Intubation—Granulation tissue
<b>Congenital</b>	Oblique ring*
Atresia	Membr.
Web	Post-tracheotomy—granuloma, stenosis
Stenosis—soft tissue	Post-surgical—tracheocephalic fistula repair
Vocal cord paralysis—Unilateral	
Bilateral (Arnold-Chiari syndrome)	
Cyst—Thyroid cartilage fossorial cyst**	

# Diagnostic assessment HISTORY

- Time of onset
- Possible trauma
- Characteristic of cry
- Relation of airway problem to feeding, position
- History of previous intubation
- Questions about possible aspiration of FB

# HISTORY (cont.)

If stridor is present since birth:

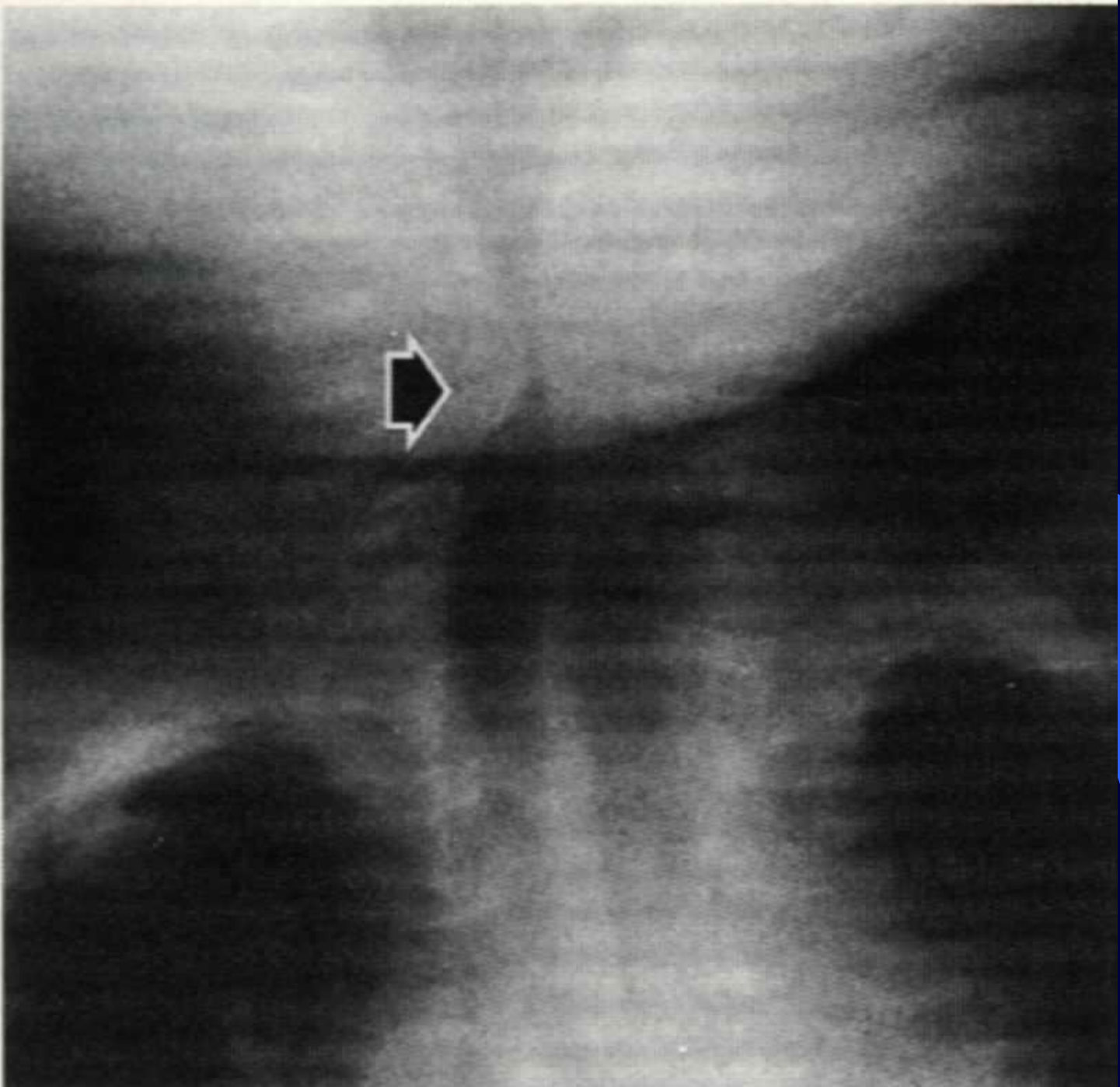
- \* congenital laryngomalacia
- \* subglottic stenosis
- \* vocal cord paralysis
- \* vascular rings

If onset of stridor is gradual and progressing:

- \* subglottic hemangioma appear between 1-3 months of age
- \* papilloma of the larynx appear at 6 months of age

# *RADIOLOGIC EVALUATION*

- Indicated for patient without respiratory distress
  - \* Plain views - soft tissue neck A.P. lateral
    - chest
  - \* Mobile pharyngeal tissue may bulge during expiration in normal infants
  - \* High-kilovoltage technique ( croup series) AP view assesses subglottic region
  - \* Fluoroscopy: dynamic A W changes

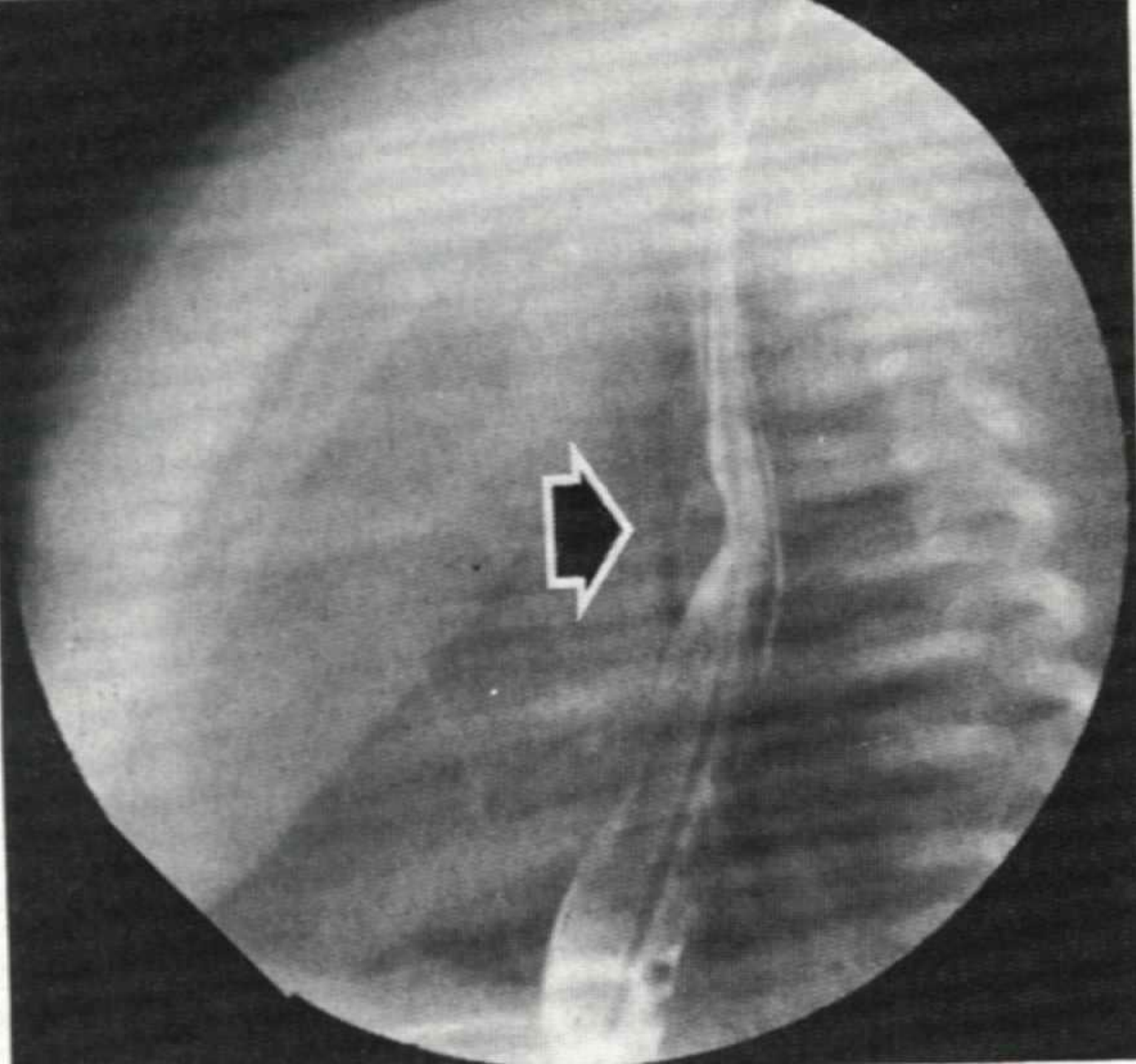




# RADIOLOGIC EVALUATION (cont.)

- \* Barium swallow
  - Assess - swallowing
  - R/O - presence of vascular rings
- \* CT scan. } good in evaluating mediastinum
- \* MRI. }





# ENDOSCOPIC EVALUATION

- *Mirror Examination: is not endoscopic.*
  - In older children and adults can provide information about hypopharynx and larynx.*
- *Telescopic Examination*
  - \* *Fibrooptic Endoscopy - excellent to assess the movement of VC.*
  - \* *Rigid bronchoscopy - done under GA*
    - may enable removal of FB*
    - assess the AW down to the main stem bronchi*

# Diagnostic assessment

- Flow volume loop
- 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

(Cont. Therapeutic options)

2. Heimlich maneuver
3. N. P. Airway
4. Oral Airway
5. Esophageal airway
6. Transoral intubation

## Cont. Therapeutic Options

7. Nasal intubation
8. Flexible fibroptic intubation
9. Transtracheal jet ventilation
10. Cricothyroidotomy
11. Tracheostomy



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

# SURGICAL TECHNIQUES

## 1. 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

(Cont. Surgical Techniques)

- **Complication**

- \* failure to establish an AW
- \* misplaced catheter in soft tissue of the neck (esp. in children)
  - pneumo mediastinum
  - pneumothorax
- \* total obstruction of the airway prevents adequate ventilation \*

(Cont. Surgical Techniques)

## 2. **PERCUTANEOUS TRACHEOSTOMY**

- \* Passing
  - needle
  - guide wire
  - series of dilators
  - the tube

(Cont. Percutaneous tracheostomy)

## **COMPLICATIONS**

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

## Cont. Surgical Techniques

### 3. **CRICOTHYROIDOTOMY**

- generally for emergency UAO.  
(failed or contraindication intubation)
- elective for head and neck or  
cardiovascular procedures
- where access to tracheal rings is limited

(Cont.Cricothyroidotomy)

**- PROCEDURE**

- may utilize horizontal or vertical incision
- use small trach. tube or endotracheal tube

(Cont. Cricothyroidotomy)

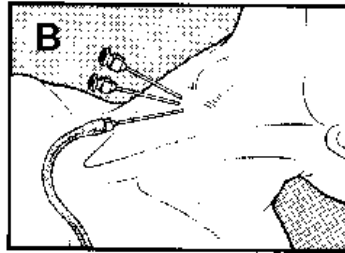
## **-COMPLICATION**

- injury of anterior jugular vein, great vessels
- injury of recurrent laryngeal nerve
- subglottic and laryngeal stenosis  
(especially in children)



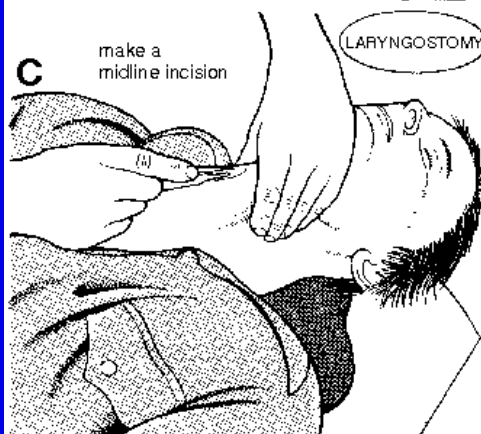
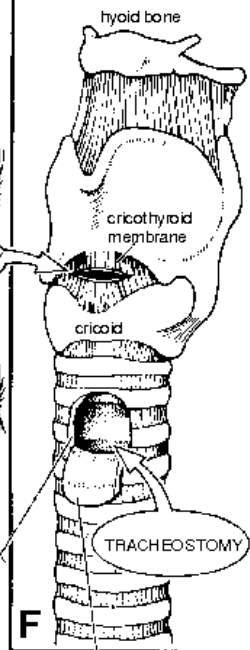
# EMERGENCY LARYNGOTOMY

needle laryngotomy using several large needles



feel for his cricothyroid membrane with your nail

## THE ANATOMY



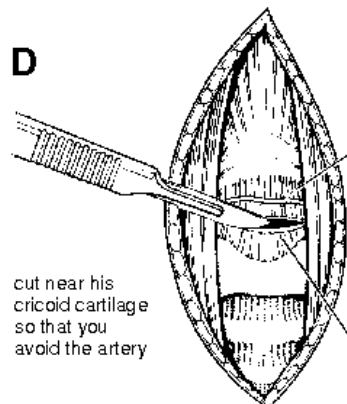
make a midline incision

LARYNGOSTOMY

TRACHEOSTOMY

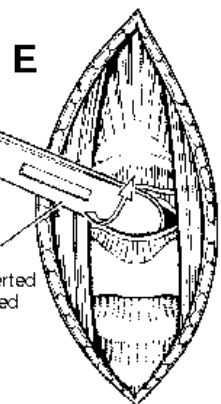
this is the minimum size

stitch to skin



cut near his cricoid cartilage so that you avoid the artery

cricothyroid membrane



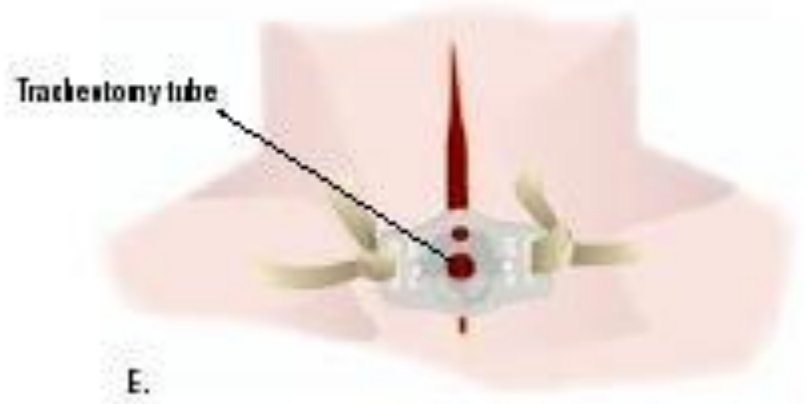
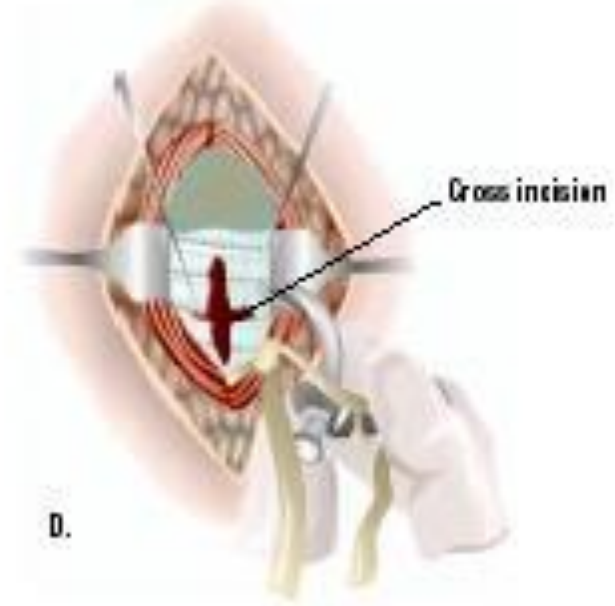
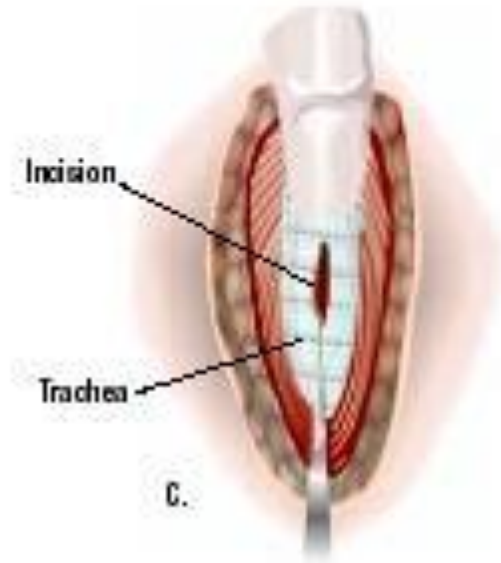
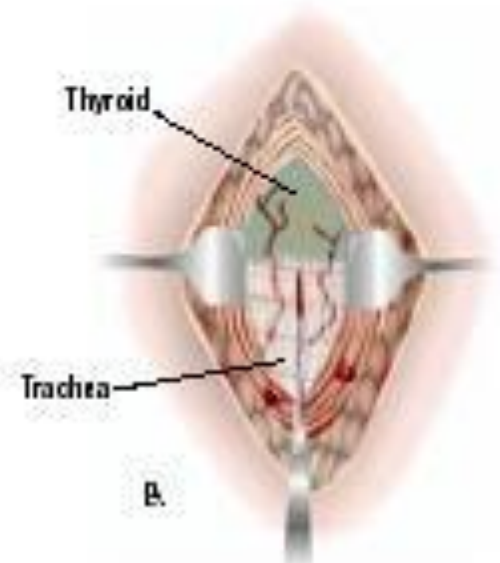
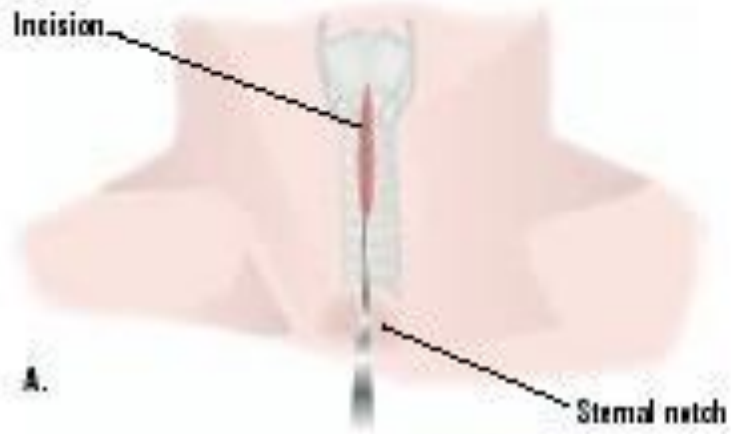
handle of knife inserted and twisted

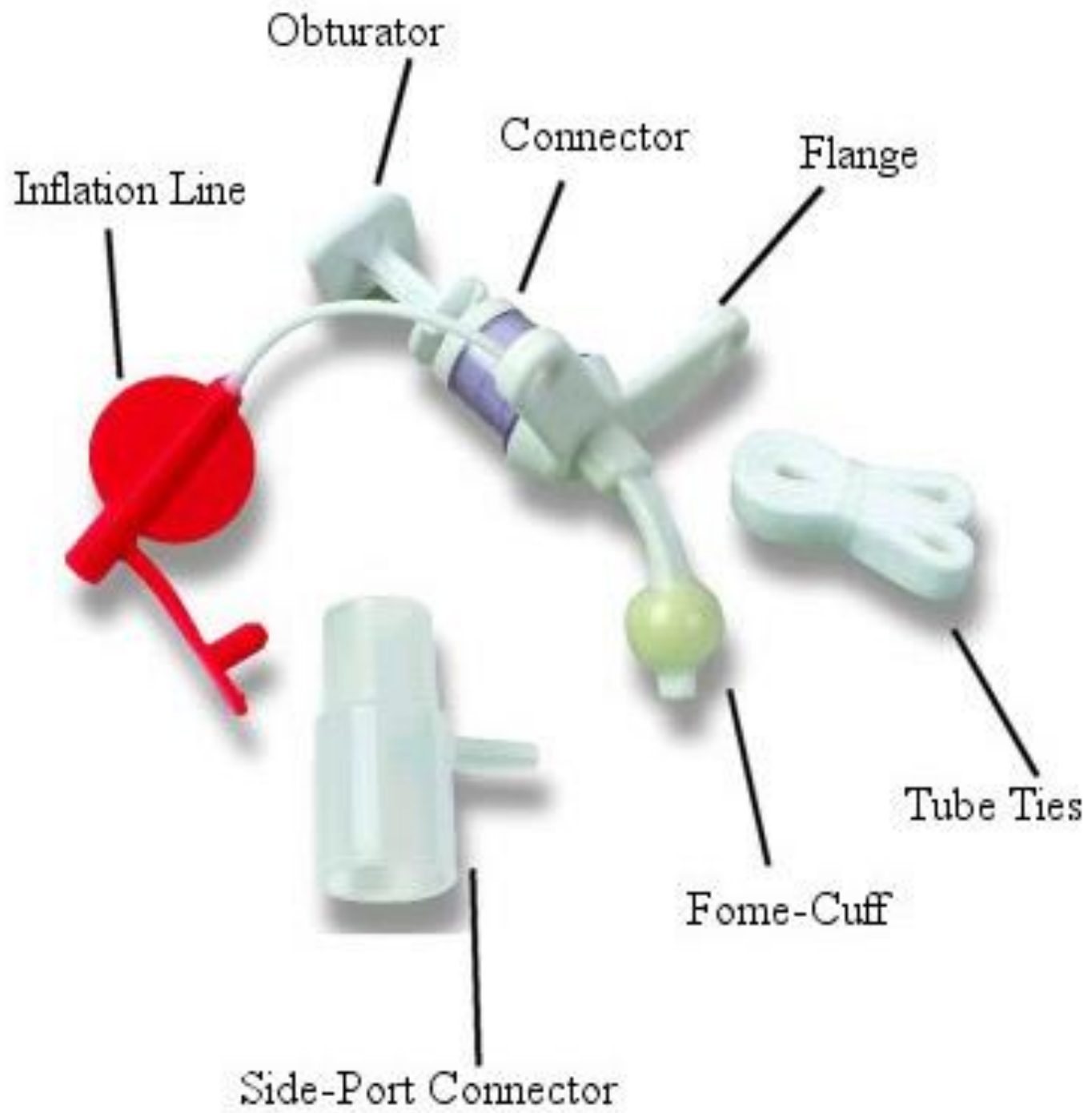
(Cont. Surgical Technique)

## 4. TRACHEOSTOMY

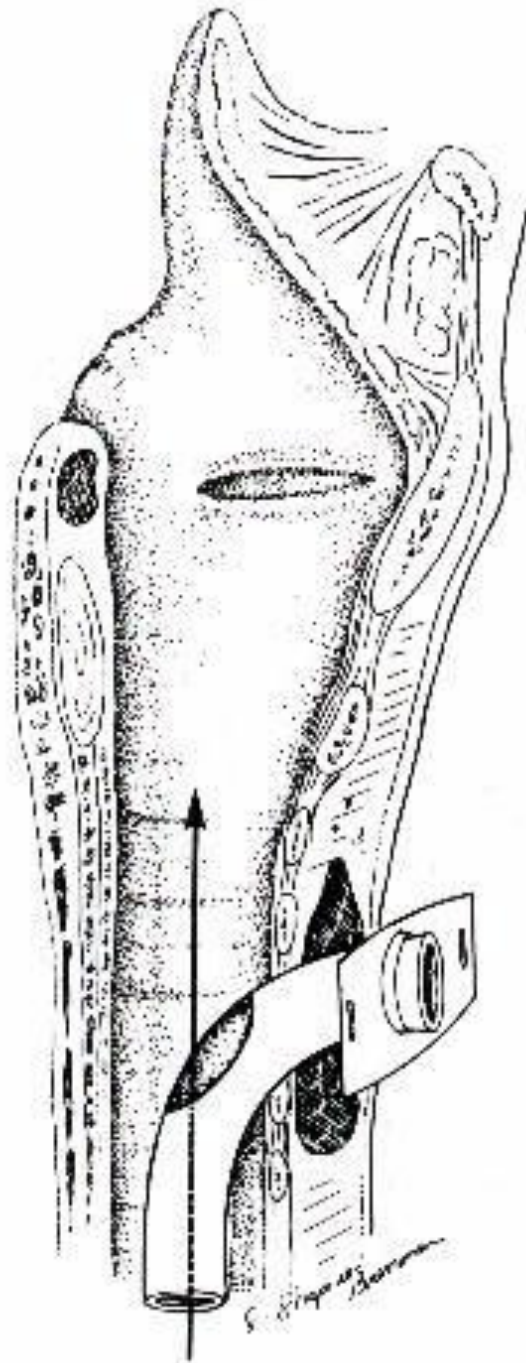
- \* for emergency or elective-airway obstruction  
acute or chronic-airway obstruction
- \* in emergency tracheostomy
  - vertical incision is preferred
  - heamostasis after establishing airway obstruction

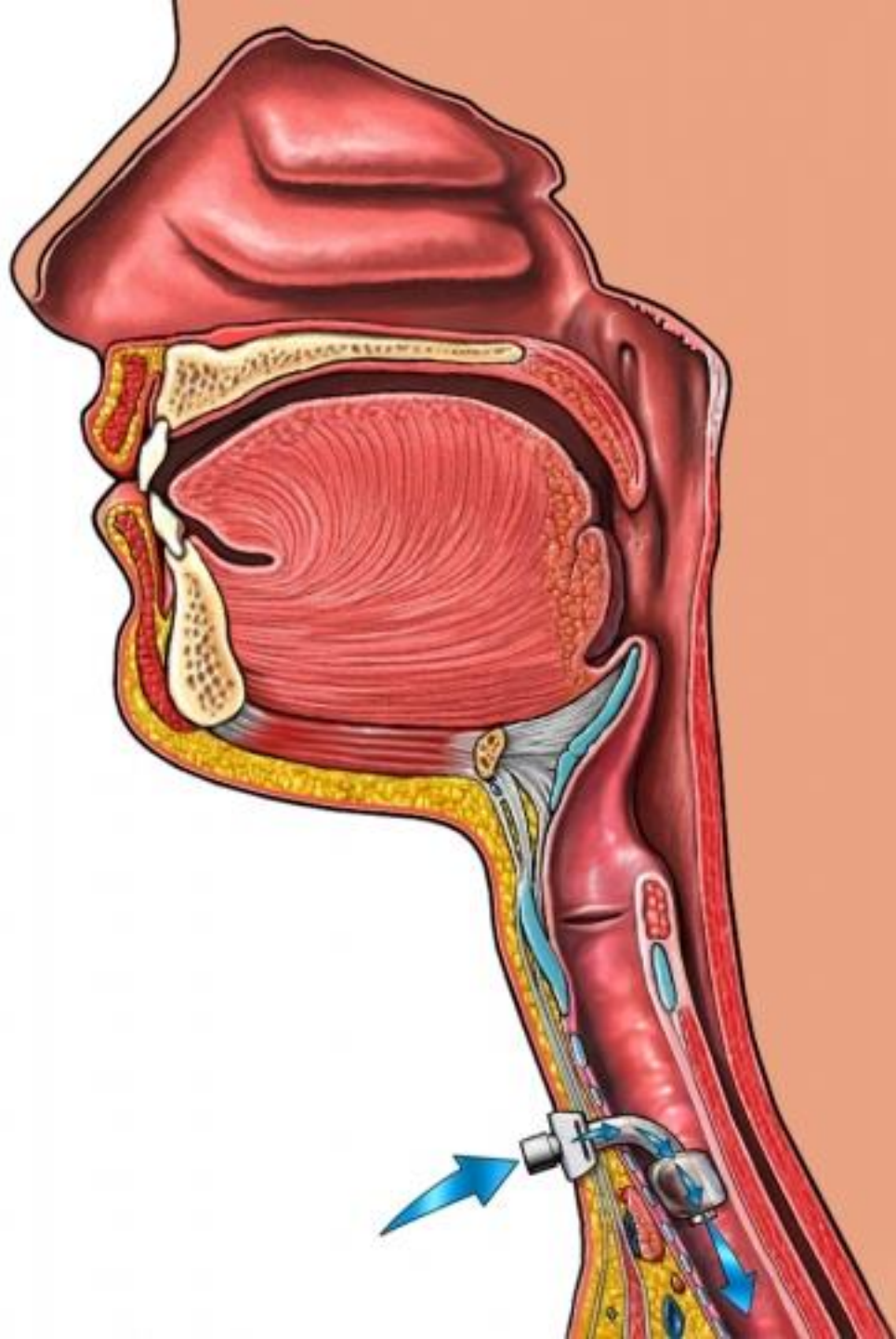
# Tracheotomy











## **\*TRACHEOSTOMY INCISION**

- vertical versus horizontal

### **VERTICAL**

#### **Advantages**

- limit injury of vascular and neural structure
- improve access of trachea  
(easy retraction of soft tissue)



## **(Cont. Vertical tracheostomy incision)**

### **Disadvantages**

- potential scar formation
- risk of communication with neck wounds (e.g. apron flap)

## **HORIZONTAL INCISION**

### **Advantages:**

- improve cosmetic appearance
- may avoid neck dissection wound

## **(Cont. Horizontal trancheostomy incision**

### **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

## A. TUMOR

- commonly tumors of aerodigestive tract or thyroid
- typically present with gradual airway obstruction
- initial management
  - O<sub>2</sub>, humidification
  - steroids and IV antibiotics

(Cont -Airway Emergency- Tumor)

## Airway stabilization

- organization between Surgeon and Anesthetist
- avoid blind attempt of intubation
- if available, fiberoptic intubation (experience)
- percutaneous jet ventilation to stabilize patient

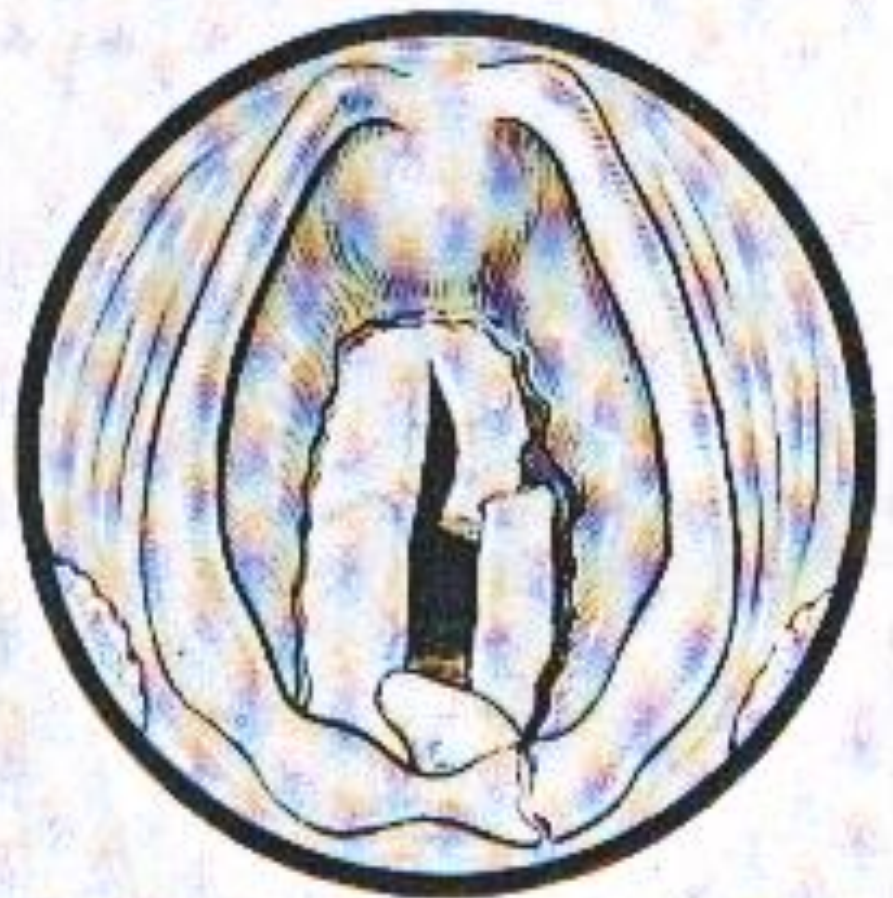
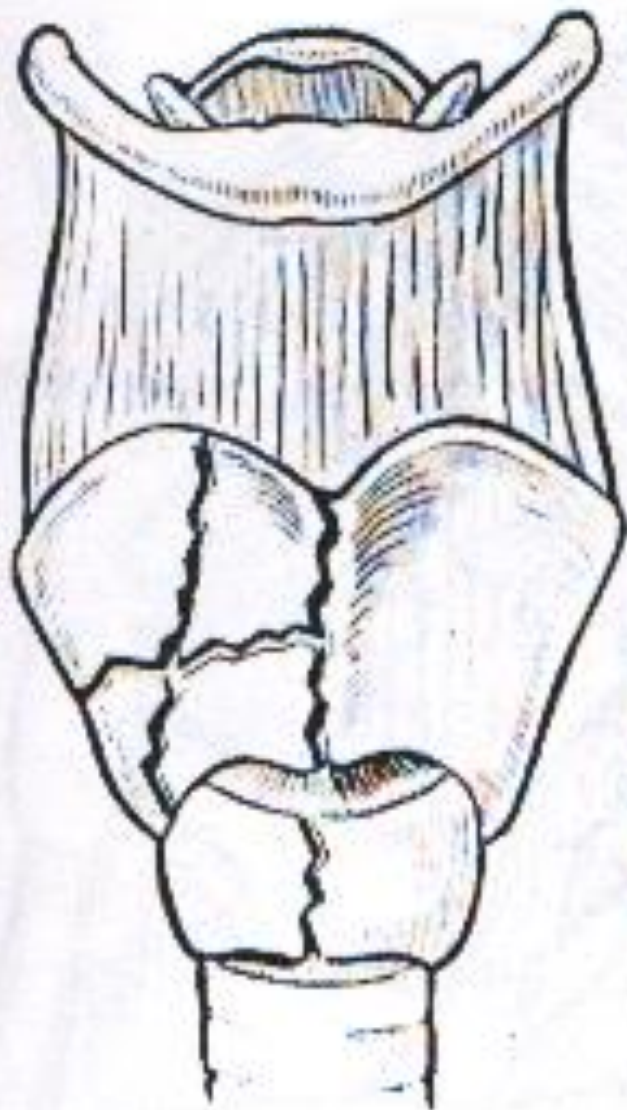
(Cont. Airway stabilization in tumor)

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

## B. TRAUMA

### \* Presenting SX

- Hoarseness
- Pain tenderness
- Hemoptysis
- Dysphagia
- SC emphysema
- Impaired respiration
- Haematoma





# CLASSIFICATION OF LARYNGEAL TRAUMA & TREATMENT

## TYPE I

- 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

(Cont. Classification of laryngeal trauma & treatment)

## **TYPE II**

- edema, haematoma, mucosal disruption  
no exposed cartilage, no displaced fracture
- Management
- tracheostomy under local anaesthesia
- CT scan to R/O displaced fracture

## (Cont. Classification of laryngeal trauma & treatment

### TYPE III

- massive edema with large mucosal laceration,  
exposed cartilage, displaced fracture  
\*  
V.C. motion impairment
- Management
  - tracheostomy
  - laryngoscopy
  - exploration and repair

(Cont.-Classification of laryngeal trauma and treatment

## TYPE IV

- same as III but more severe
- Management
  - explore and repair
  - require endolaryngeal stent

(Cont. Airway Emergency

## **C. BURN PATIENT**

- airway management is controversial
- considering the choice of airway

## (Cont.-Burn Patient-Considering the choice of AW)

- Oral or nasal endotracheal tube
  - May exacerbate 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

(Cont.-burn patient-considering the choice of AW)

▪ Tracheostomy

- Reported to have higher mortality rate as a result of infectious complication (pulmonary sepsis, necrotizing tracheitis, mediastinitis)
- Bleeding, pneumothorax, tracheal stenosis

(Cont.-burn patient-considering the choice of AW)

Tracheostomy ..... cont

- Edema of the neck results in
  - difficult procedure
  - inadvertent removal of the tube
  
- Cricothyroidotomy, may establish the airway more easily



(Cont. Burn patients)

- 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 inhalation injury with:
  - changes in ABG, O<sub>2</sub> sat, and increase CO<sub>1</sub>

(Cont. Burn patients)

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

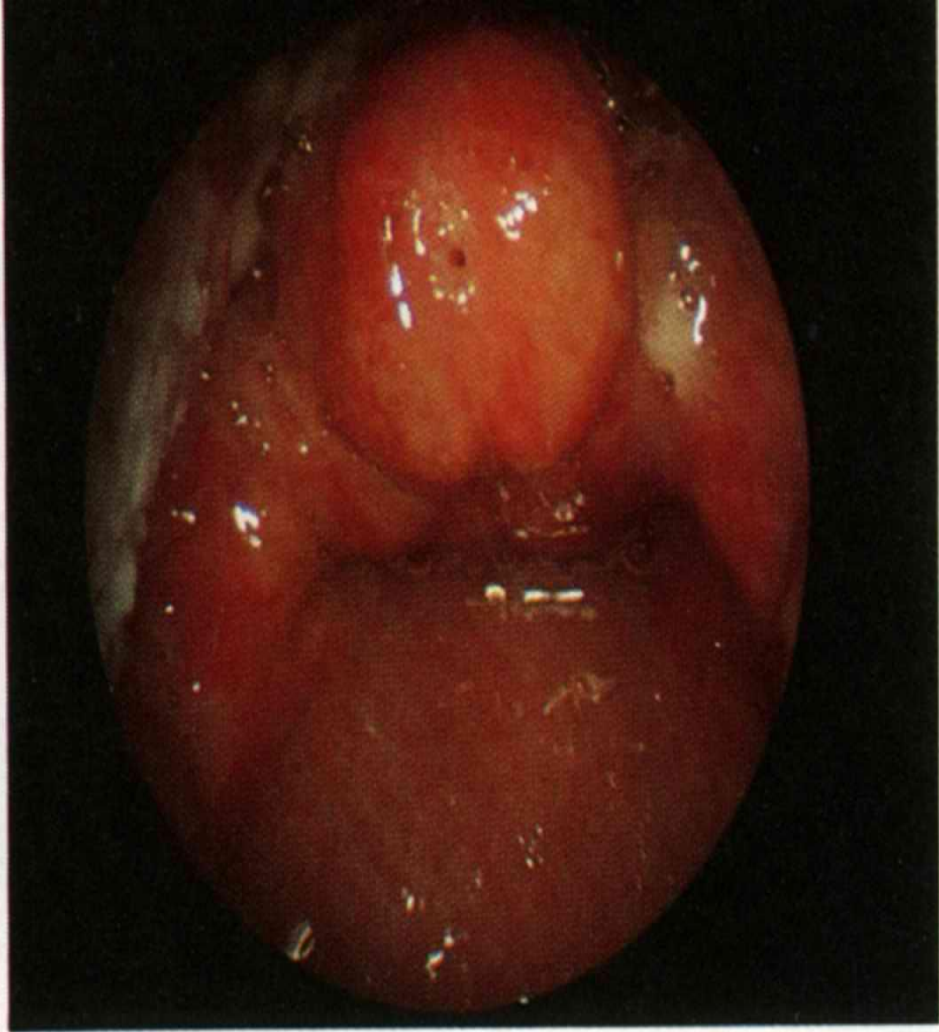
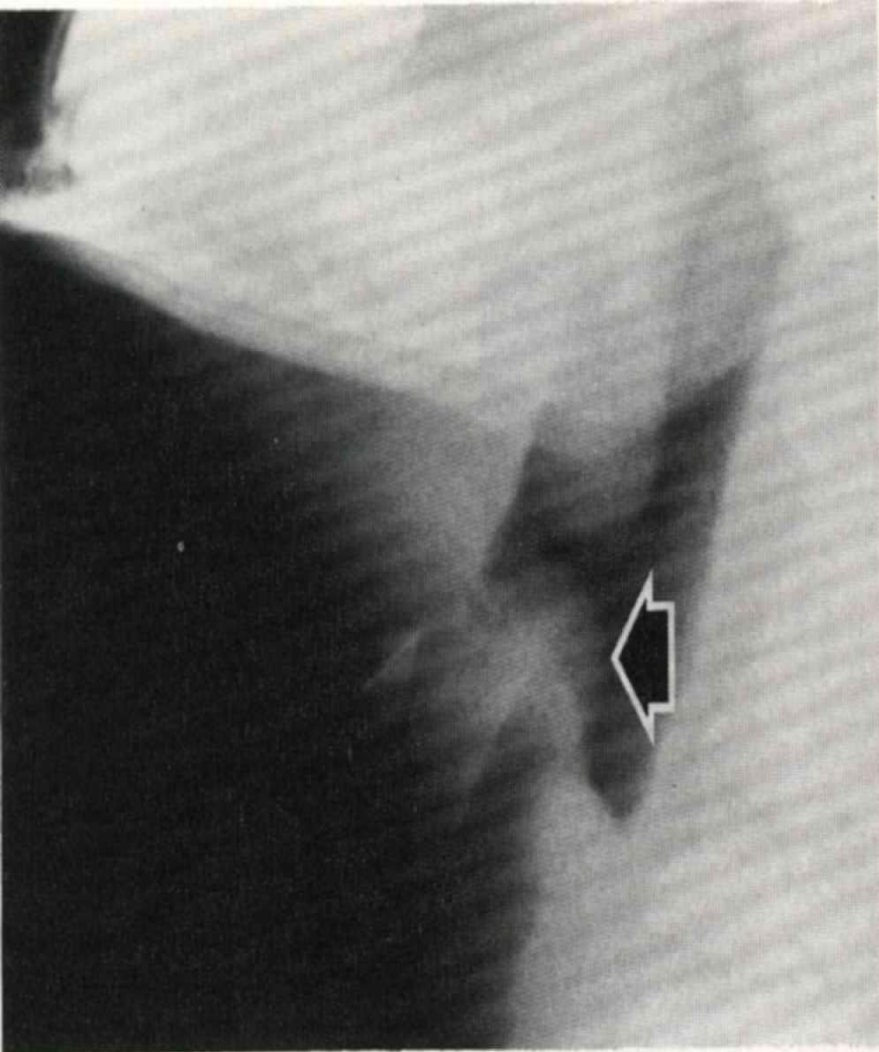
## D. SUPRAGLOTTITIS / EPIGLOTTITIS

### -PAEDIATRIC

- sudden onset
- rapidly progressive course
- high fever, respiratory distress
- drooling, painful swallowing

# ADULT

- dysphagia, severe sore throat
- fever, stridor, voice change



# MANAGEMENT

## ▫ CHILDREN

- secure airway

ET tube

tracheostomy

## ▫ ADULT

- frequently observed in an ICU
- may need intubation

# ***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 - resp. distress
  - inability to speak or cough

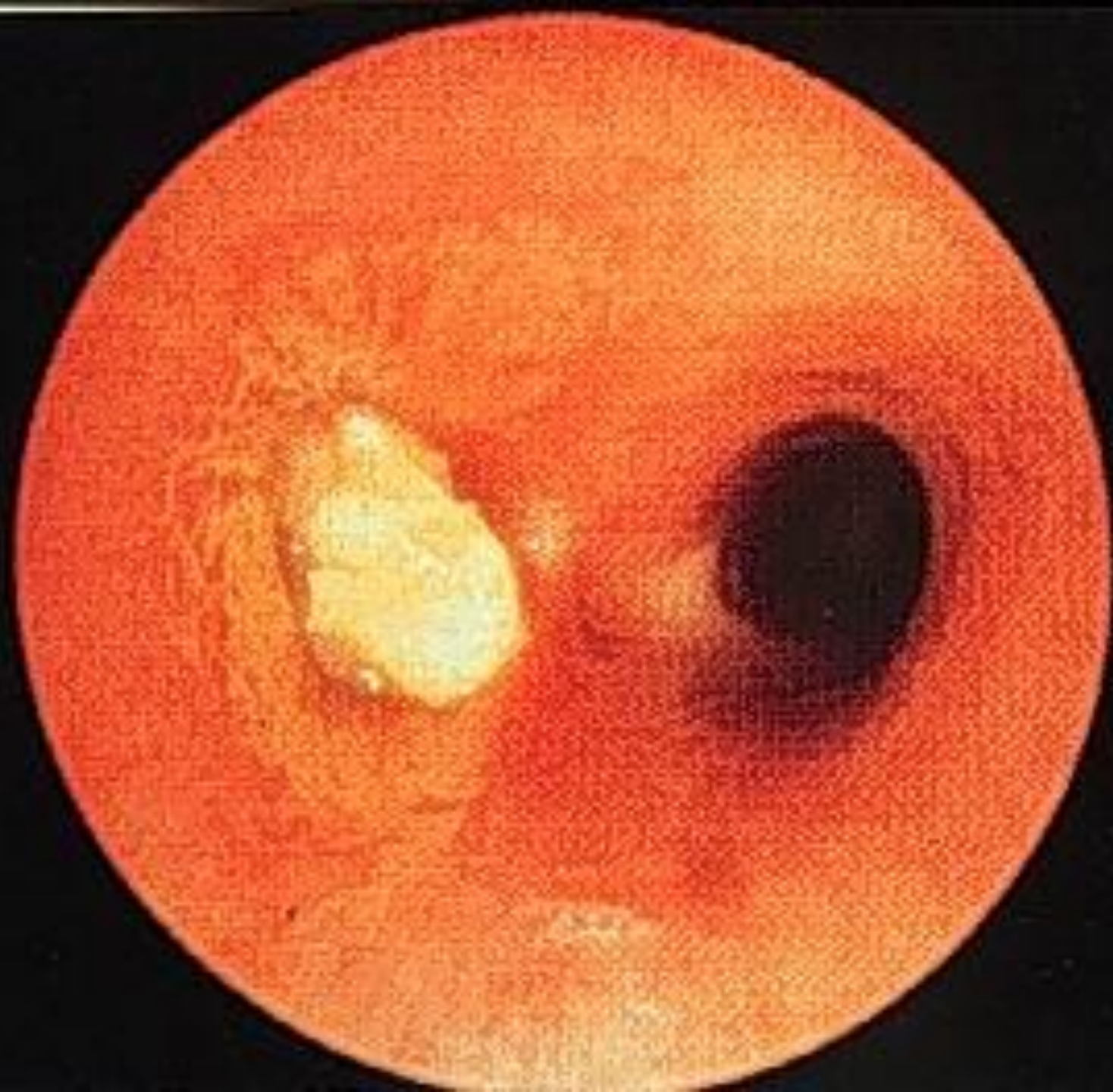
# FORIGN BODY (cont.)

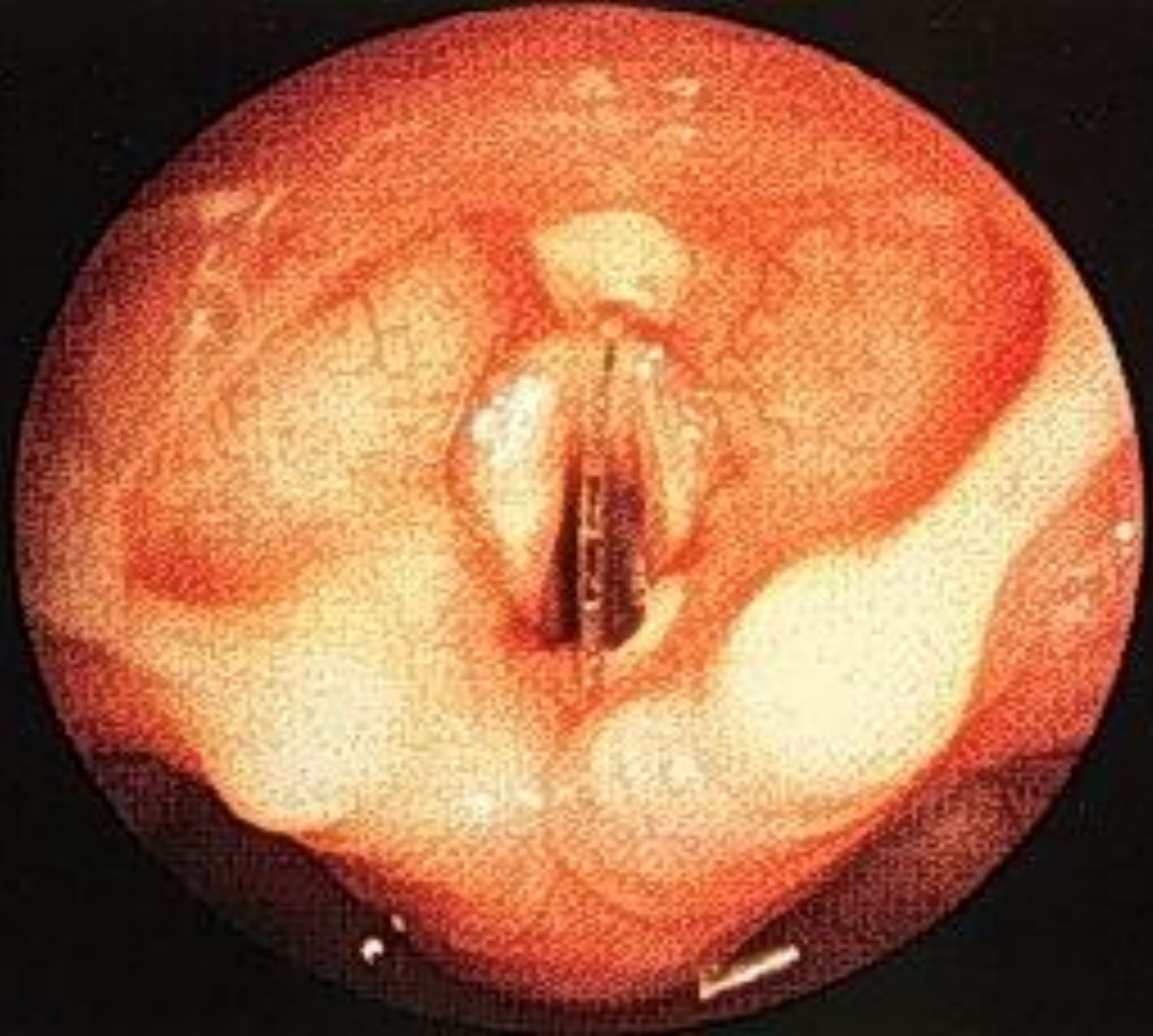
- Types of FB
  - \* vegetable matter are the most common in the children's AW
  - \* metal
  - \* plastic



# FB (cont)

- Location of FB in the AW
  - \* commonly the final destination is one of the main bronchi
    - right more common than left
  - \* Larynx -sharp objects
  - \* Trachea if there is narrowing in the trachea



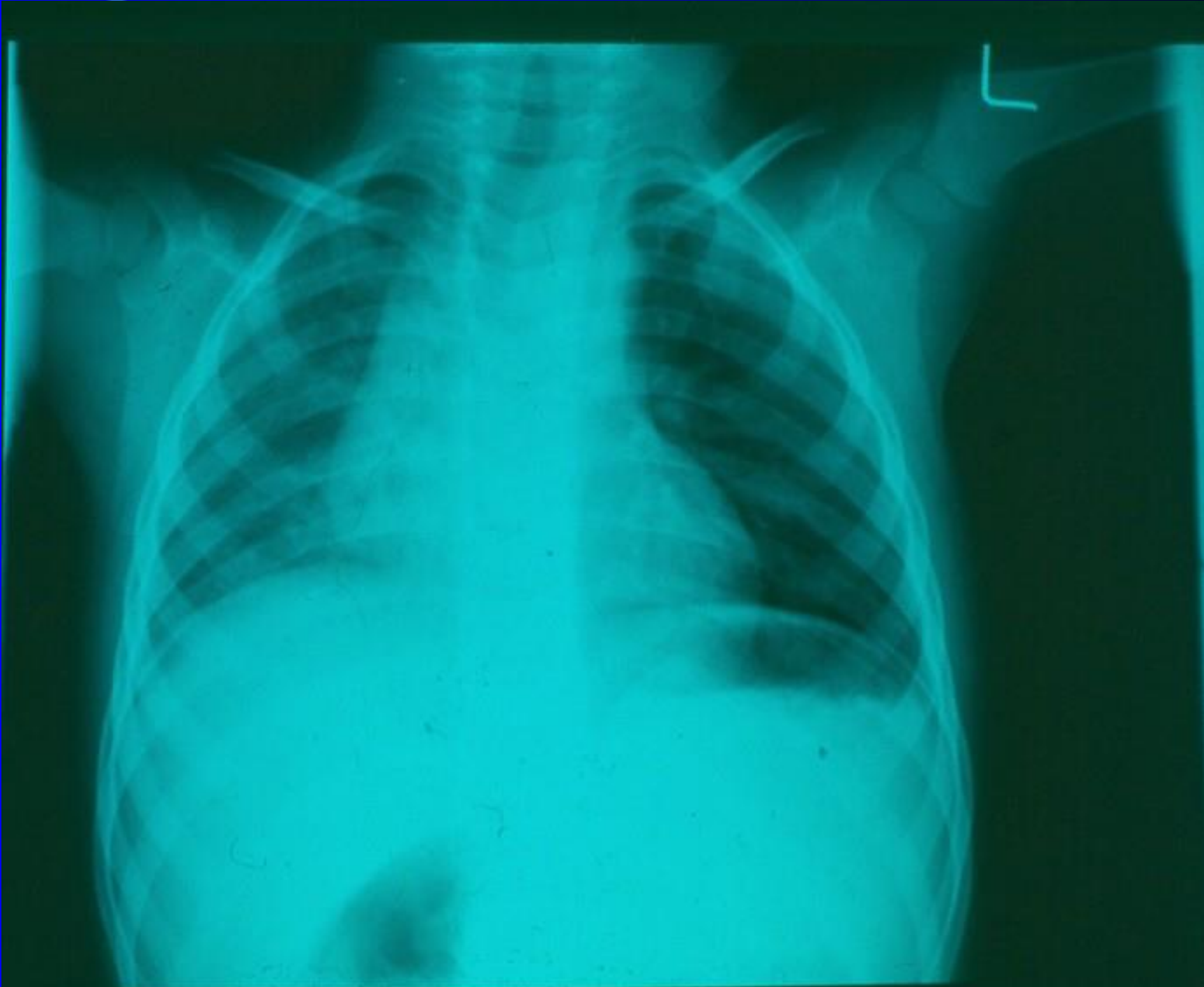


# ***FOREIGN BODY (cont.)***

## **PRESENTATION**

- Usually coughing, choking, gagging and wheezing
- No symptoms or signs  
Mimik different acute or chronic disease of lungs  
e.g. croups, bronchial asthma.
- . Stage of complications





# ***FOREIGN BODY (cont.)***

## **DIAGNOSIS**

- Radiologic - extended soft tissue neck }
  - PA, lateral chest }

most efficacious
- It can demonstrate - FB
  - Emphysema, atelectasis  
of the lung

# ***FOREIGN BODY(cont.)***

- Management:
  - \* Endoscopic removal is both diagnostic and therapeutic.



# ***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

# ***LARYNGOMALACIA ( cont.)***

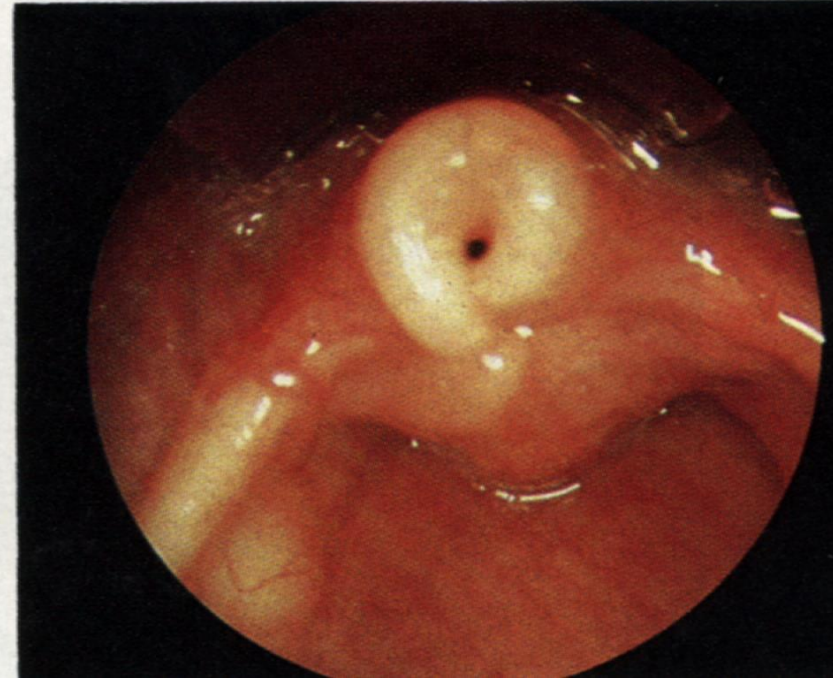
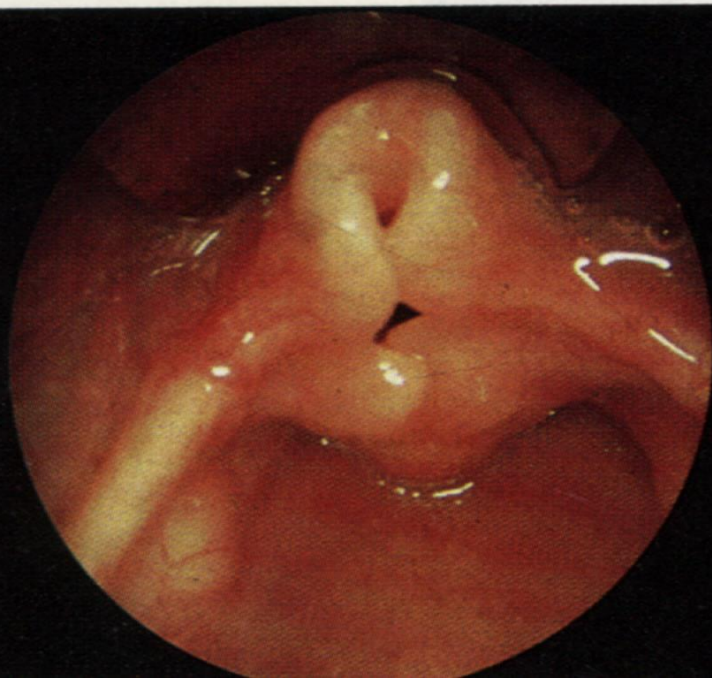
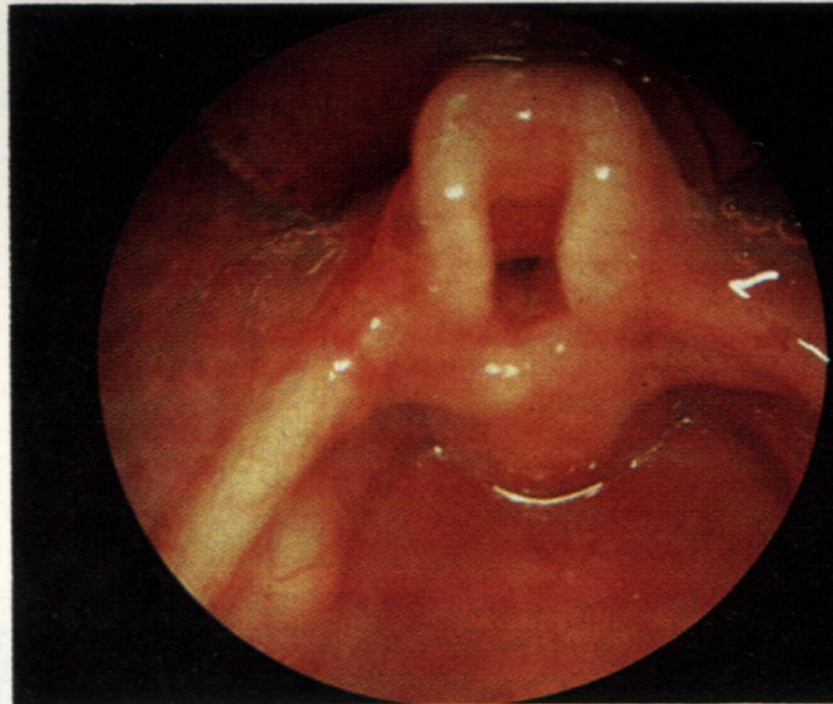
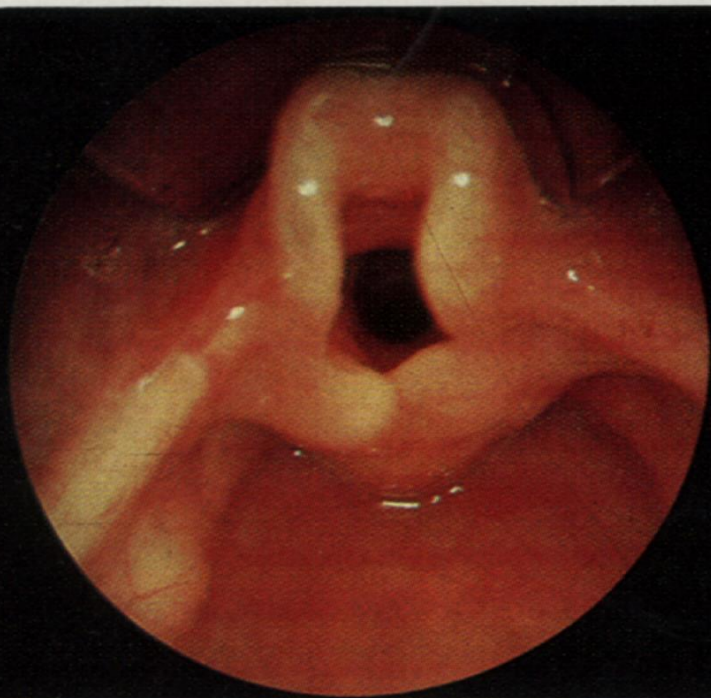
## **Cause is unknown:**

- \* 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 - infolding of the aryteroids in the AW

# ***LARYNGOMALACIA (cont.)***

- **Diagnosis:**

- \* can only be confirmed by direct observation of movement of supraglottis during respiration
- \* fiberoptic 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.



# *COMPLICATIONNL of laryngomalacia*

- Feeding difficulty
- Failure to thrive

# ***LARYNGOMALACIA***

## Treatment:

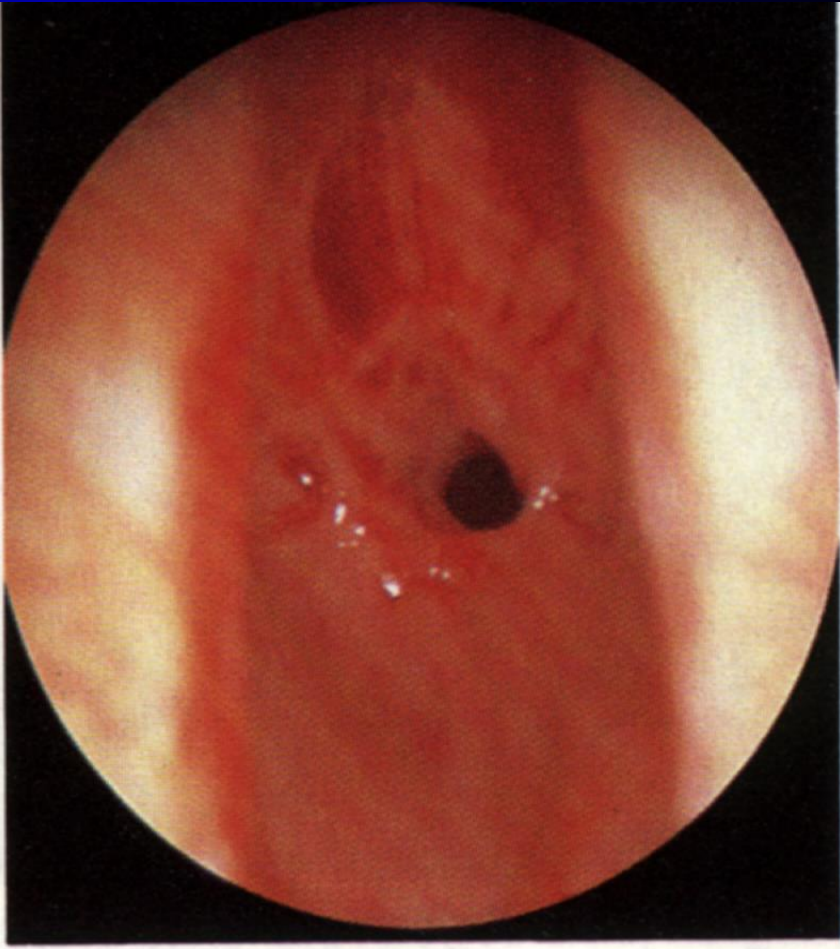
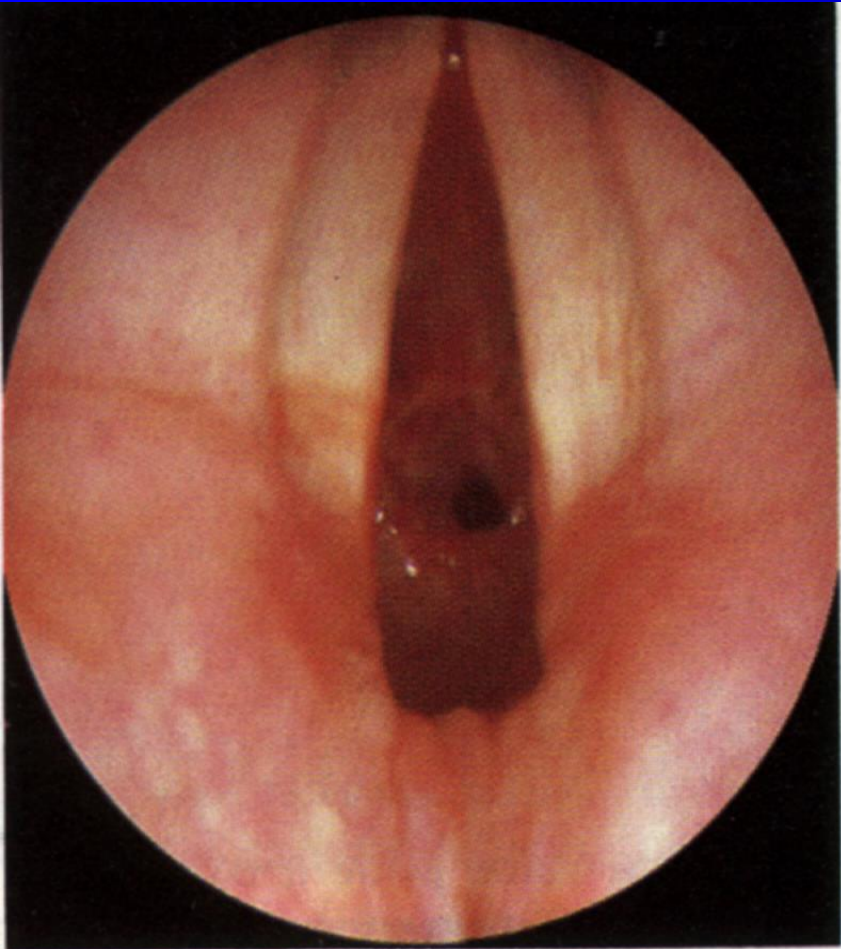
- Reassurance
- Infant can outgrow this problem
- Tracheostomy for severe cases.
- Epiglottoplasty for severe cases

# SUBGLOTTIC STENOSIS

- It is a narrowing of the subglottis.  
in newborn SG diameter of less than 3.5 mm.

Two types of Subglottic Stenosis:

- \* congenital
- \* acquired - the commonest





# Subglottic stenosis presentation

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

# ***SGS EVALUATION***

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

# ***SGS MANAGEMENT***

- \* Endotracheal intubation } emergency situations
- \* Tracheotomy }
- \* Cricothyroidotomy }
  
- \* Endoscopic Techniques
  - dilatation
  - laser

# ***SGS MANAGEMENT (cont.)***

- Open Surgical Technique
  - \* Cricoid split
  - \* Laryngotracheoplasty + Rib graft + stent
  - \* Reconnection and primary anastomosis

# Choanal atresia

- Uncommon anomaly 1/ 5000- 8000
- Unilateral: present late
- Bilateral : birth emergency
- Mixed bone-membranous CA account for 90%
- Remaining bony CA

# Association of CA

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

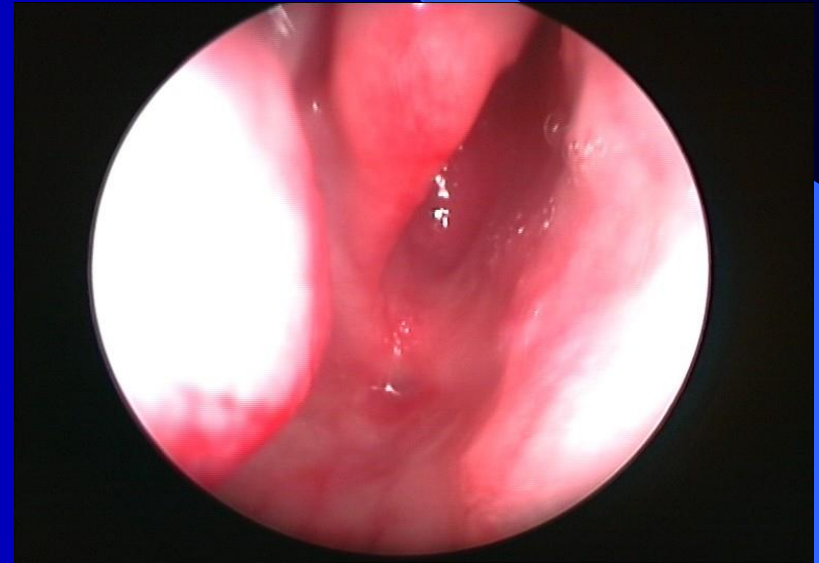
CHARGE

VATER

craniofacial anomalies

# Examination of CA

- Infants; failure to pass # 6- 8 catheter
  - pyriform aperture stenosis (1 CM)
  - choanal atresia (3.5 cm)
- 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%



