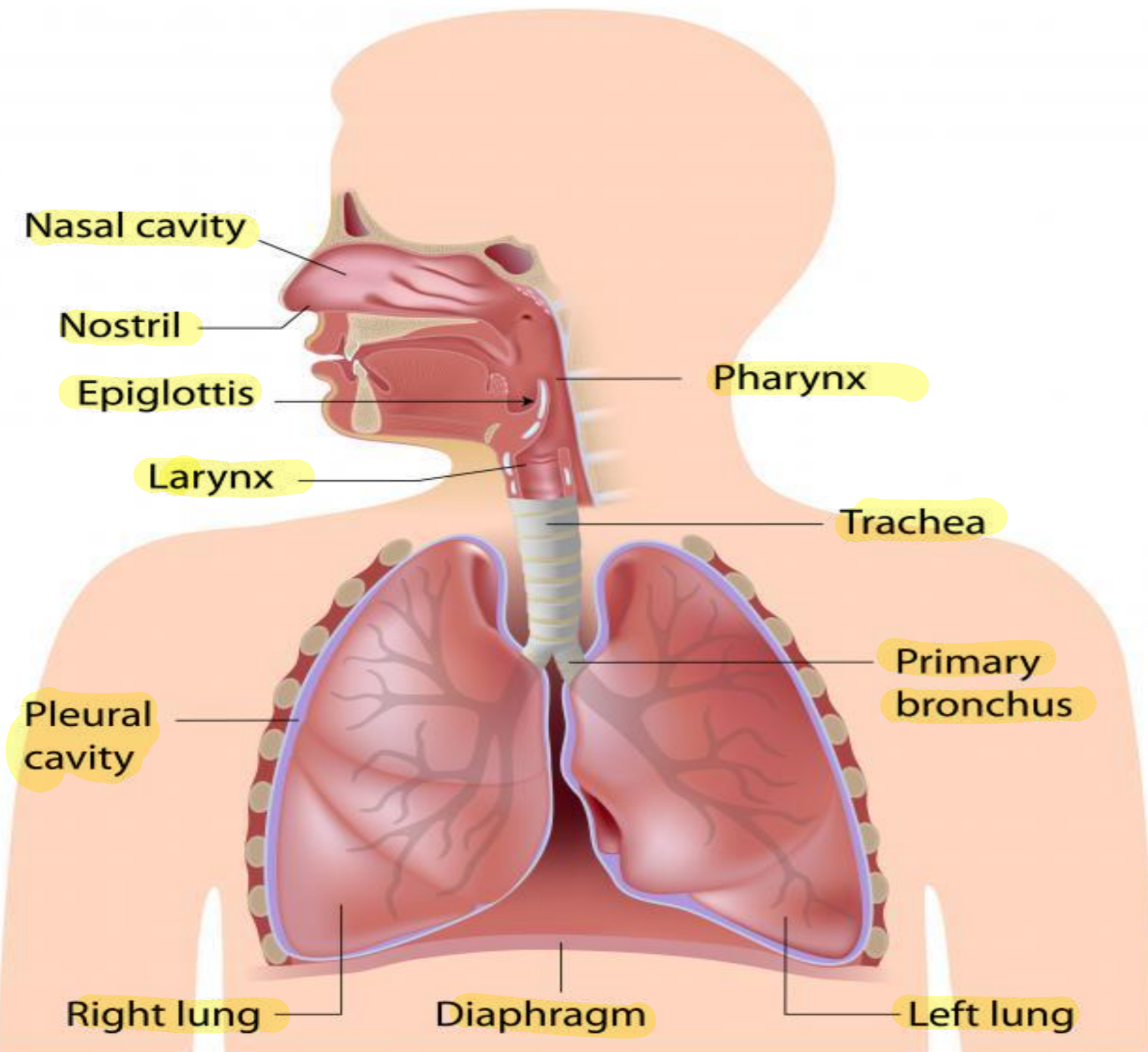


Respiratory Tract Infections in Pediatrics

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The Respiratory System



الرشح

Common cold (Coryza)

ينتج أكثر من الفايروسات وأكثر فايروس بسببها هو rhinovirus

- The common cold is usually a mild and self-limiting viral illness.

Usually it's mild symptoms mainly nasal symptoms such as nasal discharge Runny nose
low grade fever and mild cough and mild sore throat

- Symptoms : Nasal discharge, cough and fever .

RESPIRATORY SYNCYTIAL VIRUS

- Aetiology: Rhinovirus, corona virus, RSV

Show in any age

- In infants and young children, the symptoms usually peak on day 2 to 3 of illness and then gradually improve over 10 to 14 days .

- In older children and adolescents, symptoms usually resolve in five to seven days.

Common cold

that doesn't require any treatment

Treatment: Self-limiting viral illness

Symptomatic therapy if the symptoms bother the child (eg, interrupting sleep, interfering with drinking, causing discomfort)

- **Nasal symptoms** :nasal suction; saline nasal drops or spray

- **Cough** :oral hydration, warm fluids , honey (in children older than one year).

- OTC cough and cold medications should be **avoided** in children <6 years.

Over the counter or decongest or antihistamine these kind of medications are avoided to children below six years

بالأول حكينا عن تجويف الأنف لان بدنا نحكي عن pharynx الي موجود فيه ال tonsils ويسمى ال inflammation of the pharynx is pharyngitis

Pharyngitis

Mild sore throat and low grade fever and mild cough, in examination we will not the throat is red and anterior cervical lymph node enlarged and tender

- Symptoms :Sore throat, fever, cough
- Pharynx is inflamed, cervical lymph nodes enlarged.
- Usually viral etiology, *The most common cause* adenovirus, rhinovirus,
- In older children group A beta hemolytic streptococcus (GAS) is the most common bacterial cause.

Tonsillitis

Tonsillitis is inflammation of the tonsils

- A form of pharyngitis, with involvement of the tonsils.
- ① ^{The most common bacterial cause for tonsillitis}
• Common pathogens are group A beta hemolytic streptococcus (streptococcus pyogenes)
- ② ^{The most common viral cause for tonsillitis with exudate}
• Viruses like Epstein Barr virus (infectious mononucleosis)
- If bacterial tonsillitis diagnosed treatment is penicillin or erythromycin if patient allergic to penicillin.
- Treatment does not prevent post streptococcal nephritis.

Or strep throat in examination we will notes tonsils are enlarged but in pharyngitis not important to enlargement the tonsils and the pharynx red and erythema

Streptococcal Pharyngitis

In tonsillitis specifically bacteria infection usually the tonsils are enlarged and we see exudate over the tonsils

- Streptococcal tonsillitis characterized by erythema and swelling of the tonsils, exudate, petechia on the palate, tender anterior cervical lymph nodes
- Can be associated with sandpaper rash.
Other clinical manifestations is skin rash and is called sand paper
- Diagnosed with Rapid Antigen Detection Test, and throat culture, sensitivity 63-96, specificity 90-100%

Clinically how to suspect the patient has strep throat : if he have high grade fever and sore throat and in examination the tonsils are enlarged with white exudate and petechia rash on palate and we confirm the diagnosis through culture and do rapid antigen tests and if we suspect bacterial tonsillitis we should treat with use penicillin if the patient allergies for it we use macrolide for alternative treatments

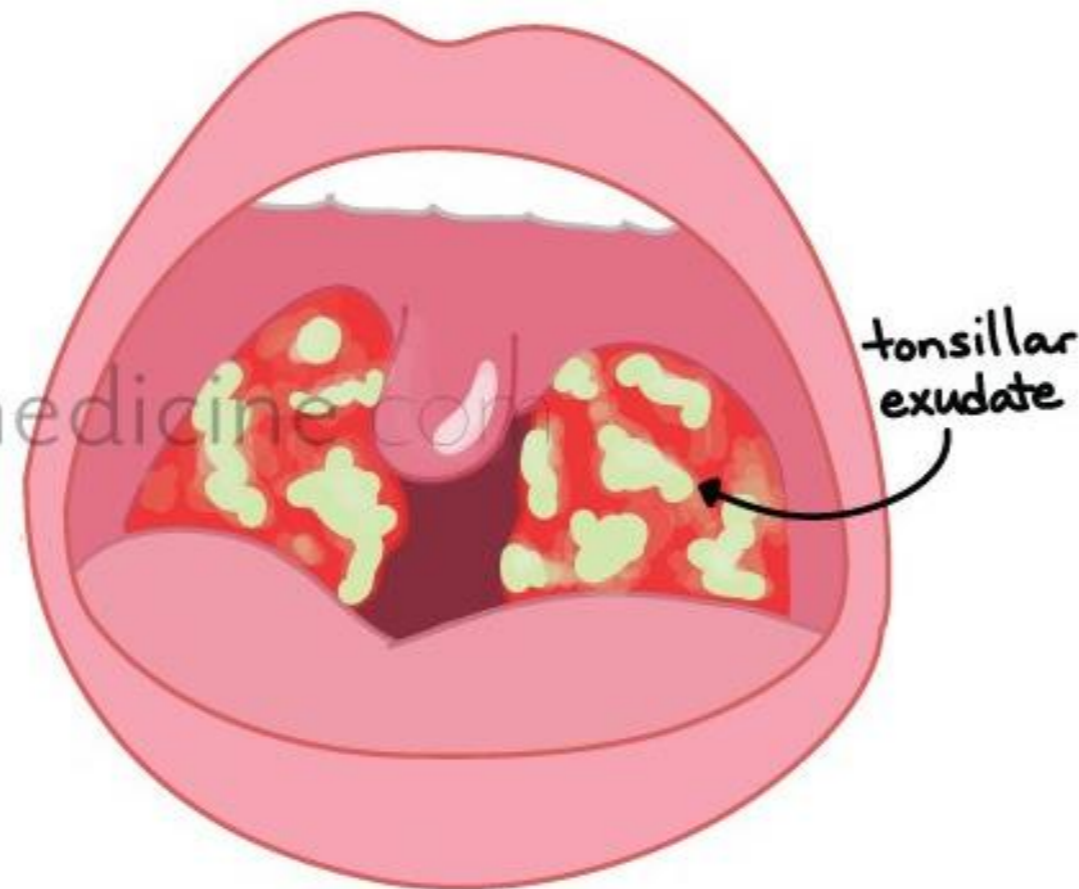
The soft palate red and enlarged with white exudate

Strep Throat (*Streptococcal Pharyngitis*)

Mclsaac Criteria

Centor Criteria Add 1 point for each:

1. Fever (subjective or $>38\text{ C}$)
2. \emptyset cough
3. Tender lymphadenopathy (anterior cervical)
4. Tonsillar exudate
5. Age
 - 3-14 yrs: Add 1 point
 - 15-44 yrs: \emptyset
 - 45+ yrs: Subtract 1 point



Total score

0-1 Unlikely strep pharyngitis

2+ Throat swab & culture or rapid antigen test

4+ Lab confirmation +/- empiric antibiotics

If we have clinical symptoms we need to start empirical treatment till throat cultures results is bad in order to prevent complications

The complications such as post streptococcal glomerulonephritis or Iga glomerulonephritis and Rheumatic fever scarlet fever is a other name for strep throat, if strep throat associated with sandpaper rashes it's called scarlet fever



Tonsillar exudate



Palatal petichiae

The soft palate red and enlarged with white exudate



Sand paper rash (small red bumps)

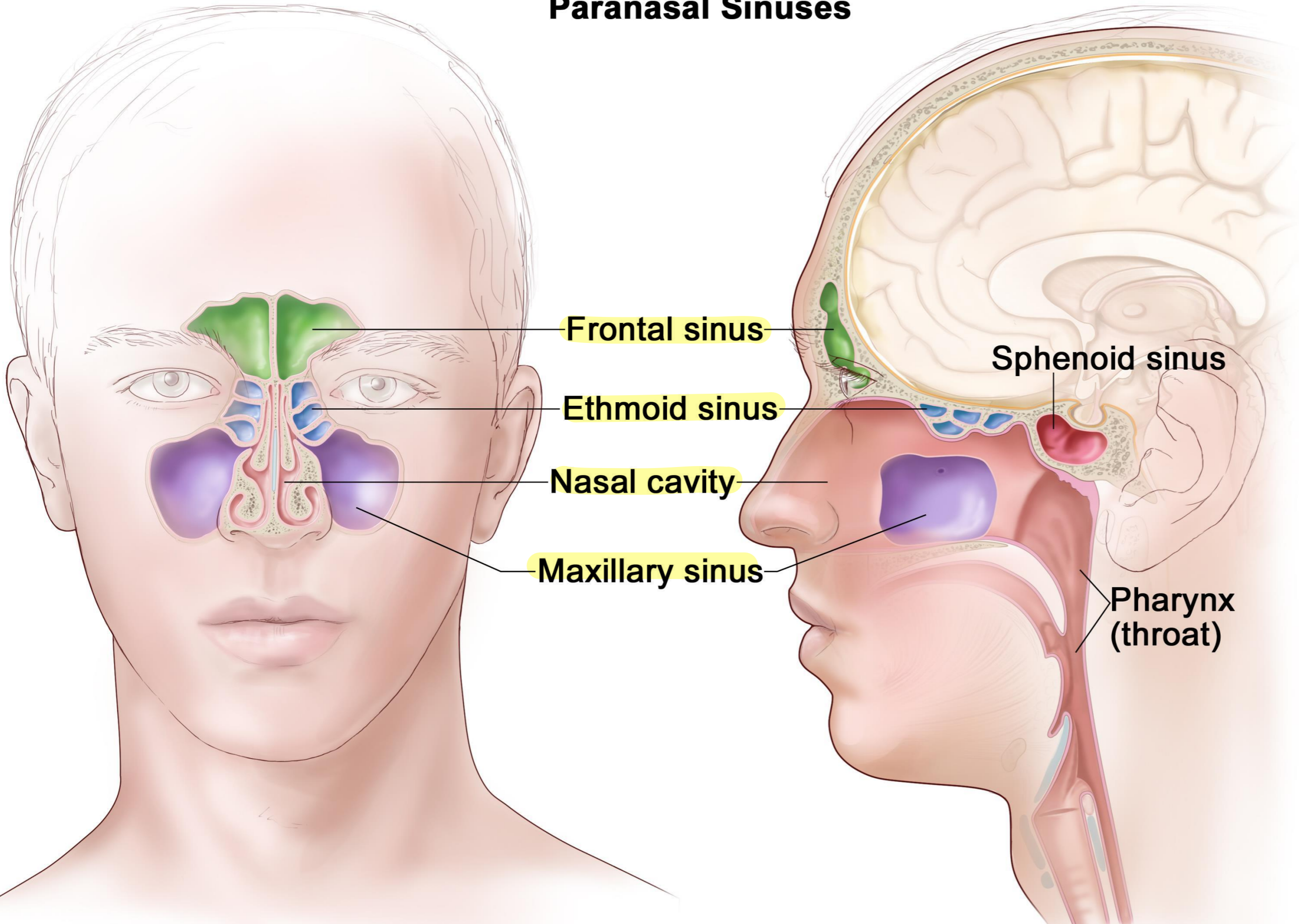
Streptococcal Pharyngitis

- Complications of strep throat:
- Rheumatic fever
- Post streptococcal glomerulonephritis
- Airway obstruction Because enlarged the tonsils
- Bacteraemia , and rarely streptococcal shock syndrome.
- Peritonsillar abscess, retropharyngeal abscess.

Sinusitis

- Inflammation of the mucosal lining of one or more of the paranasal sinuses.
- Inflammation is common during viral upper respiratory infections (URI) but usually resolves spontaneously.
- Acute bacterial rhinosinusitis (ABRS) occurs when there is secondary bacterial infection of the sinuses.
- Maxillary, Ethmoidal, Sphenoidal, Frontal
- Predisposing factors: Cystic Fibrosis, allergic rhinitis, immunodeficiencies, structural abnormalities

Paranasal Sinuses



Frontal sinus

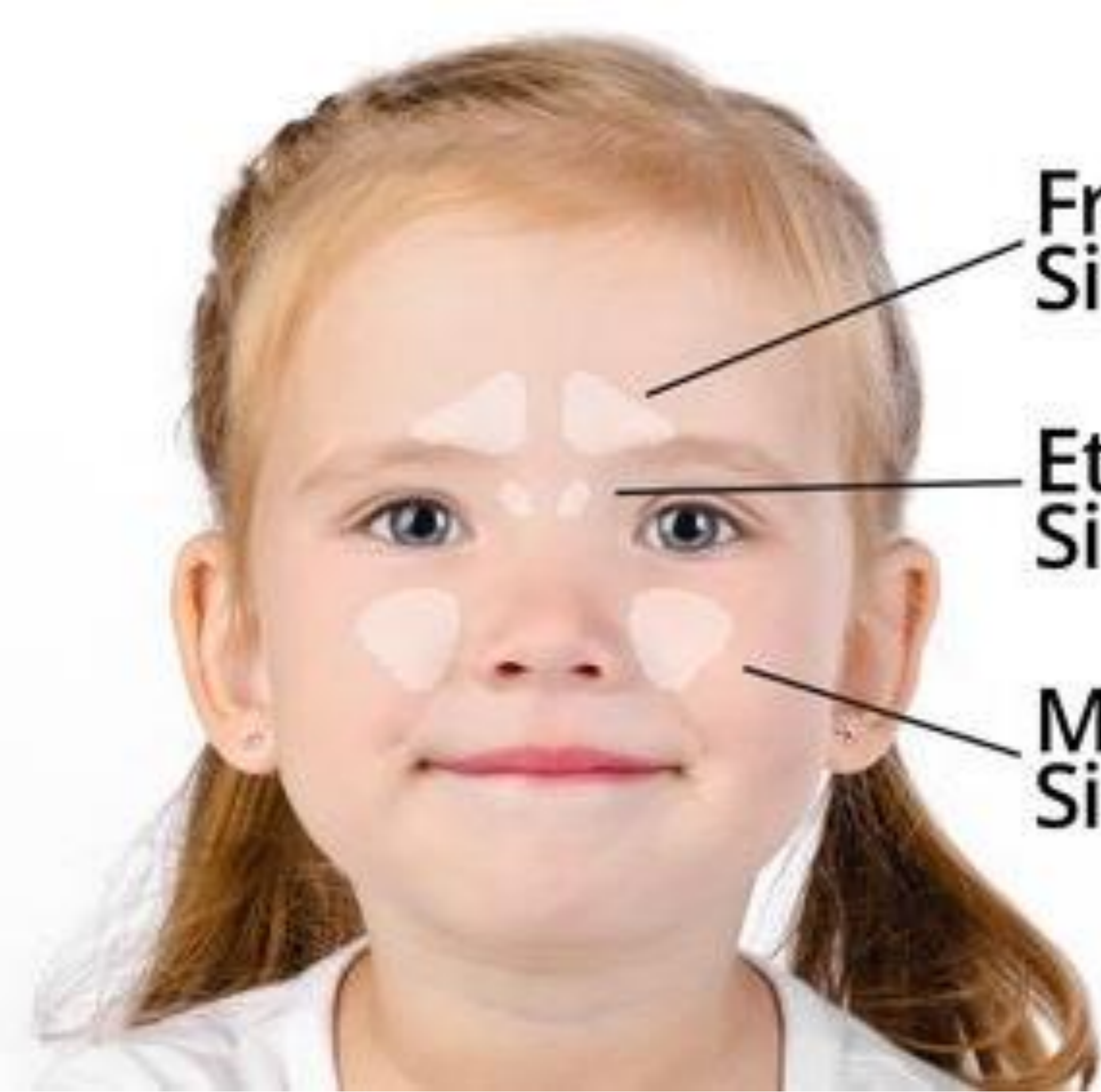
Ethmoid sinus

Nasal cavity

Maxillary sinus

Sphenoid sinus

Pharynx (throat)



**Frontal
Sinus**

**Ethmoid
Sinus**

**Maxillary
Sinus**

- The ethmoid and maxillary sinuses form in the 3rd to 4th gestational month.
- The sphenoid sinuses are pneumatized by 5 years of age
- The frontal sinuses do not appear until the 7th to 8th year of life and are not completely developed until adolescence

The sinusitis sometimes with common cold or mild pharyngitis can be mild inflammation of the sinus but if this inflammation with super imposed of bacterial infections we called Acute bacterial rhinosinusitis (ABRS) is an infection of both your nasal cavity and sinuses

Sinusitis

- Symptoms:
- Headache
- Fever
- Nasal discharge
- Cough: night time and early morning cough
- facial pain and swelling, and sore throat.
- Physical findings: nasal discharge, post nasal drip, facial tenderness

هاي ال criteria عشان نميزها عن ال common cold

هاي ال criteria لل symptoms and signs suggested of sinusitis any patient has sinusitis

Diagnosis

The diagnosis of sinusitis can be made clinically in children with symptoms and signs of sinus inflammation) **and** one of the following presentations:

- 1 -Symptoms present **without improvement** for >10 or
 - 2 -Severe symptoms (ie, ill appearance, temperature $\geq 39^{\circ}\text{C}$, and purulent nasal discharge for ≥ 3 consecutive days), or
 - 3 -Worsening symptoms (ie, increase in respiratory symptoms, new onset of severe headache or fever, or recurrence of fever after initial improvement)
- Imaging studies are not necessary for children with uncomplicated ABRS.

We don't need imaging for diagnosis only need clinical symptoms and physical examination usually facial tenderness and post nasal drip we note the mucus in the back of the throat

Sinusitis

Acute bacterial sinusitis

- Organisms that cause ABRS : streptococcus pneumonia, staph aureus, non typable Hemophilus influenza, moraxella catarralis

Treatment of uncomplicated ABRS : Oral antibiotics, amoxicillin-clavulanate .

- If symptoms worsen substantially at any time or if patient doesn't improve after three days of oral antibiotics, we switch to a different antimicrobial class

Cephalosporins

2nd Generation

Ex: Cefuroxime

Third Generation

Ex:

ceftriaxone, cefixime

Inspiratory stridor occurs when your child breathes in and it indicates a collapse of tissue above the vocal cords.
Expiratory stridor occurs when your child breathes out and it indicates a problem further down the windpipe
Inspiratory stridor is important to differentiate between mild and moderate to severe croup and if patient has
Inspiratory stridor at rest an barking cough and hoarseness this is moderate to severe

Croup

If patient has low fever and barking cough and hoarseness this is mild

- Laryngotracheobronchitis

Croup is a respiratory illness characterized by ⁽¹⁾inspiratory stridor, ⁽²⁾(barking cough) and (hoarseness).
These symptoms result from inflammation in the larynx and subglottic airway. The main symptoms of croup

(Inspiratory sounds)

- Usually caused by viruses, most commonly parainfluenza virus type 1. Other common causes include rhinovirus, respiratory syncytial virus (RSV), and adenoviruses.

- Pathophysiology: swelling of the subglottic space secondary to the viral infection

If the patient with mild croup it just supports treatment

If they present to emergency we give them dexamethasone we can give it oral or IV or IM

If moderate to severe croup we give it dexamethasone and ,nebulizer adrenaline

Croup

- age 6m-3 years most common, can happen up to 6 years *no adult*

We don't need imaging for diagnosis and don't need any blood investigation and it's viral illness the treatment depends on severity and we assess severity based on symptom

- Symptoms usually begin with nasal discharge and congestion and progress over 12 to 48 hours to include fever, hoarseness, barking cough, and stridor.
- If airway obstruction worsens, severe respiratory distress can develop.
- Croup is usually a self-limited illness that resolves within three days, though the cough may persist for up to a week.

Diagnosis

Croup is diagnosed clinically, based upon the characteristic barking cough and stridor. Neither radiographs nor laboratory tests are necessary to make the diagnosis.

However, radiographs may be helpful in select cases to exclude other causes if the diagnosis is in question. The characteristic radiographic finding in croup is subglottic narrowing ("steeple sign")

In radiology, the steeple sign is a radiologic sign found on a frontal neck radiograph where subglottic tracheal narrowing produces the shape of a church steeple within the trachea itself

Croup

- Moderate/Severe: Stridor at rest AND
 - Moderate intercostal retractions
 - Tachypnea
 - Agitation/restlessness/tired appearing
- Mild only harsh cough

The Westley Score: Classification of croup severity

Feature	Number of points assigned for this feature					
	0	1	2	3	4	5
Chest wall retraction	None	Mild	Moderate	Severe		
Stridor	None	With agitation	At rest			
Cyanosis	None				With agitation	At rest
Level of consciousness	Normal					Disoriented
Air entry	Normal	Decreased	Markedly decreased			

- Management: keep child comfortable, management according to severity

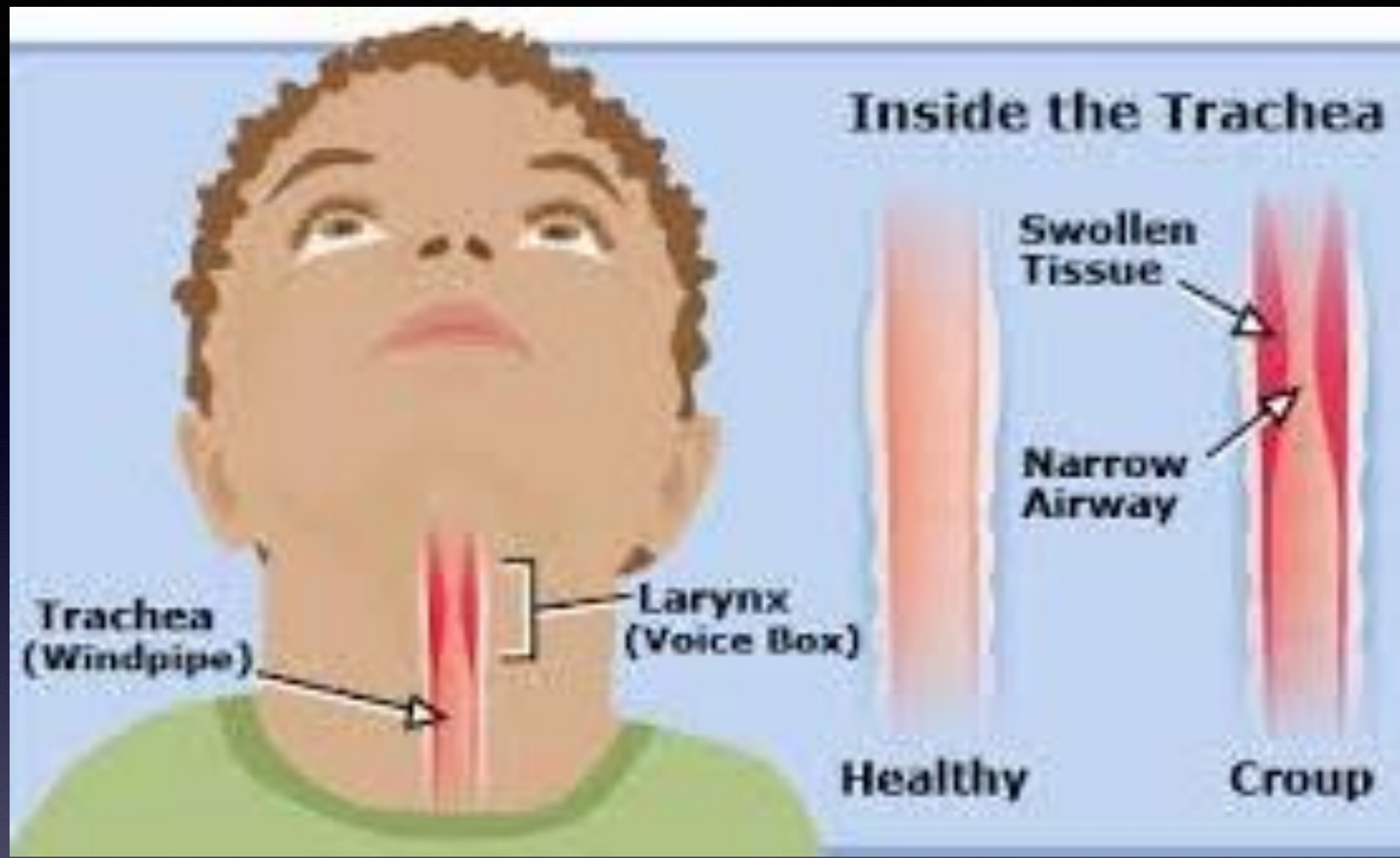
Croup

- Mild----- Steroids
 - Dexamethasone
- Moderate/Severe
 - Dexamethasone
 - Nebulized epinephrine

- Stridor is a monophonic, high-pitched inspiratory sound that is loudest over the anterior neck . The sound is caused by narrowing of the upper or central airway.

Tapering of the upper trachea ("steeply sign").





Epiglottitis

- Infection of the Epiglottis, potentially life threatening
- Most common organism is Hemophilus influenzae, ^{Type b} streptococcus and other species.
- Most common age 2-6 years
- Sudden onset of symptoms, high fever, anxious
- Patient toxic looking, drooling, tripod position, leaning forward They are not able to swallow their secretions because the upper airways restrictions To maintain the airway open
- Do not examine. if severe obstruction send to OR for intubation
- Incidence decreases significantly after Hib vaccination
- IV antibiotics after airway has been secured

If have any patient with epiglottitis try not to cause any discomfort for the patient and try not irritate to patient and avoid throat examinations

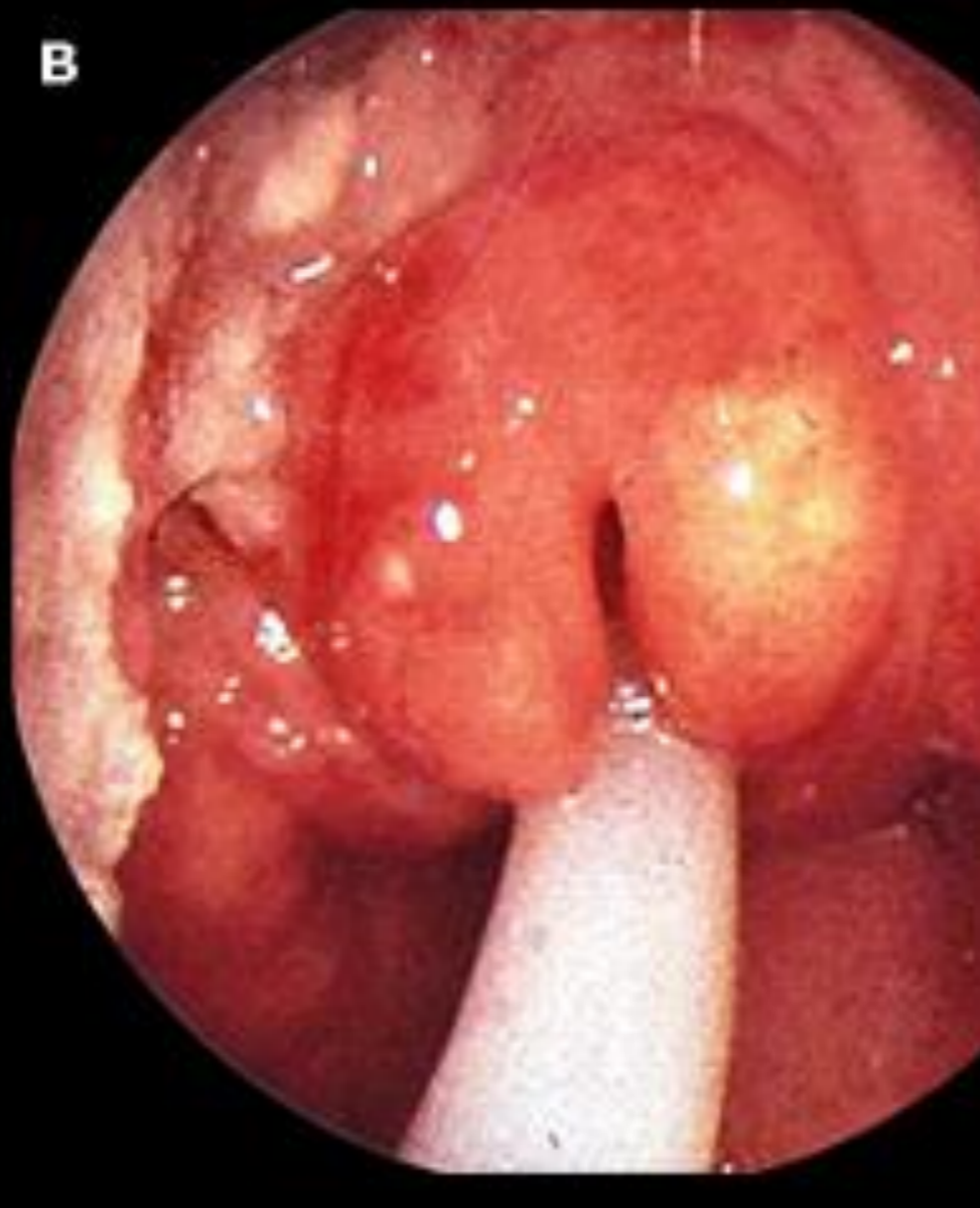
Treatment

Secure airways and antibiotic

- Antibiotics, according to organism



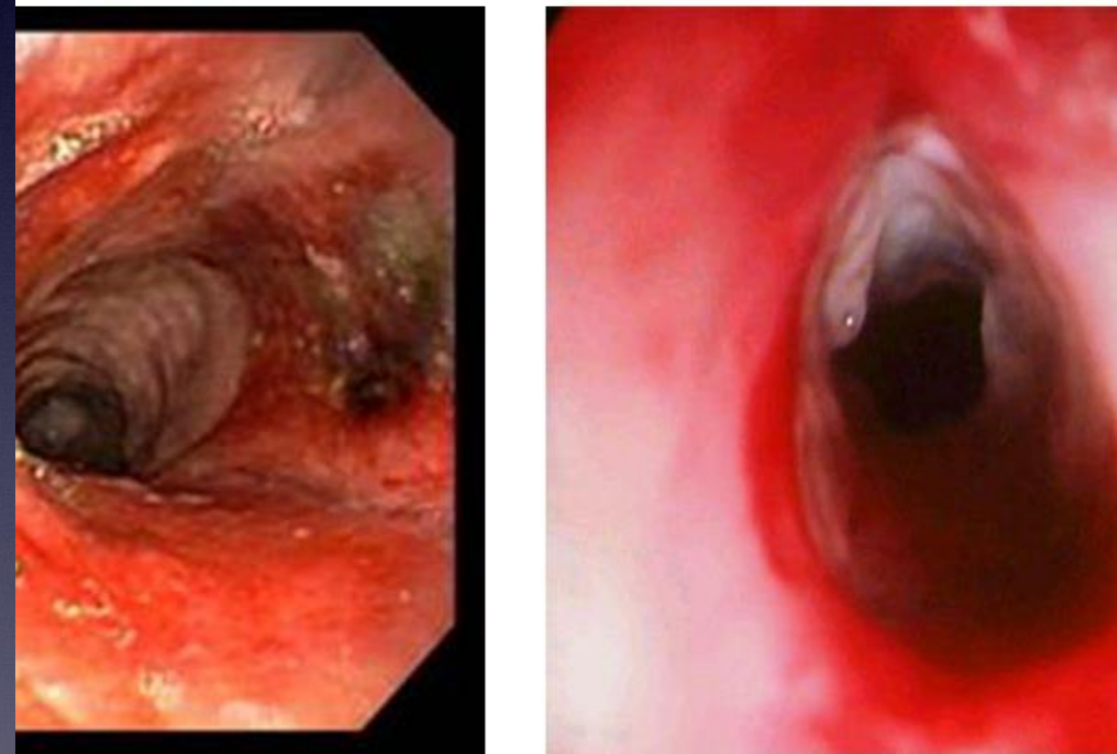
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Tracheitis

- Exudative bacterial infection of the soft tissues of the trachea.
- During first 6 years of life
- Most likely bacterial in origin
- Staph aureus most common organism
- Sick, toxic looking patient
- Stridor
- Treatment : Admission, I V antibiotics.

Tracheitis



Are very common and very important

Bronchiolitis

Bronchiolitis is a clinical syndrome of respiratory distress that occurs in children <2 years of age.

After two years or three years no speak bronchiolitis

It is characterized by initial upper respiratory symptoms (eg, rhinorrhea) followed by lower respiratory tract signs (eg, wheezing and/or crackles).

The important clinical sign

Bronchiolitis is caused by viruses, most commonly respiratory syncytial virus (RSV).

No role for antibiotics we use antibiotics for specific conditions such as newborn there age under one month if he comes with fever and bronchiolitis give him antibiotics or if we suspect super imposed infection otherwise for bronchiolitis

Bronchiolitis

- Bronchiolitis is a major cause of illness and hospitalization in infants and children younger than two years of age.
- Pathophysiology: viral infection of the lower respiratory tract, with inflammation, edema, swelling, increased mucus secretion leading to airway obstruction

Bronchiolitis

- Signs and symptoms
 - Nasal discharge, cough, fever, shortness of breath, cyanosis, apnea in infants(apnea may precede respiratory symptoms) In severe cases patient we have apnea
 - Chest exam : wheezes and crackles, retractions
 - Infection has a seasonal pattern, depending on the patient's location.

Broncholitis

- Clinical course for RSV bronchiolitis is worsening first 48-72h, then a plateau for 2-3 days followed by improvement, symptoms can last 3 weeks
- High risk patients are premature babies, babies with congenital heart disease, cystic fibrosis or chronic lung disease
- About 25-50% of patients with bronchiolitis develop recurrent wheezing

Clinical assessment

We assess the following clinical parameters for determining the severity of bronchiolitis.

- Respiratory rate

- Respiratory effort (eg, retractions and accessory muscle use, grunting, nasal flaring)

- Oxygen saturation (SpO₂)

- Episodes of apnea lasting >15 seconds

- Mental status and responsiveness

We have these parameters if patient suspects that he has bronchiolitis we need to assess respiratory rate and any respiratory distress like retraction and apnea or change in mental states why ? Because base of these parameters we assess the severity of the disease and base of the severity we decide the treatment

If the patient has only cough with wheezing on examination these consider to mild Bronchiolitis

If the patient has mild retraction and desaturation or decreased in Oxygen saturation (SpO₂) these consider moderate

If the patient has apnea or change in level of consciousness and respiratory symptoms these severe

Severity assessment

- **Mild bronchiolitis** is characterized by mild lower respiratory tract signs (wheezing and/or crackles) with little to no respiratory distress and normal activity level.
- **Moderately severe bronchiolitis** is characterized by moderate tachypnea and respiratory distress (ie, mild to moderate retractions), no apnea, and normal level of alertness.
- **Severe bronchiolitis** is characterized by persistent tachypnea, considerable respiratory distress (ie, retractions, grunting, nasal flaring), apnea, and/or poor responsiveness

Bronchiolitis

- Diagnosis
 - Viral swab: not indicated for uncomplicated cases. (rapid immunofluorescent, or PCR)
 - CBC and electrolytes normal
 - CXR : The important findings in chest X-ray Hyperinflation, perihilar infiltrates, atelectasis.....but not always routinely indicated



Management

- **Mild bronchiolitis** – Infants and children with mild bronchiolitis usually can be managed in the outpatient setting.
- Supportive care : maintenance of adequate hydration, relief of nasal congestion/obstruction, and monitoring disease progression. Because we can super imposed bacterial infections or progression from mild to severe

- moderate to severe bronchiolitis :usually require supportive care in the inpatient setting.

- **Respiratory support**

- supplemental oxygen as needed.

- For patients with severe distress, high-flow nasal canula (HFNC) is the initial mode of respiratory support.

Sometimes patient with severe case for example recurrent apnea may consider mechanical ventilation

- Rarely, endotracheal intubation may be necessary for the most severely affected patients.

Fluids – Patients with a history and/or clinical findings suggestive of dehydration should receive intravenous hydration.

• **Nasal suctioning** – Most patients with moderate to severe symptoms require intermittent nasal suctioning.

• **Trial of inhaled bronchodilator** – For most patients with a first episode of nonsevere bronchiolitis, we suggest **not** routinely administering inhaled bronchodilators . However, for patients with severe respiratory distress and wheezing, we suggest a trial of bronchodilator therapy (salbutamol) .

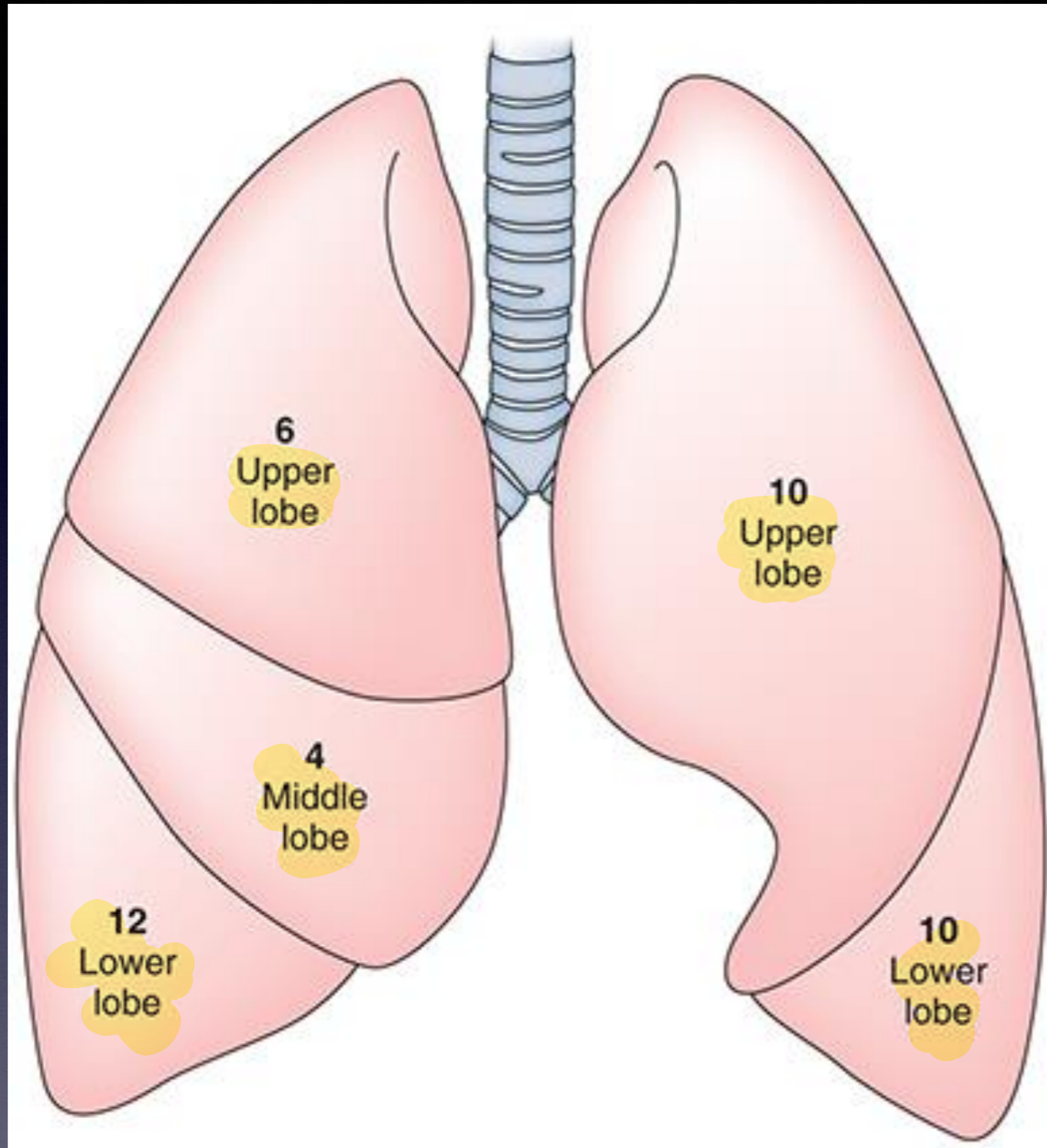
• Nebulized hypertonic saline not routinely recommended

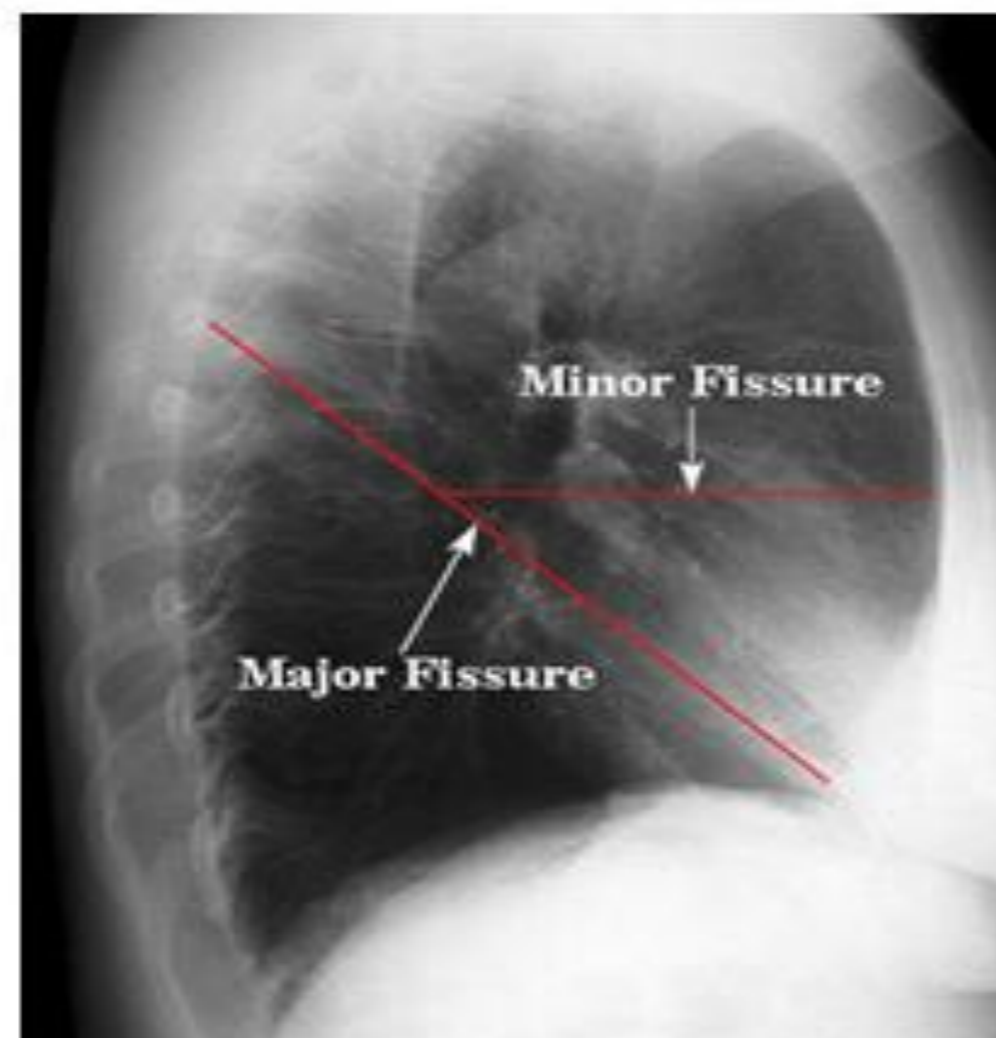
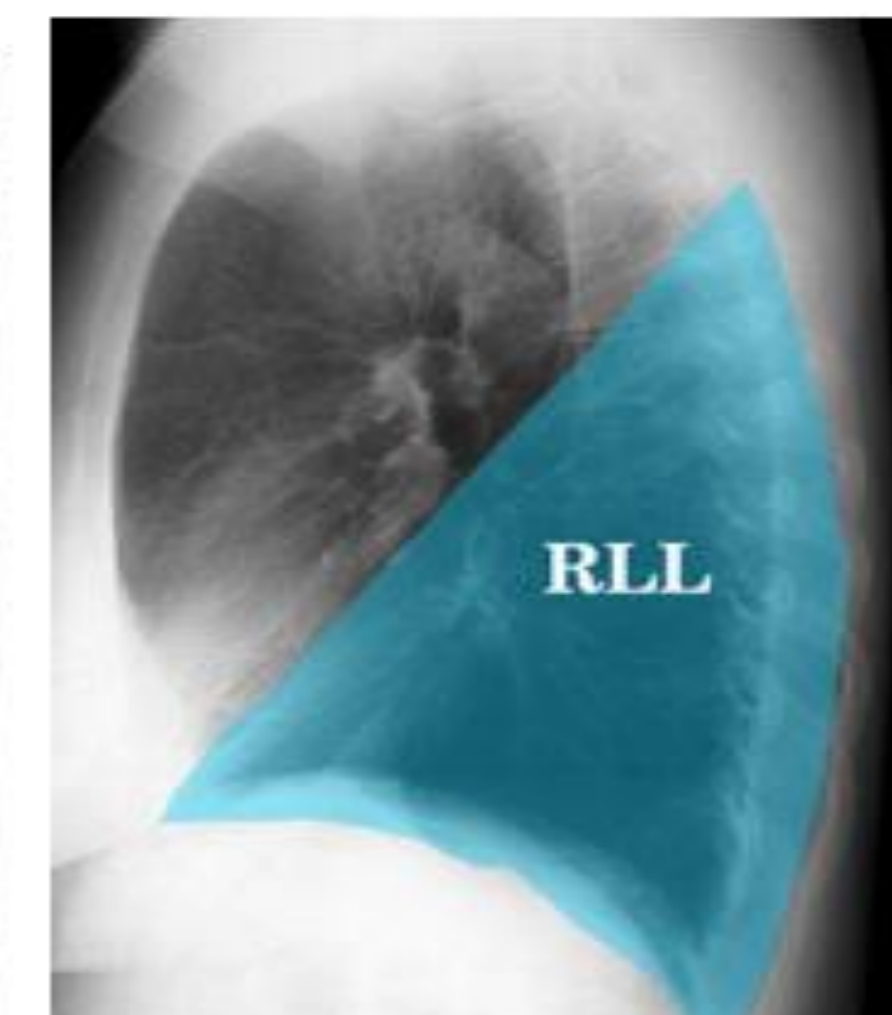
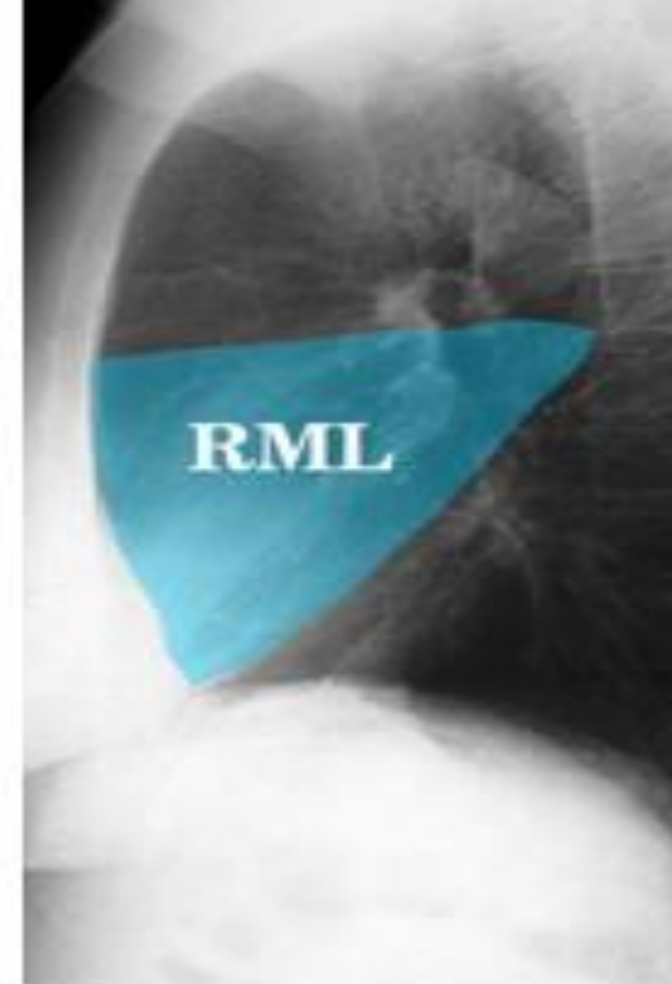
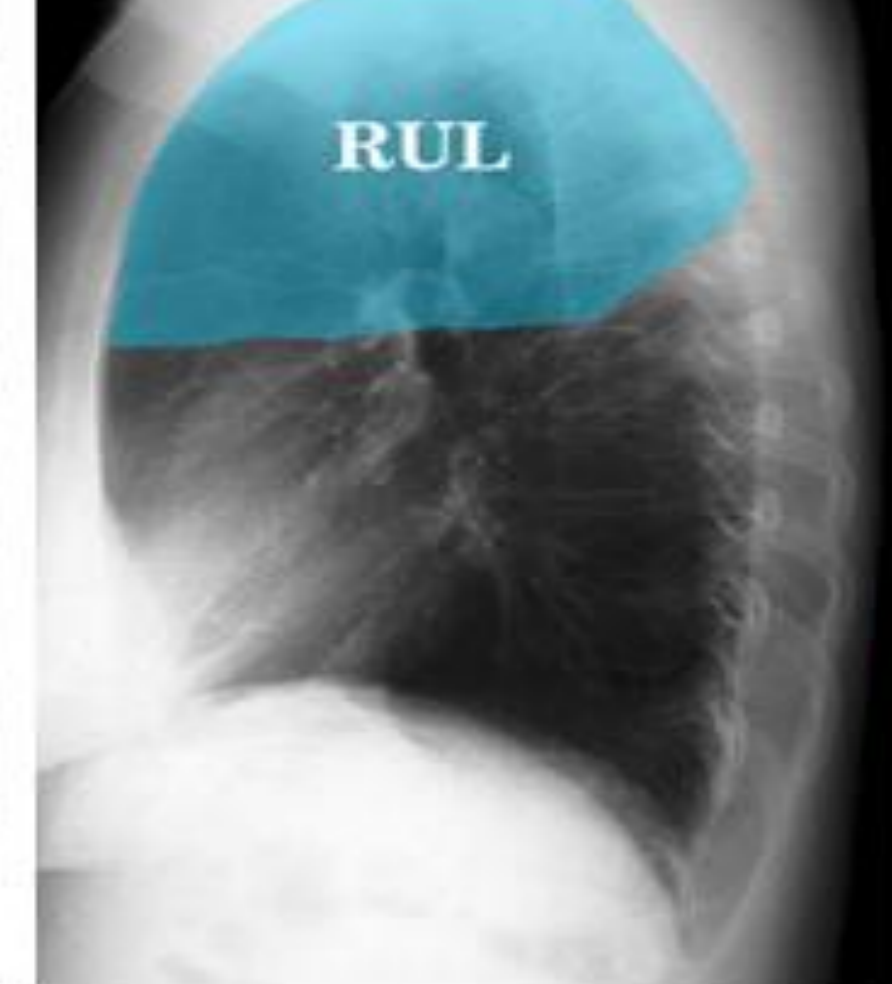
• Steroids are not recommended in previously healthy children

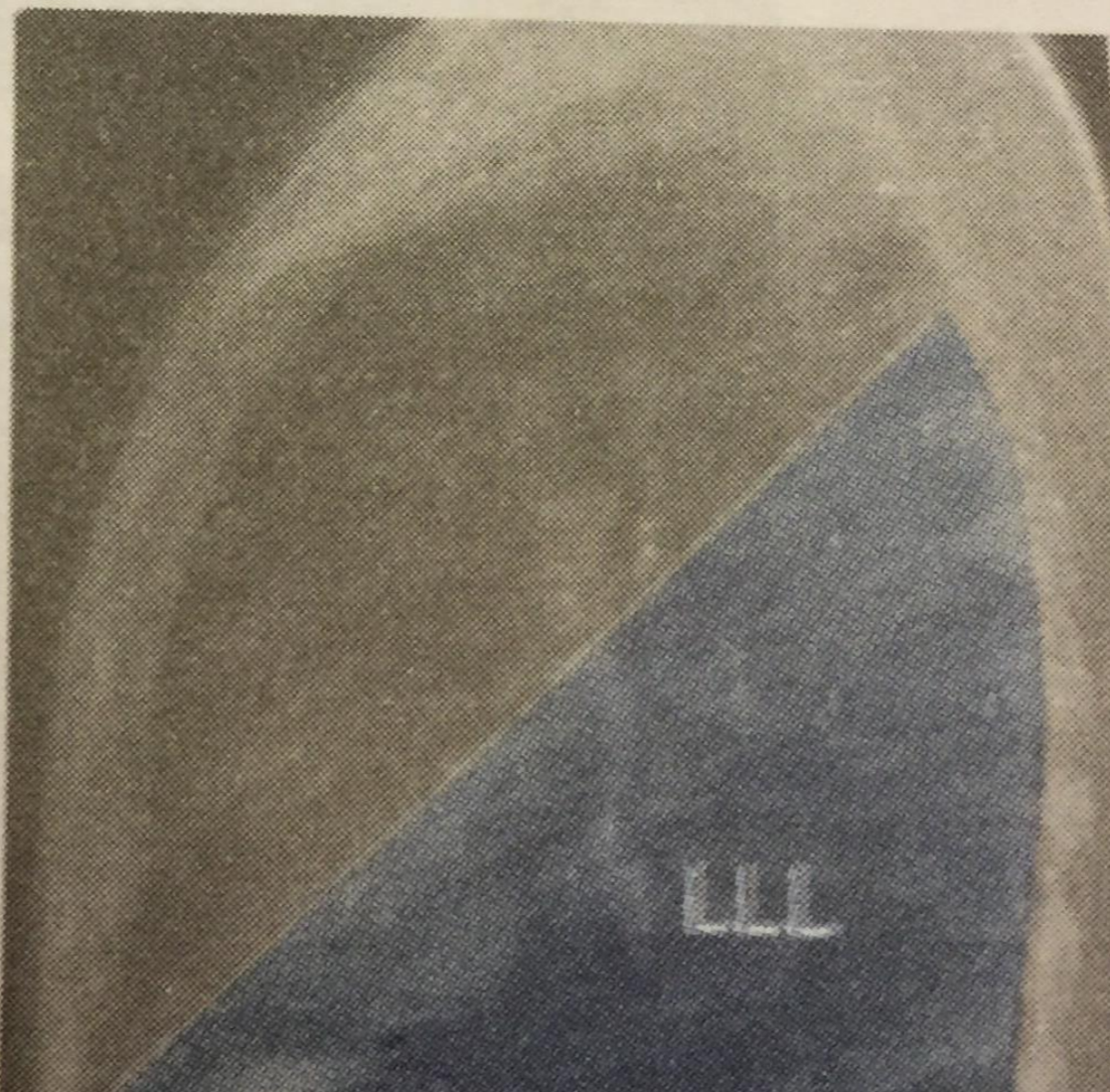
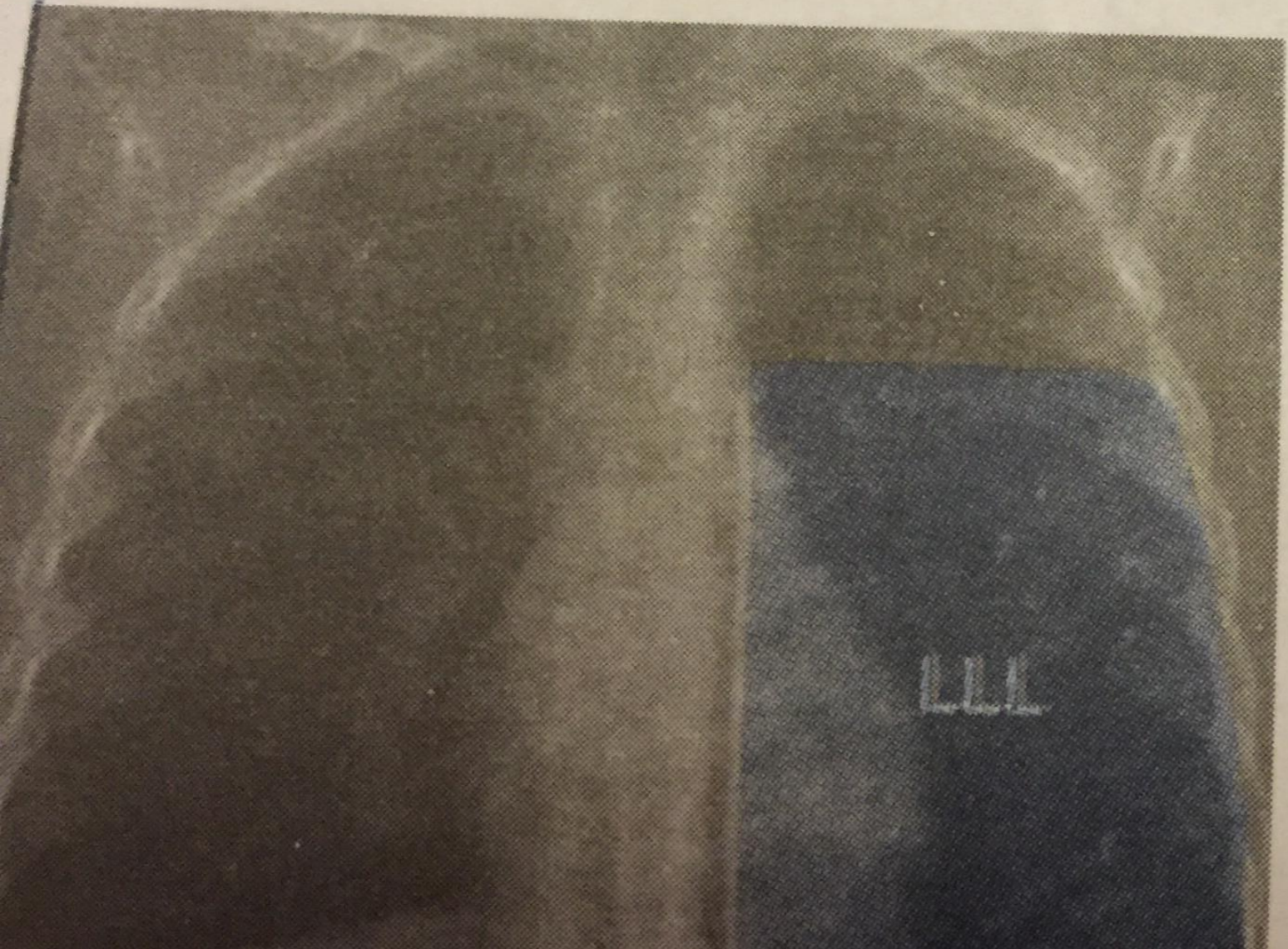
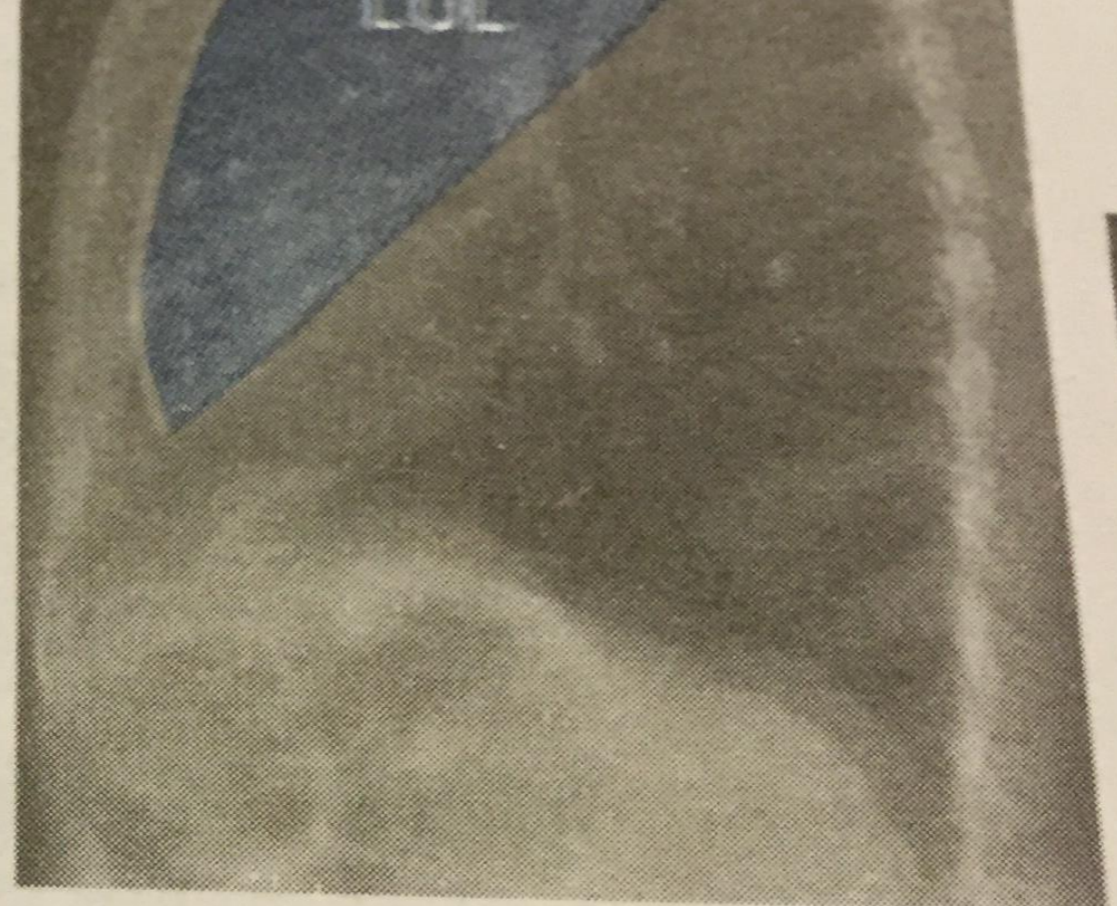
• Antibiotics are indicated only in febrile neonates (age ≤ 28 days) or if there is evidence of a coexisting bacterial infection.

Pneumonia

- Pneumonia is a condition typically associated with fever, respiratory symptoms, and evidence of parenchymal involvement, either by physical examination or the presence of infiltrates on chest radiography.







Pneumonia

- Etiology varies by community, in one study 60% were bacterial, 45% viral
- Lobar pneumonia, bronchopneumonia and interstitial pneumonia

There are five pathologic patterns of bacterial pneumonia:

• **Lobar pneumonia** – Involvement of a single lobe or segment of a lobe. This is the classic pattern of *S. pneumoniae* pneumonia. *most common cause*

• **Bronchopneumonia** – Primary involvement of airways and surrounding interstitium. This pattern is sometimes seen in *Streptococcus pyogenes* and *Staphylococcus aureus* pneumonia.

in chest X-ray the infiltrates are perihilar infiltrate And usually bacterial than viral

• **Necrotizing pneumonia** -associated with aspiration pneumonia and pneumonia resulting from *S. pneumoniae*, *S. pyogenes*, and *S. aureus*.

• **Caseating granuloma** -as in pneumonia caused by *Mycobacterium tuberculosis*

• **Interstitial and peribronchiolar** with secondary parenchymal infiltration – This pattern typically occurs when a severe viral pneumonia is complicated by bacterial pneumonia.

اللي لازم نعرفه من الجدول إنه ال *Streptococcus Pneumonia* هي ال *most common organism* اللي

يعمل pneumonia في الأطفال,

وال *mycoplasma pneumonia* بتسبب العدوى في ال 5 school age (<yo)

- There are two major pathologic patterns of viral pneumonia :
- Interstitial pneumonia .
- Parenchymal infection.

Etiology

AGE GROUP	FREQUENT PATHOGENS (IN ORDER OF FREQUENCY)
Neonates (<3 wk)	Group B streptococcus, Escherichia coli, other gram-negative bacilli, Streptococcus pneumoniae, Haemophilus influenzae (type b,* nontypable)
3 wk-3 mo	Respiratory syncytial virus, other respiratory viruses (parainfluenza viruses, influenza viruses, adenovirus), S. pneumoniae, H. influenzae (type b,* nontypable); if patient is afebrile, consider Chlamydia trachomatis
4 mo-4 yr	Respiratory syncytial virus, other respiratory viruses (parainfluenza viruses, influenza viruses, adenovirus), S. pneumoniae, H. influenzae (type b,* nontypable), Mycoplasma pneumoniae, group A streptococcus
≥5 yr	M. pneumoniae, S. pneumoniae, Chlamydia pneumoniae, H. influenzae (type b,* nontypable), influenza viruses, adenovirus, other respiratory viruses, Legionella pneumophila

Pneumonia

- Clinical features
 - Cough, fever, shortness of breath
 - Tachypnea and retractions, grunting
 - Decreases air entry or crackles over affected lobe, or may have normal breath sounds

Pneumonia

- Diagnosis
 - Diagnosis is mainly clinical
 - Increase in neutrophils
 - CBC may show elevated WBC's, left side shift.
 - Atypical lymphocytes may be seen in viral infections
 - Blood culture only in hospitalized patients
 - CRP elevated in sever disease

Pneumonia

- CXR PA and lateral *to determine the site of consolidation*
- Lobar infiltrate more likely bacterial
- Perihilar scattered infiltrates with hyperinflation and adenopathy most likely viral

Pneumonia

- Treatment
 - Oxygen
 - IV fluids if unable to do PO feeds
 - Antibiotics vary by age, severity
 - Newborns ampicillin gentamicin or cefotaxime
 - Older children, ampicillin or ampicillin clavulanic acid, in sever cases third generation cephalosporins
 - If older than 5 and mycoplasma suspected macrolides can be used
 - If patient is toxic looking add vancomycin

Pneumonia

- Influenza pneumonia
 - Zanamivir (neuraminidase inhibitors)
 - Second line is oseltamivir plus rimantidine

Pneumonia

- Complication
 - Necrosis
 - Abscess formation
 - Pneumatocele
 - Effusions parapneumonic
 - Empyema
 - Sepsis and toxic shock syndrome

Pertussis

Caused by *Bordetella pertussis* (fastidious gram-negative coccobacillus).

Other *Bordetella* species, including *Bordetella parapertussis*, can cause a clinical syndrome similar to whooping cough but are generally less severe.

- The classic presentation of pertussis includes paroxysms of coughing, an inspiratory whoop, and posttussive vomiting.

- Pertussis is divided into three stages:

- **Catarrhal stage** – Similar to a viral upper respiratory infection with mild cough and coryza. Fever is uncommon; if present, it is usually low grade . The catarrhal stage generally lasts one to two weeks .

- **Paroxysmal stage** – During the paroxysmal stage, coughing spells increase in severity. The paroxysmal cough is distinctive: a long series of coughs between which there is little or no inspiratory effort . The child may gag, develop cyanosis, and appear to be struggling for breath . May last for two to eight weeks

- **Convalescent stage** – During the convalescent stage, the cough subsides over several weeks to months.

- 3 stages
 - Catarrhal (URI like symptoms)
 - Paroxysmal (paroxysms of intense cough)
 - Convalescent (chronic cough)

Pertussis

- Diagnosis
 - PCR nasopharyngeal swab
 - Culture of nasopharyngeal swab
 - CDC recommends both test for cough >3 weeks
 - leukocytosis resulting from lymphocytosis, although the WBC count may be normal . The absolute lymphocyte count is often $\geq 10,000$ lymphocytes/microL.
 - PCR and culture can be negative after the first few weeks of symptoms

Pertussis

- Prevention
 - DTaP at 2,4,6 and 15-18 month and at 4-6 years of age
 - Tdap recommended for children 7-10y as a single dose at 11-18 year, and for adults and pregnant women

Pertussis

Complications

- Pneumonia 13% from B pertussis or secondary infection
- Hypoxic encephalopathy 1%
- Otitis media
- Hernia
- Seizures
- Cerebral hemorrhage

Pertussis

- Management
 - Antibiotics to hasten irradiation of organism and prevent spread
 - Erythromycin, clarithromycin, azithromycin
macrolides