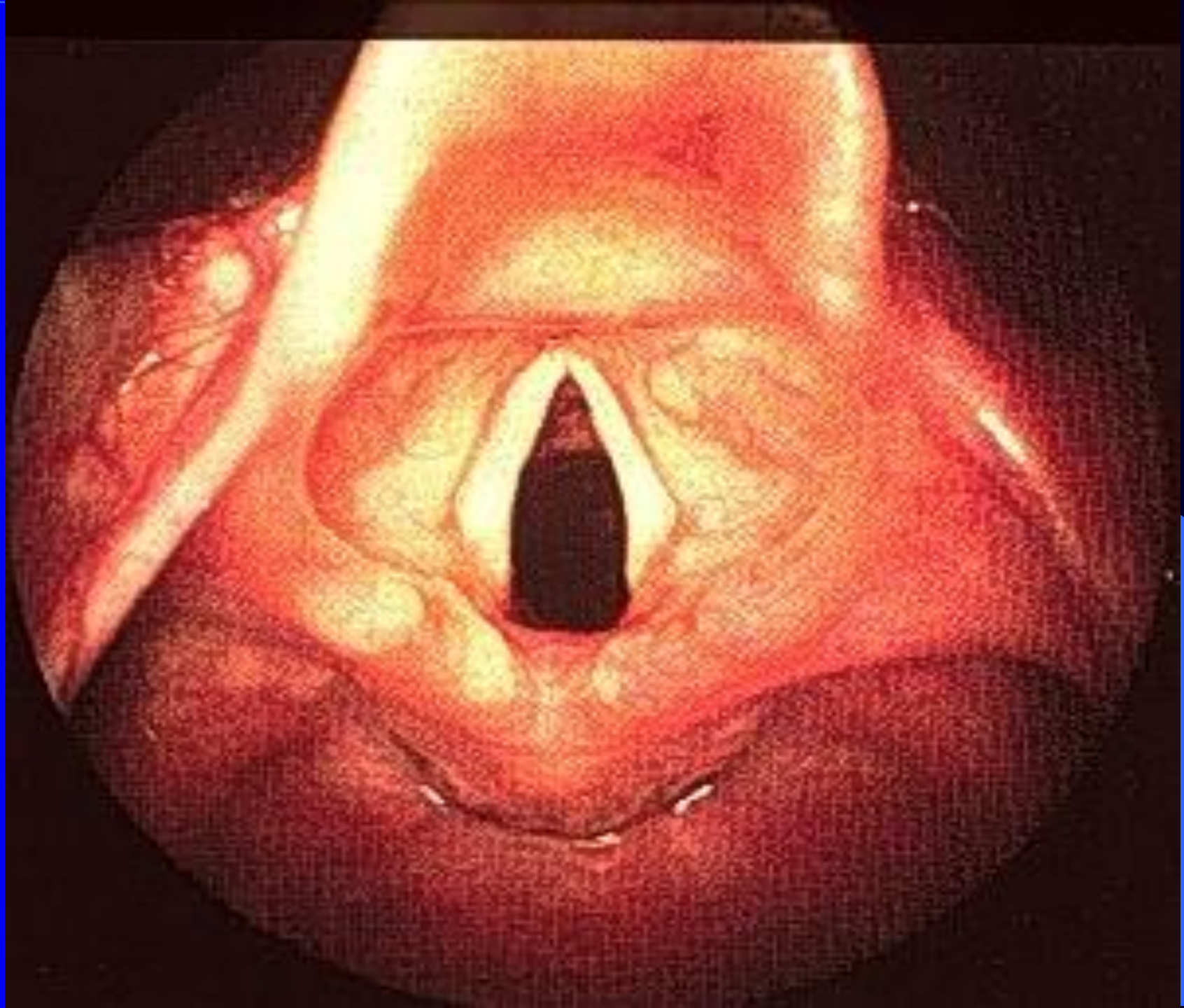
# UPPER AIRWAY OBSTRUCTION



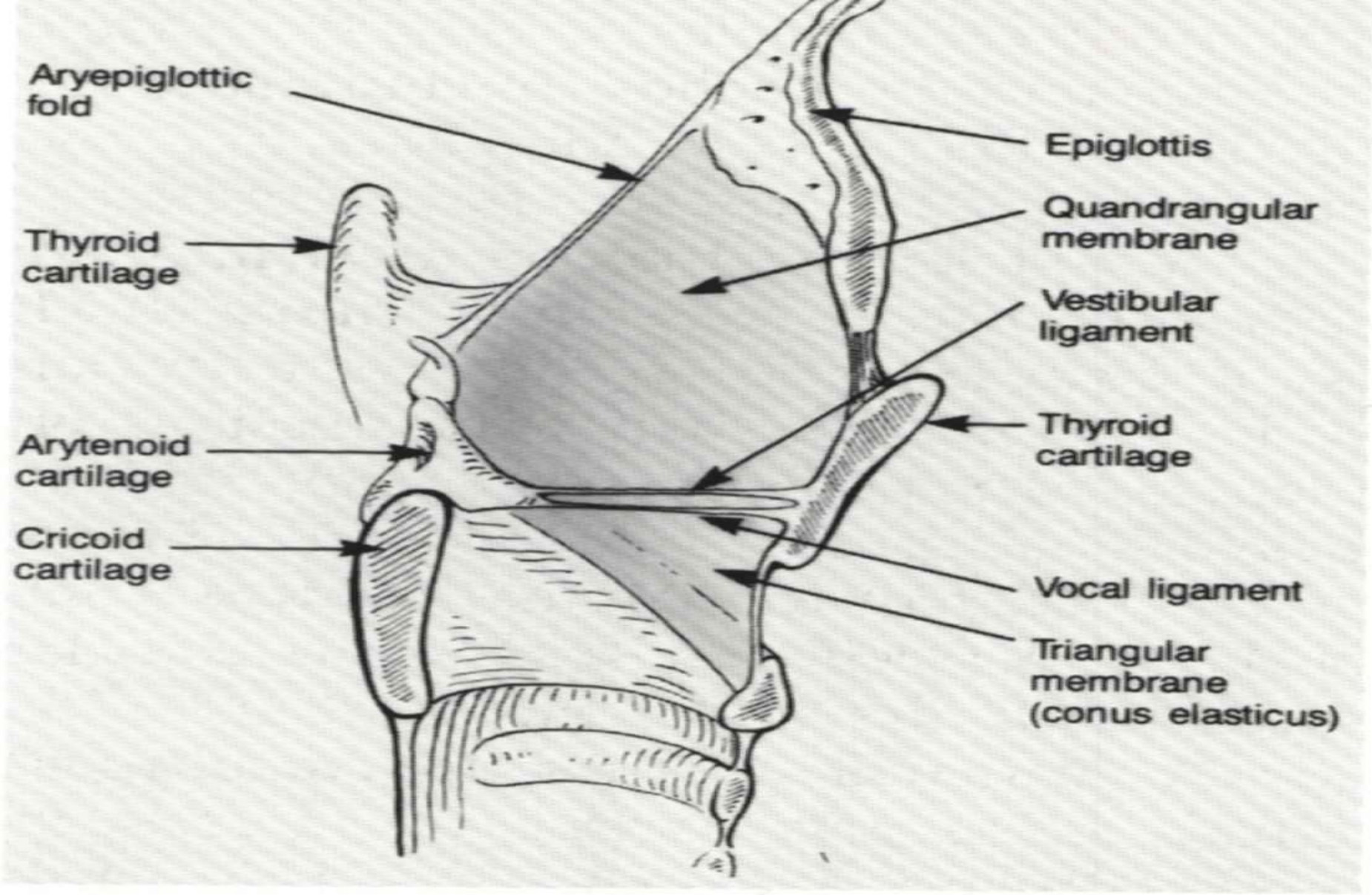



**Figure 1-3.** Midsagittal cut of the larynx showing the fibroelastic membrane attachments.

# 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 | $\frac{\text{Age in years} + 16}{4}$ |

# ***Signs of Airway Obstruction***

- Stridor is harsh high pitched musical sound produced by turbulance 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

**Supralaryngeal**
***Congenital***
Nasal obstruction, e.g., choanal atresia, encephalocele
Macroglossia, e.g., cretinism, lymphangioma, hemangioma
Facial skeletal anomalies—Pierre Robin anomalad
Cleft palate
Treacher Collins syndrome
Micrognathia
Facial edema (face presentation)
Congenital cysts—Thyroglossal duct
Dermoid of base of tongue
Ranula
Lingual thyroid
Pharyngeal masses, e.g., dermoid[36]
***Inflammatory***
Retropharyngeal abscess
Infectious mononucleosis
Adenotonsillar hypertrophy
Ludwig angina
Severe craniofacial trauma
***Neoplastic***
e.g., Rhabdomyosarcoma
***Neurologic***
Subacute sclerosing panencephalitis (Dawson disease)
***Postoperative***
Tongue obstruction
**Supraglottic**
***Congenital***
Atresia
Web
Laryngomalacia
Cleft larynx—Cleft arytenoid
Extensive cleft
Interarytenoid fixation[37]
Ventricular band hypertrophy[38, 39]
Bifid epiglottis[40]
Internal thyroglossal duct cyst
Cri du chat syndrome[41]
Cyst of epiglottis[42, 43]
Saccular cyst—Anterior[44]
Lateral
***Inflammatory***
Epiglottis—Primary infection
Secondary to trauma
Abscess[45]
***Traumatic***
Dislocated arytenoid
Edema—Suffocating trauma
Allergic
Inhalation burns
Caustic ingestion
Fracture
Foreign body[46]
***Neoplastic***
Hemangioma
Lymphangioma
Cystic hygroma
Recurrent respiratory papillomatosis
Chondroma
**Glottic and Subglottic**
***Congenital***
Atresia
Web
Stenosis—soft tissue
Vocal cord paralysis—Unilateral
Bilateral (Arnold-Chiari syndrome)
Cyst—Thyroid cartilage foraminal cyst[47]

**Glottic and Subglottic** *Continued*
***Inflammatory***
Viral croup
Bacterial laryngotracheitis, including diphtheria
Tuberculosis[48]
Sarcoid[49]
Fungal, e.g., coccidioidomycosis[50]
Allergic edema
Epidermolysis bullosa[51]
Exanthemata, e.g., measles, whooping cough[52]
***Neoplastic***
Benign—Hemangioma
Granular cell myoblastoma[53]
Neurofibroma
Hamartoma
Recurrent respiratory papilloma
Malignant—Rhabdomyosarcoma
Lymphomatoid granulomatosis
Plasmacytoma
Wegener granulomatosis
Lymphosarcoma
Fibrosarcoma[54]
***Neurogenic***
Vocal cord paralysis, e.g., syringobulbia[55, 56, 57]
Unilateral, e.g., post ductus ligation postintubation[58]
Bilateral, e.g., meningomyelocele, hydrocephalus, ventriculoperitoneal shunt failure
arthrogryposis multiplex congenita[59]
laryngeal abductor vocal cord paralysis[60]
Neuroma[61]
***Traumatic***
Foreign body[62]
Intubation—Excoriation of ventricle
Granulation tissue
Stenosis
Fibrosis
Fracture
Postextubation[63]
***Miscellaneous***
Tetanus
Tetany secondary to hypocalcemia
**Tracheal**
***Congenital***
Agenesis or atresia
Stenosis
Fibrous structures—Webs[64]
Fibrous stenosis of tracheal segments
Stenosis associated with tracheoesophageal fistula
Absence or deformity of tracheal cartilage
Tracheomalacia
Cartilage ring abnormalities (segmental malacia)
Calcification of tracheal cartilages[65]
Tracheogenic cysts
***Inflammatory***
Membranous laryngotracheitis
***Neoplastic***
Fibrous histiocytoma
***Traumatic***
Foreign body[66]
Intubation—Granulation tissue
Ciliary ring[67]
Stenosis
Post-tracheotomy—granuloma, stenosis
Postsurgical—tracheoesophageal fistula repair

# 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:

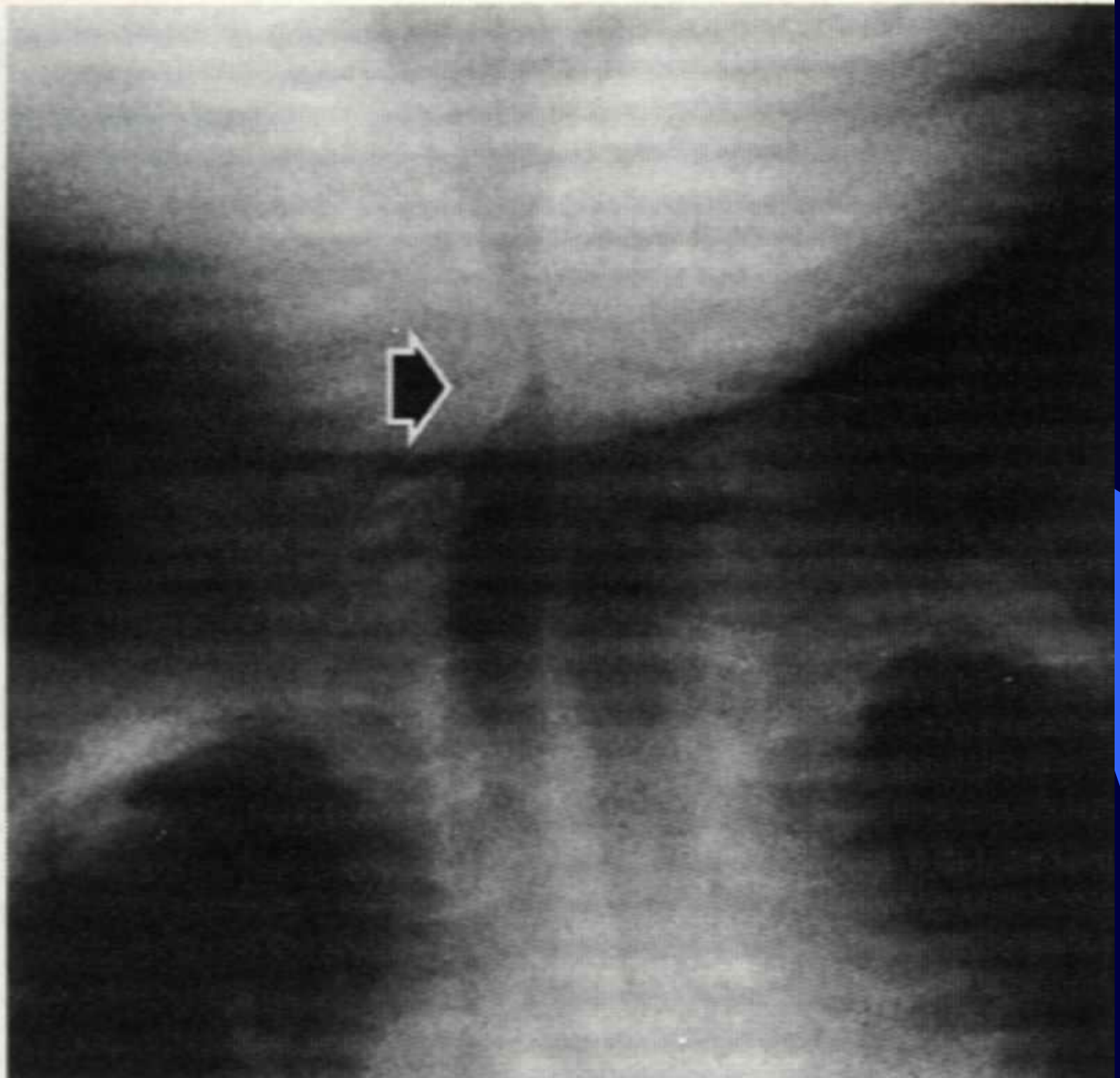
* conginetal laryngomalacia
* subglottic stenosis
* vocal cord paralysis
* vascular rings

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*

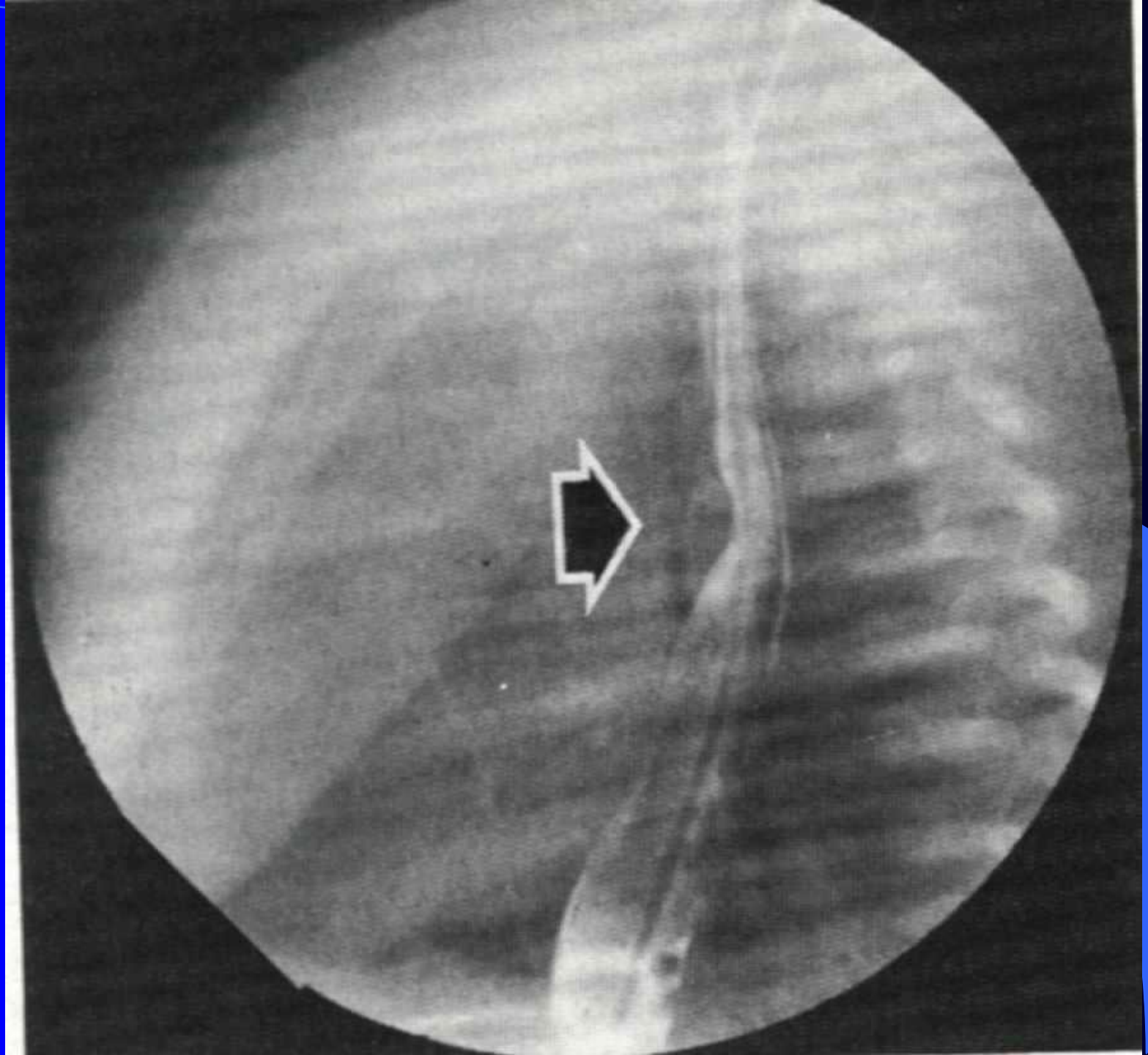
- Indicated for patient without respiratory distress
  * Plain views - soft tissue neck A.P. lateral
    - chest
  * Mobile pharyngeal tissue may bulge during expiration in normal infants
  * High-kilovoltage technique ( croup series) AP view assesses subglottic region
  * Flouroscopy: dynamic AW changes



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

## 3. Cricothyroidotomy

- generally for emergency UAO.
  (failed or contraindication intubation)

- elective for head and neck or
  cardiovascular procedures

- where access to tracheal rings is limitted

(Cont.Cricothyroidotomy)

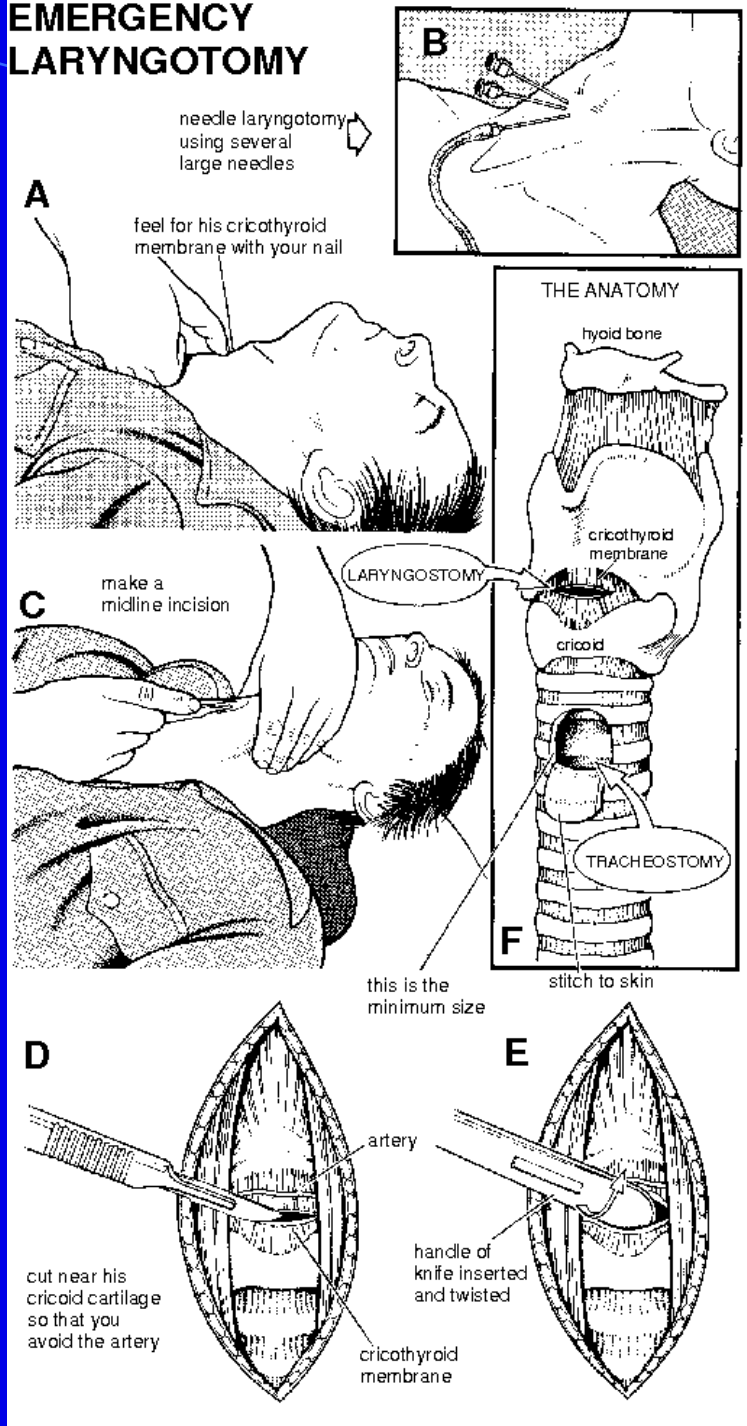
- **Procedure**
  - may utilize horizontal or vertical incision
  - use small trach. tube or endotracheal tube

(Cont. Cricothyroidotomy)

## -Complication

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

# EMERGENCY LARYNGOTOMY



(Cont. Surgical Technique)

## 4. Tracheostomy

* for emergency or elective-airway obstruction

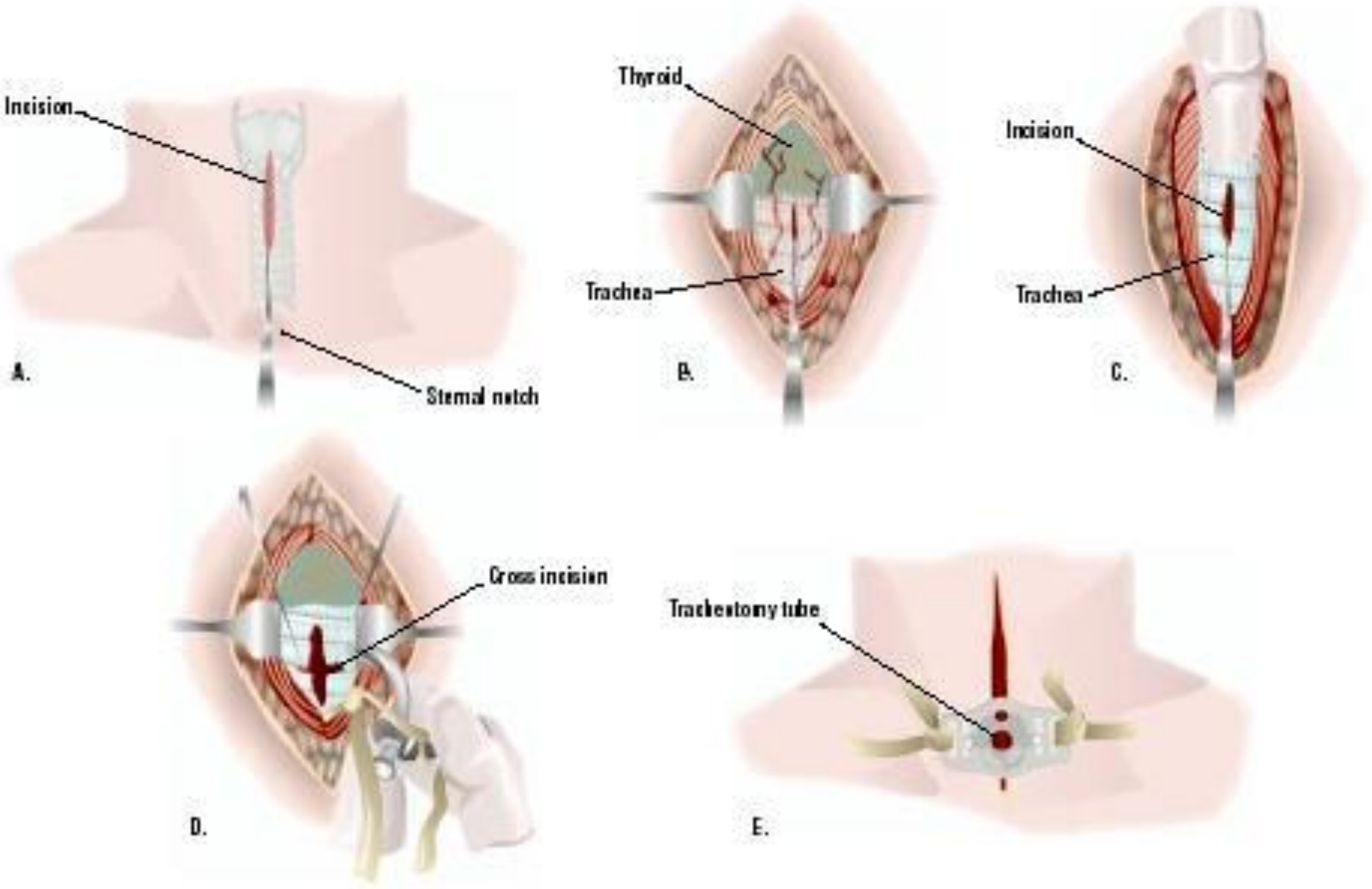
  acute or chronic-airway obstruction

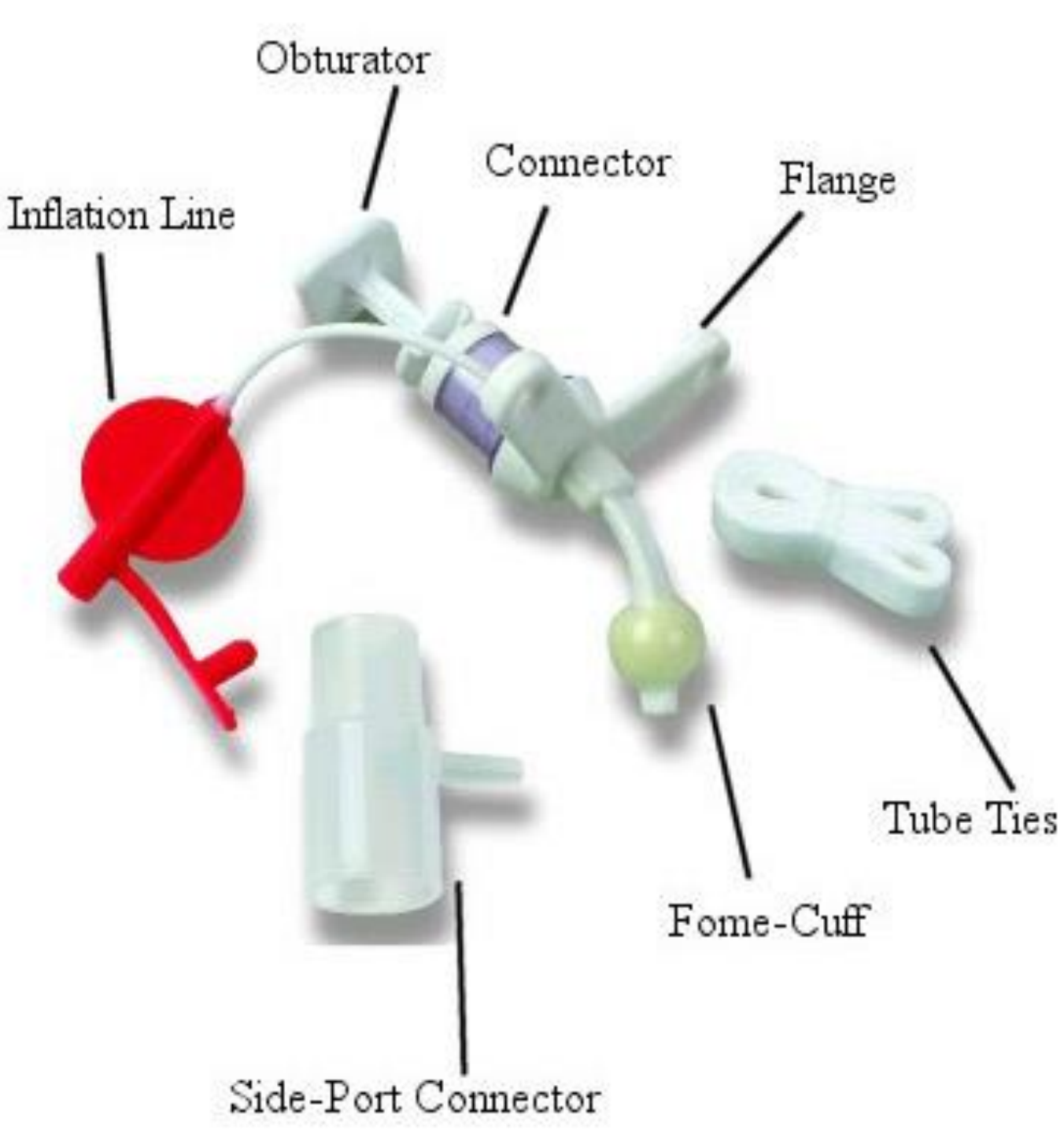
* in emergency tracheostomy

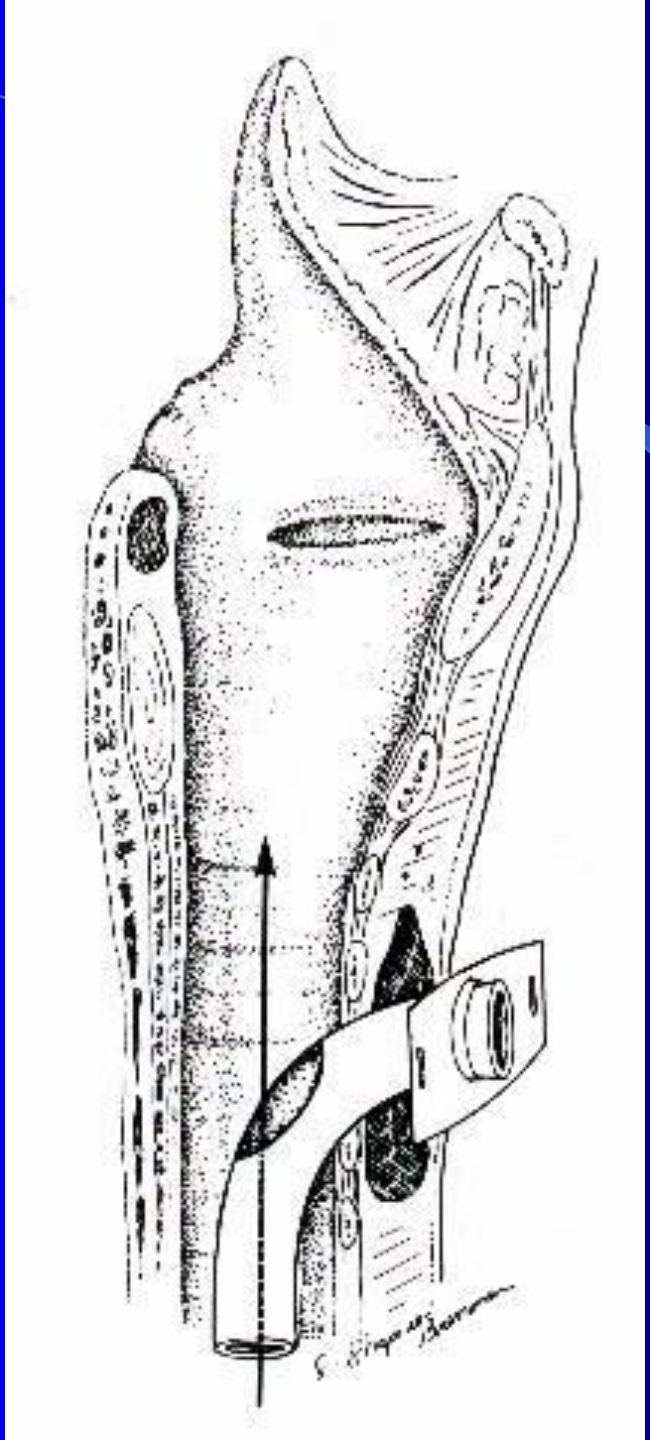
  - vertical incision is preferred

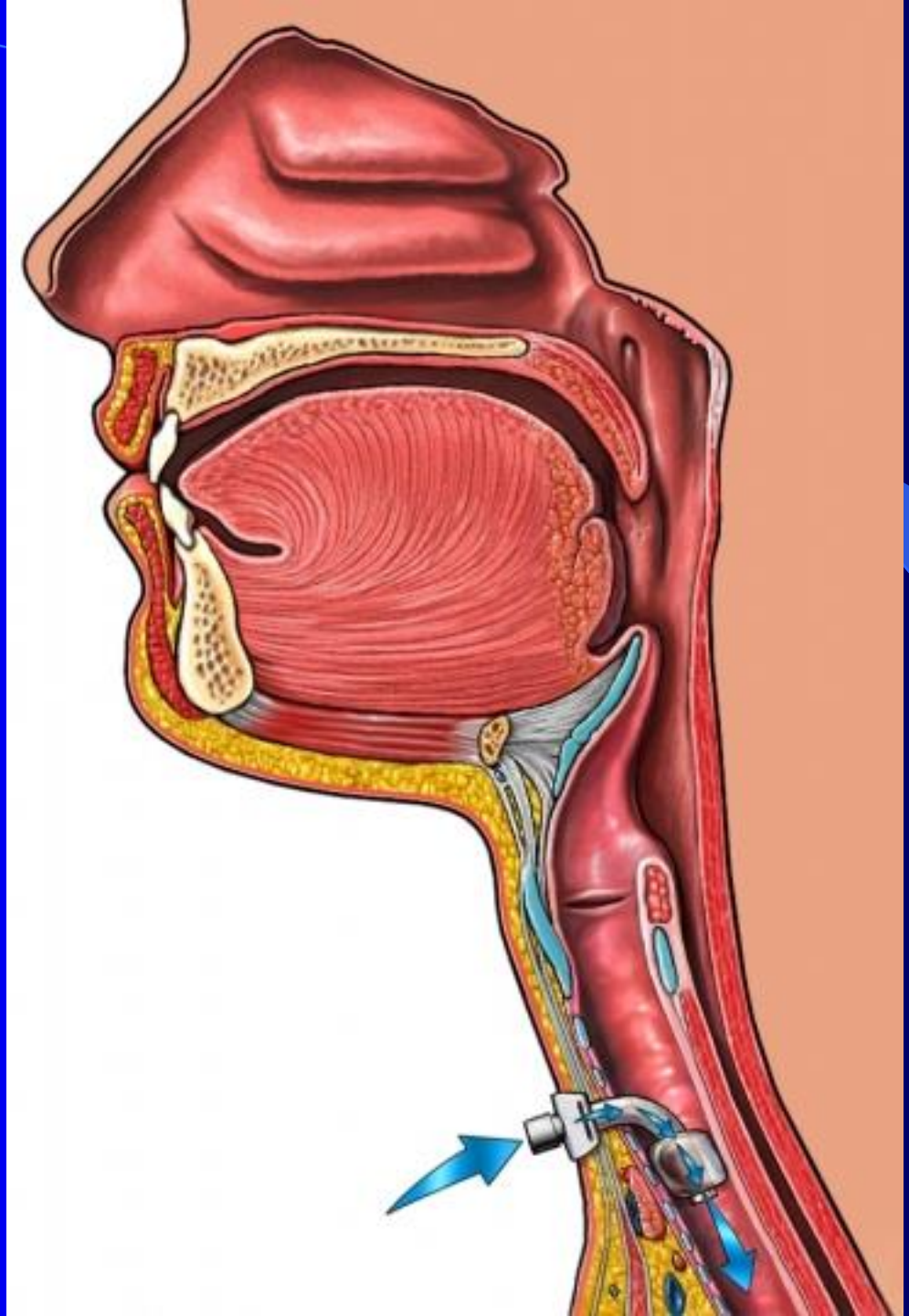
  - heamostasis after establishing airway obstruction

# Tracheotomy




Obturator
Connector
Flange
Inflation Line
Tube Ties
Fome-Cuff
Side-Port Connector





# AIRWAY EMERGENCY

## A. Tumor

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

## (Cont -Airway Emergency- Tumor)

Airway stabilization

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

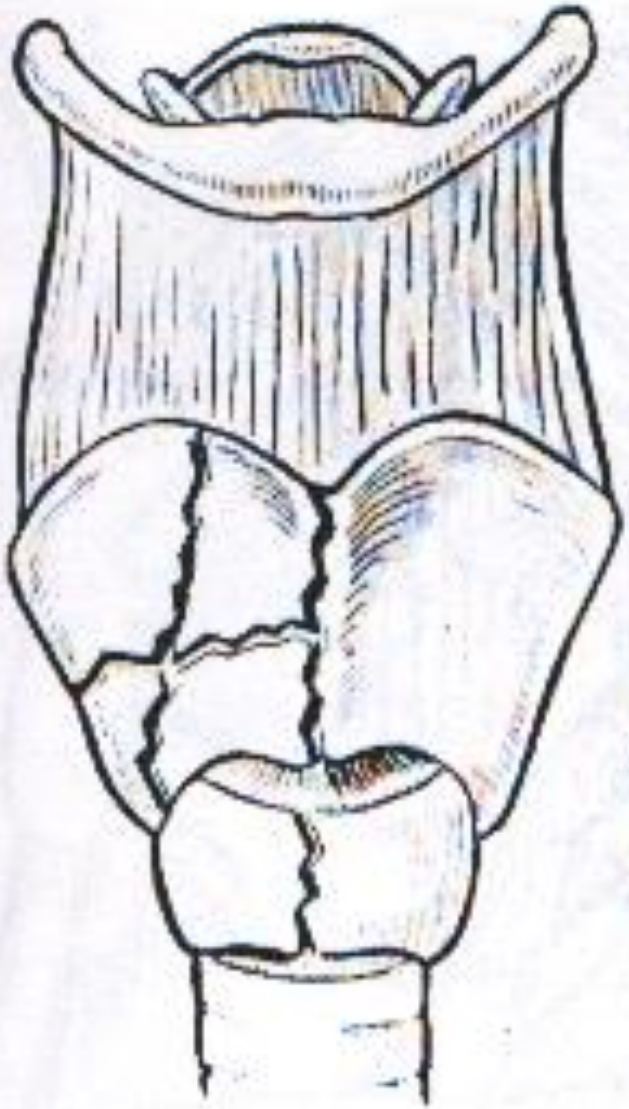
(Cont. Airway stabilization in tumor)

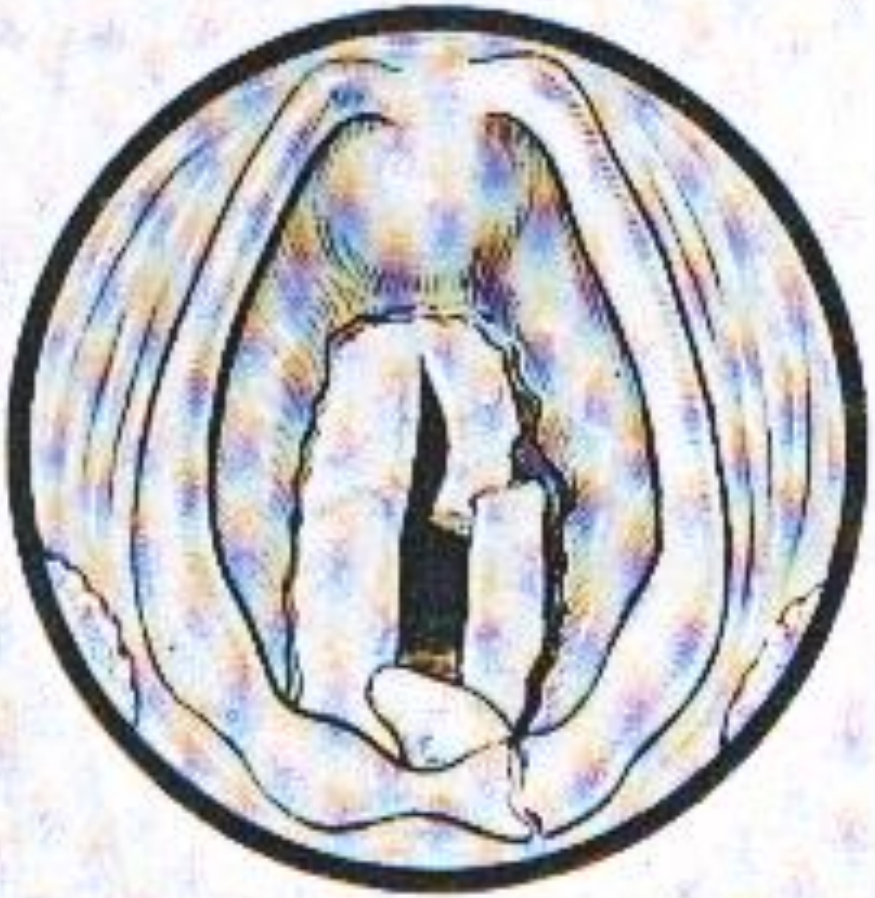
- elective awake tracheostomy under local anaesthesia is the safest method to secure the airway

- 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, trancheal stenosis

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

Tracheostomy ….. cont

- Edema of the neck results in
  - difficult procedure
  - inadvertent removal of the tube

- Cricothryroidotomy, 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 inhilation injury with:
  - changes in ABG, $O_2$ sat, and increase $CO_1$

(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

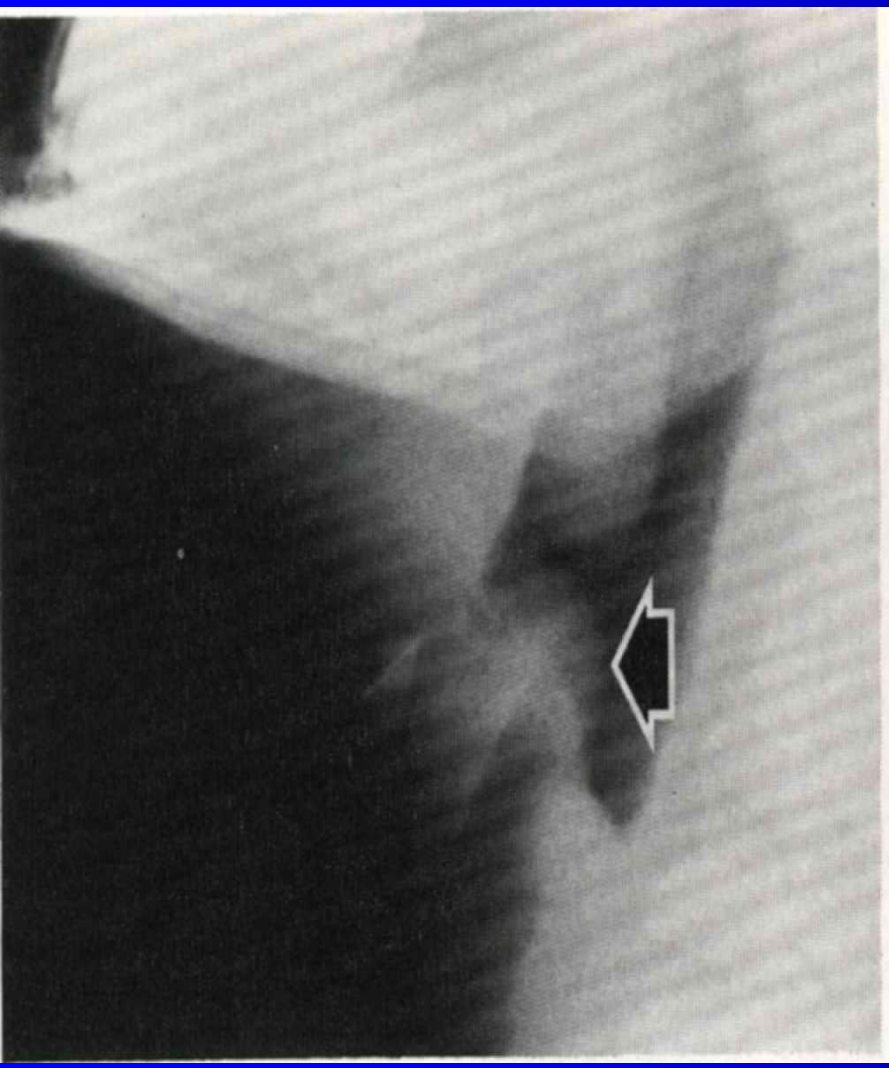
# D. SUPRAGLOTTITIS / EPIGLOTTITIS

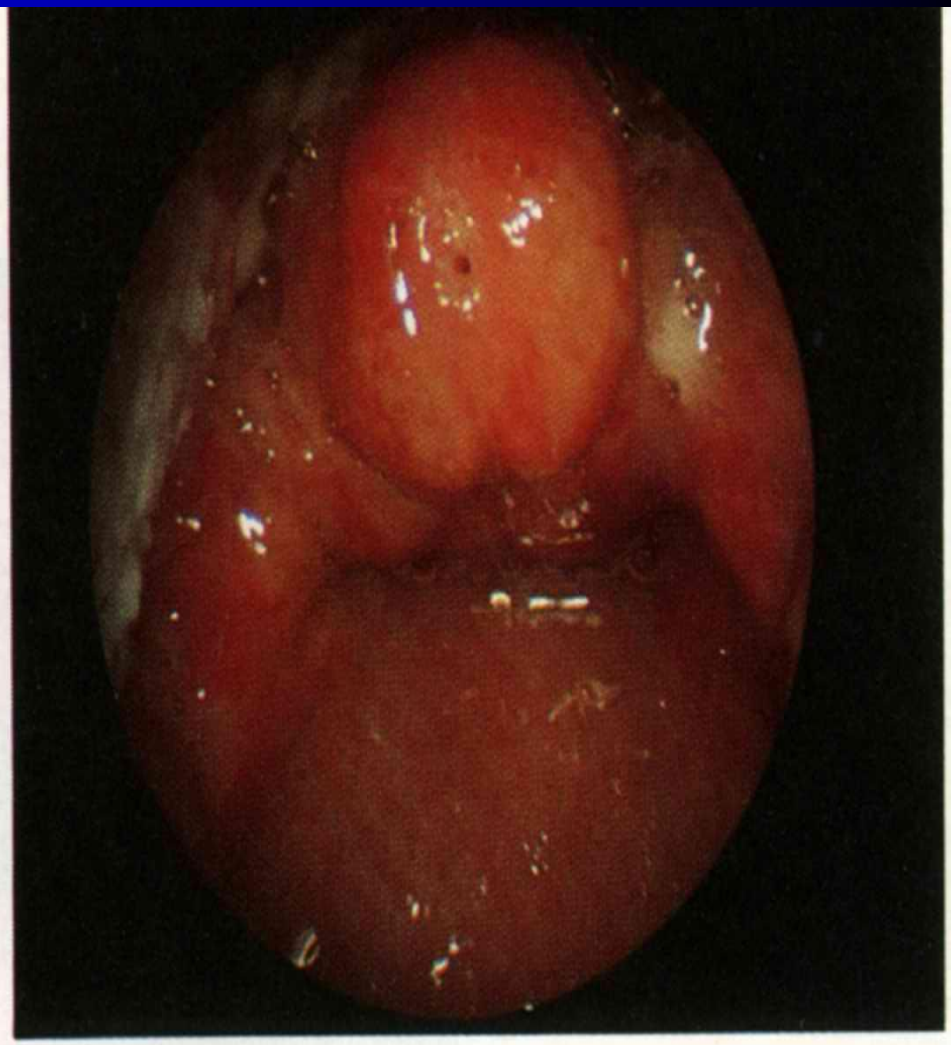
-Paediatric

- 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*

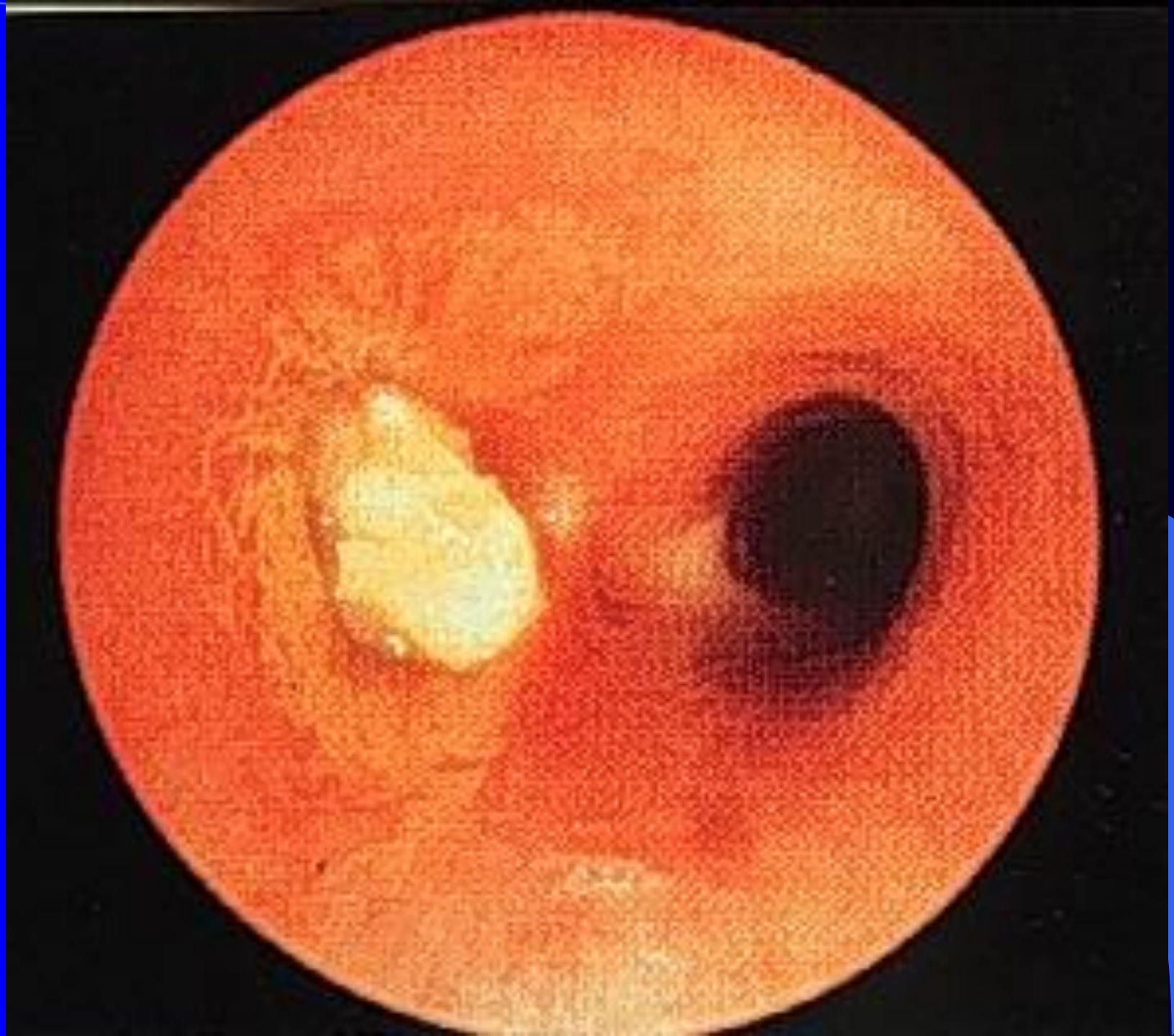
- Death from FB aspiration in USA is about 3000 per year for all ages
- Complete AW obstruction may be recognized in the conscious child as sudden - resp. distress
  - inability to speak or cough

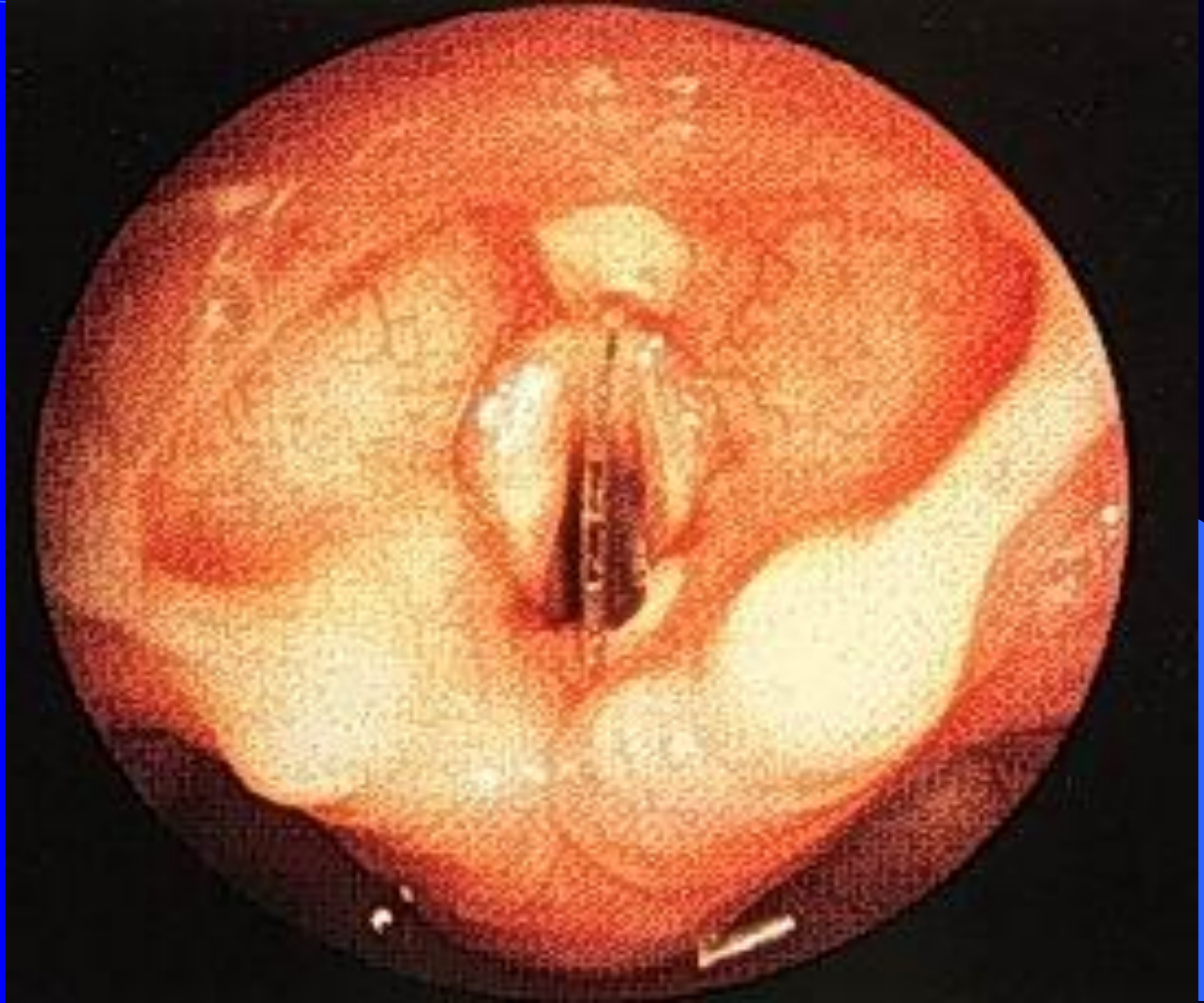
# FORIGN BODY (cont.)

- 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

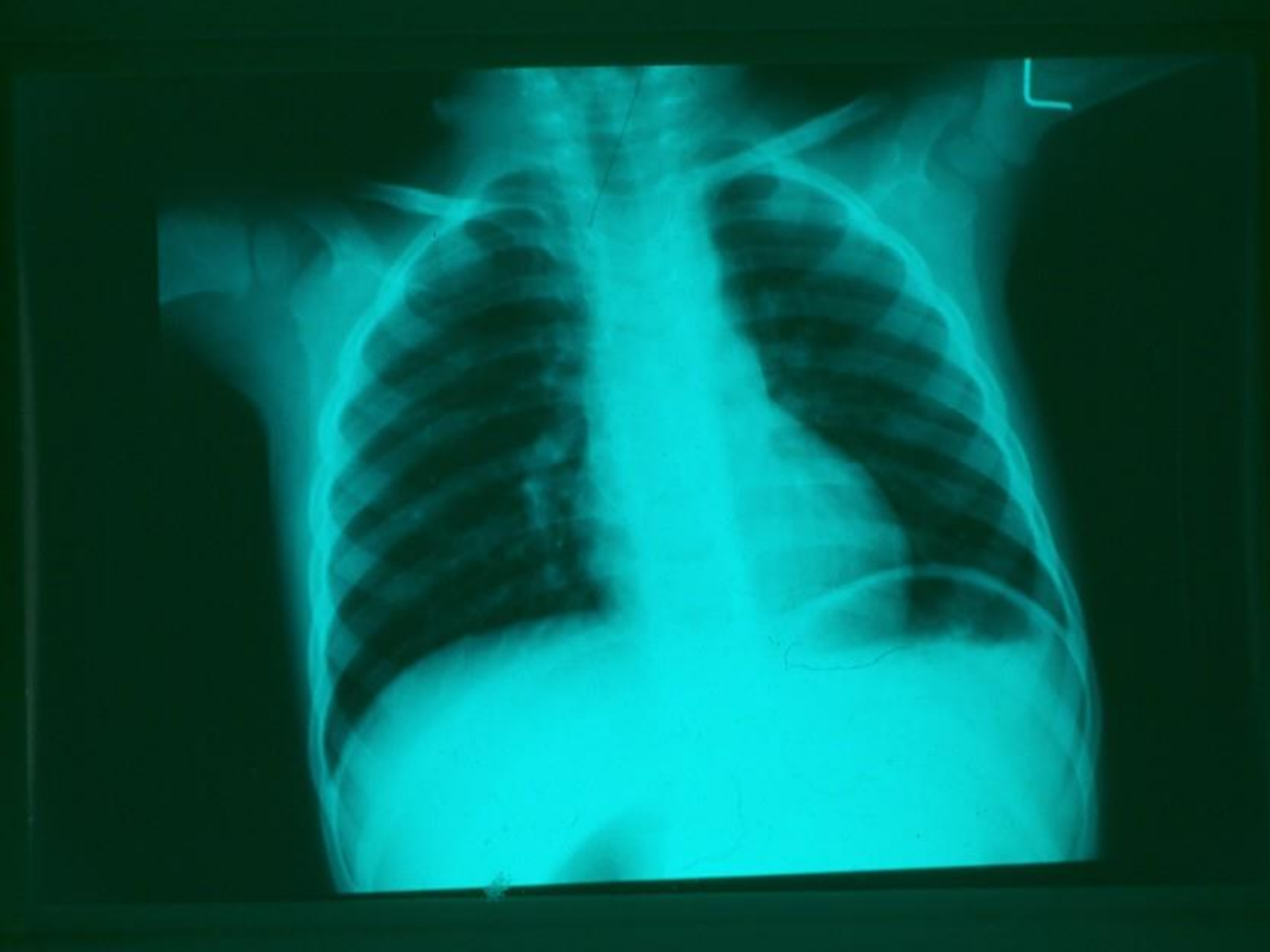




# *FOREIGN BODY (cont.)*

**PRESENTATION**

- Usually coughing, choking, gaging and wheazing
- No symptoms or signs
  Mimik different acute or chronic disease of lungs
  e.g. croups, bronchial asthma.
- Stage of complications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# *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 theraputic.

# *LARYNGOMALACIA*

- Accounts for 60% of laryngeal problems  in newborn
- Due to falcidity 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

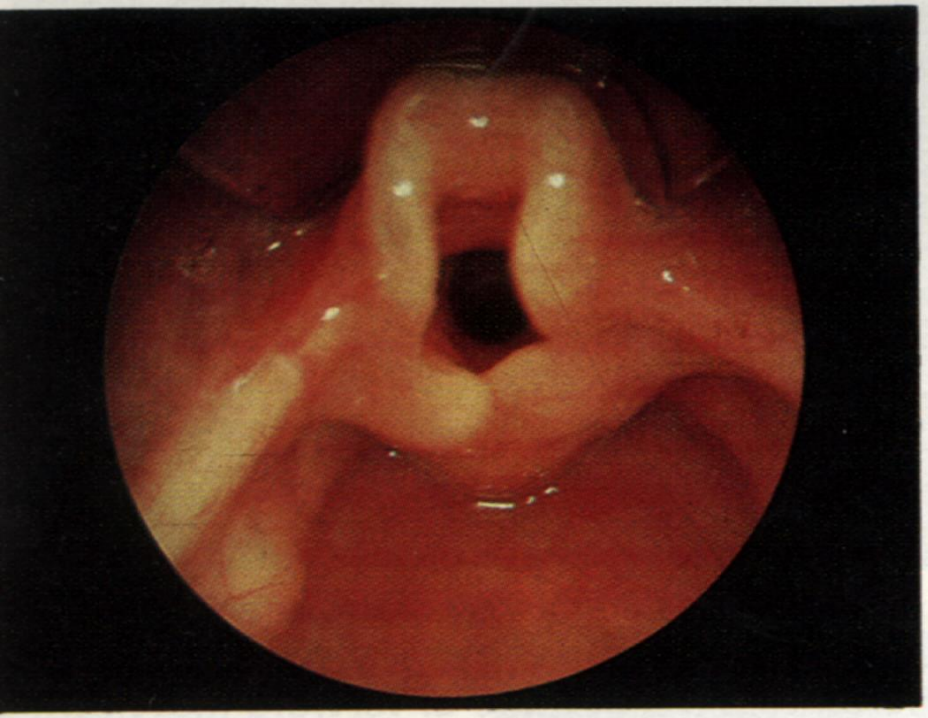
# *LARYNGOMALACIA (cont.)*

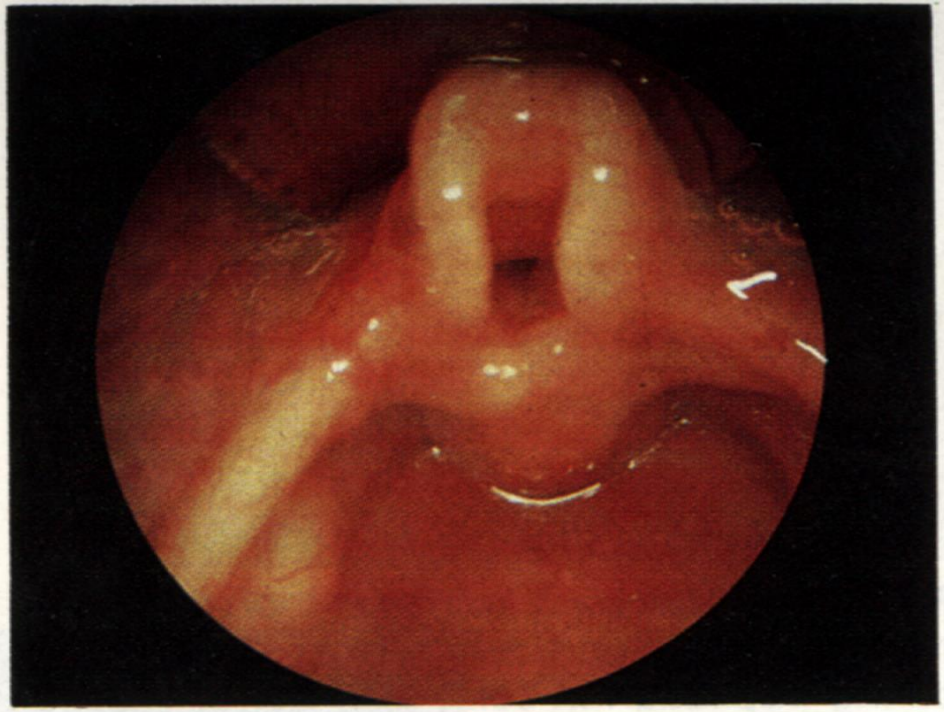
- **Diagnosis:**

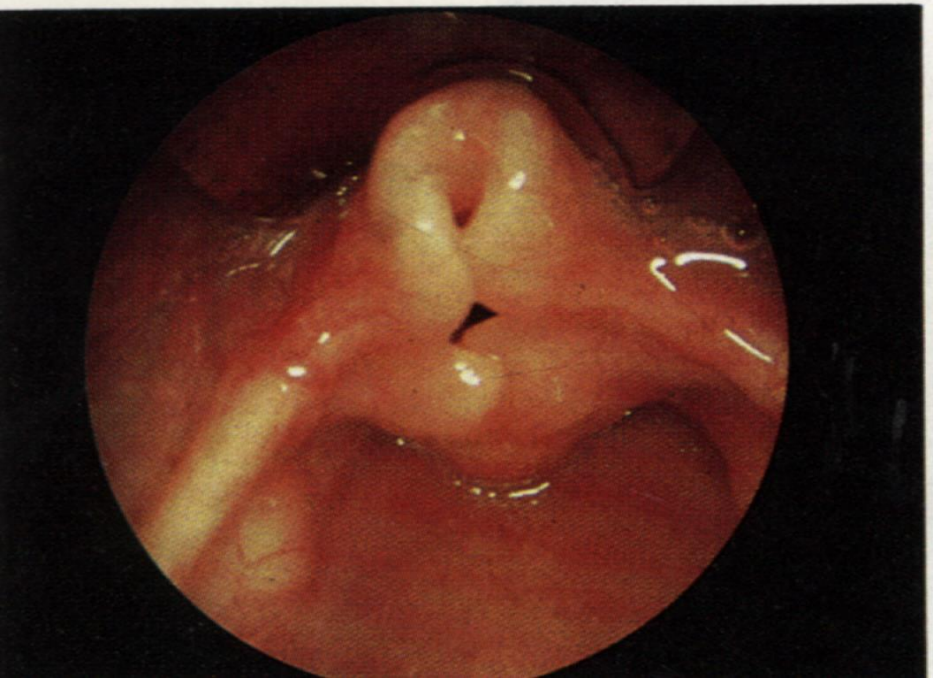
  * can only be confirmed by direct observation of movement of supraglottis during respiration

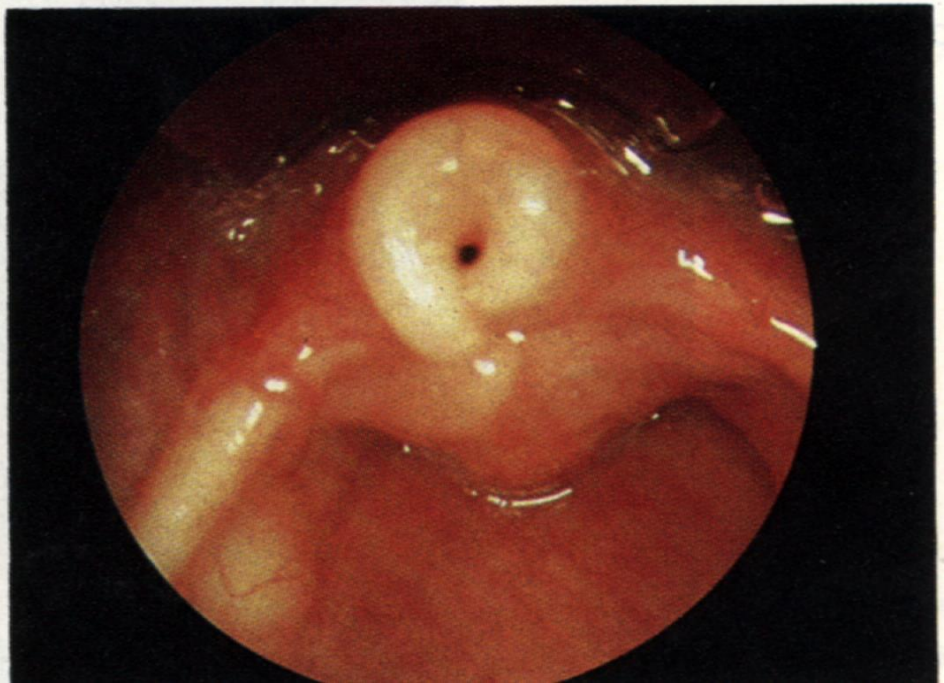
  * fibroeptic evaluation is the most appropriate method of visualization

  * 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.









# *COMPLICATIONL of laryngomalacia*

- Feeding difficulty
- Failure to thrive

# *LARYNGOMALACIA*

Treatment:

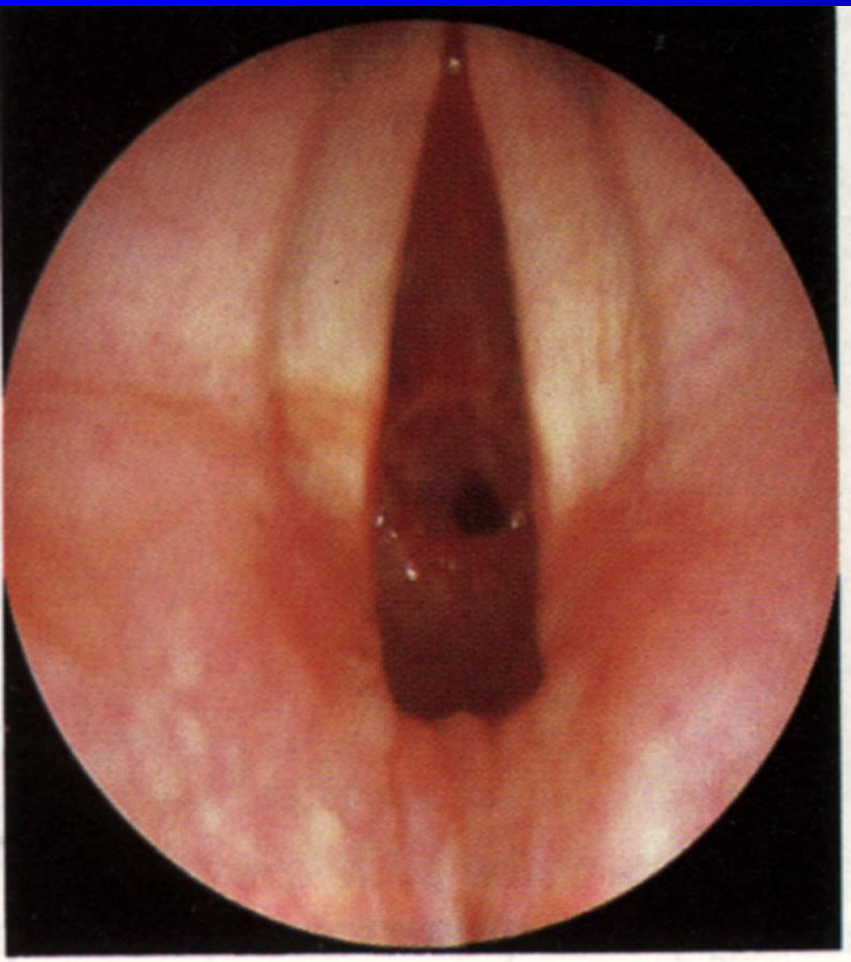
- Reassurance
- Infant can outgrow this problem
- Tracheostomy for severe cases.
- Epiglottoplasty for severe cases

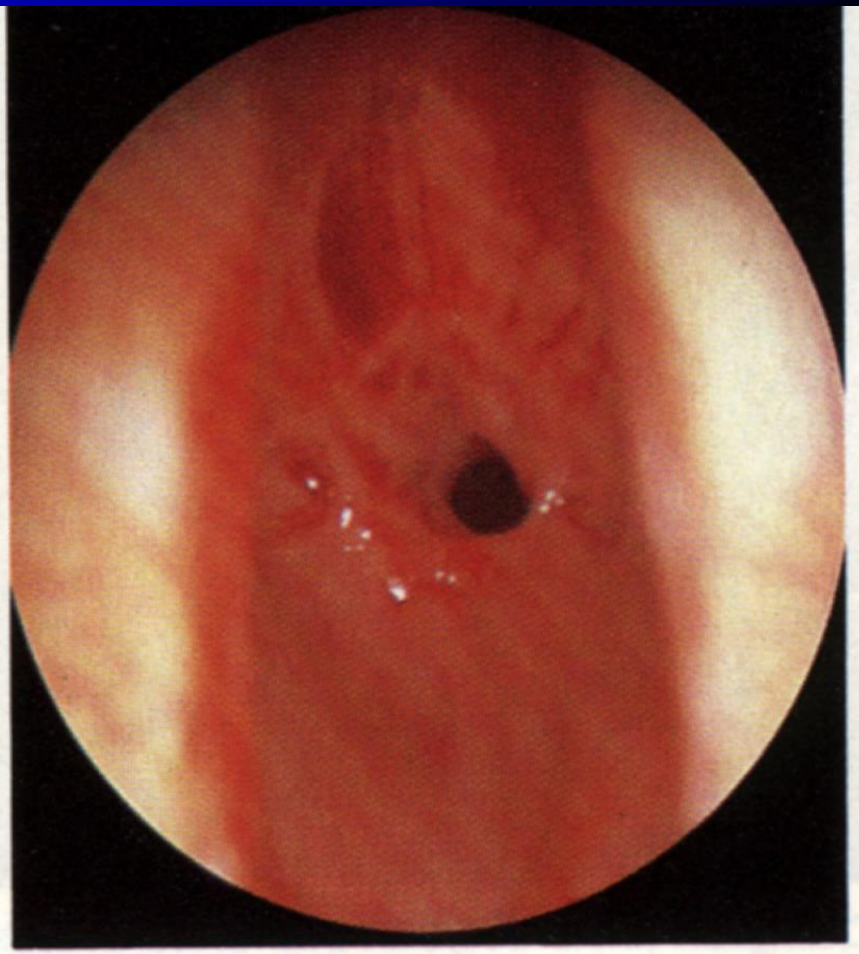
# SUBGLOTTIC STENOSIS

- 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
  * Recection and primary anastomosis

# Choanal atresia

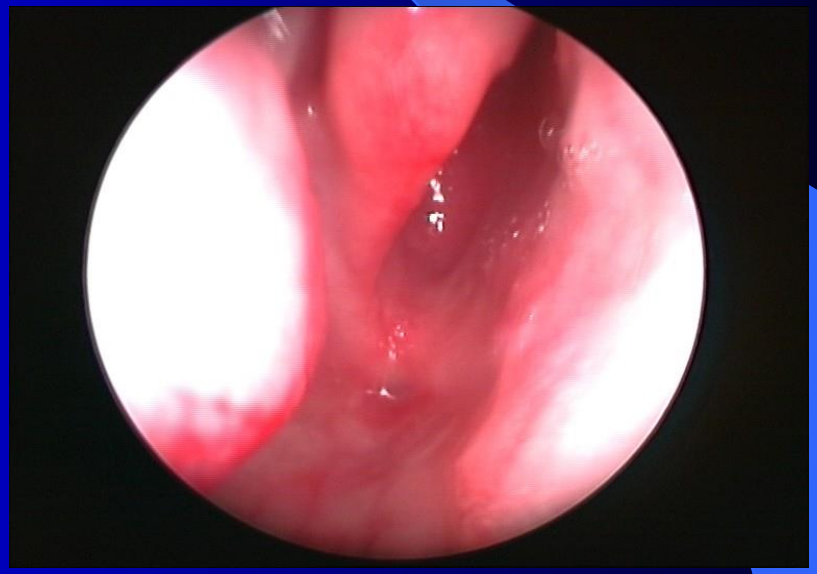
- Uncommon anomaly 1/ 5000- 8000
- Unilateral: present late
- Bilateral : birth emergency
- Mixed bone-membranous CA account for 90%
- Remaining bony CA

# 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%