

Croup Clinical Care Guideline

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یک دختر ۳ ساله با شرح حال تب و خس خس سینه به اورژانس آورده شده است ،

بیمار از ۵ روز قبل تب و علایم سرماخوردگی داشته است ،
مادر اظهار میکند که تب بیمار از دو روز قبل از مراجعه بیشتر
شده است و خس خس سینه پیدا کرده است که به مرور تا
زمان مراجعه بیشتر شده است ، در حال حاضر بیمار روی تخت
دراز کشیده است $T=39$ دارد ، بی حال است ، تاکی پنه و
تاکیکاردی دارد و سرفه های پارس مانند و استریدور دمی و
بازدمی دارد. رتراکشن بین دنده ای خفیف دارد.تبادل هوا در
سمع ریه ها خوب است ، سیانوز ندارد و اشباع اکسیژن بیمار
۹۲ درصد است.

رزیدنت کودکان با تشخیص کroup برای بیمار دگزامتازون خوراکی و نبولایزر اپینفرین و اکسیژن تجویز میکند. بیمار پس از دریافت اولین دوز اپینفرین ، کمی بهتر میشود ولی کماکان استریدور دمی و بازدمی دارد. رزیدنت کودکان سه بار به فاصله بیست دقیقه نبولایزر اپینفرین را تکرار میکند و توجه به عدم بهبودی استریدور ، دستور تعبیه رگ وریدی و تجویز متیل پردنیزولون وریدی و ادامه نبولایزر اپینفرین به فاصله هر سه ساعت میدهد.

بیمار از شب گذشته ، در حال دریافت متیل پردنیزولون و نبولایزر اپی نفرین است ، صبح توسط اتند اورژانس ویزیت میشود ، مادر از بی حالی و غذا نخوردن کودک شکایت دارد ، استریدور کودک هنوز ادامه دارد.
اتند اورژانس ، مایع درمانی را شروع میکند و دستور نبولایزر اپینفرین هر بیست دقیقه را میدهد.

بیمار ساعت ۱۲ ظهر دچار ارست تنفسی میشود.

- ✓ Acute inflammatory process
- ✓ Expressed as laryngotracheitis
- ✓ Begins in the nasopharynx
- ✓ Epithelium of larynx & trachea
- ✓ Inflammation, and edema of the vocal folds

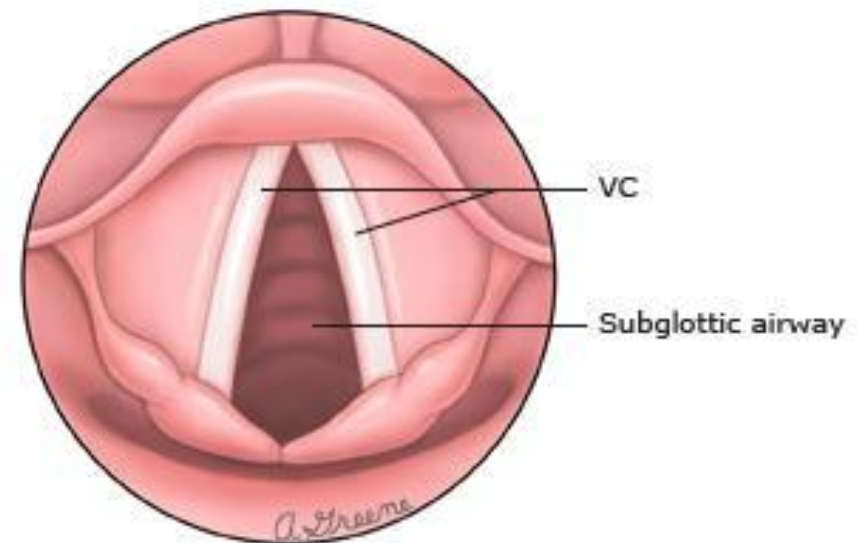
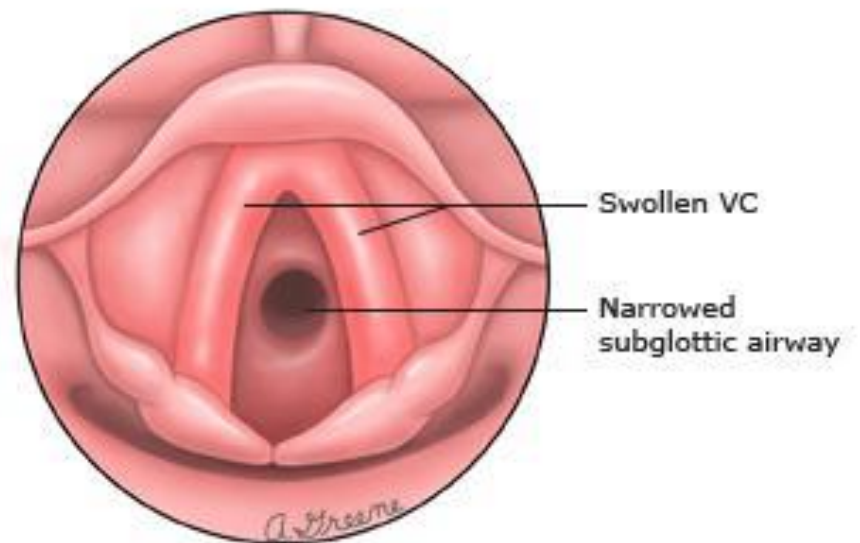
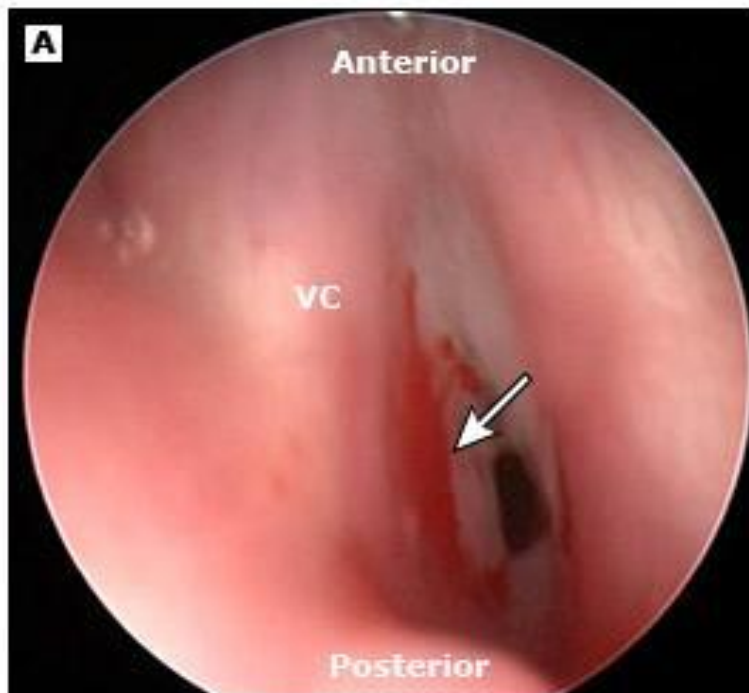
The narrowest segment
of the pediatric airway is the
subglottic region

- Encircled by the rigid cricoid cartilage ring.
- There is nonfibrous, loosely attached mucosa

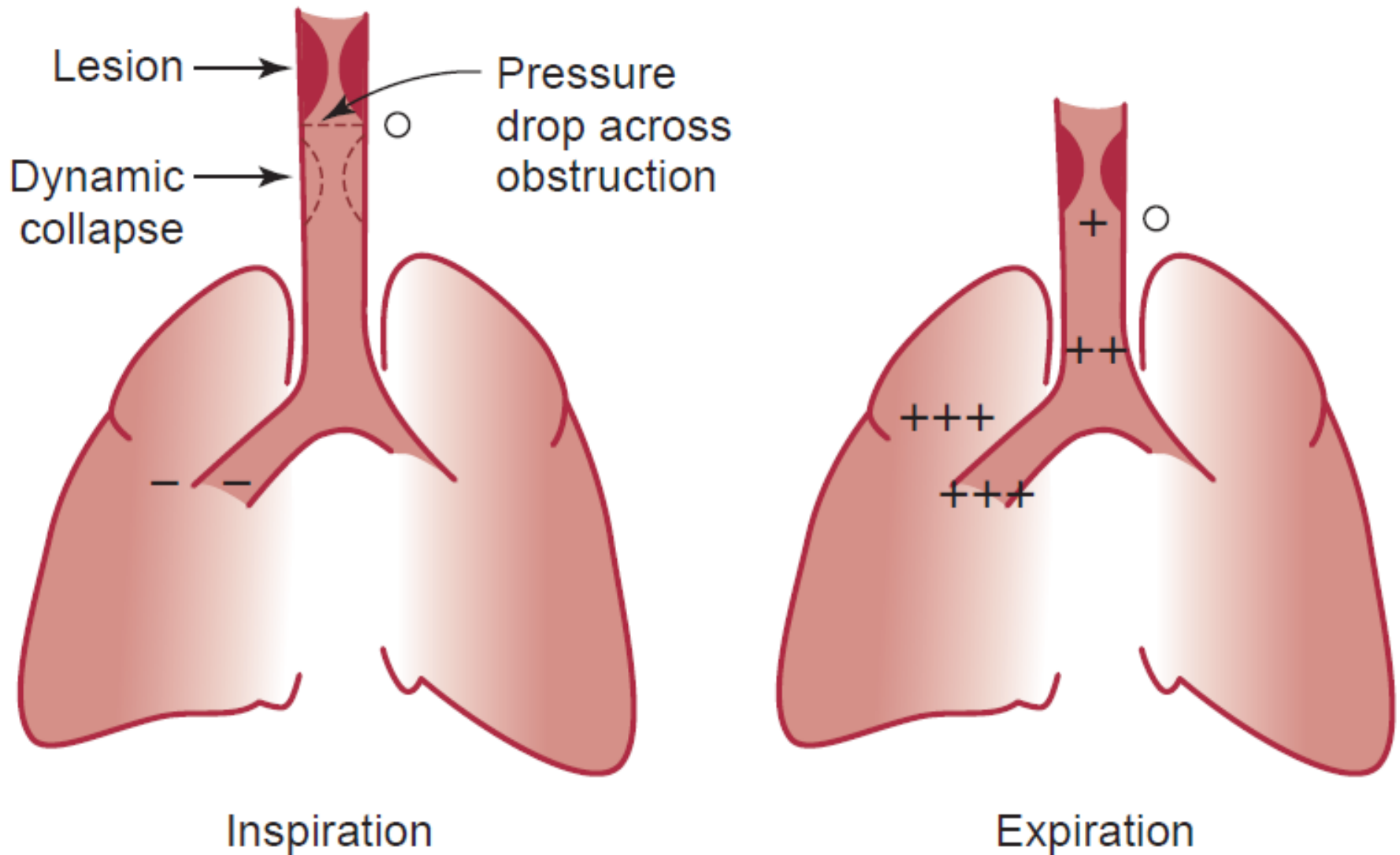
Stridor

- ✓ rapid, turbulent flow of air through a narrowed segment of a large airway.
- ✓ It is most often loud, with medium or low pitch, and inspiratory.
- ✓ It usually originates from the larynx, upper trachea, or hypopharynx.
- ✓ Progression of the disease process may make stridor softer, higher-pitched, and biphasic (inspiratory and expiratory).

The diameter of the sub-glottis in a normal newborn is approximately 5 mm, and 0.5-mm edema in this region reduces the cross-sectional area to 64% of normal (area = $\pi \times \text{radius}^2$). Air flow is directly proportional to the airway radius to the fourth power (Poiseuille's law), so a small reduction in caliber has a major effect on flow rate. The same 5-mm airway with 0.5 mm edema will have a flow rate of only 41% of baseline, assuming that pressure remains unchanged—a situation that is not necessarily the case if the Bernoulli principle is in play.



EXTRATHORACIC OBSTRUCTION



Etiology of Croup (Laryngotracheitis)

Parainfluenza type 1 (most common) 2, 3

Influenza A & B

Human metapneumovirus (hMPV)

Measles virus

Respiratory syncytial virus (RSV)

Adenovirus

Rhinovirus

Enteroviruses

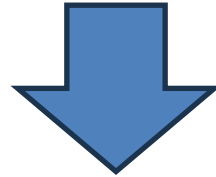
Herpes Simplex viruses

ReoViruses

Mycoplasma pneumoniae

Severity **does not** correlate with
any particular etiologic agent.

Polymorphonuclear and monocytic leukocytes infiltrate the sub-epithelium



Vascular congestion and airway wall edema.

Spasmogenic mediators, decreased airway diameter.

This may result from a
type I hypersensitivity
response to PIV, and some authors
have postulated a role for
anti-PIV-specific (IgE) in the
development of airway narrowing.

Age: 6 months to 3 yrs (Mean = 18 mos)

Duration: 3 to 7 days, symptoms maximal day 2 to 3

Epidemiology: Year round; most common fall

Uncommon in children >6 years old

Male:female ratio 1.4:1

Clinical Progress

Day 1 to 3

Rhinorrhea

Sore throat

Low grade fever

Mild cough

Day 3 to 7

Onset symptoms of upper airway inflammation

Hoarseness

Barking cough

Stridor (variable)

Respiratory distress (variable)

History

- **Fever** - The absence of fever is suggestive of spasmodic croup or other noninfectious etiology
- **Barking cough** - The classic physical finding
- **Hoarseness** - Hoarseness may be present in croup
- **Difficulty swallowing** - acute epiglottitis. ingested foreign body in upper esophagus
- **Drooling** - peritonsillar or retropharyngeal abscesses, retropharyngeal cellulitis, and epiglottitis.
- **Throat pain** - more common in epiglottitis

- Temperatures may reach 39–40°C
- Some children are afebrile

Croup is a disease of the upper airway, and alveolar gas exchange is usually normal.

Hypoxia and low oxygen saturation are seen only when complete airway obstruction is imminent.

The child who is hypoxic, cyanotic, pale, or obtunded needs immediate airway management.



Differential Diagnosis

Allergic reaction
Bacterial tracheitis
Epiglottitis
Foreign body aspiration
Hemangioma (subglottic)
Infectious mononucleosis
Laryngeal diphtheria
Laryngeal nerve compression
Paraquat poisoning
Peritonsillar abscess
Retropharyngeal abscess
Subglottic stenosis
Trauma
Tumor \ intracranial process (rare)

Rarer causes of recurrent stridor:

- Hypocalcaemia
- Angioneurotic edema
- Bronchogenic cyst
- Guillain-Barré syndrome

Spasmodic croup

- Allergic response to viral antigen
- Acute non-inflammatory swelling
- Acute nocturnal onset
- Older child
- Repeat attacks
- Do not have coryzal prodrome
- Afebrile
- Links with atopy
- Positive family history

Treatment is similar to that for viral LTB.

Some practitioners prescribe oral or inhaled corticosteroids to be kept at home and administered by the parents.

The etiology of recurrent, spasmodic croup remains unclear, suggested triggers include:

- Gastro esophageal reflux
- Anatomical abnormalities
- Allergic predisposition
- EOE

Laboratory and Radiology Studies

Diagnostic tests are only indicated if they will change outcome. Croup is a clinical diagnosis and usually no testing needed.

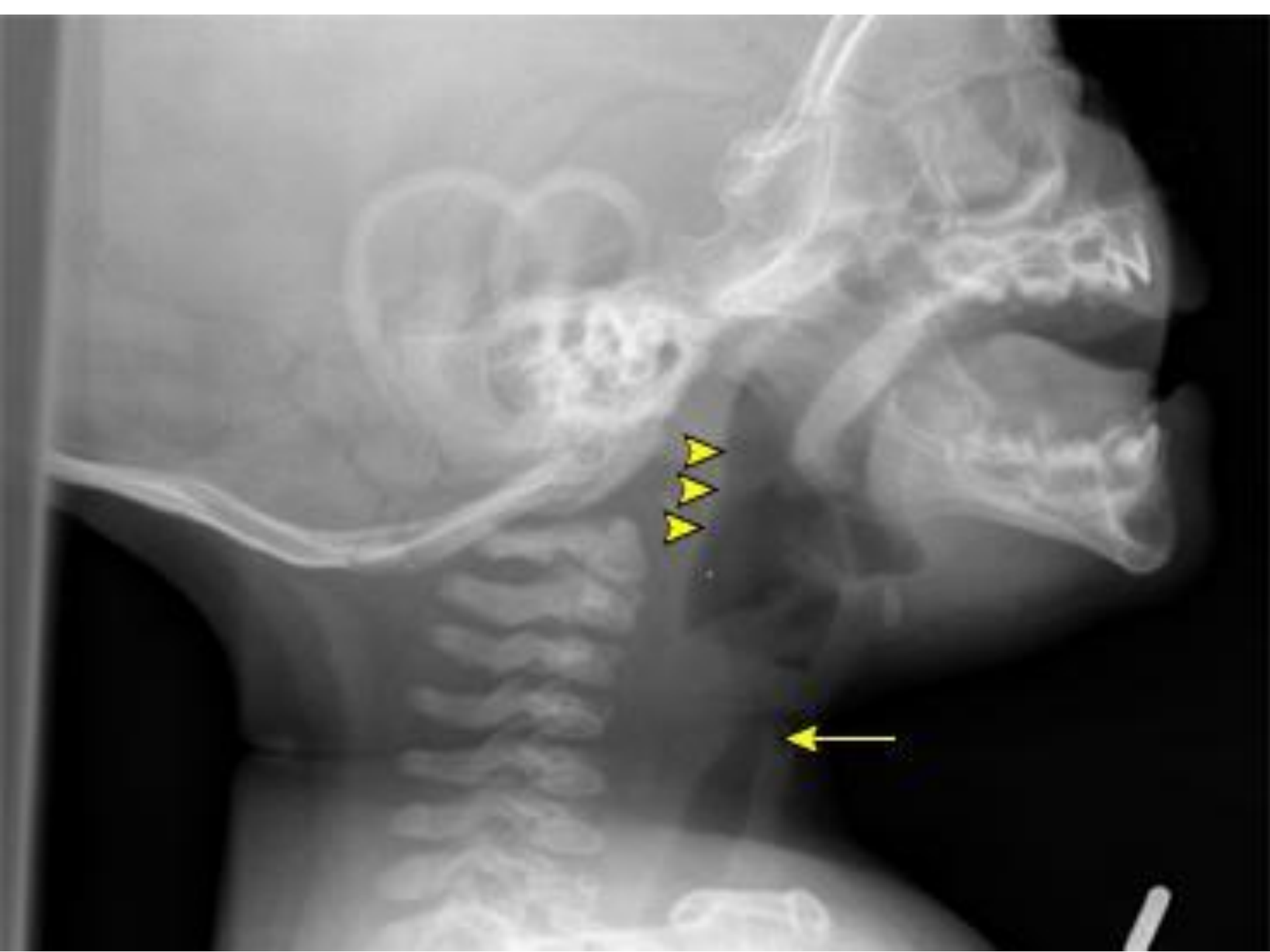
“steeple sign”

- may be absent in patients with croup,
- may be present as a normal variant,
- may occasionally be present in epiglottitis



Plain Lateral Neck View

- Rarely influences management
- Wastes time
- The neck extension can be fatal





L OPE



Monitoring

- **Oxygen saturation** (SaO₂) usually normal in croup unless tracheitis present
- **Continuous cardiac/pulse oximetry monitoring** only recommended for unstable patient or receiving repeat nebulized epinephrine
- **Follow vital signs** to assess response to therapy: temperature, heart rate, respiratory rate



Therapeutics

Home treatment

caregivers may try sitting with the child in a bathroom filled with steam generated by running hot water to improve symptoms.

This may help reassure parents that "something" is being done to reverse the symptoms.

Corticosteroids

Dosing: Single Dose

Mechanism of action: Long lasting anti-inflammatory agent
Decrease edema in laryngeal mucosa

Adverse Effects:

Risk of progressive viral infection

Risk of secondary bacterial infection

Exacerbate active varicella or TB

Mask steroid dependant upper airway lesions (hemangioma)

Dexamethasone

Dose: 0.15 to 0.6 mg/kg orally (preferred), IV, IM

Frequency: Once

Maximum Dose: 16 mg

Peak serum levels:

Oral: Within 1 to 2 h

IM: within 8 h

Duration of action: 24 to 72 h

- **Nebulized Budesonide 2mg**
Equal efficacy to dexamethasone; expensive
Consider in children with emesis or severe respiratory distress
- **Prednisolone**
Dose: 1 mg/kg
- **Prednisone**
Dose:
 - 4 mg/kg/ (equivalent 0.6 mg/kg dexamethasone)
 - 2 mg/kg/ (equivalent 0.3 mg/kg dexamethasone)
 - 1 mg/kg/ (equivalent 0.15 mg/kg dexamethasone)

Repeated corticosteroid dosing

Are not necessary on a routine basis.

Moderate to severe symptoms that persist for more than a few days should prompt investigation for other causes of airway obstruction.

Nebulized Epinephrine

Mechanism of Action: Stimulation α -adrenergic receptors
Constrict capillary arterioles causing fluid resorption from
interstitial space and decreases interstitial edema

Duration of action: less than or equal to 2 hours

Efficacy: Racemic & L-epinephrine are equally efficacious

Adverse effects: Myocardial Infarction (rare)

Racemic Epinephrine

(1:1 mixture of δ & ϑ -isomers epinephrine)

Dose: 0.05 mL/kg/dose of 2.25% solution in 2.5mL normal saline (NS) via nebulizer over 15 minutes

Weight less than 5 kg = 0.25 mL

Weight greater than or equal to 5 kg = 0.5mL

Frequency: Repeat every 20 min as indicated

Maximum Dose: 0.5 mL

L-epinephrine

Dose:

0.5 mL/kg/dose of 1:1000
in 2.5 mL of NS via nebulizer over 15 min

Frequency:

Repeat every 15 to 20 minutes as indicated

Maximum Dose:

5 mL

It is safe to send children home from the ED
after receiving racemic epinephrine if they
have been observed for
a minimum of 3 hours post therapy .

Mist:

Controversial therapy without supporting evidence

May moisten airway secretions

May decreases airway inflammation

May decreases viscosity of tracheal mucus

May increase wheezing

- Anti-tussive or decongestant

- Antibiotics

No role in uncomplicated croup

Indicated only for bacterial component
(tracheitis)

- Helium-Oxygen Mixture

Not shown to be more effective than
nebulized epinephrine

CROUP SCORE (Modified Westley)

Indicators of Disease Severity	Score
Inspiratory stridor	
None	0
Only with agitation or activity	1
At rest	2
Intercostal Retractions	
None	0
Mild	1
Moderate	2
Severe	3
Air Entry	
Normal	0
Mildly decreased	1
Severely decreased	2
Cyanosis	
None	0
With agitation \ activity	4
At rest	5
Level of Consciousness	
Normal	0
Altered	5

Severity assessment

- **Mild croup (croup score of ≤ 2)**
no stridor at rest
- **Moderate croup (croup score of 3 to 7)**
stridor at rest
- **Severe croup (croup score of ≥ 8)**
significant stridor at rest

Impending respiratory failure (Westley croup score of ≥ 12) :

- Fatigue and listlessness
- Marked retractions
- Decreased or absent breath sounds
- Depressed level of consciousness
- Tachycardia out of proportion to fever
- Cyanosis or pallor



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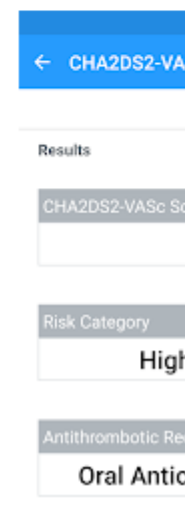
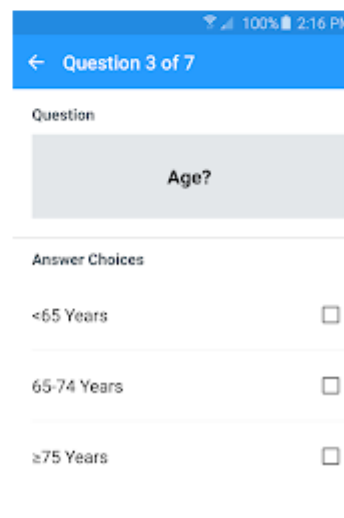
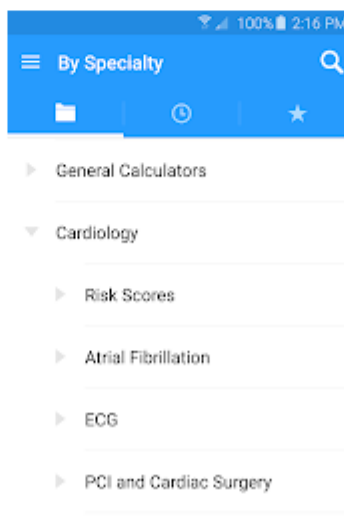
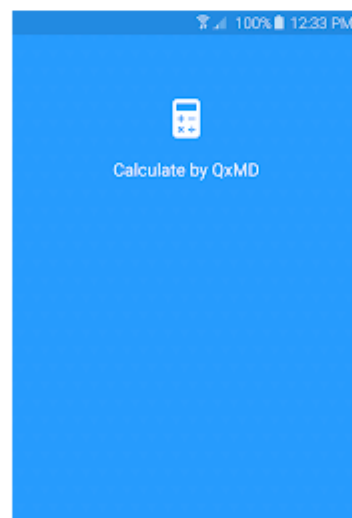
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**Mild croup (croup score of ≤ 2)
no stridor at rest**

Home treatment:

Symptomatic care including antipyretics, mist, and oral fluids

Outpatient treatment:

Single dose of oral dexamethasone **0.15 to 0.6** mg/kg

Moderate croup (score of 3 to 7)

stridor at rest

should be evaluated in the emergency department

- Single dose of oral dexamethasone 0.6 mg/kg
- Nebulized epinephrine
- Hospitalization is generally not needed

Observe for 3 hrs . Discharge if indicated.

Severe croup (score of ≥ 8)

significant stridor at rest

should be evaluated in the emergency department

- Single dose of oral/IM/IV dexamethasone 0.6 mg/kg
- Repeated doses of nebulized epinephrine
- Inpatient admission is generally required

Score < 8? Observe for 3 hrs

Score > 8? Repeat epinephrine >> PICU

Discharge Home

- Vital signs baseline
- Normal pulse oximetry
- Tolerating fluids by mouth
- No stridor at rest
- Good air exchange
- Normal color
- Caregivers understand instructions

Hospital admission

Patients with ongoing severe symptoms after initial treatment should be admitted to the hospital.

Nebulized epinephrine can be repeated
every 15 to 20 minutes.

three or more doses ?

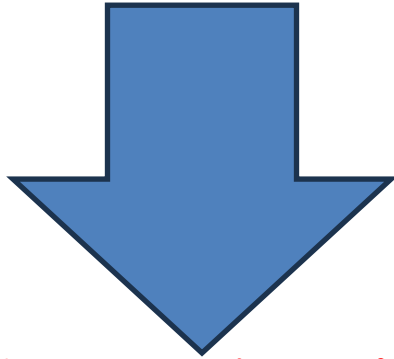


cardiac monitoring

Admit ICU

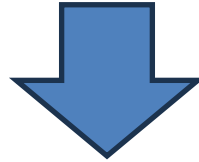
- Consider for croup score **greater than 8**
- **Escalating stridor** at rest despite therapy
- Any patient with impending respiratory failure:
 - > **SaO₂ less than 90% in 40% FiO₂**
 - > **Cyanosis with supplemental oxygen**

Do not respond to the usual therapies or are too severely compromised



urgent endotracheal intubation

The most experienced person available



Uncuffed endotracheal tube



One size smaller



Immediate tracheostomy must be available.

PROGNOSIS

Symptoms of croup resolve in most children within three days but may persist for **up to one week** .

Approximately **8 to 15 percent** of children with croup require **hospital admission** and among those, **<3 percent require intubation** .

Mortality is rare, occurring in **<1 percent** of intubated children.

Who Should Be Evaluated?

- multiple episodes
- severe or frequent
- slow to resolve
- absence of obvious infections

seven days?

- **Underlying airway abnormality**
- **Complication of croup**

Investigation is usually centered on
airway endoscopy.

Acute Epiglottitis

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Etiology:

- *Haemophilus influenzae* type B (Hib)
- *H. influenzae* types A and F, and nontypeable
- *Haemophilus parainfluenzae*
- *Streptococcus pneumoniae*
- *Staphylococcus aureus*
- Beta-hemolytic streptococci: Groups A, B, C, F, G
- *Pasteurella multocida*
- *Moraxella catarrhalis*
- *Klebsiella pneumoniae*
- *Neisseria meningitidis* and other *Neisseria* species
- *Escherichia coli*
- *Enterobacter cloacae*
- *Pseudomonas aeruginosa*

Etiology:

Viral causes

- Herpes simplex virus type 1
- Varicella zoster virus
- Parainfluenza virus type 3
- Influenza B viruses
- Epstein-Barr virus

Fungal causes

- Candida albicans

NonVaccinated:

The typical patient was 2-4 yr of age, although cases were seen in the 1st year of life and in patients as old as 7 yr.

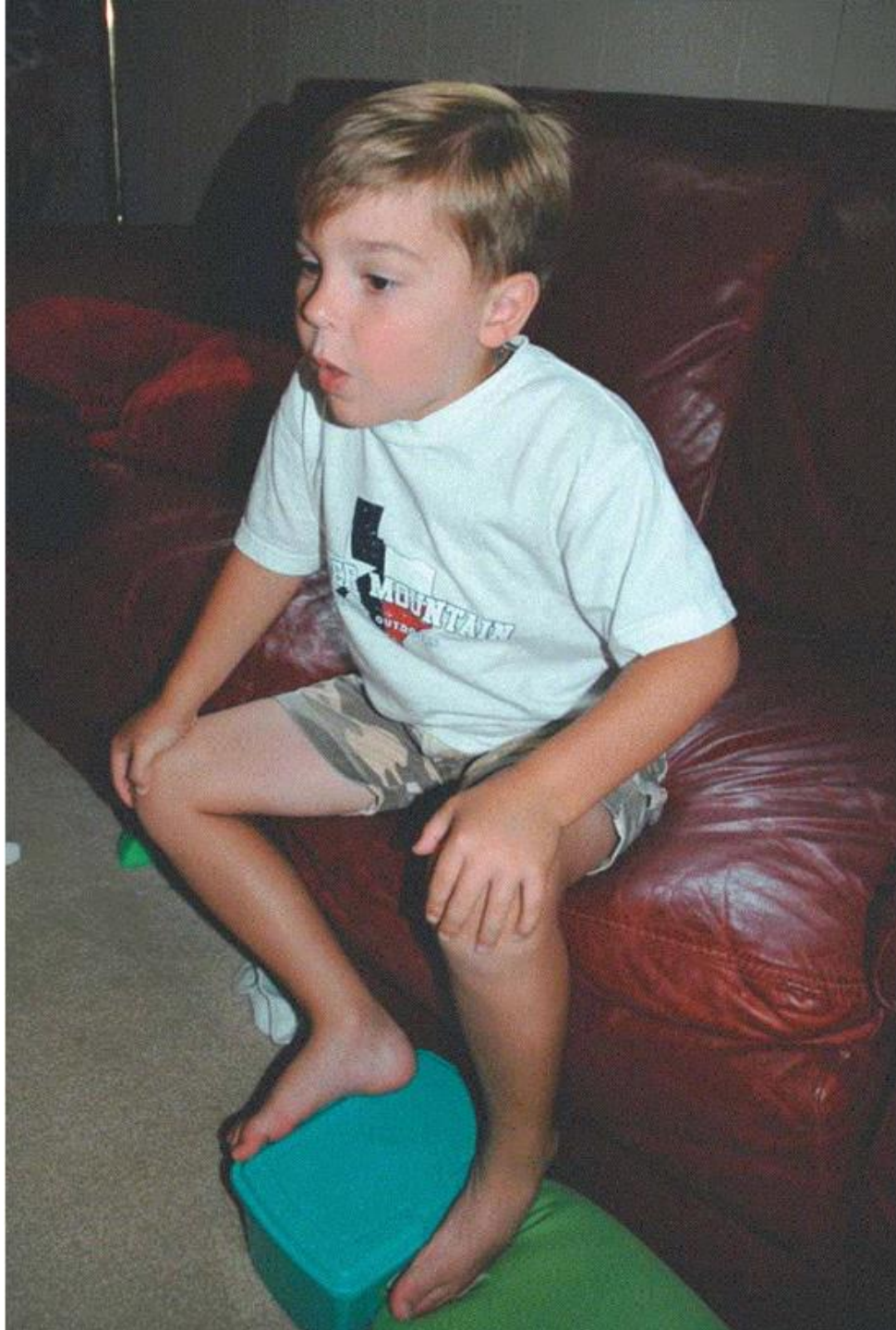
Vaccinated:

The typical patient with epiglottitis is an adult with a sore throat.

Acute fulminating course of
high fever, sore throat, dyspnea,
and
rapidly progressing respiratory obstruction.

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

Drooling is usually present and the
neck is hyperextended
in an attempt to maintain the airway.





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

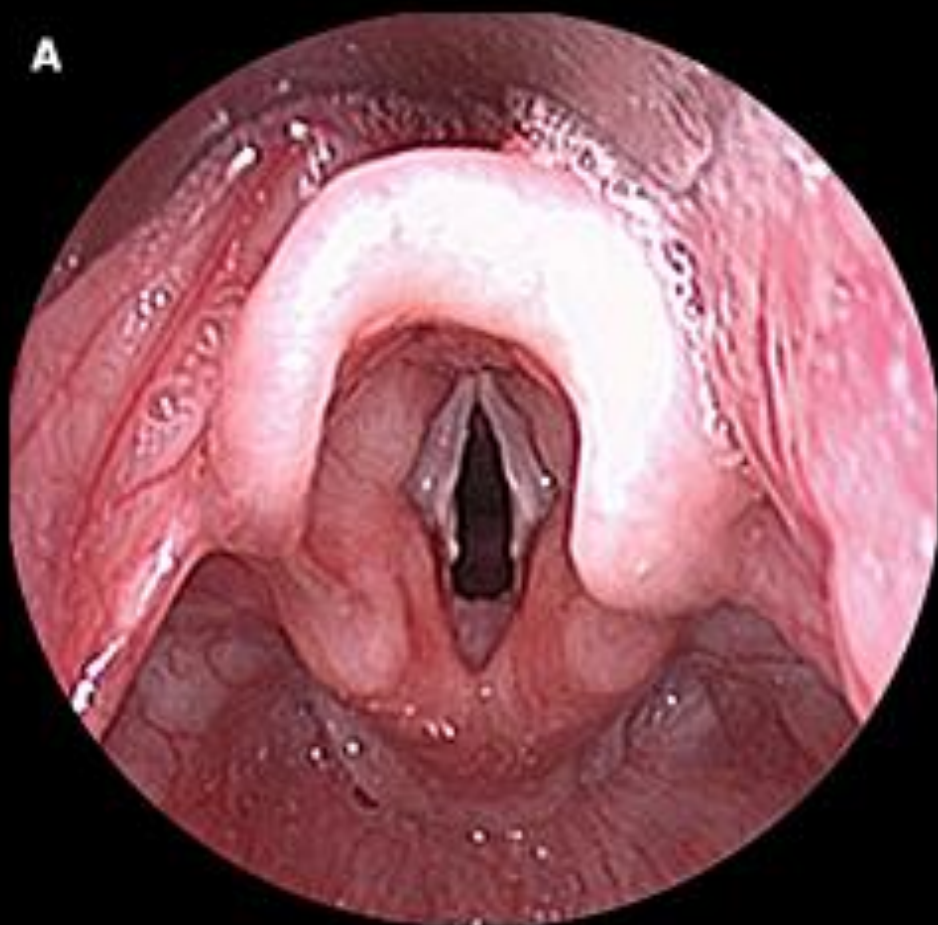
The **barking cough**
typical of croup is **rare**.

Usually, no other family members are ill
with acute respiratory symptoms.

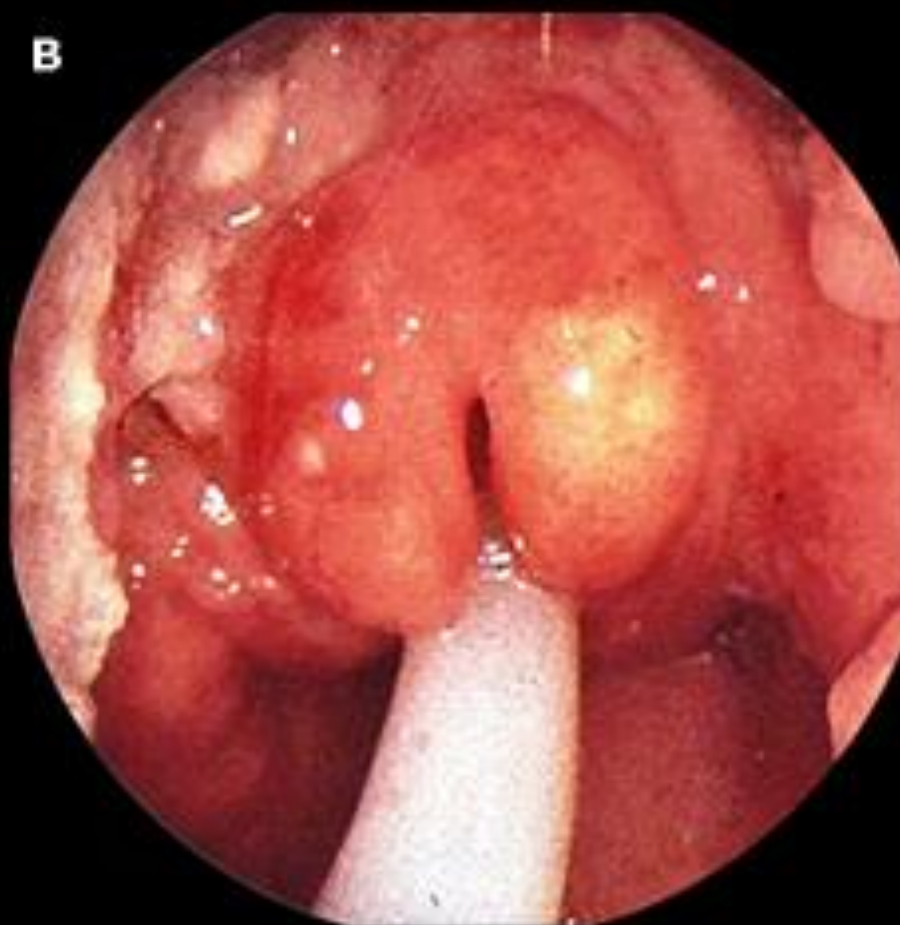
The diagnosis:

visualization of a large, "cherry red" swollen epiglottitis by laryngoscopy.

A



B



EPIGLOTITIS

Normal Epiglott



Epiglottitis



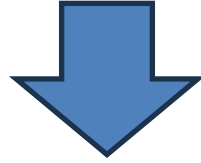
Anxiety-provoking interventions such as phlebotomy, intravenous line placement, placing the child supine, or direct inspection of the oral cavity should be avoided until the airway is secure.



Base of tongue
epiglottis



Establishing an airway by nasotracheal intubation or,
less often, by tracheostomy



regardless of the degree of apparent respiratory
distress,

6% of children with epiglottitis without an artificial
airway die, compared with <1% of those with an
artificial airway.

children with acute epiglottitis are intubated for 2-3 days, because the response to antibiotics is usually rapid .

Most patients have concomitant bacteremia;
occasionally, other infections are present, such as
pneumonia,
cervical adenopathy,
otitis media.
Meningitis,
Arthritis.

Racemic epinephrine and corticosteroids are ineffective.

Cultures of blood, epiglottic surface, and, in selected cases, cerebrospinal fluid should be collected after airway stabilization.

Treatment:

**Ceftriaxone, cefotaxime, or Meropenem
AND
Vancomycin**

7-10 days.

Indications for rifampin prophylaxis (20 mg/kg orally once a day for 4 days)

- (1) any contact <48 mo of age who is incompletely immunized.
- (3) an immunocompromised child in the household.

Acute Infectious Laryngitis

Viruses cause most cases; diphtheria is an exception but is extremely rare in developed countries.

The onset is usually characterized by an upper respiratory tract infection during which sore throat, cough, and hoarseness appear.

- The illness is generally mild
- Respiratory distress is unusual
- Hoarseness and loss of voice

The physical examination is usually not remarkable except for evidence of pharyngeal inflammation.

The principal site of obstruction is usually the subglottic area.

Bacterial Tracheitis

life-threatening airway obstruction

- Staphylococcus aureus the most common
- Moraxella catarrhalis
- non-typable H. influenzae
- anaerobic organisms
- Streptococcus pyogenes
- Streptococcus pneumoniae

The mean age has been between
5 and 7 yr.

Often follows a viral respiratory infection
(a bacterial complication of a viral disease).

This life-threatening entity is more common than
epiglottitis in vaccinated populations.

Typically, the child has a
brassy cough,
High fever and "toxicity"
with respiratory distress.

The patient
Can lie flat,
does not drool,
does not have the dysphagia.

50-60% of patients required intubation

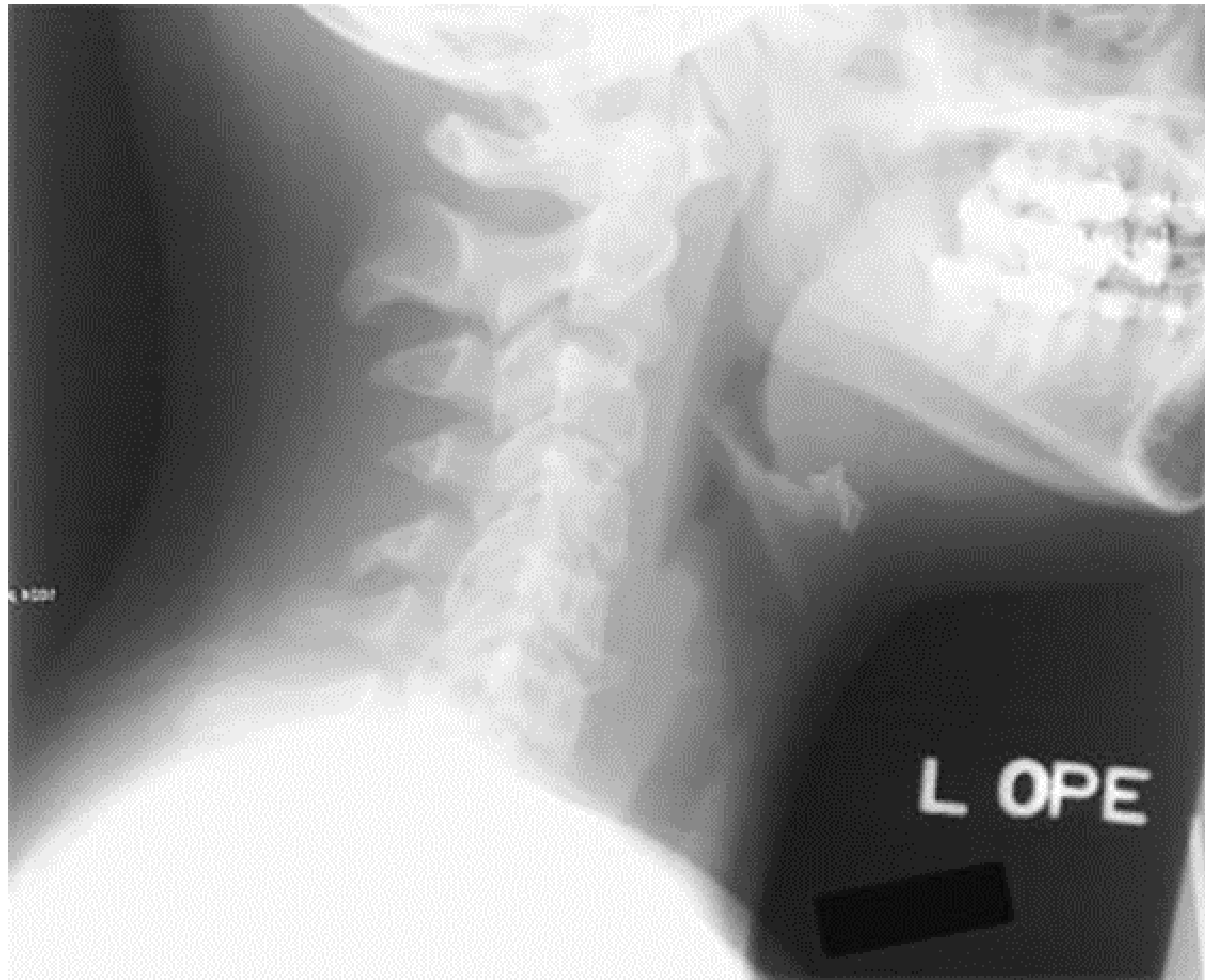
The major pathologic feature appears to be mucosal swelling at the level of the cricoid cartilage complicated by copious thick, purulent secretions

X-rays are not needed but may show
the classic findings.

(pseudomembrane detachment)

purulent material is noted below the
cords during endotracheal intubation.







TREATMENT:

antistaphylococcal agents

artificial airway should
be strongly considered.

Toxic shock syndrome
has been associated with
staphylococcal tracheitis.

یک دختر ۳ ساله با شرح حال تب و خس خس سینه به اورژانس آورده شده است ،

بیمار از ۵ روز قبل تب و علایم سرماخوردگی داشته است ، مادر اظهار میکند که تب بیمار از دو روز قبل از مراجعه بیشتر شده است و خس خس سینه پیدا کرده است که به مرور تا زمان مراجعه بیشتر شده است ، در حال حاضر بیمار روی تخت دراز کشیده است و خواب آلود است.
T=39 دارد ، بی حال است ، تاکی پنه و تاکیکاردی دارد و سرفه های پارس مانند

و استریدور دمی و بازدمی دارد. رتراکشن بین دنده ای خفیف دارد.تبادل هوا در سمع ریه ها خوب است ، سیانوز ندارد و اشباع اکسیژن بیمار ۹۲ درصد است.

**CROUP SCORE
(Modified Westley)**

Indicators of Disease Severity	Score
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رزیدنت کودکان با **تشخیص کروپ** برای بیمار دگزامتازون خوراکی و نبولایزر اپینفرین و اکسیژن تجویز میکند.

بیمار پس از دریافت اولین دوز اپینفرین ، کمی بهتر میشود **ولی کماکان استریدور دمی و بازدمی دارد.**

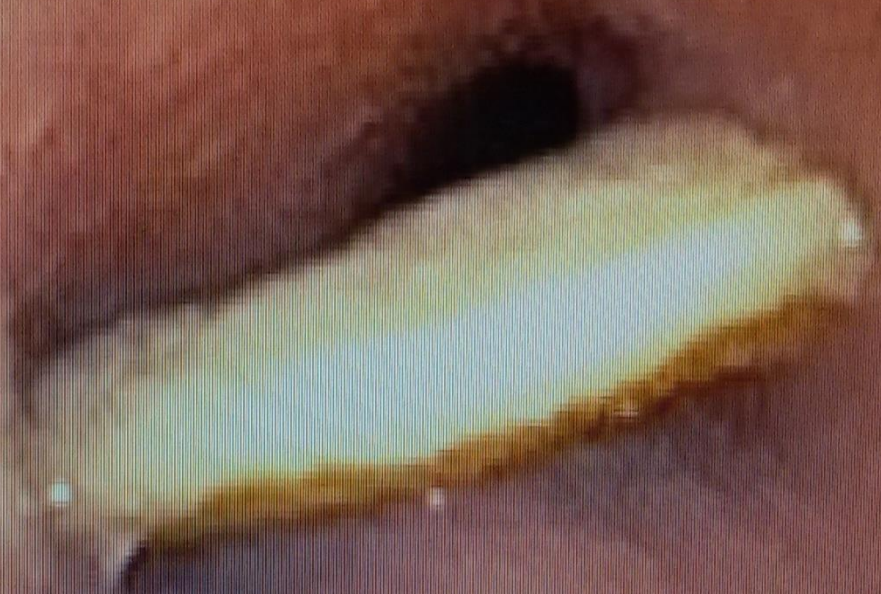
رزیدنت کودکان **سه بار به فاصله بیست دقیقه** نبولایزر اپینفرین را تکرار میکند و توجه به عدم بهبودی استریدور ، دستور تعبیه رگ وریدی و تجویز متیل پردنیزولون وریدی و ادامه نبولایزر اپینفرین به فاصله هر **سه ساعت** میدهد.

بیمار از شب گذشته ، در حال دریافت متیل پردنیزولون و نبولایزر اپی نفرین است ، صبح توسط اتند اورژانس ویزیت میشود ، مادر از بی حالی و غذا نخوردن کودک شکایت دارد ، استریدور کودک هنوز ادامه دارد. اتند اورژانس ، مایع درمانی را شروع میکند و دستور نبولایزر اپینفرین هر بیست دقیقه را میدهد.

بیمار ساعت ۱۲ ظهر دچار ارست تنفسی میشود ، بلافاصله تیم احیا وارد عمل میشود و بیمار را انتوبه میکند و بیمار به ای سی یو کودکان فرستاده میشود ، هنگام انتوباسیون ترشحات چرکی در تراشه دیده میشود.

روز بعد بیمار در اتاق عمل برونکوسکوپی میشود و تصاویر زیر مشاهده میشود. کشت از ترشحات ارسال میشود که استافیلوکوک اورئوس در کشت رشد میکند. بیمار پس از ۵ روز اکستوبه میشود و با حال عمومی خوب و بدون استریدور پس از دریافت ۱۰ روز آنتی بیوتیک تزریقی ترخیص میشود.

جسم خارجی در کارینا





An endoscopic image showing a foreign body (FB) in the carina. The foreign body is a small, light-colored, irregularly shaped object located in the center of the image, partially obscured by the surrounding mucosal tissue. The mucosa is a reddish-pink color with visible vascular patterns. The text "FB in Carina" is overlaid in the bottom left corner.

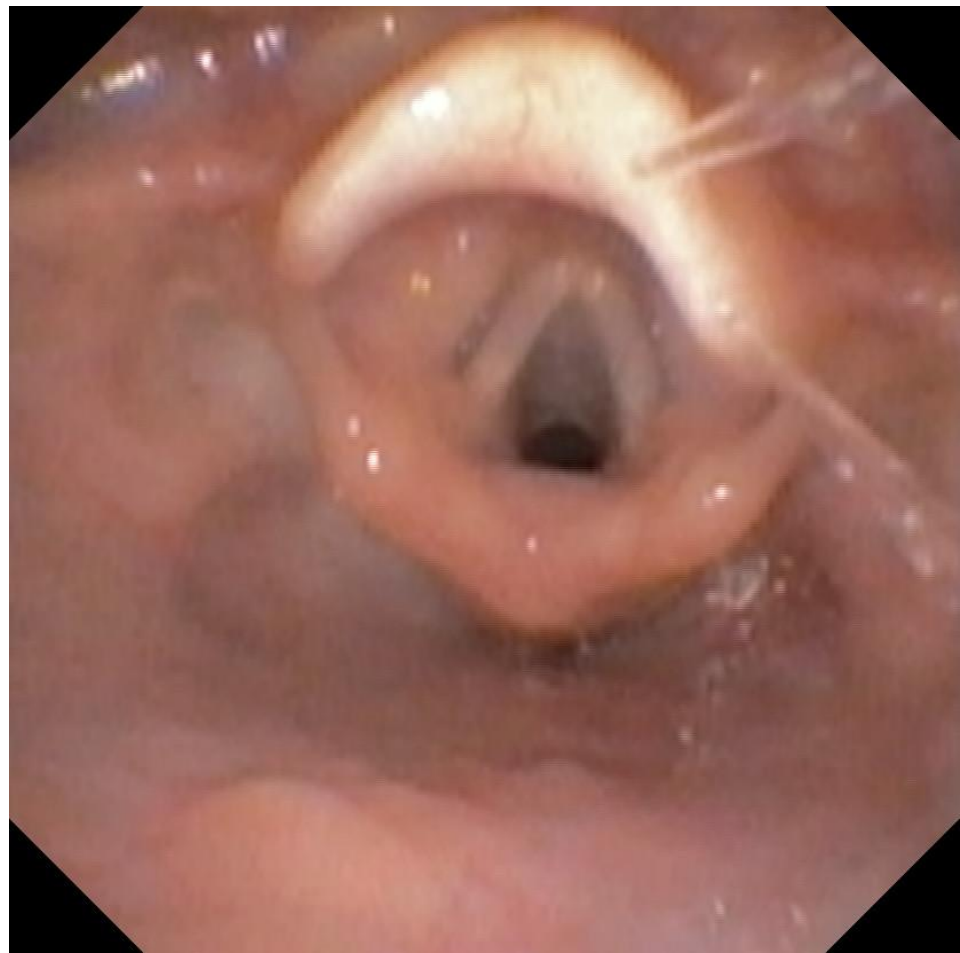
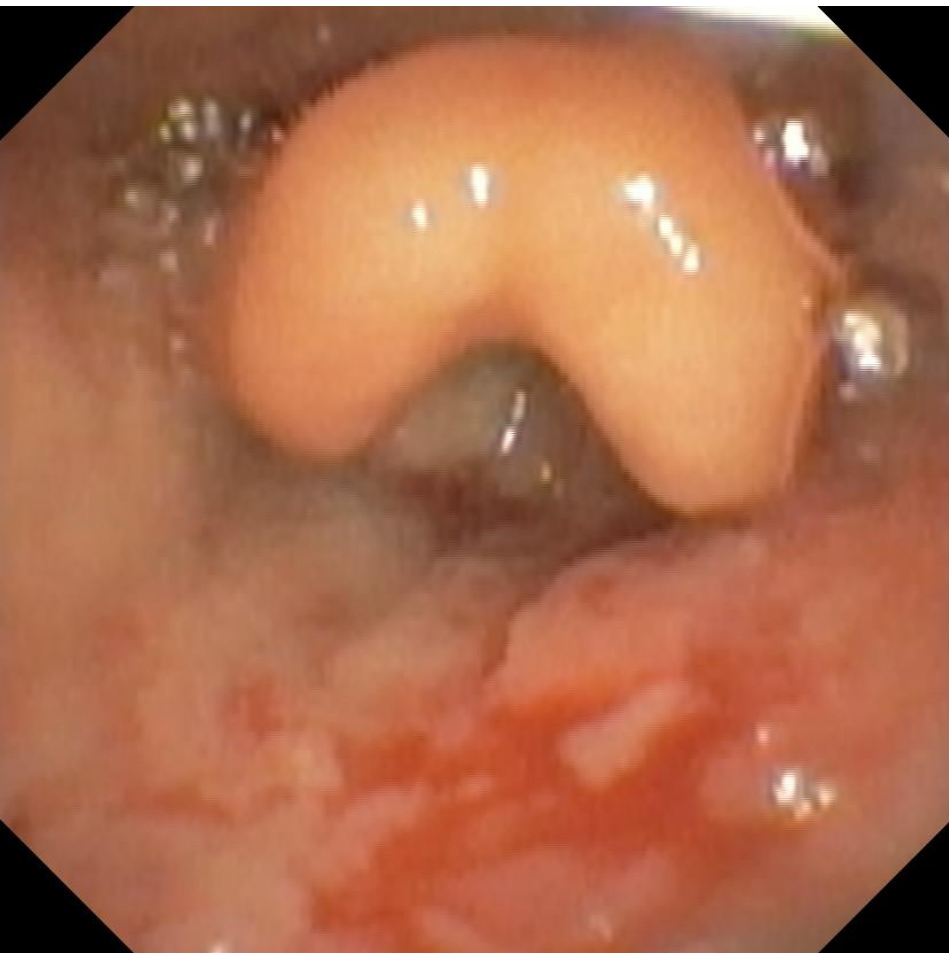
FB in Carina

















Thank you for your attention

