

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

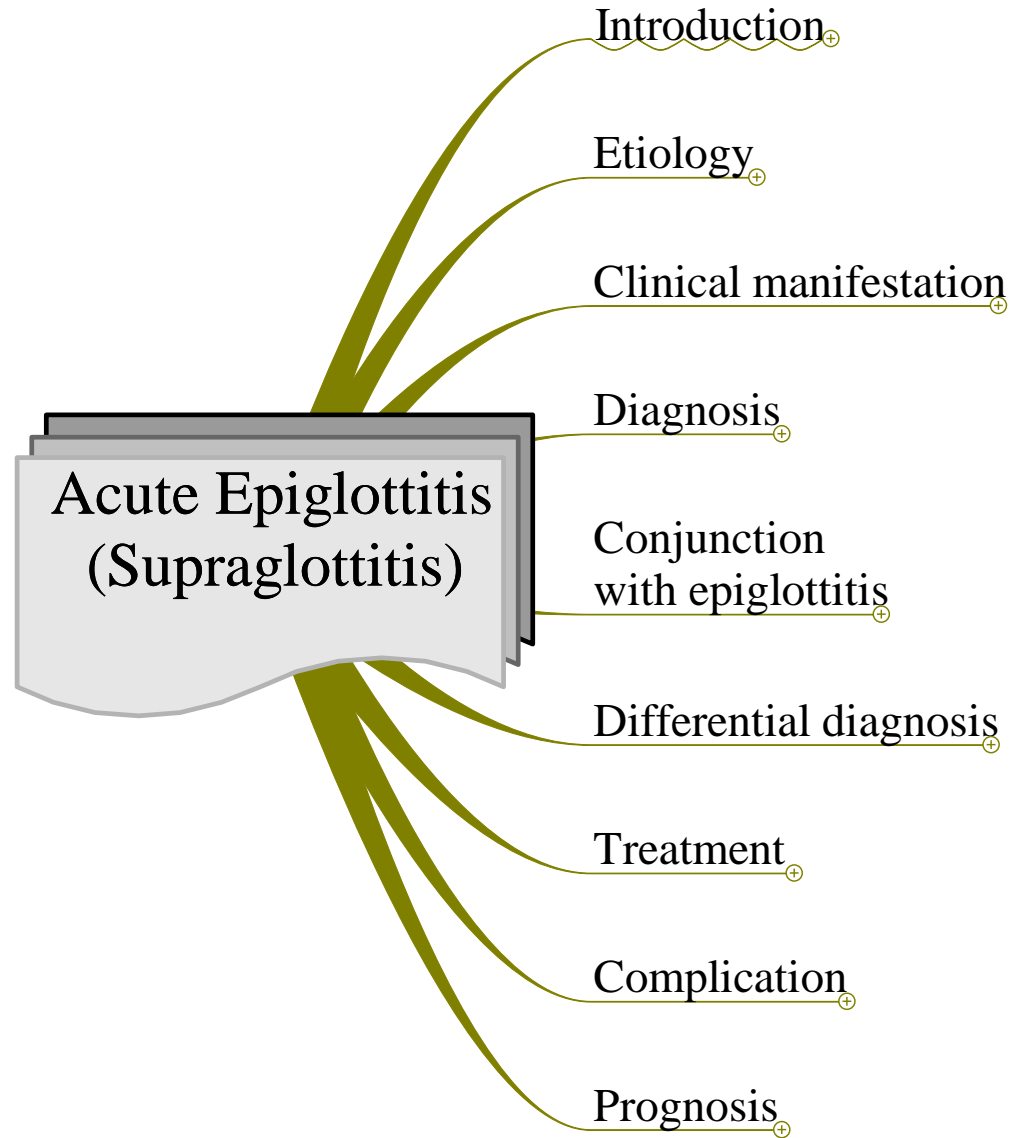
Upper Airway Obstruction in Pediatrics *“Updates”*

Dr.Sadr

Upper Airway Obstruction in Pediatrics

- **Congenital**
 - Laryngomalacia
 - Others Upper airway anomaly
- **Acquired**
 - **Infectious**
 - Parapharyngeal abscess
 - Laryngotracheobronchitis (Croup)
 - Acute Epiglottitis (Supraglottitis)
 - Bacterial tracheitis (membranous tracheitis)
 - Others
 - **Noninfectious**
 - Trauma
 - Caustic injury
 - Others

*Acute Epiglottitis
(Supraglottitis)*



Inflammation of the structures superior to the cords
(i.e., arytenoids, aryepiglottic folds [“false cords”], epiglottis)

A cellulitis of the tissues comprising the laryngeal inlet

Introduction

Direct bacterial invasion of the involved
tissues is probably the initiating pathophysiologic event.

Because of the risk of sudden,
unpredictable airway obstruction

medical emergency

rare, but still dramatic and potentially lethal

Can occur at any age

In the prevaccine era
or in underimmunized children
or vaccine failures

Haemophilus influenzae type b was the most commonly

Typical patient: 2-4 yr of age, But seen in the
1st yr of life and in patients as old as 7 yr of age.

ETIOLOGY

Since the widespread use of the H. influenzae type b vaccine, invasive disease
caused by H. influenza type b in pediatric patients has been reduced by 99%.

In the postvaccine era

Coronavirus/Candida

most common presentation of epiglottitis is an adult with a sore throat

Other agents, such as Streptococcus pyogenes, Streptococcus
pneumoniae, nontypeable H. influenzae, and Staphylococcus aureus,
represent a larger portion of pediatric cases of epiglottitis in vaccinated
children.

No infectious etiology (ingestion of a toxic or hot liquid, or a traumatic event)

CLINICAL MANIFESTATIONS

Often, the otherwise healthy child suddenly develops a sore throat and fever.

Within a matter of hours, the patient appears toxic, swallowing is difficult, and breathing is labored.

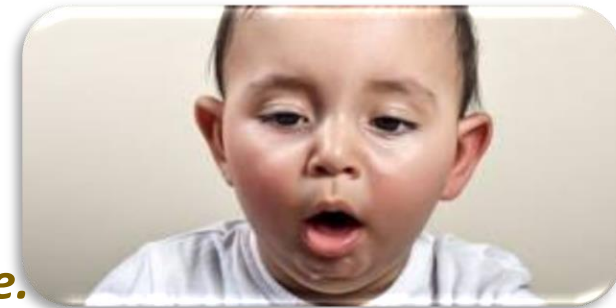
an acute rapidly progressive and potentially fulminating course of high fever, sore throat, dyspnea, and rapidly progressing respiratory obstruction.

The degree of respiratory distress at presentation is variable.

respiratory distress can also be the 1st manifestation

Drooling is usually present

Tripod position ⊕



In the older child, pain may be noted on movement of the hyoid bone.

CLINICAL MANIFESTATIONS



A brief period of air hunger with restlessness may be followed by rapidly increasing cyanosis and coma.

The initial lack of respiratory distress can deceive the unwary clinician

Stridor is a late finding and suggests near-complete airway obstruction.

The barking cough typical of croup is rare.

Usually no other family members are ill with acute respiratory symptoms

Pulmonary edema can be associated with acute airway obstruction.

Occasionally, the pattern of severe laryngotracheobronchitis is difficult to differentiate from epiglottitis, despite the usually more acute onset and rapid course of the latter.

An older cooperative child might voluntarily open the mouth wide enough for a direct view of the inflamed epiglottis.

Diagnosis

Laryngoscopy

Indication

In a patient in whom the diagnosis is certain or probable based on clinical grounds

In possible cases, If the concern for epiglottitis still exists after the radiographs, direct visualization should be performed.

When

expeditiously

Where

In a controlled environment such as an operating room or intensive care unit

Who

A physician skilled in airway management

What is seen

a large, cherry red, swollen epiglottis

Occasionally, the other supraglottic structures, especially the aryepiglottic folds, are more involved than the epiglottis itself.

Cultures

Where

Blood

Epiglottic surface

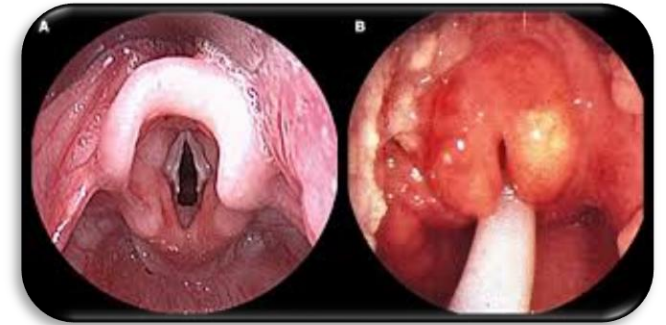
CSF in selected cases

When

after the airway is stabilized

Laboratory evaluation is nonspecific in patients with epiglottitis.

Radiographs





lateral radiographs
of the upper airway

Indication

If epiglottitis is thought to be possible but not certain in a patient with acute upper airway obstruction, the patient may undergo lateral radiographs of the upper airway 1st.

How

Proper positioning

Adequate hyperextension of the head and neck

What is seen

Thumb sign

The epiglottis can appear to be round if the lateral neck is taken at an oblique angle

Go with

A physician skilled in airway management

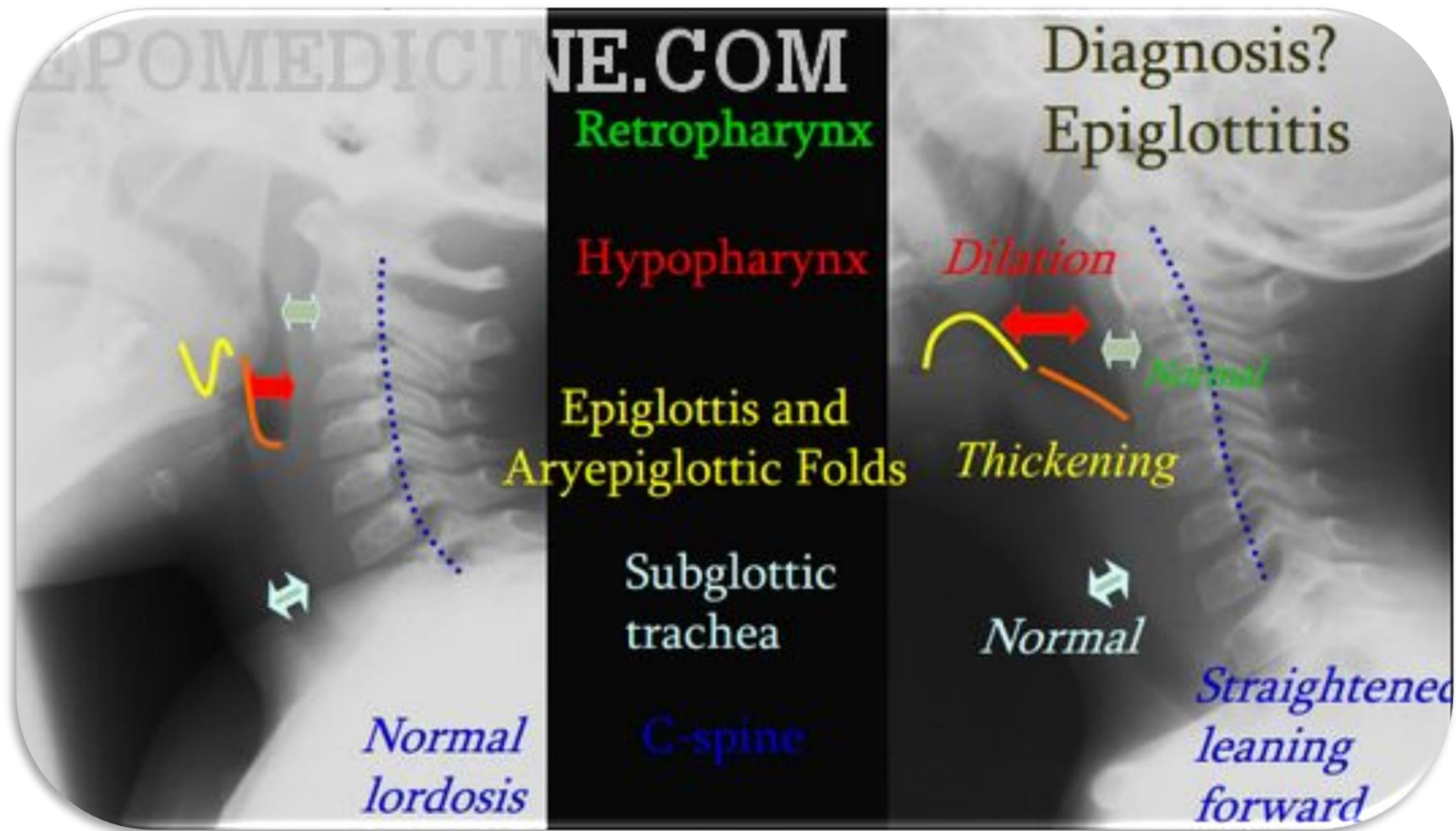
Radiographs

The steeple sign may rarely be present in patients with epiglottitis.

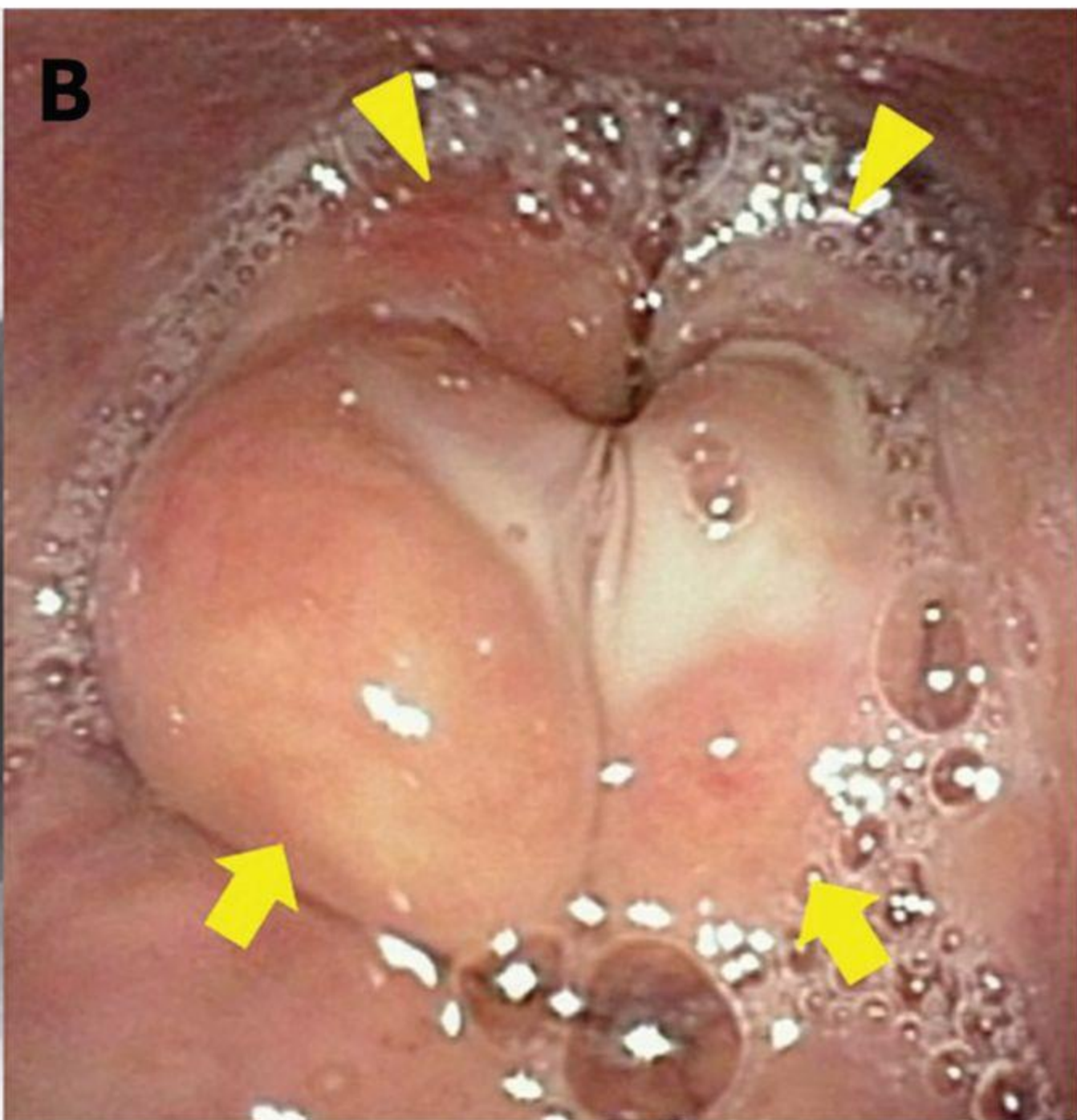
bedside

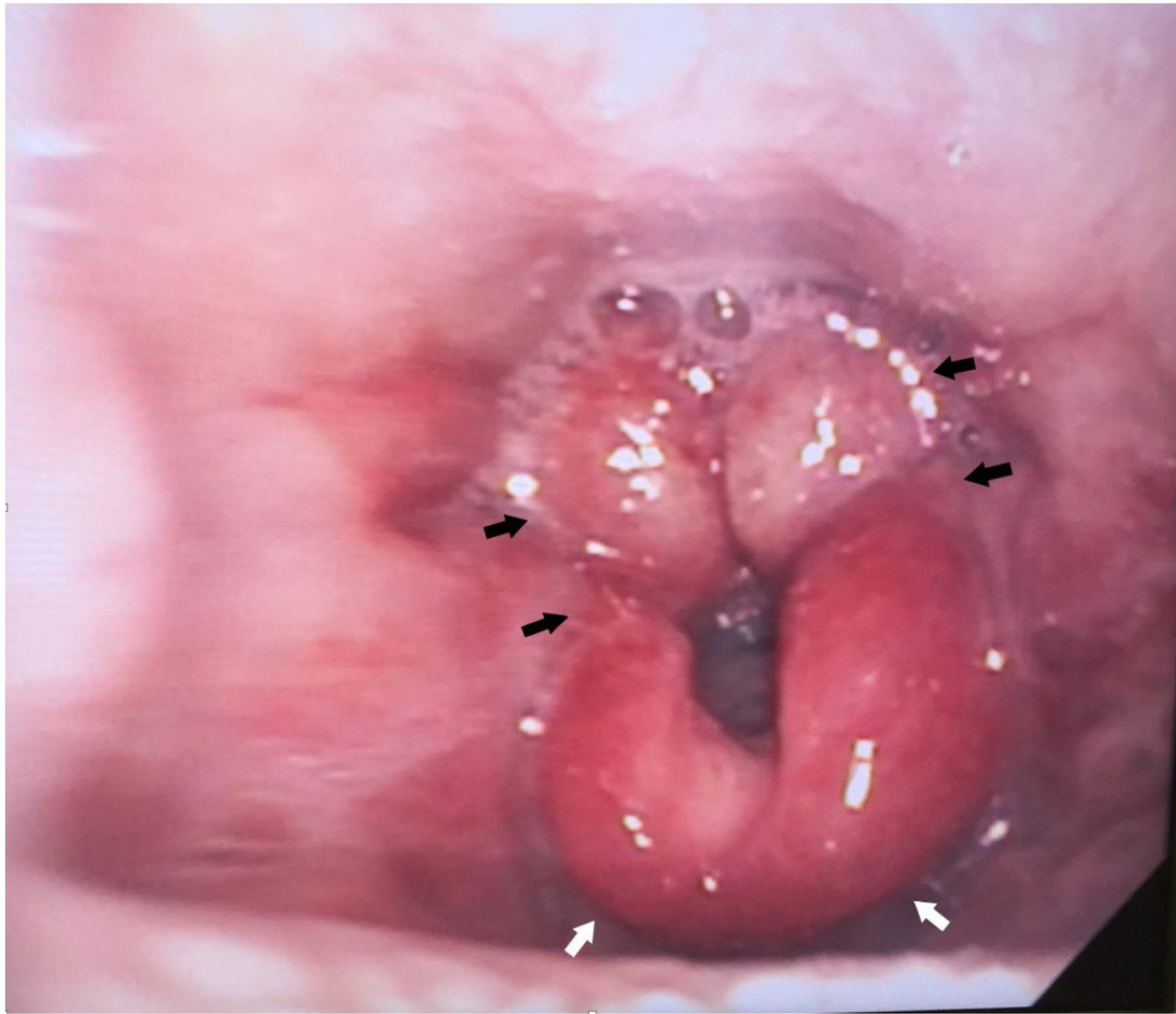
Radiographs may be helpful in distinguishing between severe laryngotracheobronchitis and epiglottitis, but airway management should always take priority.

CT scanning of the neck



- 1.Enlarged epiglottis (> 8mm) – thumbprint sign
- 2.Loss of vallecular air space
- 3.Thickened aryepiglottic folds
- 4.Straightening aryepiglottic folds (>7 mm)
- 5.Distended of cervical spine





Most patients have concomitant bacteremia

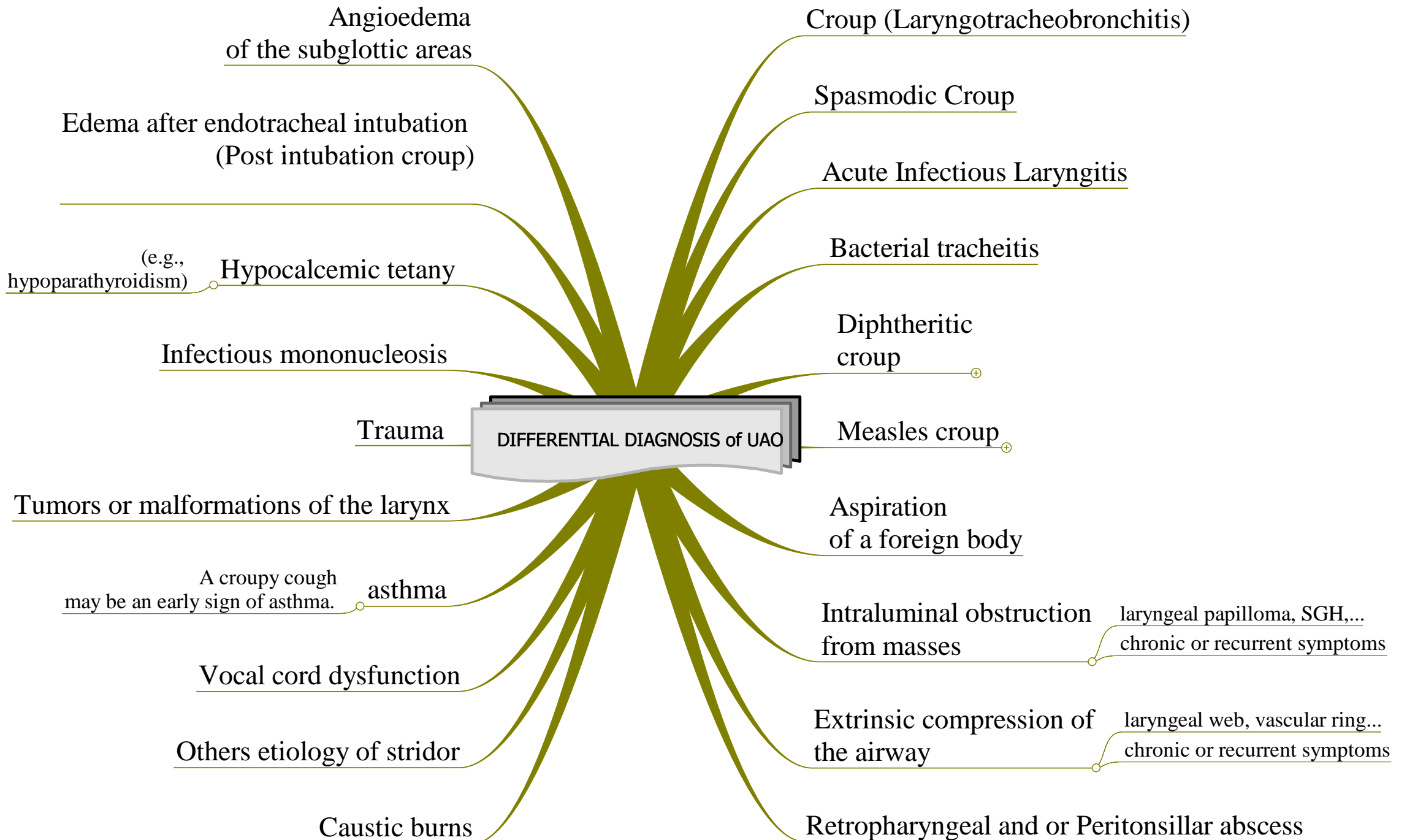
Occasionally, other infections are present, such as pneumonia, cervical adenopathy, or otitis media.

conjunction
with epiglottitis

Meningitis, septic arthritis, and other invasive infections with *H. influenzae* type b are rare.

Purulent pericarditis

DIFFERENTIAL DIAGNOSIS of UAO



Early symptoms of diphtheria include malaise, sore throat, anorexia, and low-grade fever.

Diphtheritic croup

Within 2-3 days, pharyngeal examination reveals the typical gray-white membrane, which can vary in size from covering a small patch on the tonsils to covering most of the soft palate. .

The membrane is adherent to the tissue, and forcible attempts to remove it cause bleeding.

The course is usually insidious, but respiratory obstruction can occur suddenly.

Measles croup almost always coincides with the full manifestations of systemic disease.

Measles croup

The course may be fulminant

Rare DDx

All patients should receive oxygen en route unless the mask causes excessive agitation.

Treatment

Establishing an airway

Indication All young patients with epiglottitis

By Endotracheal or Nasotracheal intubation
or, less often, by Tracheostomy

Size Tube that is 0.5-1.0 mm
smaller than estimated by age or height

Where An operating room or intensive care unit if time permits.

Fast impact The patient should improve immediately, and
respiratory distress and cyanosis should disappear.

Duration of intubation Determined by frequent examination using direct
laryngoscopy or flexible fiberoptic laryngoscopy

Usually within a few days(2-3 days)

Sometimes within 24 hr

Antibiotic therapy

What "Ceftriaxone, cefepime, or meropenem" (IV),
pending culture and susceptibility reports

At least 10 days

When Until patients are able to take fluids by mouth

Percutaneous Transtracheal Ventilation (needle cricothyrotomy or translaryngeal ventilation)



*Contraindication until
the airway is secure*

Anxiety-provoking interventions

- Phlebotomy
- IV line placement
- Placing the child supine
- Direct inspection of the oral cavity

Attention

Indications for rifampin Chemoprophylaxis

**All household members include a
child within the home who is:**

- Younger than 4 yr of age and incompletely immunized
- Younger than 12 mo of age and has not completed the primary vaccination series
- Immunocompromised

Dose (20 mg/kg orally once a day for
4 days; maximum dose: 600 mg)

Ineffective therapy

**Racemic epinephrine
corticosteroids**

C.A.S.H Treatment

COMPLICATIONS

Postintubation croup

Pulmonary Edema

└ Increased negative interstitial pressure

Toxic Shock Syndrome

└ with toxin producing *S. aureus* or *S. pyogenes*

conjunction with epiglottitis

the localized infection itself can prove to be fatal

PROGNOSIS

Untreated epiglottitis has a mortality rate of 6% in some series.

if the diagnosis is made and appropriate treatment is initiated before the patient is moribund, the prognosis is excellent.

- Children older than 2 years with epiglottitis do not need vaccination, because the disease provides immune protection.
- Recurrent episodes?

Laryngomalacia

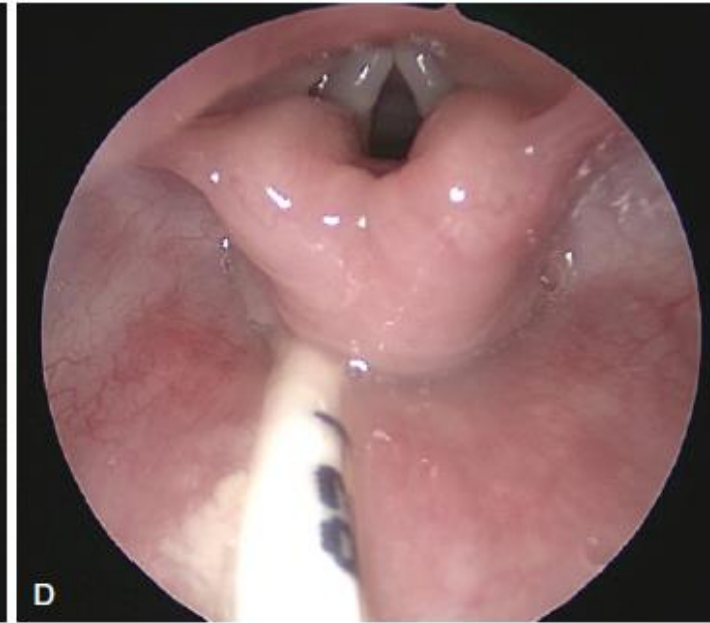
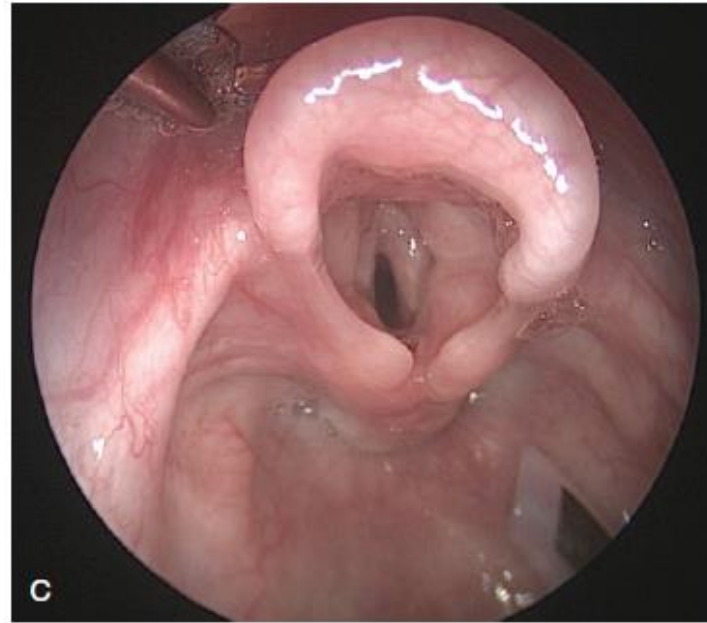
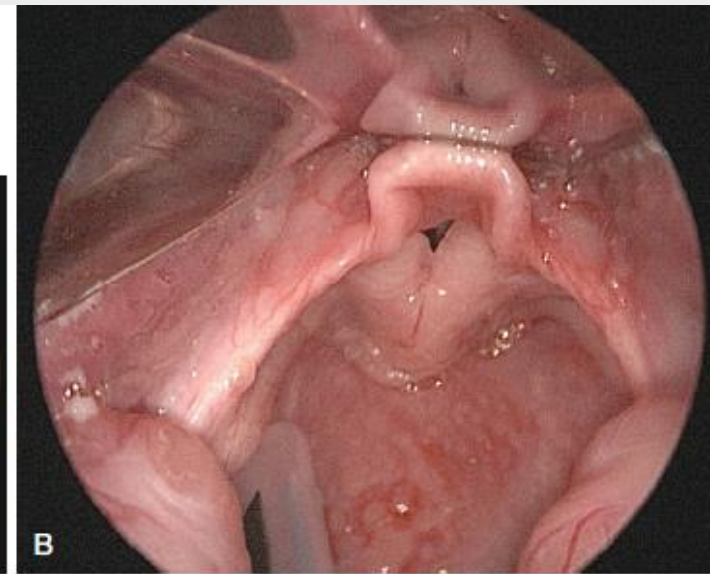
Appearances of laryngomalacia at microlaryngobronchoscopy.

(A) Typical omega-shaped epiglottis.

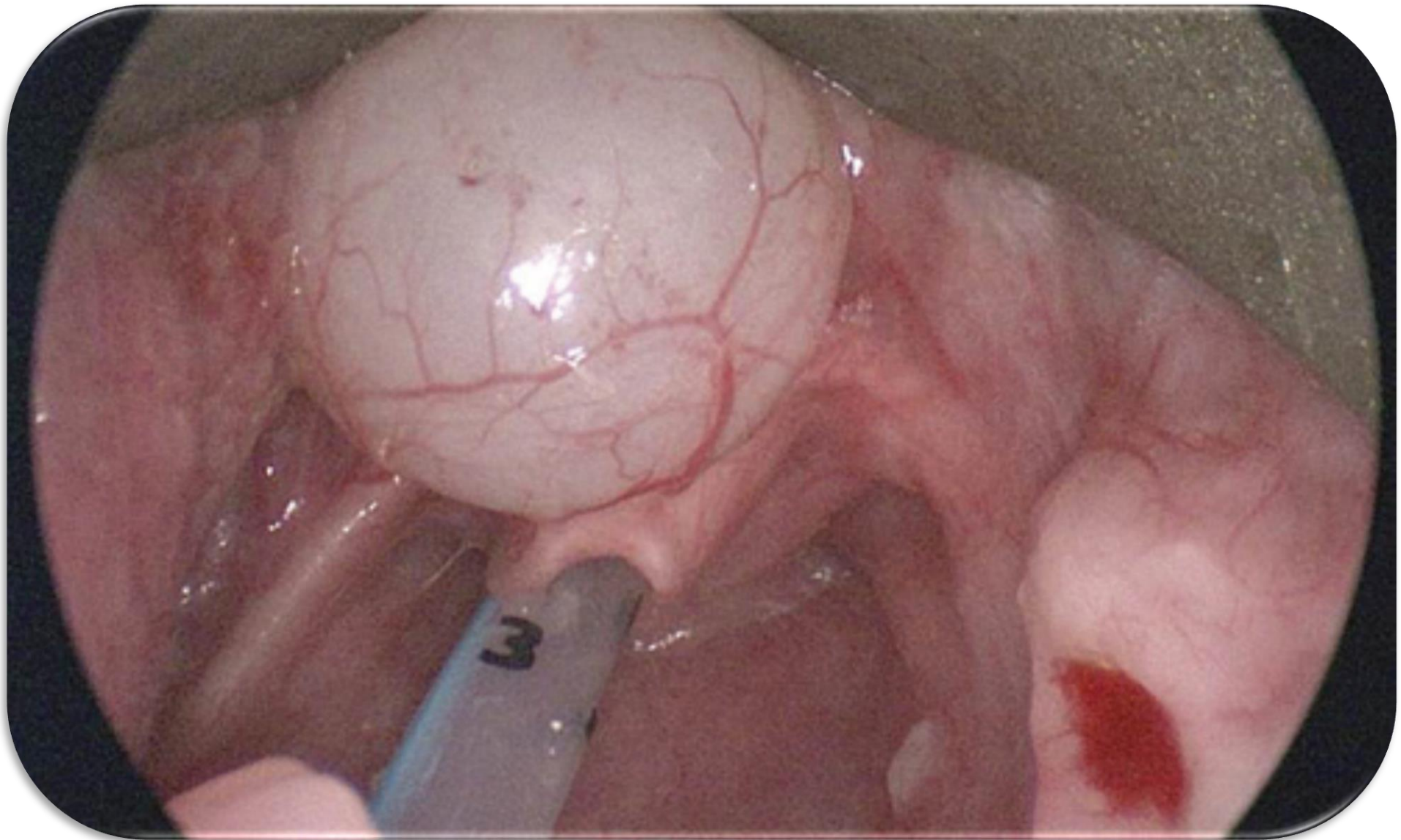
(B) Posterior view of collapsing laryngeal inlet.

(C) Shortened aryepiglottic folds.

(D) prominent arytenoid cartilages.



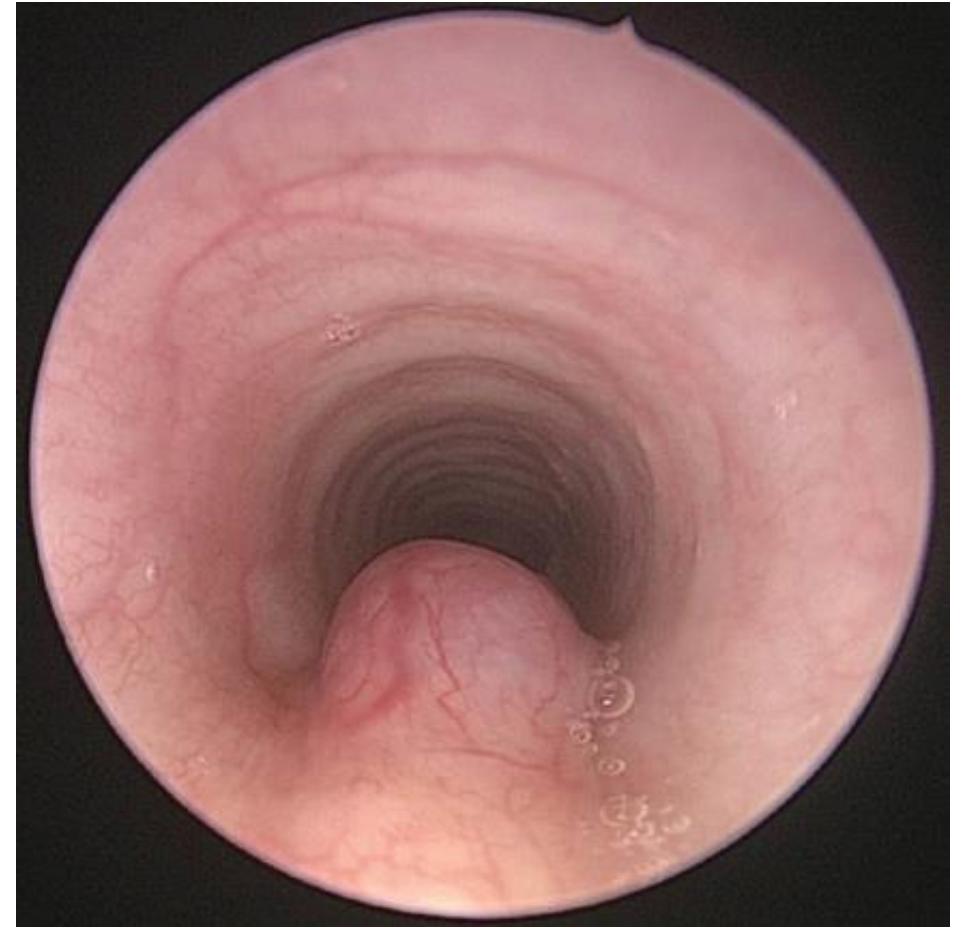




A large vallecular cyst seen on fiberoptic nasoscopy. It was subsequently excised at microlaryngobronchoscopy.

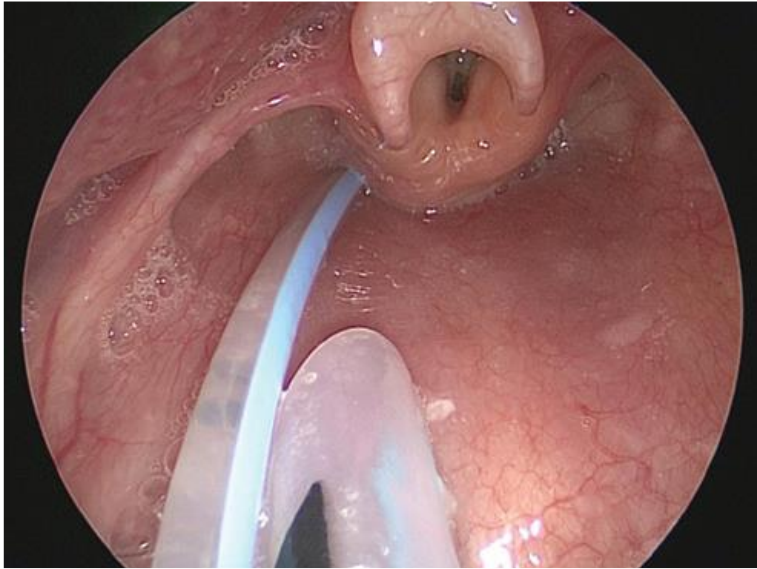


Congenital saccular cyst of aryepiglottic fold.

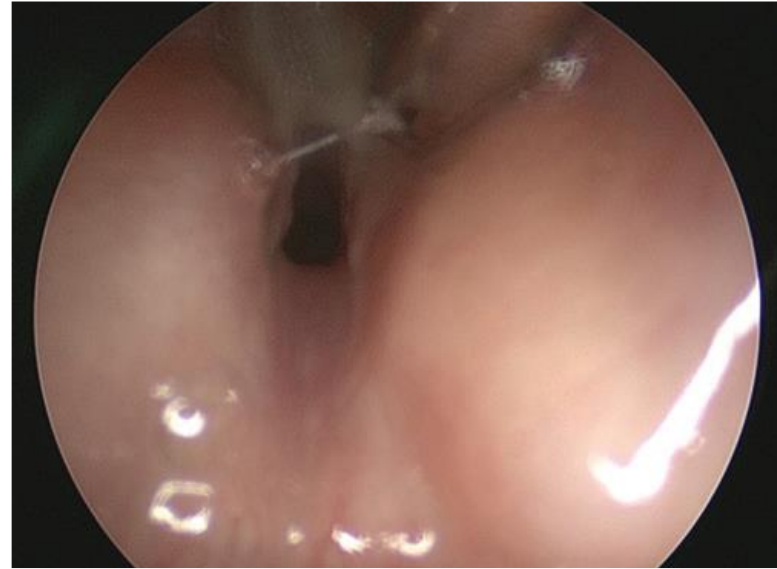


(A and B) Case of tracheal hemangioma prepropranolol and postpropranolol therapy (pictures 2 weeks apart).

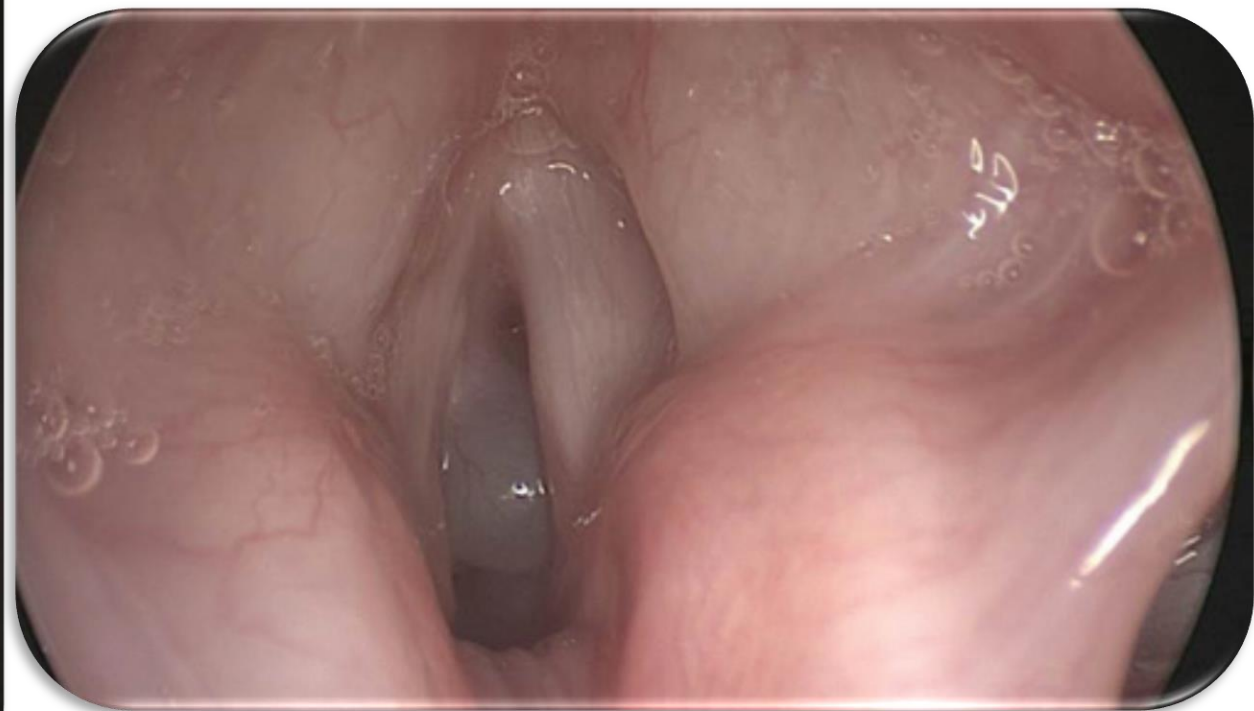
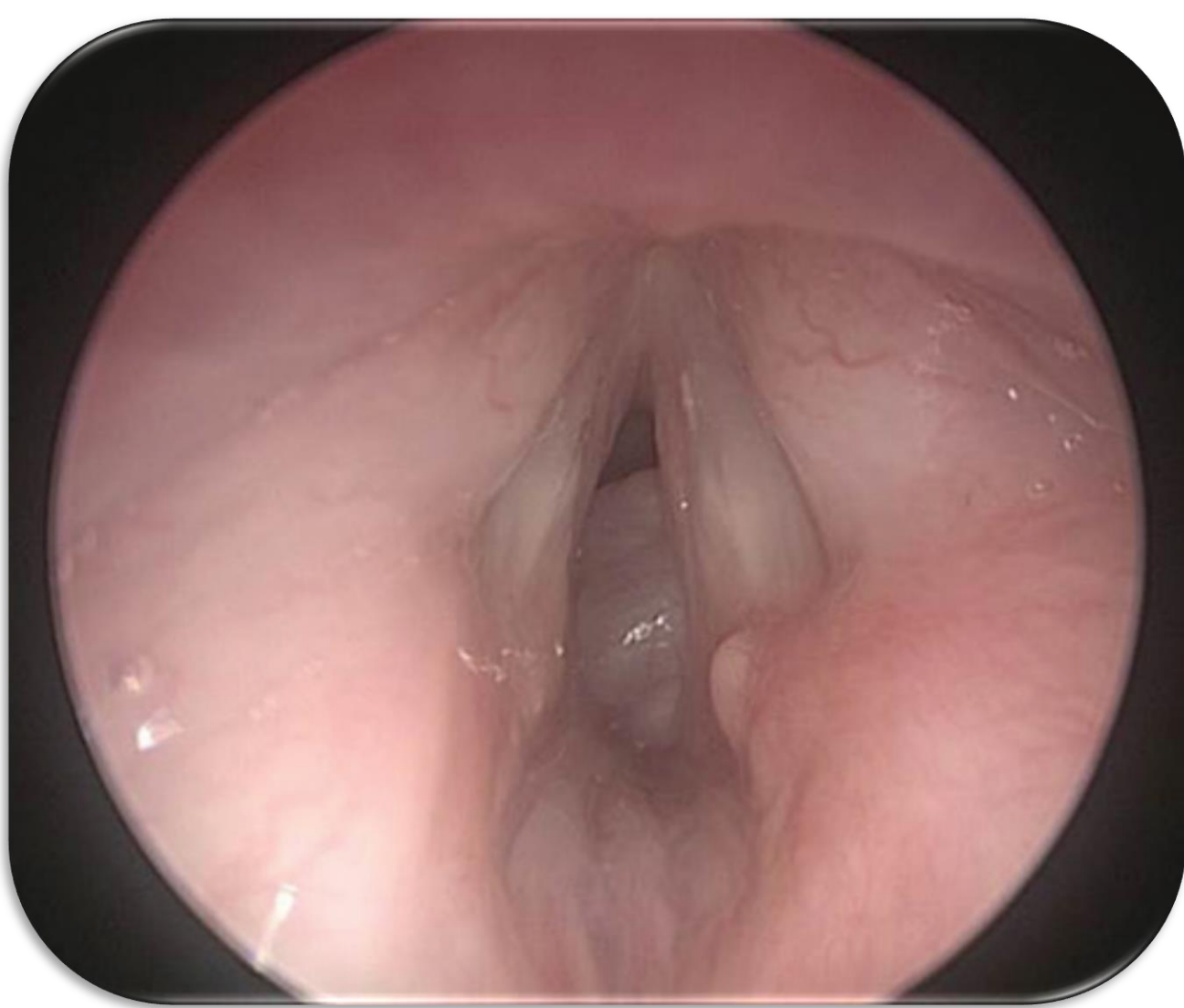
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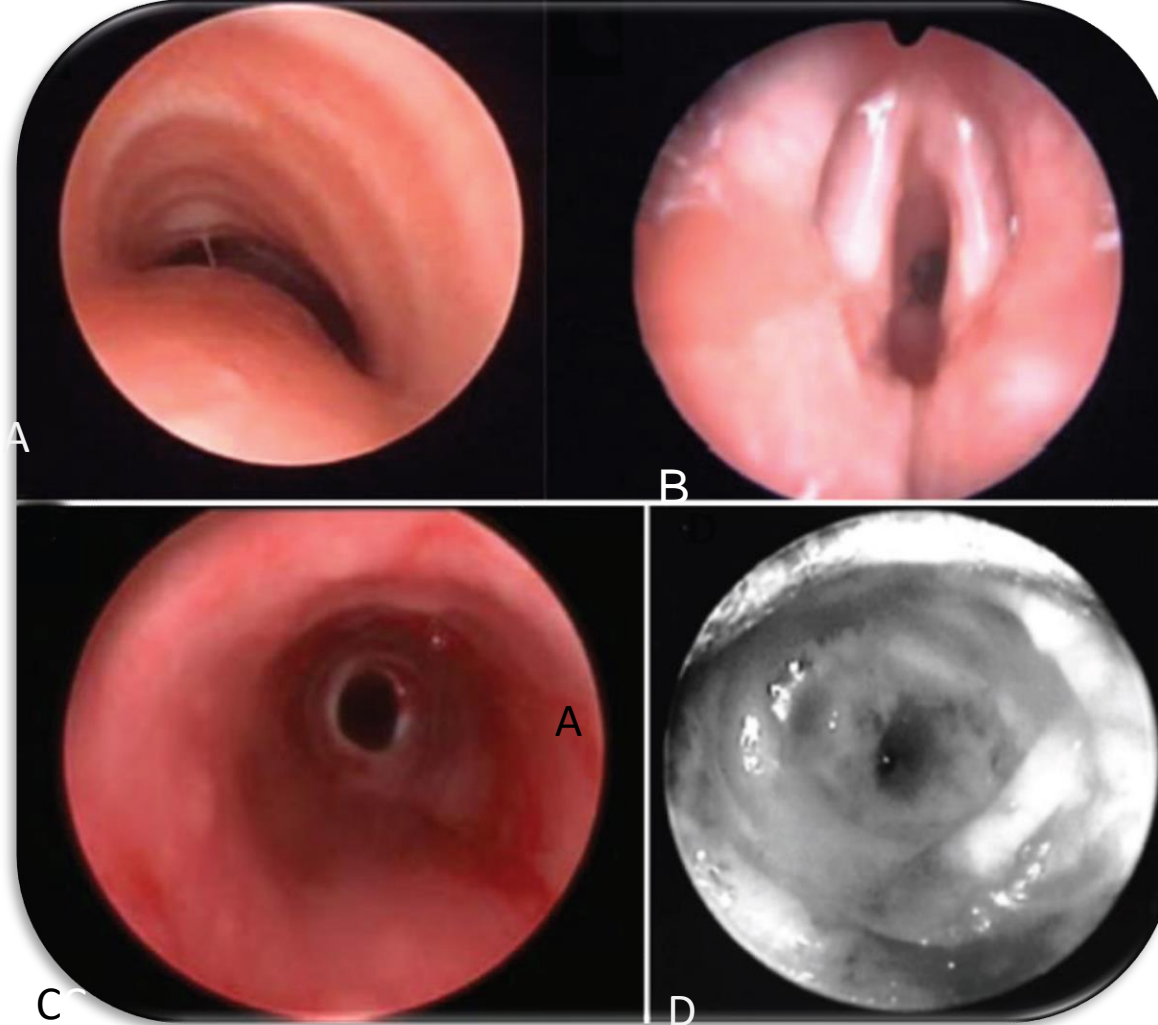
B



Laryngeal web seen at microlaryngobronchoscopy before (A) and after (B) treatment.



Two examples of subglottic cysts secondary to intubation.



Airway endoscopy abnormalities

(A) Lower trachea appearance under general anesthesia, showing severe airway malacia.

(B) Appearance of subglottic stenosis immediately below the vocal fold.

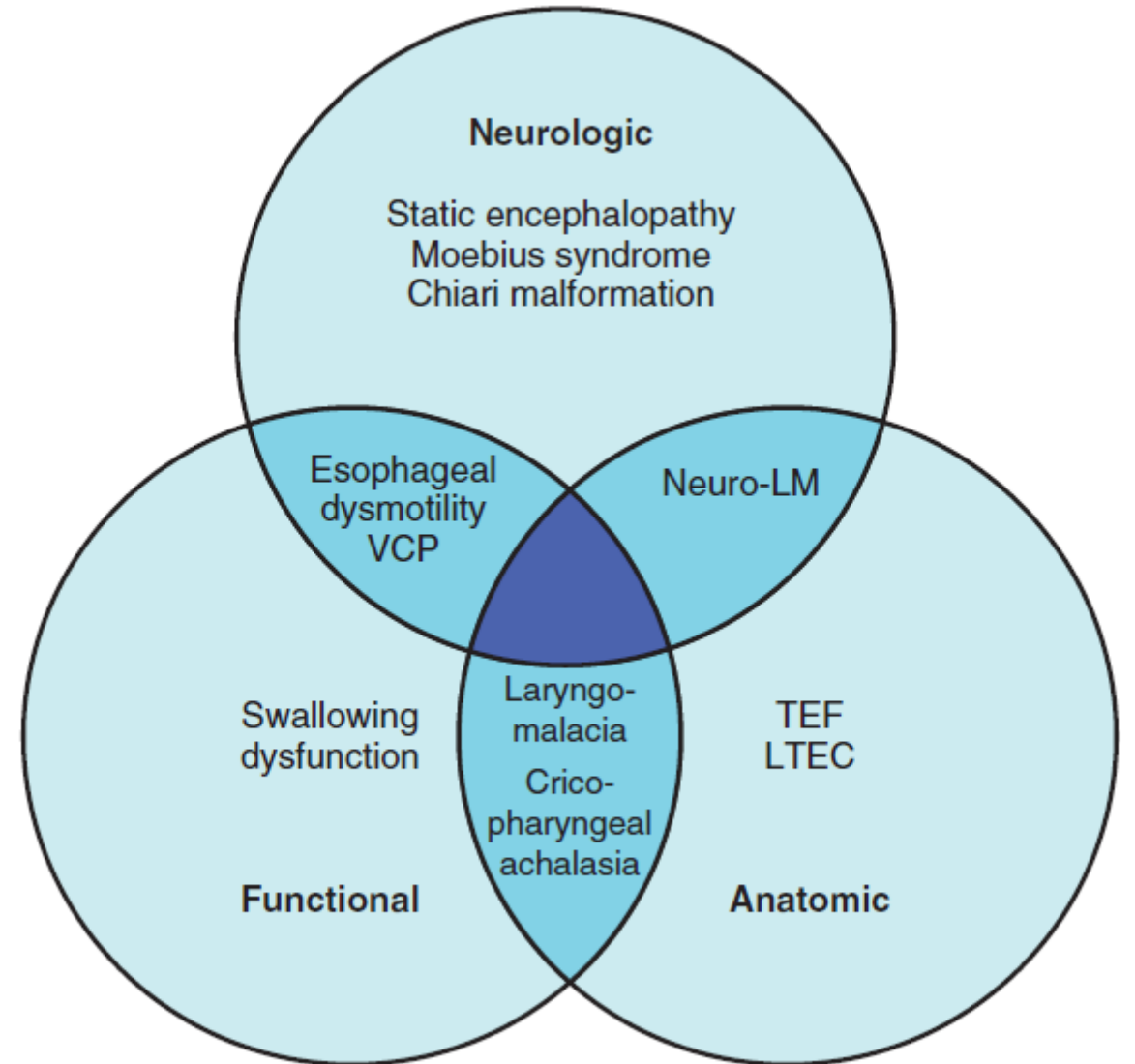
(C) Midtracheal stenosis due to previous intubation.

(D) "Pinpoint" severe tracheal stenosis.

LM & Aspiration

Interrelationship of neurologic, anatomic, and functional causes of chronic aspiration.

(Neuro-LM: neurologic-variant laryngomalacia)



❖ *Any lesion resulting in persistent or intermittent upper airway obstruction can disrupt the timing of the swallow.*

*Laryngomalacia is the best recognized of these causes, as **feeding problems** are the second most common presenting symptom after stridor.*

- *In children with laryngomalacia caused by **tight aryepiglottic folds or tall prolapsing arytenoids**, surgical treatment can effectively improve both stridor and aspiration.*
- *Supraglottoplasty should be considered cautiously, however, in patients with apparent laryngomalacia caused by poor upper airway tone (i.e., “**neurologic-variant laryngomalacia**”), as aspiration may be worsened following surgery in these patients.*

Bacterial tracheitis (membranous tracheitis)

A mind map diagram with a central box containing the text 'Bacterial tracheitis (membranous tracheitis)'. The box is blue with a white background and a blue border. Below the box, seven green curved lines branch out to seven text labels: EPIDMIOLOGY, ETIOLOGY, CLINICAL MANIFESTATIONS, DIAGNOSIS, TREATMENT, COMPLICATIONS, and PROGNOSIS. Each label has a small yellow circle with a plus sign underneath it.

Bacterial tracheitis
(membranous tracheitis)

EPIDMIOLOGY

ETIOLOGY

CLINICAL MANIFESTATIONS

DIAGNOSIS

TREATMENT

COMPLICATIONS

PROGNOSIS

Epidemiology

More common than epiglottitis in vaccinated populations

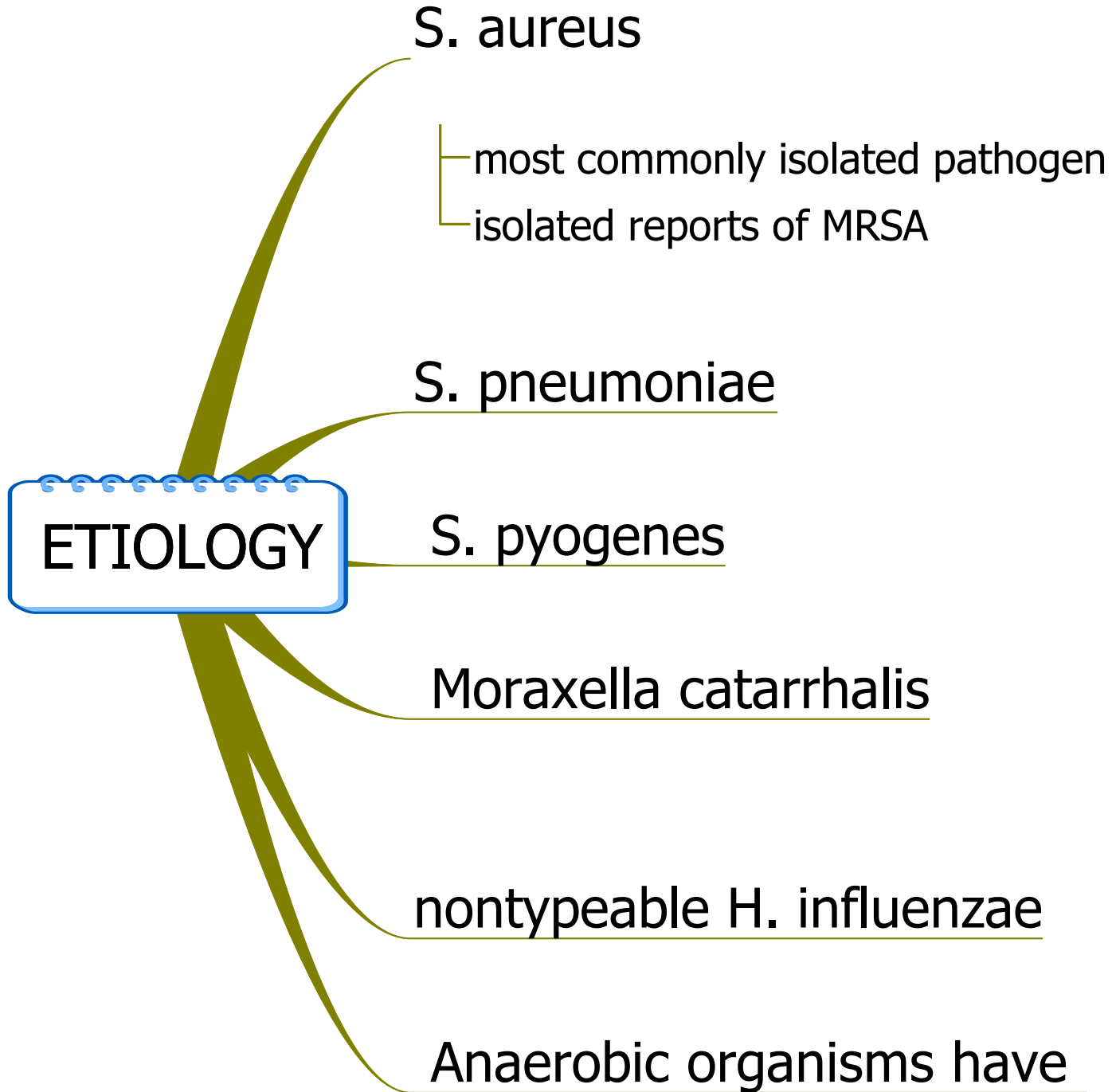
Mean age: between 5 and 7 yr

A slight male predominance

Life-threatening

An acute bacterial infection of the upper airway

- often follows a viral respiratory infection (especially laryngotracheitis)
- may be considered a bacterial complication of a viral disease
- a primary bacterial illness



Typically the child has a brassy cough, apparently as part of a viral laryngotracheobronchitis. High fever and toxicity with respiratory distress can occur immediately or after a few days of apparent improvement

CLINICAL MANIFESTATIONS

Course

A complication of viral croup rather than a distinct disease

A 2-phased illness, with the 2nd phase after a croup-like illness associated with high fever, toxicity, and airway obstruction.

Without a 2nd phase and appears as a continuation of the initial croup-like illness, but with higher fever and worsening respiratory distress rather than the usual recovery after 2-3 days of viral croup.

Can lie flat, does not drool, and does not have the dysphagia

Based on evidence of bacterial upper airway disease, which includes high fever, purulent airway secretions, and an absence of the classic findings of epiglottitis.

Lateral radiograph of the neck

X-rays are not needed but can show the classic findings

— pseudomembrane detachment in the trachea

— Subglottic narrowing and a rough and ragged tracheal air column can often be demonstrated radiographically.

DIAGNOSIS

During direct laryngoscopy for endotracheal intubation

— purulent material is noted below the cords

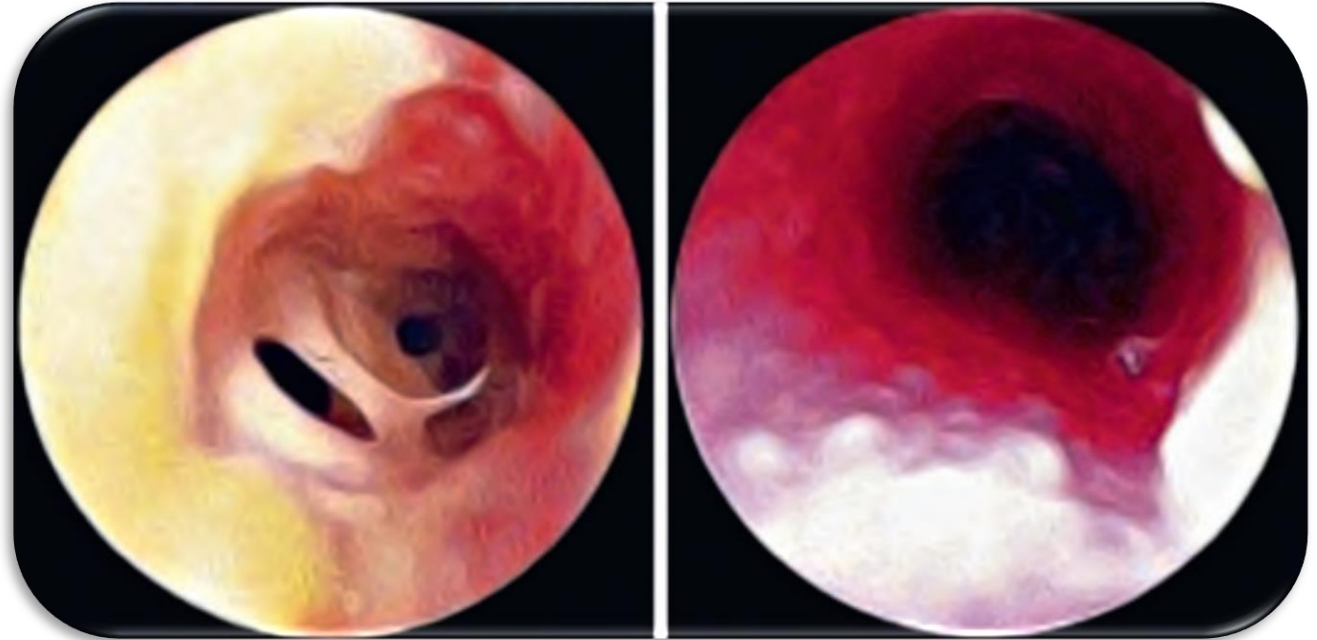
Mucosal swelling at the level of the cricoid cartilage, complicated by copious, thick, purulent secretions, sometimes causing pseudomembranes.

Bronchoscopy

In contrast to croup, tenacious secretions are seen throughout the trachea, and in contrast to bronchitis, the bronchi are not affected.



Lateral radiograph of the neck of a patient with bacterial tracheitis, showing pseudomembrane detachment and narrowing in the trachea.



Thick adherent membranous secretions.

Treatment

Supplemental oxygen is usually necessary

Intubation or less often tracheotomy

- is required for 50–60% patients
- younger patients are more likely to need intubation

During direct laryngoscopy for endotracheal intubation and or bronchoscopy

- Suctioning these secretions, although occasionally affording temporary relief, usually does not sufficiently obviate the need for an artificial airway.

Antimicrobial therapy

Empiric therapy

vancomycin or clindamycin and a 3rd-generation cephalosporin (e.g., ceftriaxone or cefepime)

Ineffective therapy

Racemic epinephrine

Corticosteroids

COMPLICATIONS

Cardiorespiratory arrest can occur

└ If airway management is not optimal

Toxic shock syndrome

└ with toxin producing *S. aureus* or *S. pyogenes*

Others

PROGNOSIS

For most patients is excellent

Usually become afebrile within 2-3 days of the institution of appropriate antimicrobial therapy.

In recent years, trend toward a less-morbid condition.

With a decrease in mucosal edema and purulent secretions, extubation can be accomplished safely

prolonged hospitalization may be necessary

Differentiation of Principal Infective Causes of Upper Airway Obstruction

	Viral Laryngotracheobronchitis	Epiglottitis	Bacterial Tracheitis	Diphtheria	Retropharyngeal Abscess
Principal organisms	Parainfluenza 1–3 Adenovirus respiratory syncytial virus	<i>Haemophilus influenzae</i> , <i>Streptococcus</i>	<i>Staphylococcus aureus</i> , <i>Moraxella catarrhalis</i> , <i>H. influenzae</i>	<i>Corynebacterium diphtheria</i>	Mixed flora, including <i>S. aureus</i> , <i>Streptococcus</i> , <i>H. influenzae</i> , anaerobes
Age range	6 months–4 years (peak, 1–2 years)	2–7 years	6 months–8 years	All ages	<6 years
Incidence	Common	Rare	Rare	Rare if vaccinated	Uncommon
Onset	Insidious usually follows upper respiratory tract infection	Rapid	Slow, with sudden deterioration	Insidious	Gradual
Site	Below the vocal cords	Supraglottis	Trachea	Tonsils, pharynx, larynx, nose, skin	Retropharyngeal space
Clinical manifestations	Low-grade fever Nontoxic barking (seal-like) cough Stridor hoarseness Restlessness	High fever Severe sore throat Minimal nonbarking cough Toxic stridor Drooling Dysphagia Muffled voice Tripod position	High fever Toxic, brassy cough Stridor Hoarse voice Neck pain Choking	Fever Toxic stridor Sore throat Fetor oris Cervical lymphadenopathy Bull neck	Fever Sore throat Neck pain and stiffness (especially on extension) Dysphagia Stridor (less common) Drooling Retropharyngeal bulge N/A
Endoscopic findings	Deep red mucosa Subglottic edema	Cherry-red or pale and edematous epiglottis Edematous aryepiglottic folds	Deep red mucosa Ulcerations Copious, thick tracheal secretions Subglottic edema, with normal epiglottis and arytenoids	Gray, adherent membrane on the pharynx	
Intubation	Occasional	Usual	Usual	Occasional	Unusual
Therapy	Corticosteroids Nebulized epinephrine	Intubation (1–3 days) IV antibiotics	Intubation (3–7 days) IV antibiotics Tracheal suction	Diphtheria antitoxin IV antibiotics Immunization during convalescence	IV antibiotics ± surgery

DIAGNOSIS	AGE	HISTORY	EXAM	IMAGING AND LABS	TREATMENT
INFECTIOUS					
Croup (<i>parainfluenza</i> and other viruses)	6 mo-3 yr	Fever, URI	Nontoxic, stridor, barking cough, hoarse	Steeple sign	Aerosolized epinephrine, systemic steroids, cool mist
Epiglottitis (<i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i> ; respiratory viruses)	2-6 yr	High fever, rapid onset, no cough, unable to swallow	Toxic, agitated, tripod sitting, drooling, stridor	Thumb sign Leukocytosis	Intubation, antibiotics
Bacterial tracheitis (<i>Staphylococcus aureus</i> , <i>Moraxella catarrhalis</i>)	Any age	High fever, rapid onset, no URI symptoms	Toxic, anxious, \pm stridor, \pm cough	Ragged tracheal border Leukocytosis	Intubation, antibiotics
Retropharyngeal abscess (<i>S. aureus</i> , Group A strep., oral anaerobes)	<6 yr	Fever, insidious onset, sore throat, no URI/cough	Moderately toxic, drooling, arched neck, inflamed pharynx	Thickened retropharyngeal space Leukocytosis	Antibiotics, surgical drainage
Peritonsillar abscess (Group A strep., oral anaerobes)	>8 yr	Fever, sudden worsening, sore throat, trismus	Moderately toxic, "hot potato" voice, drooling, asymmetric tonsil swelling	Imaging not needed Leukocytosis	Antibiotics, surgical drainage
NONINFECTIOUS					
Angioedema	Any age	No fever, sudden onset, urticarial, facial swelling, \pm allergen exposure	Nontoxic (unless anaphylaxis), \pm stridor, hoarse, facial edema	Steeple sign	Aerosolized or intradermal epinephrine, systemic steroids, antihistamines
Spasmodic croup	6 mo-6 yr	Sudden onset, no fever/URI, recurrent, often nocturnal	Nontoxic, \pm stridor, hoarse, barking cough	Often normal	Aerosolized epinephrine, antihistamines, antacids, systemic steroids
Foreign body	6 mo-5 yr	Sudden onset, cough and choke	Nontoxic, anxious, stridor, aphonic, brassy cough	Radiopaque object may be seen	Rigid bronchoscopy

Differentiating Supraglottic From Subglottic Causes of Acute Airway Obstruction

FEATURE	SUPRAGLOTTIC OBSTRUCTION	SUBGLOTTIC OBSTRUCTION
Common clinical syndromes	Epiglottitis, peritonsillar and retropharyngeal abscess	Croup, angioedema, foreign body, bacterial
Stridor	Quiet	Loud
Voice	Muffled	Hoarse
Dysphagia	Yes	No
Tripod or arching posture	Yes	No
Barking cough	No	Yes
Toxic	Yes	No, unless tracheitis
Trismus	Some	No
Drooling	Yes	No

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