

Respiratory conditions In Children



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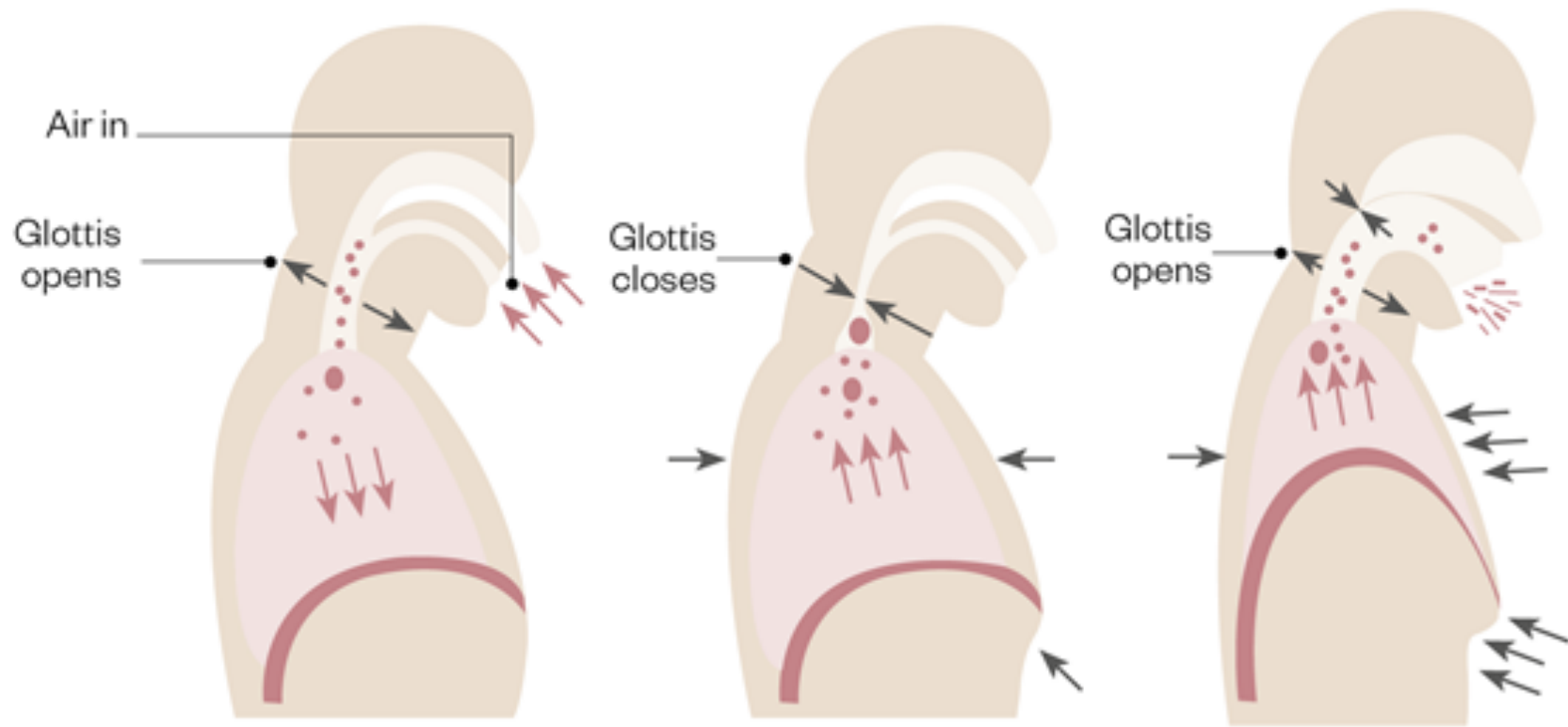
Objectives

- Cough as a common symptoms for respiratory conditions in children.
- Partial obstruction of lower airways children.
- Partial obstruction of upper airways in children.

COUGH

Pathophysiology

- There is an initial deep breath (inspiratory mechanism);
- The closing of the epiglottis to entrap the air within the lungs (compressive mechanism);
- The opening of the glottis, closure of the nasopharynx and expiration through the mouth with noise (expulsive mechanism).



1. Inspiratory phase
Air is taken into the lungs
(2.5-3.0 litres)

2. Compressive phase
Glottis closes and
intrathoracic pressure
builds as a result of
expiratory muscle
contraction

3. Expiratory phase
Sudden release of air
at high velocity
(50-500mph)

→ = Movement of air

What do you need to know to diagnose cough??

❖ The two most common types of cough are a dry cough and a chesty/productive cough:

- **Dry cough:**

A non-productive cough can be caused by the following:

- Asthma;
- Environmental irritants or medicines such as angiotensin converting enzyme (ACE) inhibitors.
- Common signs include lack of phlegm (mucus) and the patient may describe it as “tickly”.

- **Chesty/productive cough:**

- Common causes include:

- Upper airway cough syndrome (previously referred to as post-nasal drip syndrome);
- Gastroesophageal reflux disease/ usual dry but if complicated with chronic bronchitis;
- Chronic obstructive pulmonary disease;
- Infection caused by a bacteria or virus.

Duration of cough?

❖ **Acute cough:**

Defined as a cough persisting for less than two weeks.

Acute cough is usually self-limiting and can be caused by viral infections, bacterial infections or inhalation of a foreign irritant.

The choice of diagnostic test depends on the origin of the cough, allergy testing, throat swabs and examination of the throat.

❖ Subacute cough

- Defined as a cough lasting for between 2-4 weeks
- Subacute cough is most commonly caused by airway hyper-responsiveness following specific infections such as Mycoplasma pneumonia.
- Alternatively, it may be following resolution of Bordetella pertussis infection, where a post-infectious cough persists.

❖ Chronic cough

- A cough lasting for more than 4 weeks some say more than 8 weeks
- It is most commonly caused by:

Asthma,

Upper airway cough syndrome (previously referred to as post-Nasal drip syndrome),

Upper respiratory tract infection

Gastroesophageal reflux disease (GORD).

The clinical assessment of a chronic cough includes:

- Cough severity (e.g. is there sputum or blood associated with the cough?);
- Frequency (e.g. is the cough occurring throughout the day or is it worse in the morning or at night?);
- Impact on the patient's well being (e.g. are they not able to do things they previously could?).

Identifying red flags

- Abundant production of sputum;
- Fever and sweats;
- Considerable breathlessness;
- Unexplained weight loss;
- Coughing up blood or red phlegm;
- Heartburn;
- If the cough quickly gets worse or the patient cannot stop coughing;
- If the cough is persistent (e.g. it lasts for more than three weeks).

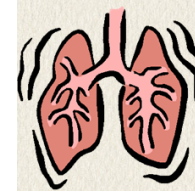
Duration	Common Etiologies
Acute cough(<2 weeks)	<ul style="list-style-type: none"> • Classical recognizable cough: <ul style="list-style-type: none"> • Laryngotracheobronchitis – barking cough • Staccato – Chlamydia (infant) • Paroxymal – pertussis and para-pertussis • Psychogenic – honking cough • Acute upper / lower respiratory tract infection (ARI) • Foreign body aspiration • Asthma • Inhalation injury (acute exposure to smoke or volatile substances) • Embolism hemorrhage (rare)
Subacute cough(2-4 weeks)	<ul style="list-style-type: none"> • Post viral cough • Acute bronchitis
Chronic cough (> 4 weeks)	<ul style="list-style-type: none"> • Non specific cough: <ul style="list-style-type: none"> • Post viral • Increased cough receptor sensitivity • Asthma • Gastroesophageal reflux • Upper airway problems • Functional disorders • Subacute bronchitis • Bronchiectasis or recurrent pneumonia: <ul style="list-style-type: none"> • Cystic fibrosis • Ciliary dyskinesia • Immunodeficiency • Congenital lung lesions • Aspiration • Chronic infections: <ul style="list-style-type: none"> • Tuberculosis • Non-tuberculous mycobacteria • Mycoses • Interstitial lung disease (i.e. Rheumatic diseases) • Cardiac

Lower Airways Obstruction

Wheeze

- A high-pitched musical sound during mainly expiration. However, can happen during inspiration (biphasic).
- Reflects a partial obstruction of the lower airways due to inflammation, spasm, or excessive secretion following an acute infection.

Case 1



- **Hx:**
 - 12 year old child ,presented to the clinic with hx of cough for 7 days duration .Cough (dry ,worse at night and post exercise ,ass with whistling sound) ,symptoms started following a recent URTI).it worsened over last 2 days with dyspnea at times.
 - Past Hx : previous episodes occurring mostly during winter , has hay fever ,had eczema during early childhood. Positive family hx of similar condition.

P/E :

Afebrile ,RR 35 (20-30) ,

Pulse rate 100 .

SPO2 89%.

ENT :Hyperemic throat.

Intercostal and subcostal retractions .

Chest :

diffuse Expiratory wheeze, prolonged expiratory phase with decreased air entry .

CVS :normal ,liver not palpable ,

hands : no finger clubbing .

Question 1

1-What are important questions you should ask in history ?

Mention anything relevant in :HOI,ROS,Past medical ,Birth ,Social
Vaccination, drug hx

NOTE:

Hx of present illness :

1-Cough :

- Onset ,course ,progression : gradual onset , intermittent increasing in frequency and intensity over past 24 hours
- Nature : Dry
- Character :Dry no specific character ,non paroxysmal
- Diurnal variation : worse at night (after midnight and during early hours of morning)
- Severity of cough :
cough disturbs sleep ,child sits right at night ,interferes with physical activity and missed 2 days of school .
cough sometimes followed by vomiting (post tussive) ,associated with dyspnea and chest tightness
- Aggravating factors : Aggravated by exercise , laughter or crying ,usually have cough when exposed to smoking, perfumes, detergents
- Relieving factors : cough relieved by using his puffer ,or nebulizers at ER visits

2-Associated symptoms :

- Shortness of breath ,worse over the past 24 hours
- Wheeze(whistling sound) ,usually appears when Child breathes out .
- Chest tightness expressed by child when short of breath
- No Cyanosis
- Symptoms of URTI 3 days ago : sneezing , nasal discharge

NOTE:

-3-Relevant questions :

--Fever : felt warm 2 days ago ,resolved ,not documented

--previous similar episodes in the past ,last episode one month ago , also had similar episodes during winter season for the past 5 years since ion .to ER for nebulizers he was 7 years old .admitted to hospital two times for his condition.

--positive hx of similar condition in his older brother and his mother

---The child has eczema on his arms and legs

---He also has nasal discharge ,sneezing and itching from the eyes specially in spring seasons

---his father is a smoker

---the have a first floor house with few olive trees around .

---He uses a puffer ,blue in color whenever he has symptoms not in daily basis .

R.O.S :

-ENT : has symptoms of nasal congestion /blockage ,sneezing in spring .

-Heart : no symptoms of CHF ,no cyanosis ,no extensional dyspnea unless having an attack of coughing and wheezing , he feels some palpitation after taking his blue puffer when unwell .

-GI : no diarrhea ,no vomiting (unless post tussive) ,no heartburn

-CNS : free ,

-Skin : has eczema since early childhood : red itchy scaly areas around elbows and knees

NOTE:

Past Medical :

Two admissions to hospital with similar attacks ,for 2 to 3 days , received O2 and nebulizers and some injections

Multiple ER visits with less severe episodes

No PICU admissions

No regular follow up at pediatric or chest clinics

Past surgical :

Underwent tonsillectomy at age of 5 for recurrent ENT infections

Medications :

Receives frequently antihistamines syrup for nasal symptoms

Uses a blue puffer when unwell ,but this time did not help much , not compliant on any other inhalers on daily basis

Uses his puffer directly through the mouth without a spacer

Social hx :

Father smoker , no pets at home

First floor apartment with olive tree around the house

Some humidity (molds) on the wall reported by his mum more in winter

“Should comment on income ,job and educational level of parents “

NOTE:

Vaccination :

Given his vaccines up to age as per MOH ,Jordan

Not given flu vaccine this year

-Not given the pneumococcal conjugated vaccine

Growth :

Growing well ,parameters on 50th percentile

Development :

Good school performance ,however affected while unwell .

Nutrition :

breast fed for 3 months then formula when young . Now regular table food

No hx of food allergies

Question 2

-What are important findings you should look for in Physical Examination ?

Please observe video below ,

<https://www.bing.com/videos/search?q=video+physical+examination+for+a+child+with+asthma&&view=detail&mid=1716B617D91DA36B8E271716B617D91DA36B8E27&rvsmid=25C76EB9BD41A07D6EE925C76EB9BD41A07D6EE9&FORM=VDRVRV>

Please refer to the link for demonstration of physical examination for a child with respiratory problem

NOTE:

Comments :

- General condition :alert ,responsive ,can complete a sentence or not ,comment if on nebulizer or supplemented with O2 therapy
- Comment if audible wheeze or stridor noted
- Observe for signs of respiratory distress (tachypnea, tachycardia, cyanosis, retractions ,use of accessory muscles ,flaring of nostrils, increased work of breathing
- LOC : alert (agitated irritable which occurs with Hypoxemia (occurs early in an attack) or drowsy (narcosis : CO2 retention ,late severe stage of distress)
- Vital signs and SPO2 : RR ,PR,Temp ,Blood pressure (pulsus paradoxicus)
SPO2 % his sat is 87% Room air (normal > 93%)
- Skin : eczema
- Fingers : no clubbing
- comment on growth parameters or dysmorphism
-
- ENT : positive PND (post nasal drip) hyperemic throat ,clear tympanic membranes

NOTE:

-Chest :

-Inspection ,Palpation ,percussion ,auscultation : findings :

Child has some signs of respiratory distress

Hyperresonant chest

Bilateral diffuse expiratory wheeze

Diminished air entry

Prolonged expiratory phase

Relevant Organs :

-Liver :

Palpable 1 finger below costal margin

But liver span performed by percussion found to be normal

Why is this ?

Due to hyper inflation of lungs which pushes the liver downward

-Hear :

Comment on S1 S2 no S3 no gallop no murmur

Why important (e.g 1- Left sided CHF can cause respiratory symptoms (pulmonary edema) ,

2-chronic respiratory illness (fibrosis ,bronchiectasis) can cause Rt sided heart failure :cor -pulmonale)

The following are signs found in this child can you comment ?



NOTE:

Signs :

1-ENT : signs of allergic rhinitis ,common in asthma (allergy)

Nasal polyposis : rare in children .usually present in adults with asthma triad (aspirin sensitivity, asthma, nasal polyposis)

But rare in younger children with asthma ...if present at an early age ;suspect CF ,ciliary dysfunction.

2-sniffing signs for children with allergic rhinitis

3-Allergic shiners : dark halos around the eyes for allergic rhinitis (+/_ allergic conjunctivitis)

4- Eczema on extensor surfaces

Q 3 : what is you DDX

What is your DDX

What is the most likely Dx

Explain ,discuss

DDX

1-Bronchial Asthma

2-Cystic Fibrosis :

2-Primary ciliary dyskinesia

3-GERD :

4-Foreign body aspiration

NOTE:

Most likely dx is bronchial asthma why ?

Typical signs and symptoms ,repeated previous episodes ,seasonal variation ,presence of atopy and family history

spirometry ,chest x-ray findings ...etc

Less likely DDX:

1-Cystic Fibrosis : no GI manifestations ,child growing well ,normal chest film ,no clubbing ...etc

2-Primary ciliary dyskinesia : present with nasal polyposis (not present in this child) ,recurrent draining ears with tubes in place , may have dextrocardia ,clubbing .bronchiectasis 1...etc

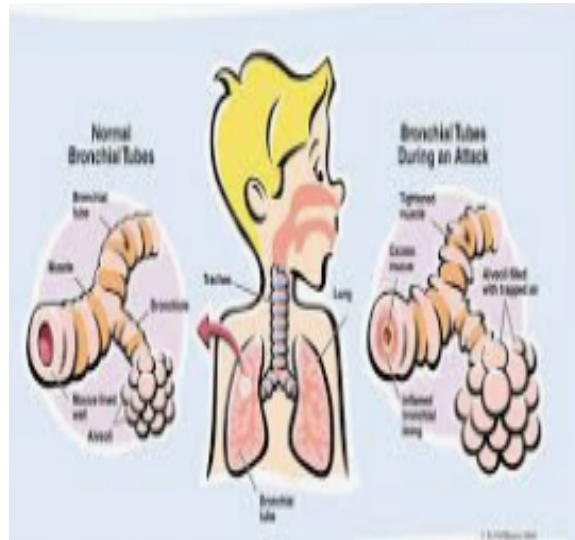
3-GERD : No GI symptoms

4-FB aspiration ,, hx not suggestive as no choking ,wheeze and hyperinflation often localized ,though not necessary

What is your diagnosis ?



Bronchial Asthma



Why Asthma

Typical signs and symptoms
,repeated previous episodes ,
seasonal variation ,
presence of atopy and family history

spirometry ,chest x-ray findings ...etc

Question 3

What important investigation should be performed for this child ?

See notes/discussion below

NOTE:

Depends on clinical status

1-If Child comes to the clinic with chronic or episodic symptoms and stable :

If symptoms and P/E suggestive of reactive airway disease and the child has no warning signs to suggest other diagnosis then you are making a clinical diagnosis without needing investigations before you can start treatment .

However ,some investigations are needed if available to evaluate : severity , response to treatment , assess for presence of atopy or screen for co morbidities .

1- Chest Xray :

Not necessary to dx asthma but indicate if warning /atypical signs and symptoms

(e.g : chronic wet cough ,

repeated chest infections ,

prolonged fever with respiratory symptoms ,

clubbing ,

asymmetrical findings on auscultation ,inspiratory crackles or inspiratory wheezeetc)

or if child comes to ER with severe distress and you need to look for complications like (pneumothorax ,atelectasis, pneumonia ..)

NOTE:

2- Lung function test :

spirometry it confirms asthma if pattern is obstructive (small airway obstruction with bronchodilator reversibility > 12% in FEV1) : FEV1 < 80% predicted , FVC normal ,FEV1/FVC <80% , however ,normal spirometry is commonly seen in asthmatic children when well and does not exclude asthma , usually performed for cooperative children ,above 7 years of age .

3-Allergy tests :

e.G skin prick test for inhaled allergen sensitizations. Positive test means child has atopy ,helps to identify then avoid triggering allergens if present Other tests :RAST for specific IgE response

4- CBC ,usually not indicated unless you are looking for eosinophilia in atopic asthma , or leukocytosis if infection or pneumonia suspected .

5-Total IgE ,if atopy is suspected ,not of clinical benefit unless your patient is severe persistent not responding to treatment or keeps relapsing and you are considering anti – IgE therapy ,or other immune therapy , or suspecting ABPA (allergic bronchopulmonary aspergillosis)

NOTE:

6- **Vitamin D** can be ordered if poor response to treatment to screen for vitamin D deficiency ,it has been shown to have important immune modulatory and anti inflammatory effect .

7-Scintigraphy : contrast study for swallowing if chronic aspiration is suspected as a cause for cough and wheeze or repeated chest infections

8- PH study ,if GERD is suspected to aggravate asthma or is the primary cause for chronic cough specially if symptoms related to food

NOTE:

Consider other tests if indicated : e.g

- 1- CT chest if other DDX suspected (bronchiectasis ,CF ,interstitial lung diseaseOr for remodeling of airways if chronic persistent asthma in adolescents or adults
- 2- Echo :if cardiac asthma is suspected
- 3- Bronchoscopy ; if poor response to treatment ,DDX is suspected like severe airway malacia or congenital stenosis of airways , or foreign body .. Or to obtain culture if suppurative lung disease is suspected
- 4-Immune testing ,when indicated if recurrent pneumonia is considered

In acute settings at ER :

Most important is to assess for SPO2 CXR : when indicated (not for every attack)
a blood gas is indicated if severe respiratory distress is present

CXR

- Usually non is needed , to review old chart and previous imaging if available .
- If child in severe distress, suspect complication or other DDx needs to be excluded .

This is the child's CXR ,what is your interpretation ?



NOTE:

hyperinflation : more than 6 and 8 ribs ant and post respectively

flattening of diaphragm ,both domes are parallel to each other ,right is pushed downward by hyper inflated lungs

narrow mediastinum

Increased lucency of lung fields

SPT to common inhaled allergens



NOTE:

SPT skin prick test positive when a weal is more than 3 – 4 mm

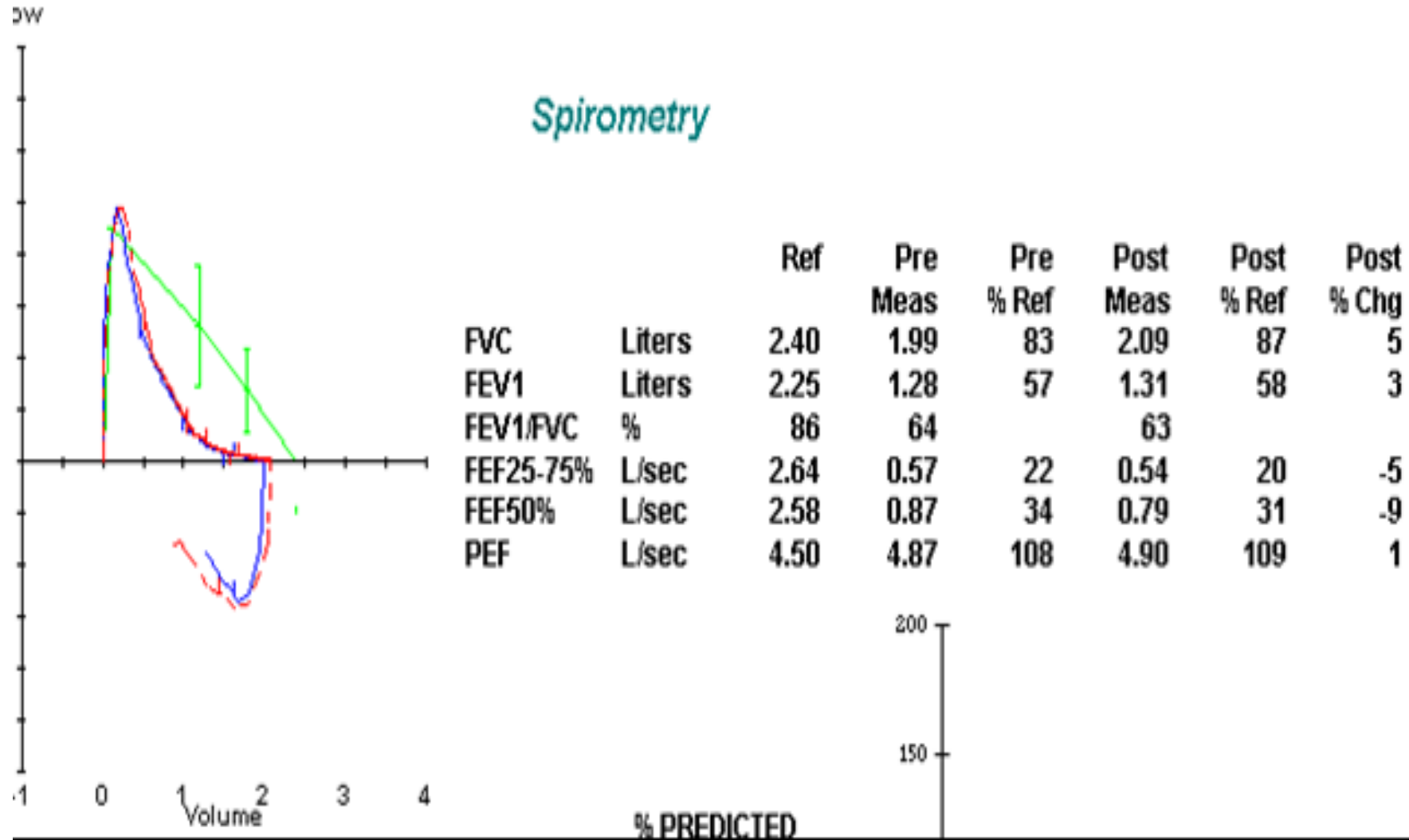
Anti histamine medications should be stopped 5 days prior to test



Spirometry



This is a flow volume loop for this child ,what is your interpretation ?



NOTE:

low FEV1
low FEV1/FVC
normal FVC

intra thoracic
obstruction ,no
response to
ventolin

Other condition causes wheeze

❖ Bronchiolitis:

- Younger age
- Always associated with viral illness
- Could be recurrent
- No interval (between illnesses) symptoms
- No FHx of atopy
- No atopy hx in the patient
- No response to bronchodilators like asthmatics.



Upper Airway Obstruction in Children



- A parent brings her 2.5-year-old son into the paediatric clinic because her son has a loud cough, noisy breathing and a runny nose.

What are the Questions that we need to ask?

Cough characteristics

- When did the cough start?
- Is the cough dry or productive?
- Has the child been feeling unwell recently (e.g. experiencing fever, runny nose, aches, pains and sore throat)?
- Is there wheeze associated with the cough?
- Is the child experiencing any stridor, tachypnoea or swallowing difficulties?
- Could this cough be aspiration of a foreign object?

Patient medical history

- Does the child have any medical issues?
- Are they currently taking any medicines?
- Is this the first presentation of cough?
- How old is the child and are they up to date with their childhood vaccination schedule?
- Has the cough had an impact on the child's wellbeing (e.g. poor growth, finger clubbing, haemoptysis or shortness of breath)?

Scenario ...continues...

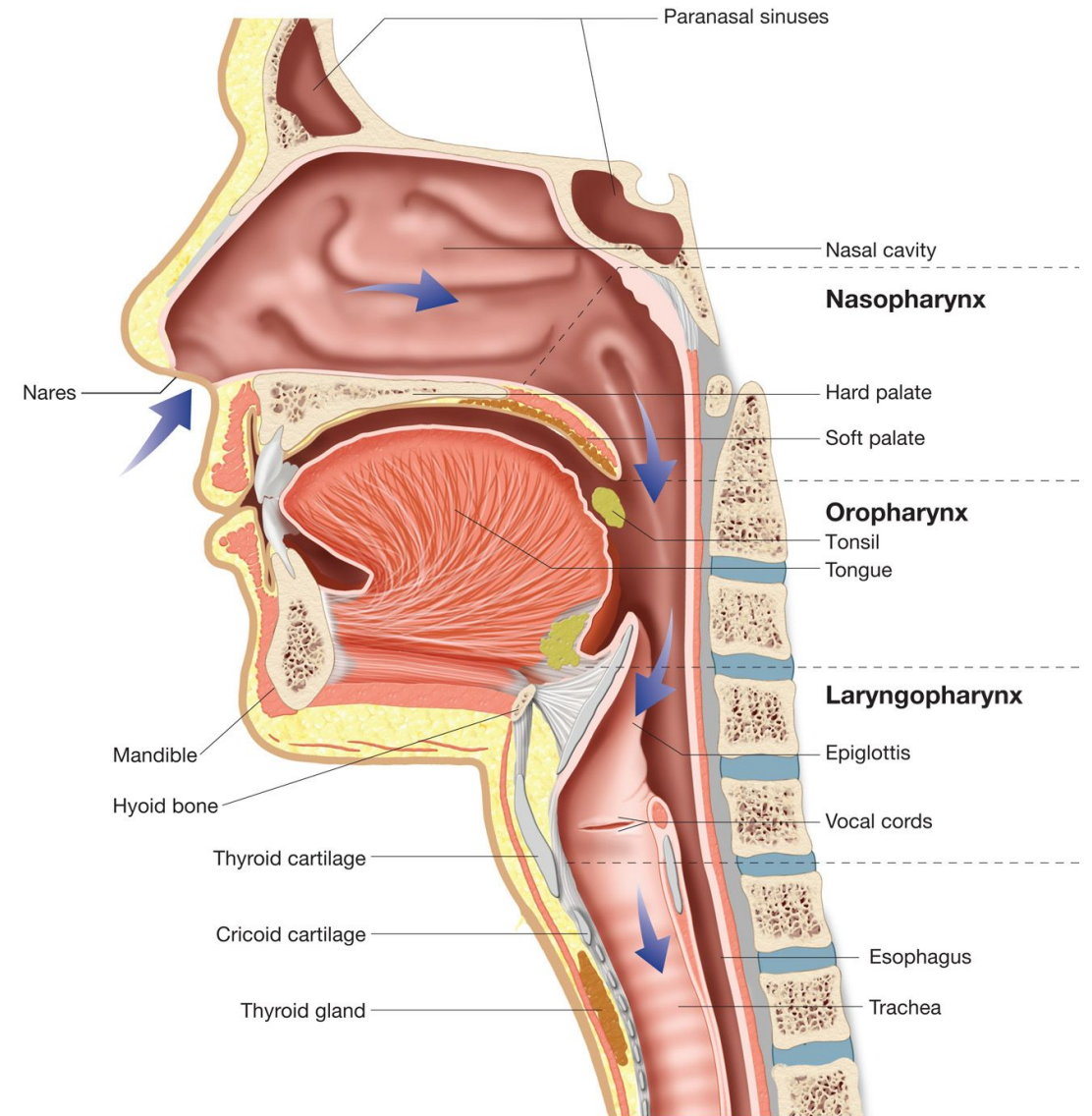
- The parent explains that her son has been coughing for the past three days, mostly at night.
- It is a dry cough that sounds like a barking noise and his voice is a bit hoarse.
- The child has no previous respiratory symptoms nor has been hospitalised for any infections.
- He is up to date with his vaccination schedule.

On examination:

- The child looks well apart from a runny nose and he does not have a temperature or shortness of breath.
- **Diagnosis:** The child most likely has croup.
- This is a common viral illness in a child, which causes a characteristic 'barking' cough.
- The illness is self-limiting. However, to be managed with nebulized adrenaline and dexamethasone IM/IV if starts to have stridor at rest.

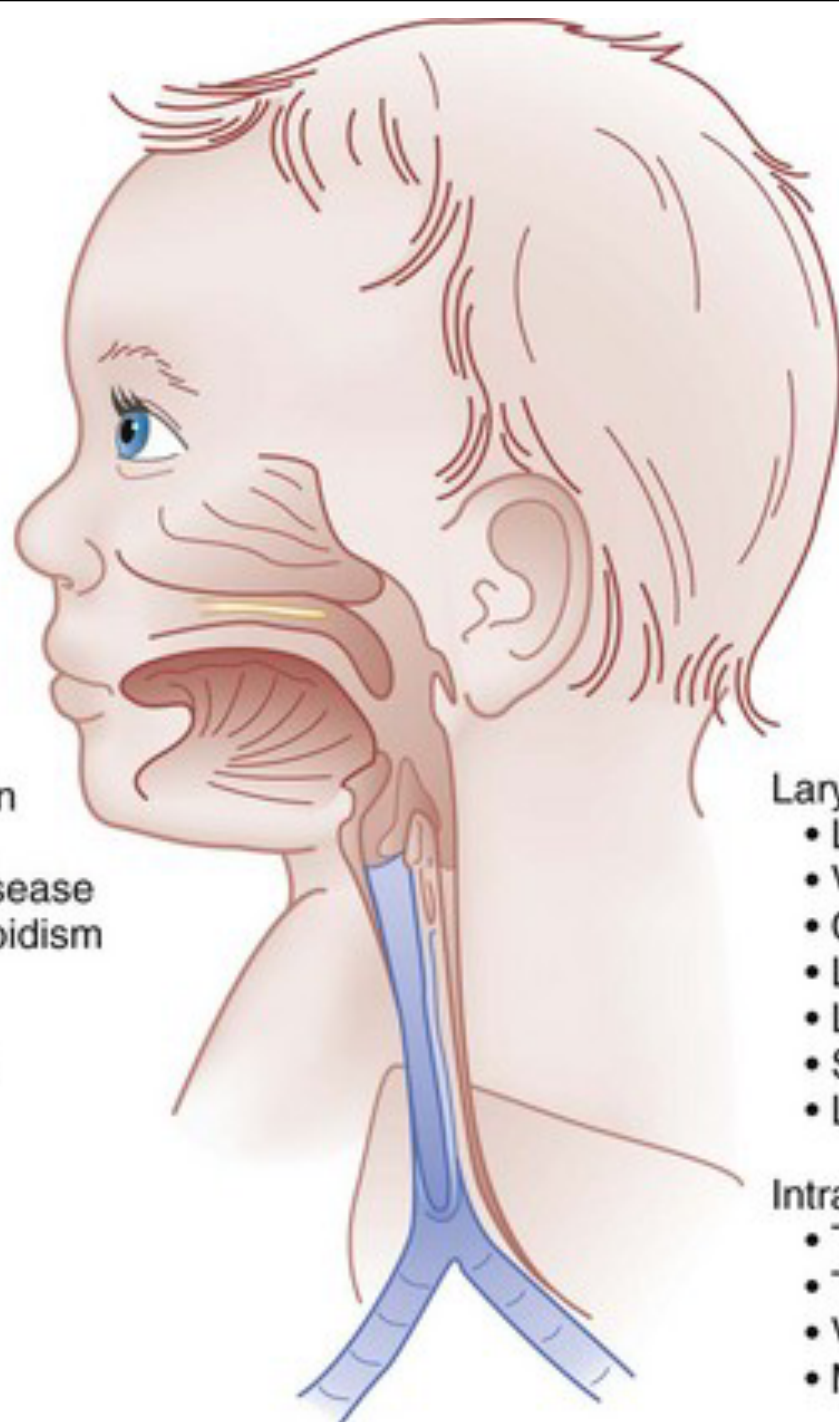
Anatomy

- Upper airway includes:
 - ✓ Nose
 - ✓ Pharynx
 - ✓ Larynx
 - ✓ Trachea



Supraglottic

- Craniofacial
 - Pierre Robin
 - Treacher Collins
 - Hallermann-Streiff
- Macroglossia
 - Beckwith-Wiedemann
 - Down syndrome
 - Glycogen storage disease
 - Congenital hypothyroidism
- Choanal atresia
- Encephalocele
- Thyroglossal duct cyst
- Lingual thyroid



Laryngeal

- Laryngomalacia
- Vocal cord paralysis
- Congenital subglottic stenosis
- Laryngeal web
- Laryngeal cyst
- Subglottic hemangioma
- Laryngotracheoesophageal cleft

Intrathoracic

- Tracheomalacia
- Tracheal stenosis
- Vascular rings/slings
- Mediastinal masses

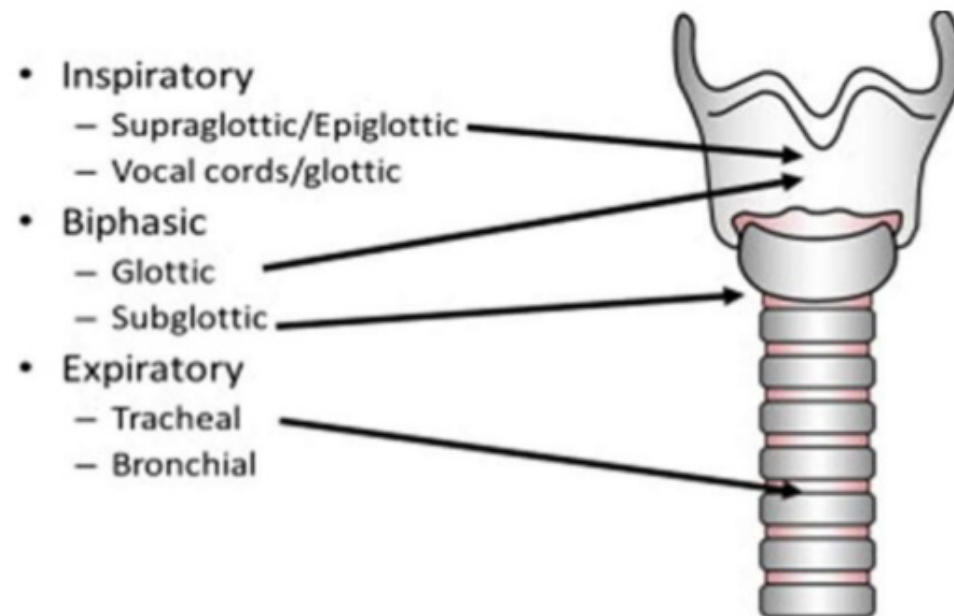
Age Related Differential Diagnosis of Upper Air way obstruction

Newborn	Infancy	Toddlers
<ul style="list-style-type: none">• Choanal atresia• DigGeorge syndrome• Laryngeal web , atresia• Vocal cord paralysis• Pharyngeal collapse	<ul style="list-style-type: none">• Laryngomalacia• Viral croop• Subglottis stenosis• Laryngeal web• Vascular ring• Rhinitis	<ul style="list-style-type: none">• Viral croop• Bacteria tracheitis• Foreign body• Retrolaryngeal abscess• Hypertrophied tonsil• Laryngeal papillomatosis

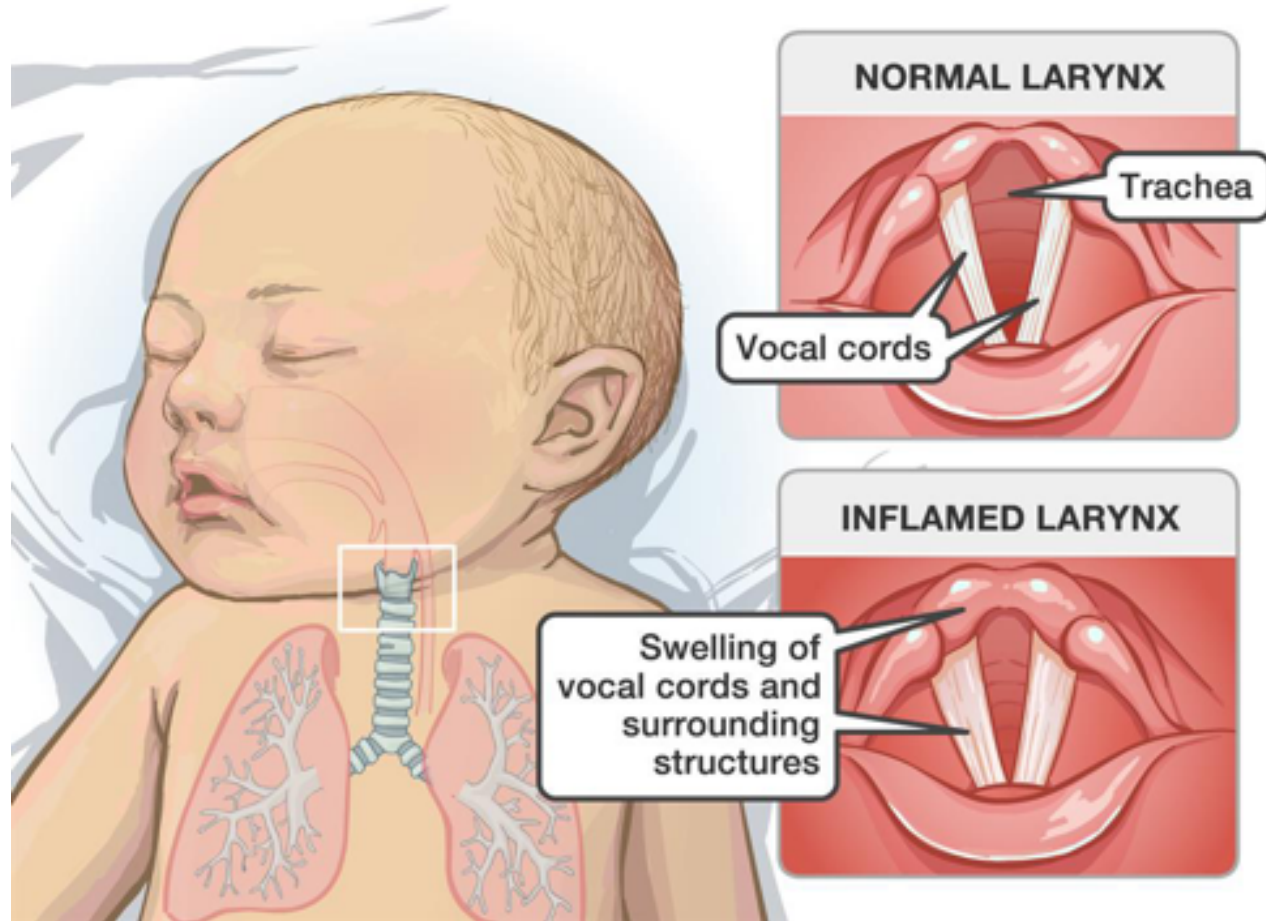
Stridor

Is a high-pitched breath sound resulting from turbulent air flow in the upper airways...A cute or chronic

TYPES OF STRIDOR



Croup



Clinical Manifestations

- Usually starts with **minor respiratory symptom**: non-specific cough, rhinorrhea and fever
- **Barking cough**, stridor, and resp distress that develops suddenly during the evening or at night
- **Stridor** typically occurs during **inspiration**. Biphasic with more severe cases.
- Hoarseness of voice

Steeple sign on CXR



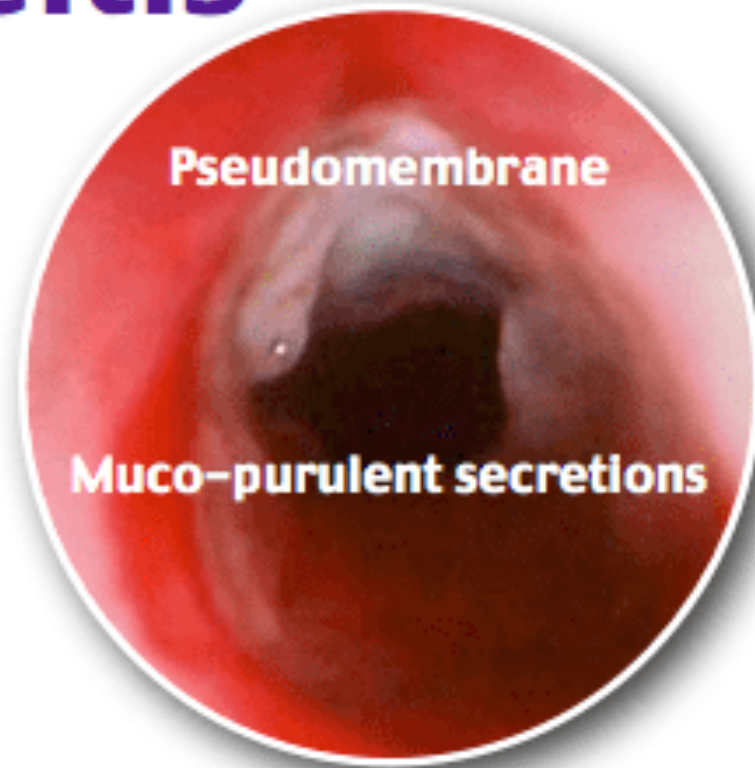
Bacterial Tracheitis



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

[Looks similar to croup/epiglottitis]

Rapid progression



Pseudomembrane

Muco-purulent secretions

But...Toxic appearing

Airway emergency

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



Source: J.E. Tintinalli, J.S. Stapczynski, O.J. Ma, D.M. Yealy, G.D. Meckler, D.M. Cline:
Tintinalli's Emergency Medicine: A Comprehensive Study Guide, 8th Edition
www.accessmedicine.com
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Epiglottitis

Clinical presentatic

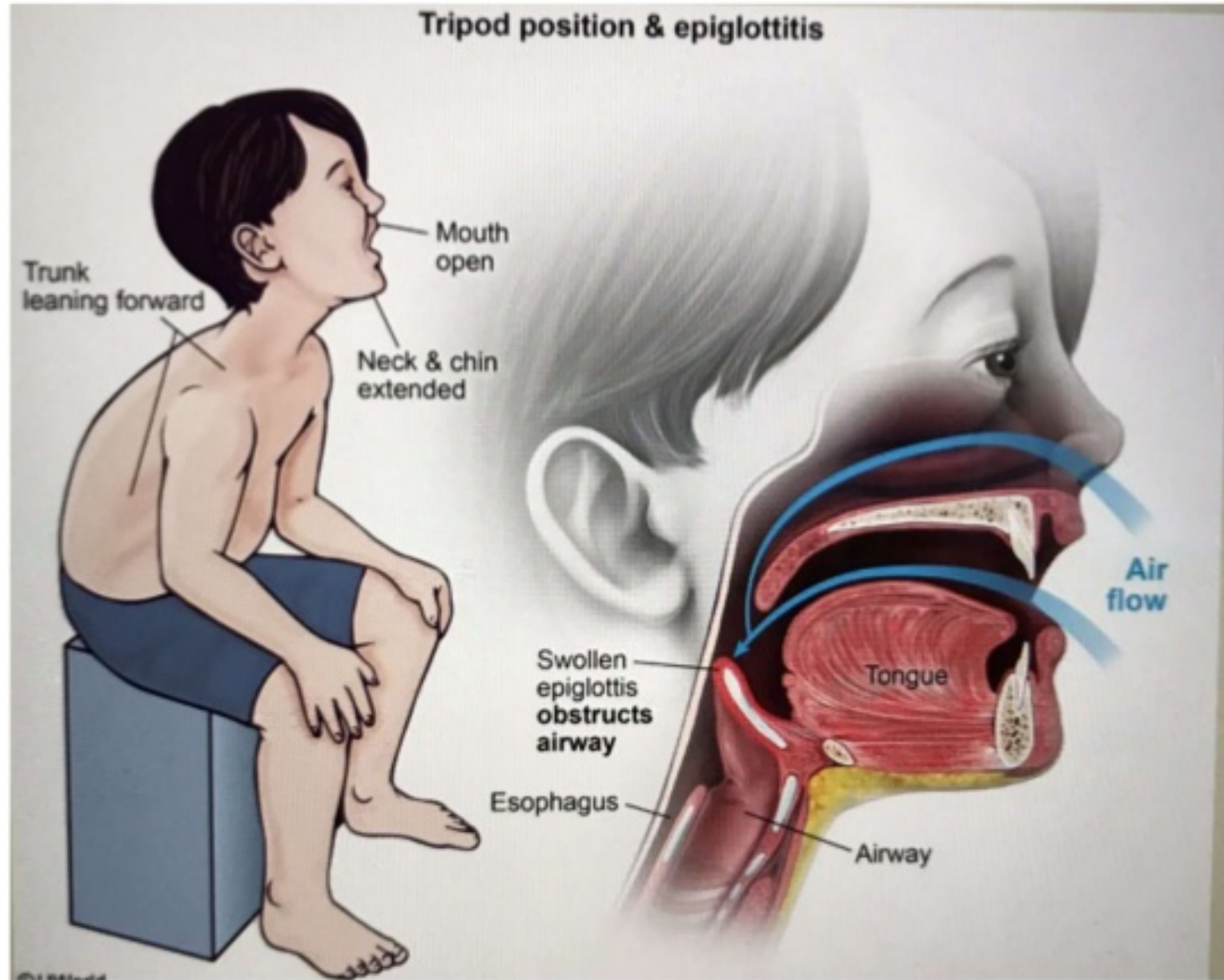
Drooling

Sick looking

Hyperextended ne

Stridor

Cough is unusual





Thumb sign-
narrowing of
airways

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

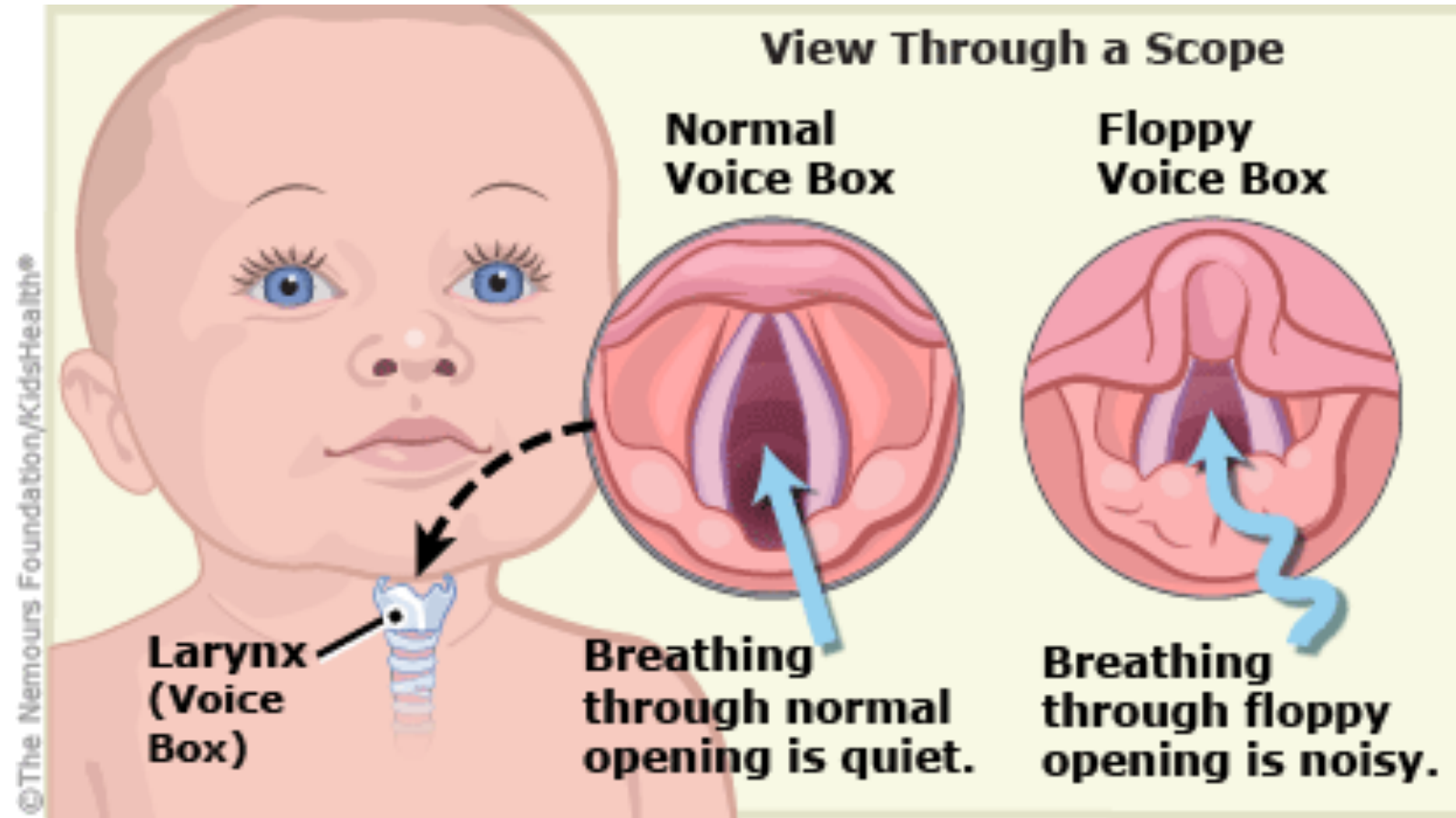
- Obtain cultures if possible, continue airway intubation in an ICU setting until a leak develops, and begin appropriate antibiotics as indicated

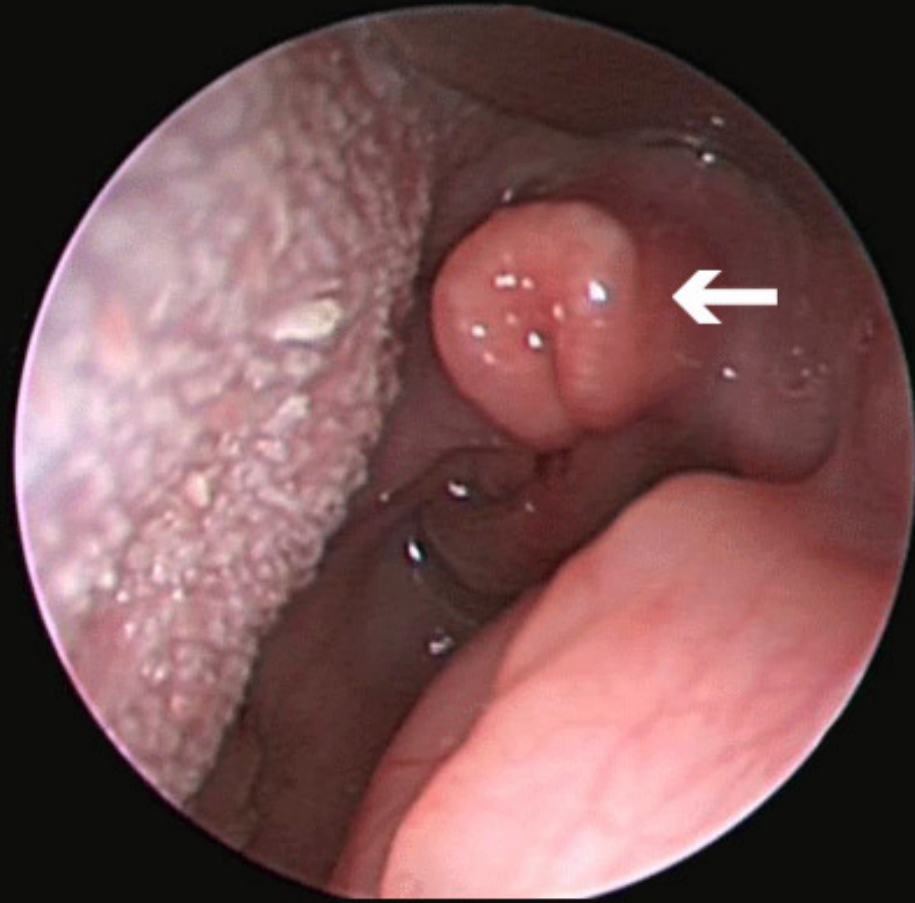
Extubation

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

Laryngomalacia

M/C cause of chronic stridor



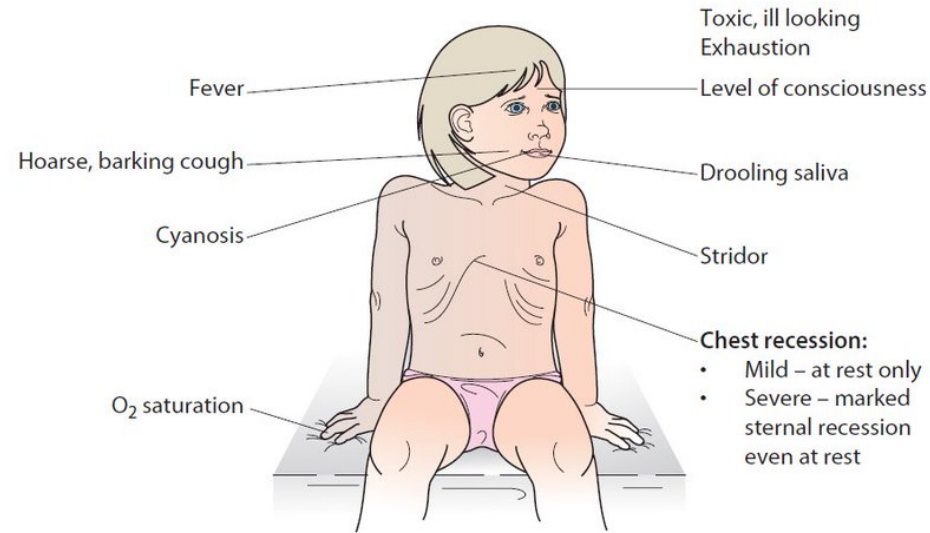


Signs/Symptoms

- Low 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

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

THANK YOU