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MODIFIED NO.2



كتابة: دكتور 021

تدقيق: ميس قشّوع و ديماء العزة

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Upper Airway Obstruction in Children



Color code



Slides



Doctor



Additional info



Important

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- ❑ The flow of information in this lecture:
 1. Discussing the meaning and types of **Stridor**.
 2. Discussing the **Croup**.
 3. Discussing the **Bacterial Tracheitis**.
 4. Discussing the **Epiglottitis**.
 5. Discussing the **Retropharyngeal Abscess**.
 6. Discussing the **Laryngomalacia**.

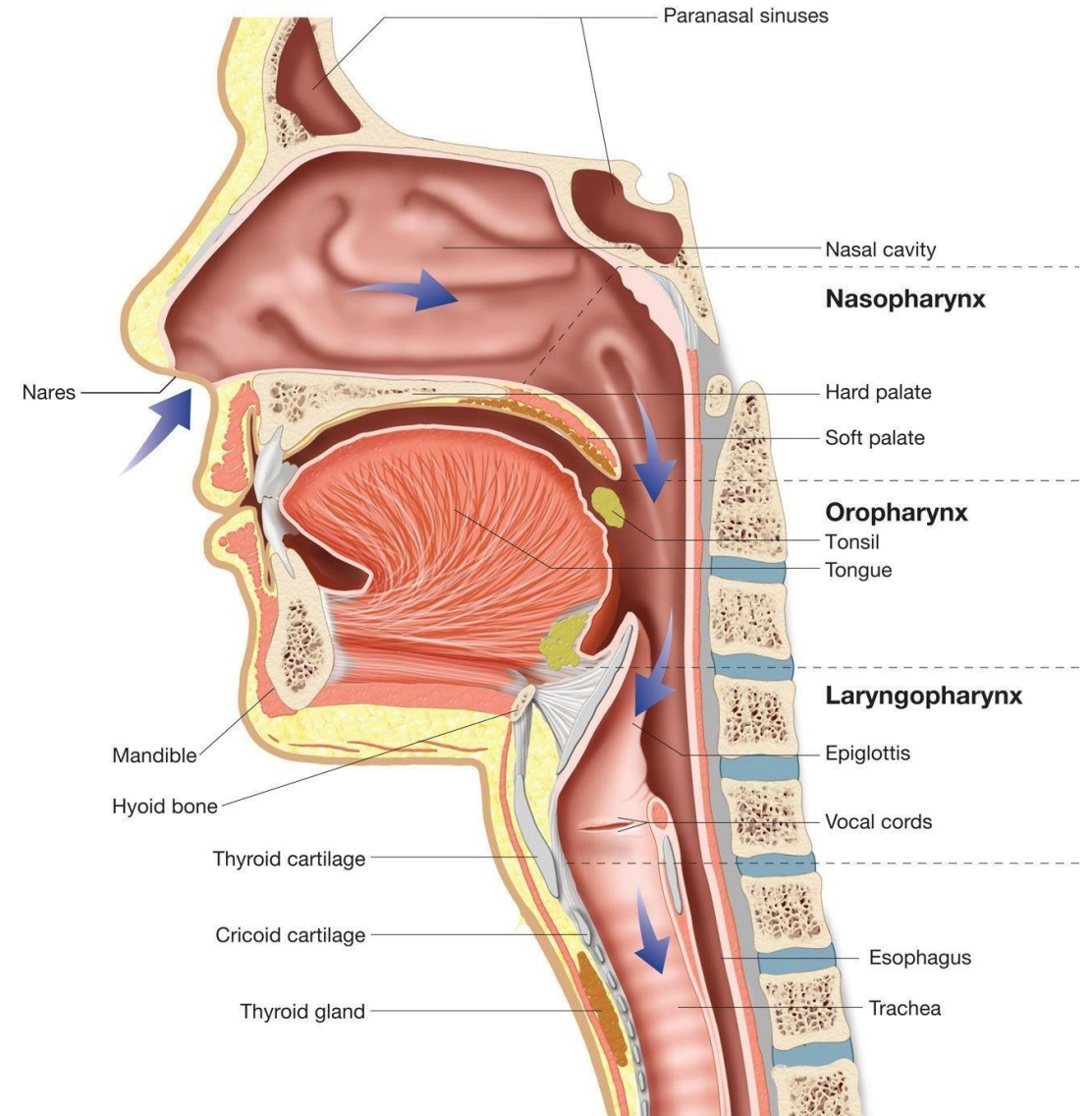
بِسْمِ اللَّهِ نَبْدَأُ

Anatomy

- Upper airway includes:

- ✓ Nose
- ✓ Pharynx
- ✓ Larynx
- ✓ Trachea

- Any partial obstruction at the level of any of these anatomical regions might cause a partial obstruction to the entire upper airway leading to significant clinical symptoms.
- The partial obstruction of the upper airway in children leads to what's called "stridor"



Stridor

[Stridor sound](#)

Is a high-pitched breath sound (noisy) resulting from turbulent air flow in the upper airway.

Stridor in children is classified to acute and chronic (chronic if it lasts more than 6 Weeks)

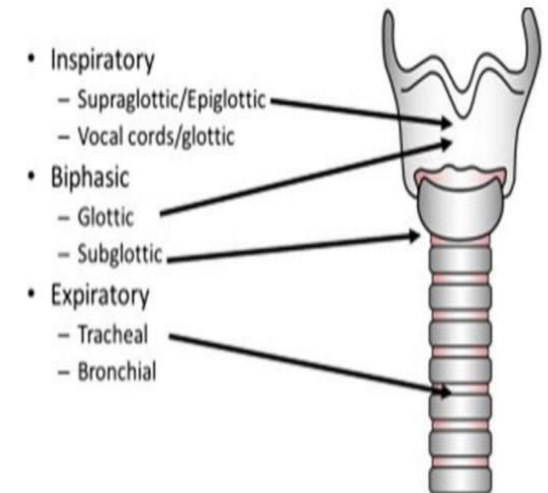
• It also has 3 types according to the level of the partial obstruction:

1. **Inspiratory: the most common in children:** usually appears during inspiration, usually happens due to supraglottic or epiglottic obstructions, or if there is a lesion at the vocal cord level.

2. **Expiratory:** appears during expiration, the partial obstruction will be at the level of the trachea or even lower, at the level of the bronchi.

3. **Biphasic:** the stridor happens during both inspiration and expiration, the partial obstruction will be at the level of glottis or sub-glottis.

TYPES OF STRIDOR



Causes of Stridor in Children

1. Acute Stridor

➤ Infectious Causes:

- **Croup:** most common cause of acute stridor.
- **Tracheitis**
- **Epiglottitis**
- **Retropharyngeal Abscess**

➤ Foreign Body Aspiration:

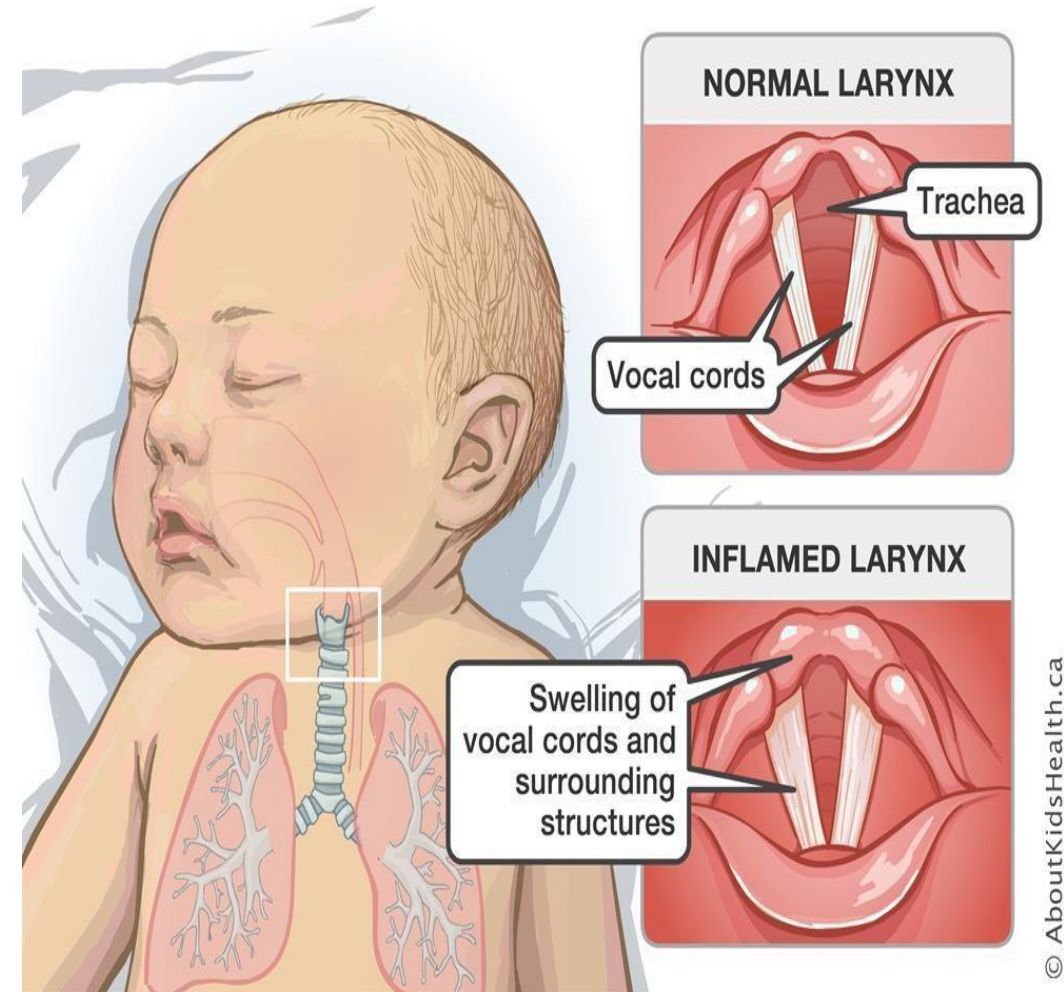
- It is considered acute, because children with foreign bodies aspiration come with acute symptoms without any infectious suggestive diagnosis.

2. Chronic Stridor

- **Laryngomalacia** : (رخاوة الحنجرة) most common cause of chronic stridor
- **Vocal cord palsy**

1.Croup

- Again, **it is the most common cause of acute stridor in children.**
- In croup, the larynx is swollen, and the upper part of the trachea may be inflamed and swollen also.



Clinical Manifestations

- The usual clinical presentation is a mother comes to the ED with her baby who suffered from acute onset of stridor for few hours or days. These manifestations Usually starts with **minor respiratory symptom**: non-specific cough, rhinorrhea and fever,
- Barking cough, then stridor, and resp distress that develops suddenly during the evening or at night
- Stridor typically occurs during inspiration. Biphasic with more severe cases which reflects the severity of the case but it is usually very brief.
- Hoarseness of voice

- The clinical presentation depends on the severity of the croup, if it is mild the patient might not have respiratory distress, but if it is moderate or severe, the patient will usually present with increased work of breathing (WOB).
- In some severe cases he might look sick to the point that you will think of other more severe diagnosis than croup like tracheitis or epiglottitis.
- So, if a mother comes with her previously healthy baby telling you that the baby woke up at night or early morning with **barking cough, stridor and hoarseness of the voice, and that these symptoms were preceded by runny nose and respiratory symptoms,** you should think of **acute stridor, more commonly croup.**

Key Points

- Croup is a common cause of airway obstruction in young children **which it is usually caused by viral illness -parainfluenza-**.
- Symptoms are usually mild to moderate (worse at night and on day two) and self-limiting but
- can be severe and rarely, life-threatening.
- Avoid distressing a child with croup as this may exacerbate symptoms.

Steeple sign on CXR

- NOTICE this AP-CXR: -
- Side note: the diagnosis of croup in children is clinical, it is not based on investigations, so CXRs aren't required, however, this is a neck XR.
- Neck XR is performed in radiology by taking whole CXR with the upper airways and the doctor focuses on the investigated part.

- Look at the image: Notice the larynx, and below it there is the trachea, the black tube (black: air), the white arrows point to the **narrowing in the trachea, reflecting an edema**, wide soft tissue **swelling**, mucosal swelling and inflammation secondary to the viral infection, which lead to partial obstruction of the upper airway → this is what we call **steeple sign** on XR indicating croup.



Management

- Management of croup in children typically **begins with assessing the ABCs**: checking the **Airway** for secretions, evaluating **Breathing** [if hypoxic he will need oxygen] , and assessing **Circulation**. Since croup primarily affects breathing, the focus should remain on "B" (breathing).
- Croup often presents with symptoms such as low-grade fever, respiratory distress, a barking cough, hoarseness, and acute stridor. The standard treatment includes nebulized adrenaline and systemic corticosteroids (dexamethasone 0.3 mg/kg as a single dose).
- Nebulized adrenaline is administered once, followed by a minimum observation period of 4 hours. During this time, the child's condition is monitored to determine whether they can be safely discharged (if calm and without stridor at rest) or require admission (if the single nebulization is insufficient and additional doses are needed). In severe cases, referral to the ICU may be necessary.

Management

- Recommended management includes:
- The appropriate use of corticosteroids and nebulised adrenaline. These interventions have been shown to reduce the need for, and duration of endotracheal intubation, length of stay, and representation rates to emergency services.
- Nursing the child upright on carer's lap

Bacterial Tracheitis

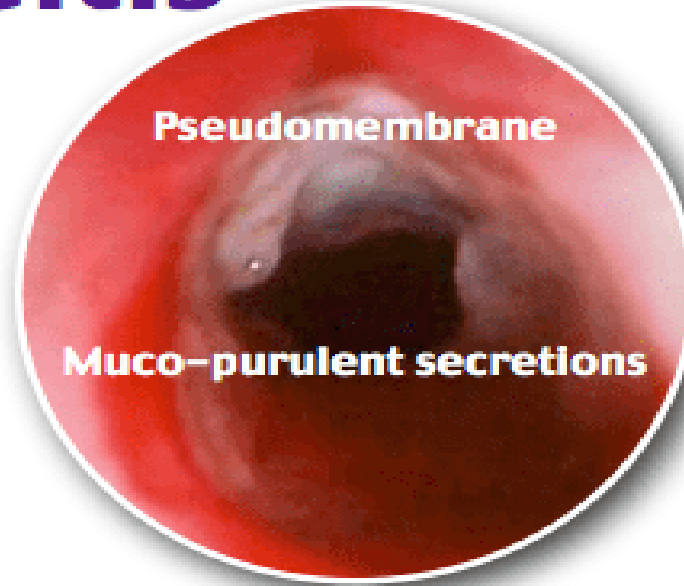


- 3 - 5 years old
- Fever
- Barky cough
- Stridor

[Looks similar to croup/epiglottitis]

But...Toxic appearing

Rapid progression



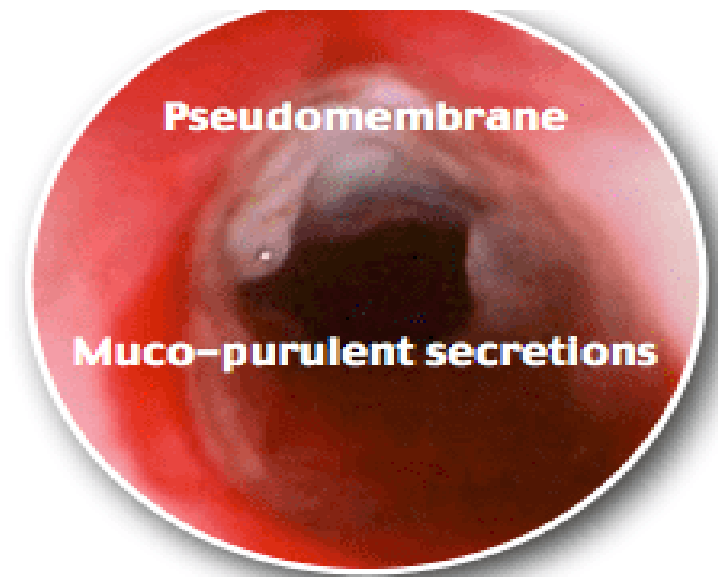
Airway emergency

- Aggressive airway management (in OR)
- IV antibiotics (broad spectrum)
- IV fluids
- Bronchoscopy

2. Bacterial Tracheitis

- The 2nd acute infectious cause of acute stridor in children is bacterial tracheitis, which usually happens between the age of three and five years.
- The presentation is an **acute onset of stridor** usually the clinical picture for a patient with bacterial tracheitis is more severe than a patient with croup, usually they're present with **high-grade fever** because the **causative agent most likely to be staph. aureus** so we are talking now about bacterial infection rather than viral infection, so these patients usually present with **high-grade fever, increase secretions from the trachea** they **look usually sick with fever barking cough in addition to the stridor.**

- This picture shows a **bronchoscopy** done on a patient with tracheitis for the diagnosis (we don't usually do investigations to diagnose bacterial tracheitis, usually we diagnose this patient clinically) but if you do a flexible bronchoscopy, you will see **edema, swelling, and there is a lot of secretion sitting there** so this reflects an infection in the trachea.



Diagnosis

- Direct laryngoscopy
- Characteristic x-ray findings



- Another way to diagnosis is direct laryngoscopy which can be done by the ENT team, but again we don't ask for it to diagnose.
- The other way is Characteristic x-ray findings: if you would like to confirm your diagnosis you can do a lateral x-ray for the neck by looking at the trachea but usually, we don't do an investigation, we diagnose acute tracheitis clinically.

- The white rim line, pointed by the red arrows, should be straight but here there's a bump that reflects a swollen mucosa of the trachea.
- Also, the black tube (trachea) is narrowed indicates an inflammation or edema of the mucosa which reflects an infection. So, in addition to the clinical situation with findings in the chest in the chest x-ray, this can confirm your diagnosis of tracheitis.

Management

- Stick with **ABC**: **Adequate** airway ensured, **breathing** (if the patient is hypoxic → provide oxygen, Stridor → adrenaline nebulizer, Secretions → Suctioning the airway) then **circulation**.
- **If the fever is high**, a lot of secretion, the patient is unwell, and bacterial infection is suspected, use **Antibiotics** effective against *S. aureus* and streptococcal species.
- Initial antibiotics should cover *S. aureus*, including methicillin-resistant *S. aureus* (MRSA), and streptococcal species (less commonly); IV vancomycin and ceftriaxone (Rocephin), or any 2nd,3rd generation of cephalosporine should be enough (wide spectrum) may be appropriate empirically.

Everything was mentioned in the previous slide

Management

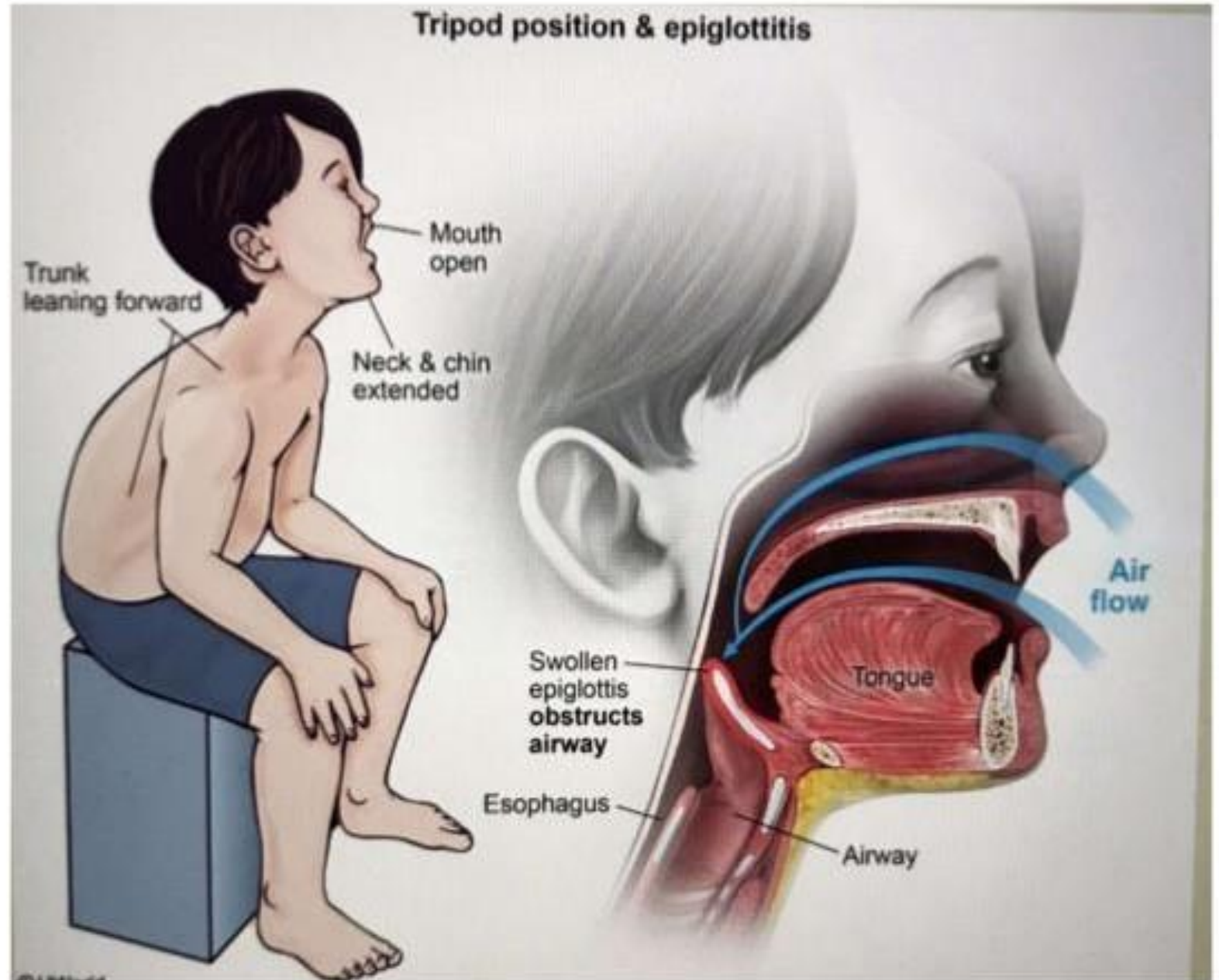
- Adequate airway ensured
- Antibiotics effective against *S. aureus* and streptococcal species
- Initial antibiotics should cover *S. aureus*, including methicillin-resistant *S. aureus* (MRSA), and streptococcal species; IV vancomycin and ceftriaxone may be appropriate empirically.

3. Epiglottitis

Clinical presentation:

- Drooling.
- Sick looking.
- Hyperextended neck.
- Stridor.
- Cough is unusual.

- Go to the next slide for further explanation->

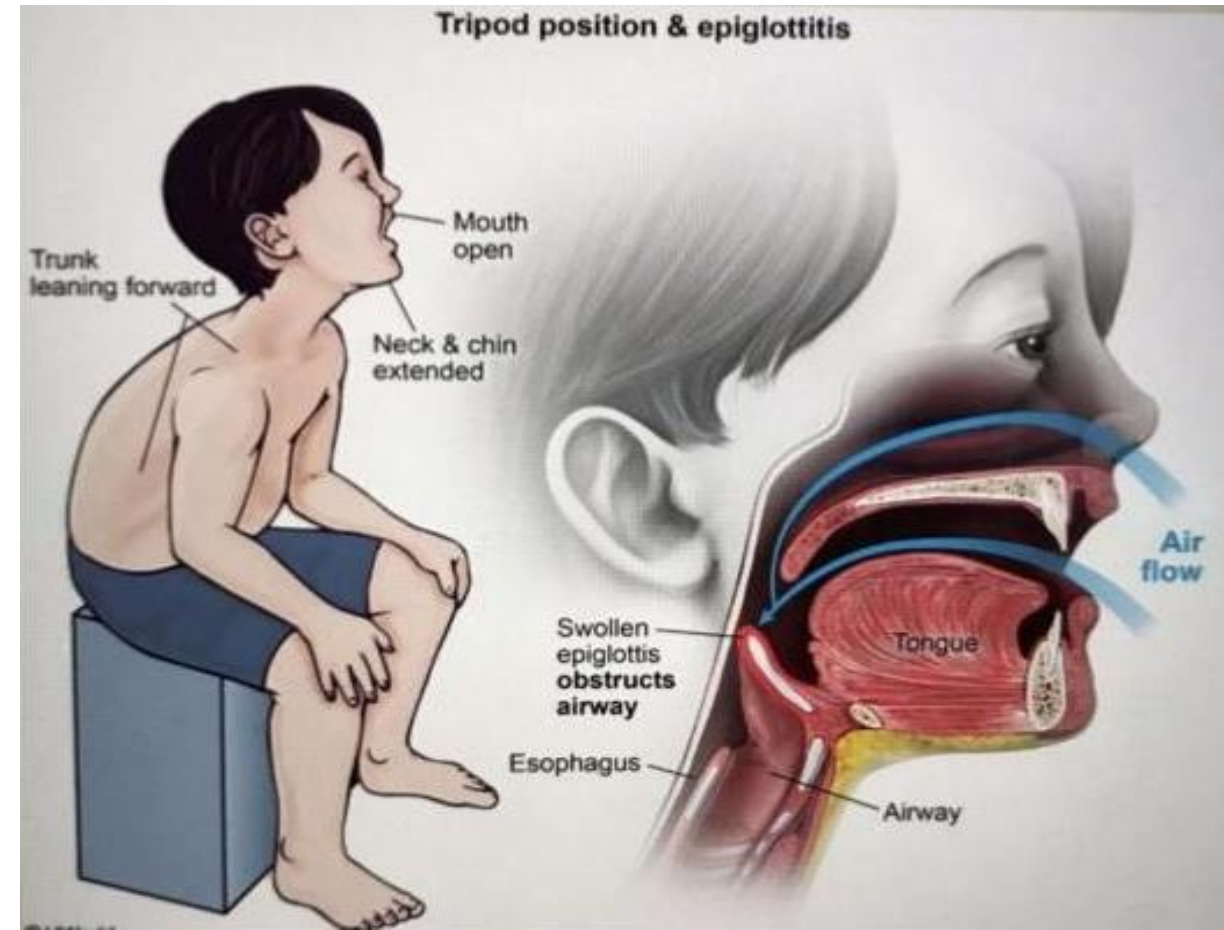


Epiglottitis

- The third infectious cause of acute stridor in children.
- Rare to see, thanks to vaccines.
- The causative agent is typable Hemophilus influenzae. (Bacterial)

Very severe clinical presentation:

- ✓ Drooling: because of difficulty of swallowing of the saliva.
- ✓ Sick looking.
- ✓ **Hyperextended neck**: the child comes with characteristic posturing with a sniffing position leaning forward and trying to hyperextend the neck to keep the airway open.
- ✓ Stridor.
- ✓ Cough is unusual.
- ✓ High-grade fever.



- Despite the severe presentation, treatment is very easy!

- Just make sure you don't touch or irritate the patient because his epiglottis is swollen, edematous and very big so any stimulation will cause the epiglottis to close the vocal cords and this leads to respiratory compromise.

- Additionally, in case of emergency you might not be able to intubate this patient... why?

Because in order to intubate we insert an endotracheal tube through the vocal cord, but to see the vocal cord, for better visualization, you wait until the patient breathes and the epiglottis moves up then you see the vocal cord and you can insert the endotracheal tube.

But in patients with epiglottitis, the swelling will make visualizing the vocal cords hard, prohibiting intubation.

-> In this situation, you should call ENT and anesthesia and take the child to the theater ([operating room](#)) where the anesthesia team should anesthetize the child, as they are the best team to intubate by using a fiberoptic scope and just in case the intubation fails, ENT should be available to do tracheostomy to secure the airway to keep the patient alive.



- Lateral neck x-ray of patient with epiglottitis.
- The arrows point the very swollen epiglottis which is called thumb sign reflecting edema in the epiglottis leading to narrowing of the airway.
- Normally the epiglottis should be third the size of this inflamed epiglottis and you can see how the airways (the black line) are narrowed.

Assessment

- Initial rapid assessment of potential for epiglottitis

Examination

- Approach the child calmly and avoid aggravating the child, do not use a tongue depressor to examine the oral cavity

Personnel Resources

- Ensure the multi-disciplinary team is available and alerted for the potential patient

Airway Management

- Airway management if necessary should be performed in the operating room with mask ventilation proceeding to airway evaluation and intubation; a surgical airway is a last resort

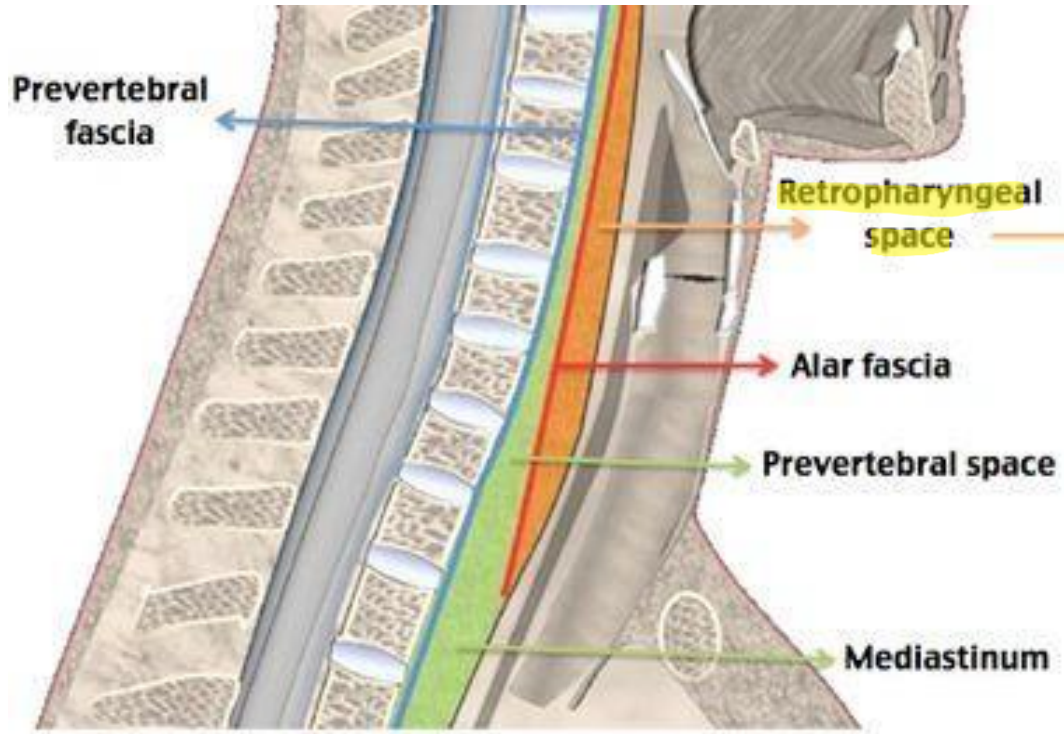
Ongoing Care

- Obtain cultures if possible, continue airway intubation in an ICU setting until a leak develops, and begin appropriate antibiotics as indicated

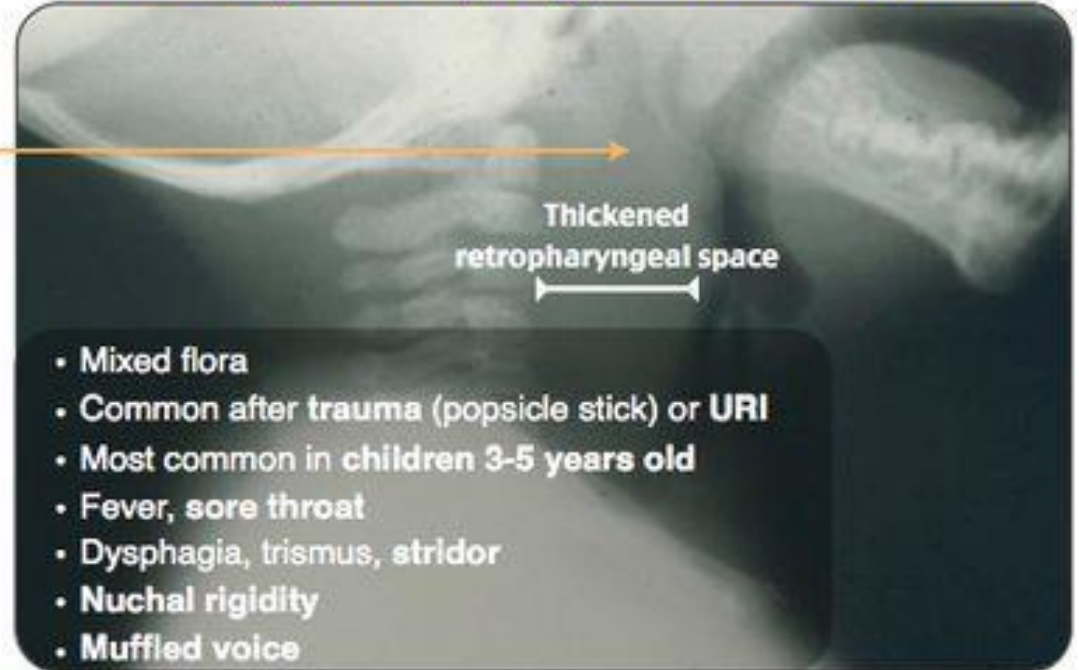
Extubation

- Wean to extubate as airway parameters permit; consider an interval examination in the operating room prior to extubation

4. Retropharyngeal Abscess



Retropharyngeal Abscess



- Usually, patients come with high-grade fever, high inflammatory markers with drooling because they cannot swallow and sometimes with neck or throat pain.

When you examine the throat, you can see bulging and deviation of the uvula, here you need to ask the ENT to come and examine this patient and this abscess should be drained and you start broad-spectrum antibiotics.

- The abscess appears as soft tissue or soft thickening in the x-ray .

Continue.....

- Retropharyngeal abscesses are uncommon but potentially life- threatening diagnoses.
- They can occur at any age, although are most commonly found in children under the age of five.
- Without proper treatment, retropharyngeal abscesses can lead to upper airway obstruction and asphyxiation. It's a serious condition.

Continue....

- Retropharyngeal abscesses are often polymicrobial infections.
- Bacteria that commonly contribute to these infections include **Group A Streptococcus pyogenes, Staphylococcus aureus, Fusobacterium, Haemophilus species**, and other respiratory anaerobic organisms.

All can be treated with broad-spectrum antibiotics.

Treatment

- Hospital admission. ABCs, as mentioned before.
- Intravenous antibiotics: to cover upper respiratory organisms including anaerobic organisms.
- Patients presenting airway compromise should have immediate surgical incision and drainage performed to relieve their upper airway obstruction.

You have to consult the surgical or ENT team to drain the abscess, if you don't the patient will keep the spiking fever and the inflammatory markers will take ages to improve and go back back to normal, so taking the abscess out is part of the treatment.

Laryngomalacia

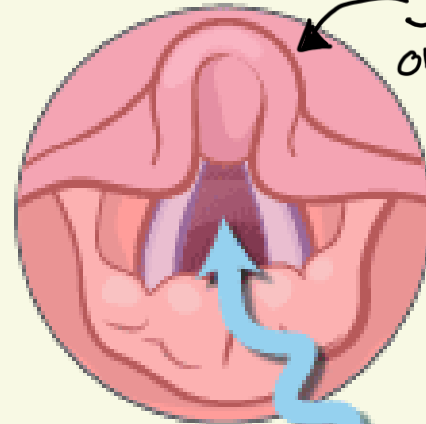
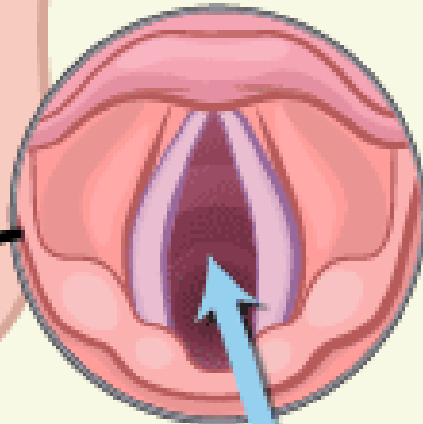
Most Common cause of chronic stridor

بالعربية:
رخاوة الحنجرة

View Through a Scope

Normal
Voice Box

Floppy
Voice Box



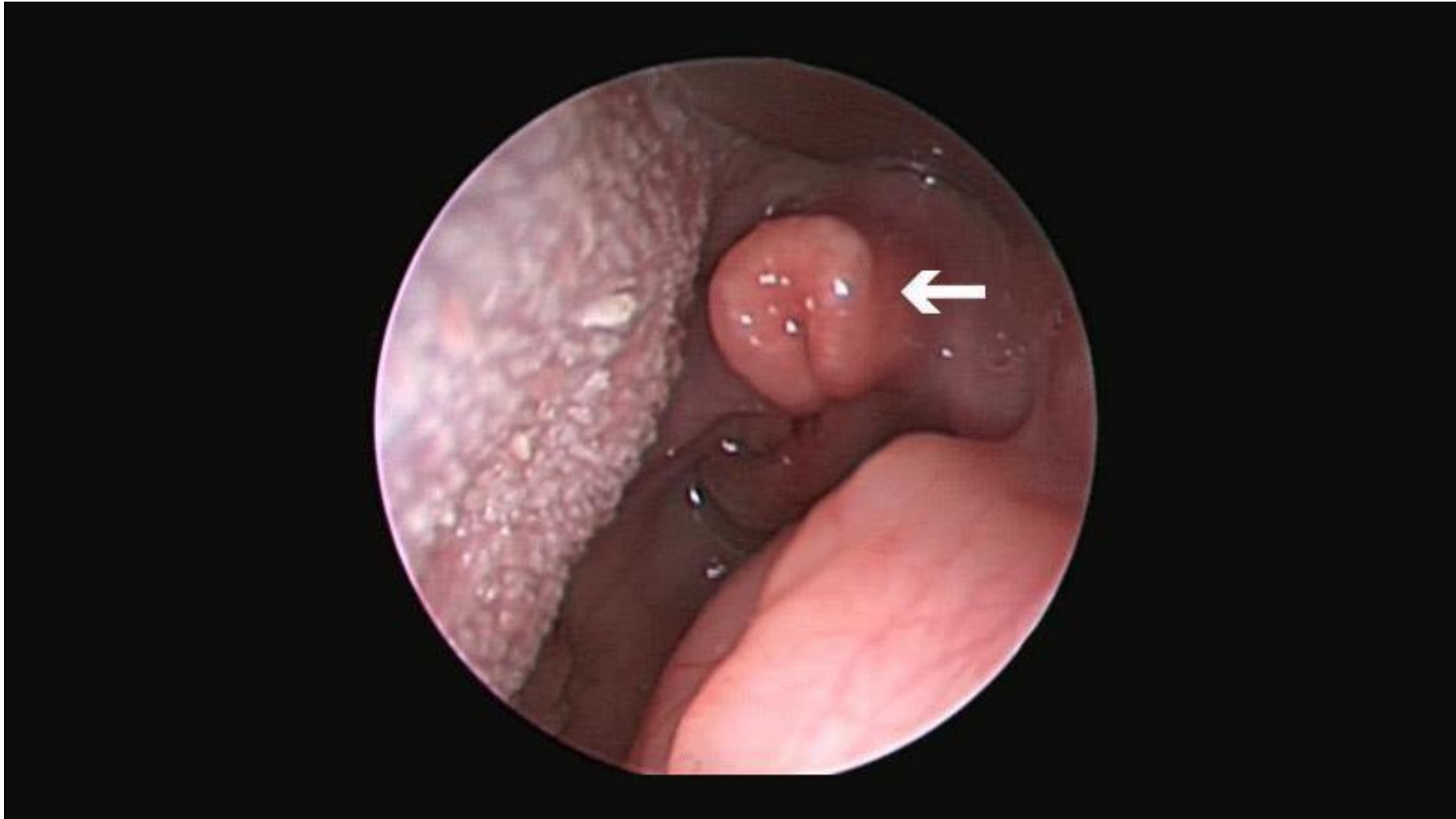
Breathing
through normal
opening is quiet.

Breathing
through floppy
opening is noisy.

Larynx
(Voice
Box)

- Usually, the clinical presentation is a normal healthy child of full-term pregnancy, delivered normally without any respiratory compromise or symptoms during the first month of life, so the symptoms usually start as noisy breathing and then inspiratory stridor around age 6 - 8 weeks, usually this stridor is exaggerated with infection, crying, agitation, or any stimulation that can provoke or aggravate the stridor in case of laryngomalacia.
- Notice the omega shape in the picture<—

Laryngoscope: The Omega-shaped epiglottis is diagnostic for laryngomalacia. Ω



Signs/Symptoms

- HIGH pitched inspiratory stridor:
 - Peaks at 6-9 months
 - Positional variation
 - Exacerbated by activity (feed, exertion), supine position, and during viral illnesses.
 - appears within first 2 weeks of life
 - diminishes by rest, prone position and sleeping
- Rarely produces cyanosis

-Stridor starts to appear at 6-8 weeks.
-It peaks at 6-9months.
-Around a year and a half (19 months) stridor starts to improve.
-Until it disappears totally at 2 years.

-The occasional clinical scenario: a mother comes with her baby, saying that:
-> when he is sleeping/prone->there is no stridor.
-> but when he starts crying for different reasons as mentioned or when he has a viral infection -> there is stridor.

In original slides it says “low pitched stridor” but that is incorrect we checked with the doctor and changed it to high



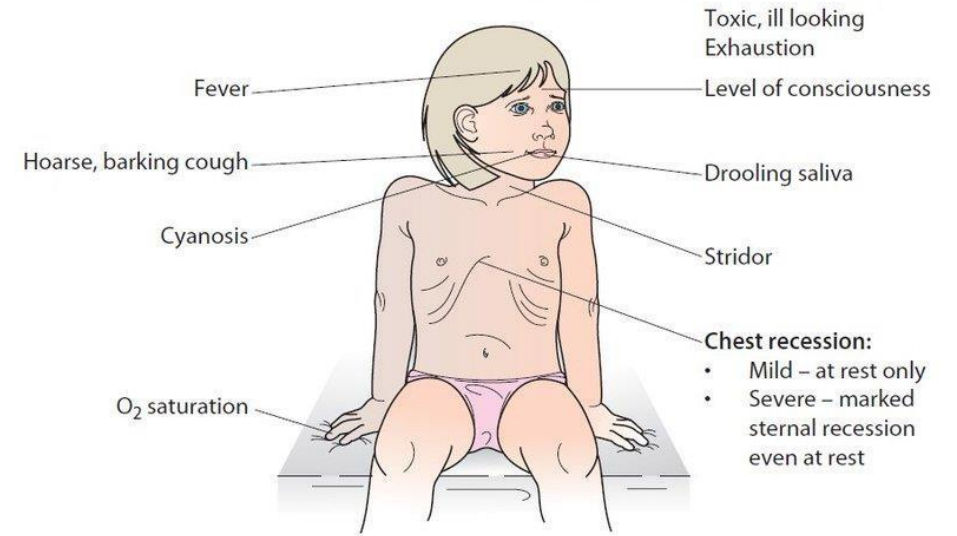
Summary:

Child with the stridor:

- Take a brief history.
- Think of the Infectious causes (the most common causes of **acute** stridor) and particularly croup, bacterial tracheitis, epiglottitis.
- If the history of stridor is **chronic**, you need to think of laryngomalacia or any congenital airway abnormalities.

The child with stridor

Clinical features to assess



Clinical conditions

Croup

- Mostly viral
- 6 months to 6 years of age
- Harsh, loud stridor
- Coryza and mild fever, hoarse voice

Bacterial tracheitis:

- High fever, toxic
- Loud, harsh stridor

Inhaled foreign body

- Choking on peanut or toy in mouth
- Sudden onset of cough or respiratory distress

Laryngomalacia or congenital airway abnormality:

- Recurrent or continuous stridor since birth

Epiglottitis:

- Caused by *H. influenzae* type b, rare since Hib immunisation
- Mostly aged 1–6 years
- Acute, life-threatening illness
- High fever, ill, toxic-looking
- Painful throat, unable to swallow saliva, which drools down the chin

Other rare causes:

- See Box 16.1

Summary of the important points as mentioned by the doctor:

- 1- Stridor: is noisy breathing caused by a partial obstruction of the upper airway.
- 2- Any disease that causes partial obstruction of the upper airway at any level from the nose to the carina can cause stridor, usually the upper part of the trachea can cause stridor.
- 3- The most common cause of acute stridor is: croup.
- 4- The most common cause of chronic stridor is: laryngomalacia.
- 5- You need to be able to differentiate between the different infectious causes of chronic and acute stridor.
- 6- You need to know the course and history of laryngomalacia.

THANK YOU

Past Paper question:

A 2 year old child presents to the pediatric clinic with dry barking cough and loud breathing sound during inspiration. This was associated with low grade fever and nasal discharge. On physical examination, the child had inspiratory stridor, hoarseness of voice, and signs of respiratory distress. According to this clinical profile, which part of the respiratory system is likely to be affected by this pathology?

- A. Terminal bronchioles
- B. Lungparenchyma.
- C. Larynx and upper trachea.
- D. Lung interstitial tissue.
- E. Paranasalsinuses.

Answer : C

E-Learning questions:

A 4-year-old child with a harsh, honking cough, inspiratory stridor, and increased respiratory effort presents to the clinic. The child's parent reports a recent upper respiratory infection. What is the most likely cause?

- A. Viral croup.
- B. Epiglottitis.
- C. Bacterialtracheitis.
- D. Tracheomalacia.
- E. Laryngomalacia.

Answer: A

Which viral infection is commonly associated with croup?

- A. Parainfluenza virus.
- B. Influenza.
- C. Respiratory syncytial virus (RSV).
- D. Human metapneumovirus.
- E. Adenovirus

Answer: A

Additional sources

<https://youtu.be/iR6cvd0nuok?si=-N5bqrAZaZNyX6Eo>



VERSIONS	SLIDE #	BEFORE CORRECTION	AFTER CORRECTION
V1→ V2			
V2→V3			



امسح الرمز و شاركنا بأفكارك لتحسين أدائنا !!