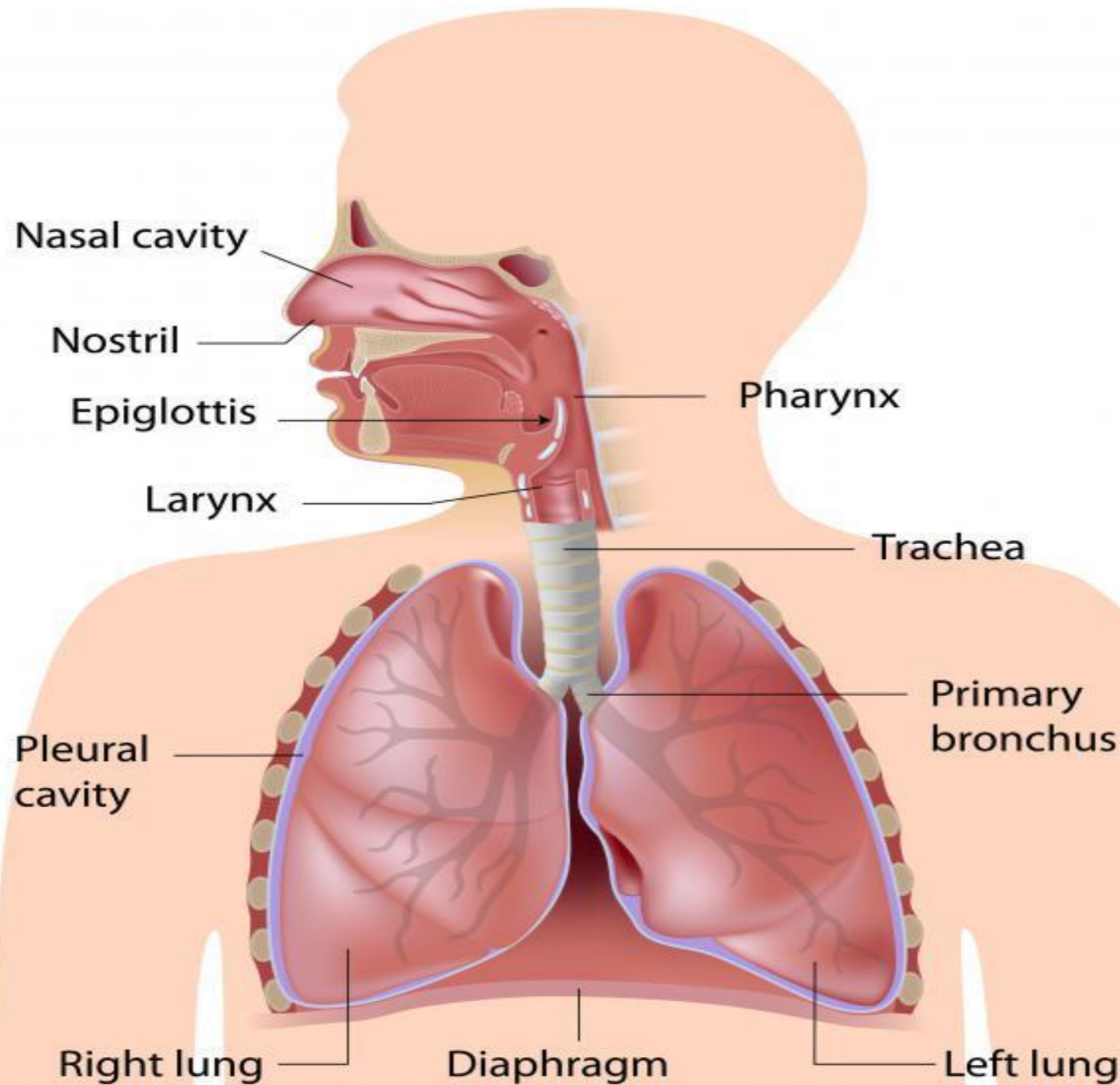


Respiratory Tract Infections in Pediatrics

Sara Alremawi, MD

The Respiratory System



Common cold (Coryza)

- The common cold is usually a mild and self-limiting viral illness.
- Symptoms : Nasal discharge, cough and fever .
- Aetiology: Rhinovirus, corona virus, RSV
- 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

- 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.

Pharyngitis

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

Tonsillitis

- A form of pharyngitis, with involvement of the tonsils.
- Common pathogens are group A beta hemolytic streptococcus (streptococcus pyogenes)
- Viruses like Ebstein 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.

Streptococcal Pharyngitis

- 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.
- Diagnosed with Rapid Antigen Detection Test, and throat culture, sensitivity 63-96, specificity 90-100%

Strep Throat (*Streptococcal Pharyngitis*)

Mclsaac Criteria

Centor Criteria

Add 1 point for each:

1. Fever (subjective or >38 C)
2. \emptyset cough
3. Tender lymphadenopathy (anterior cervical)
4. Tonsillar exudate

5. Age

3-14 yrs: Add 1 point

15-44 yrs: \emptyset

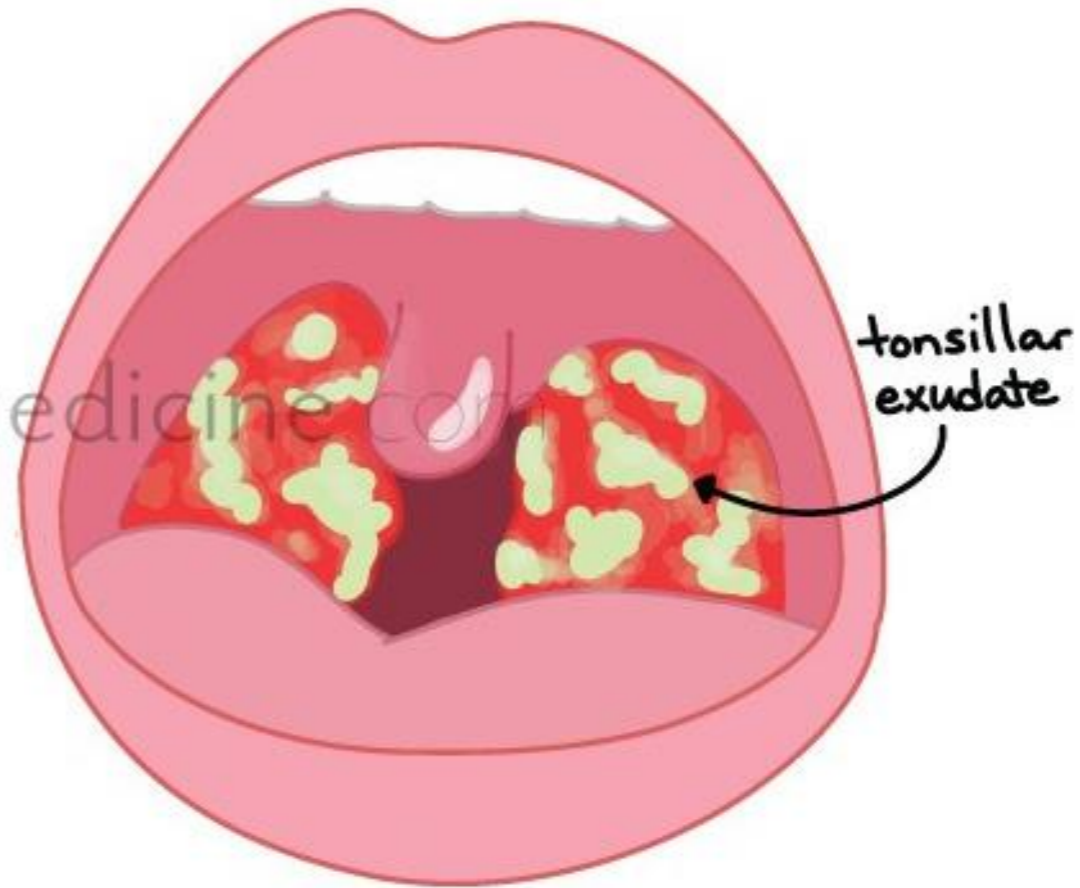
45+ yrs: Subtract 1 point

Total score

0-1 Unlikely strep pharyngitis

2+ Throat swab & culture or rapid antigen test

4+ Lab confirmation +/- empiric antibiotics





Tonsillar exudate



Palatal petichiae



Sand paper rash (small red bumps)

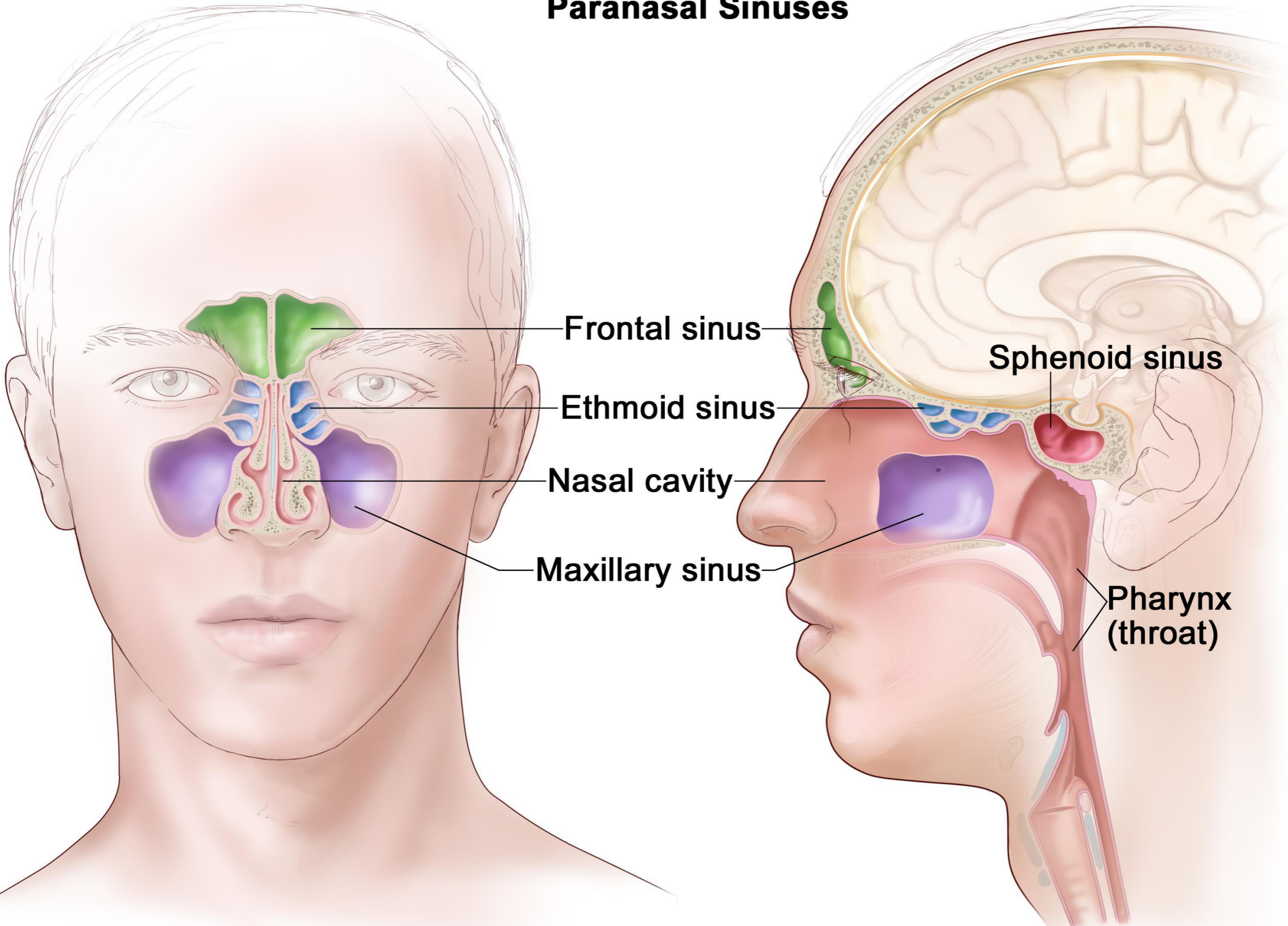
Streptococcal Pharyngitis

- Complications of strep throat:
- Rheumatic fever
- Post streptococcal glomerulonephritis
- Airway obstruction
- 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

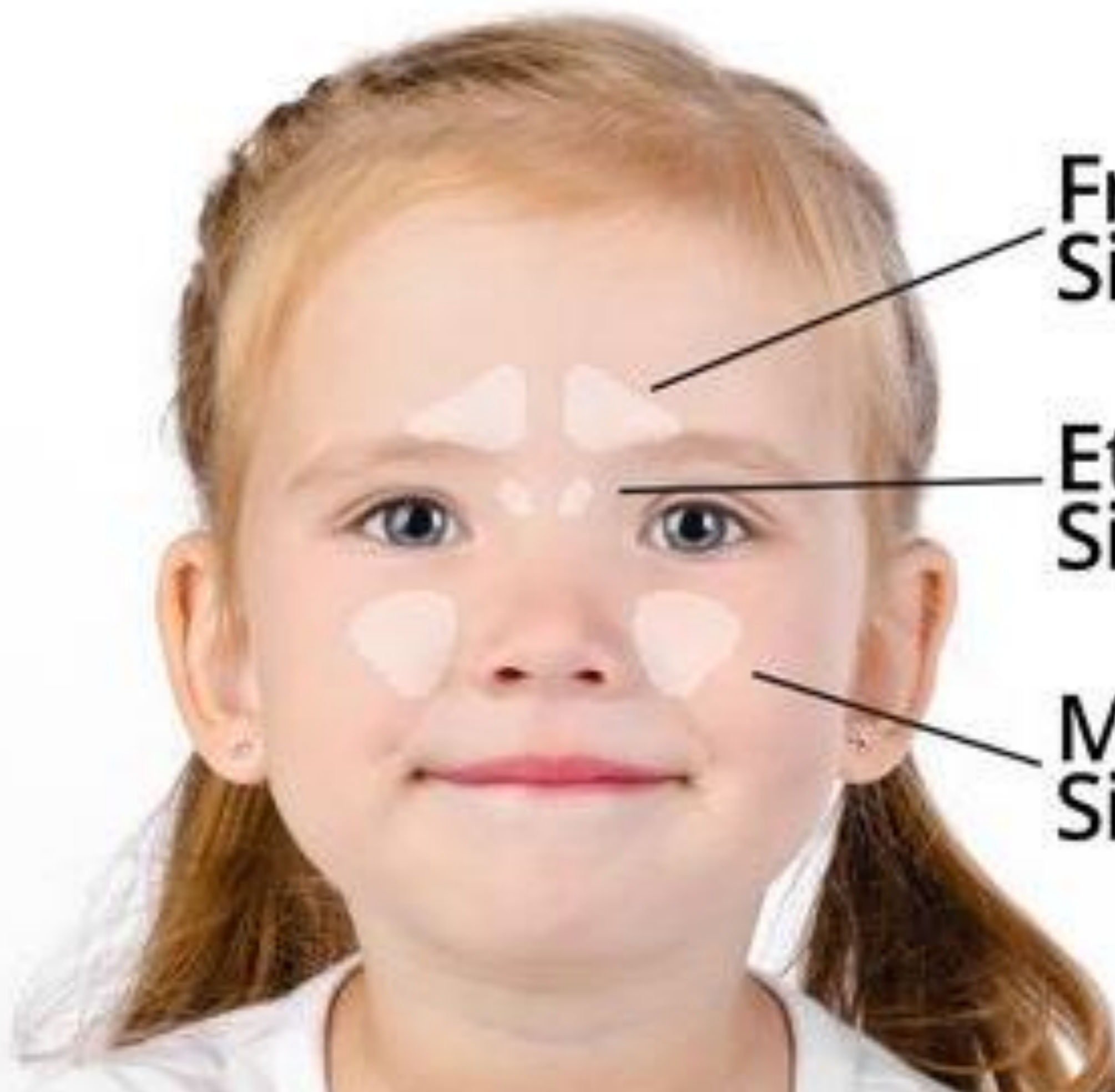
Ethmoid sinus

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

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

• **Diagnosis**

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

• -Symptoms present **without improvement** for >10 or

• -Severe symptoms (ie, ill appearance, temperature $\geq 39^{\circ}\text{C}$, and purulent nasal discharge for ≥ 3 consecutive days), or

• -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.

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

Croup

- Laryngotracheobronchitis

- Croup is a respiratory illness characterized by inspiratory stridor, barking cough, and hoarseness. These symptoms result from inflammation in the larynx and subglottic airway.

- 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

Croup

- age 6m-3 years most common, can happen up to 6 years

- 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")

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

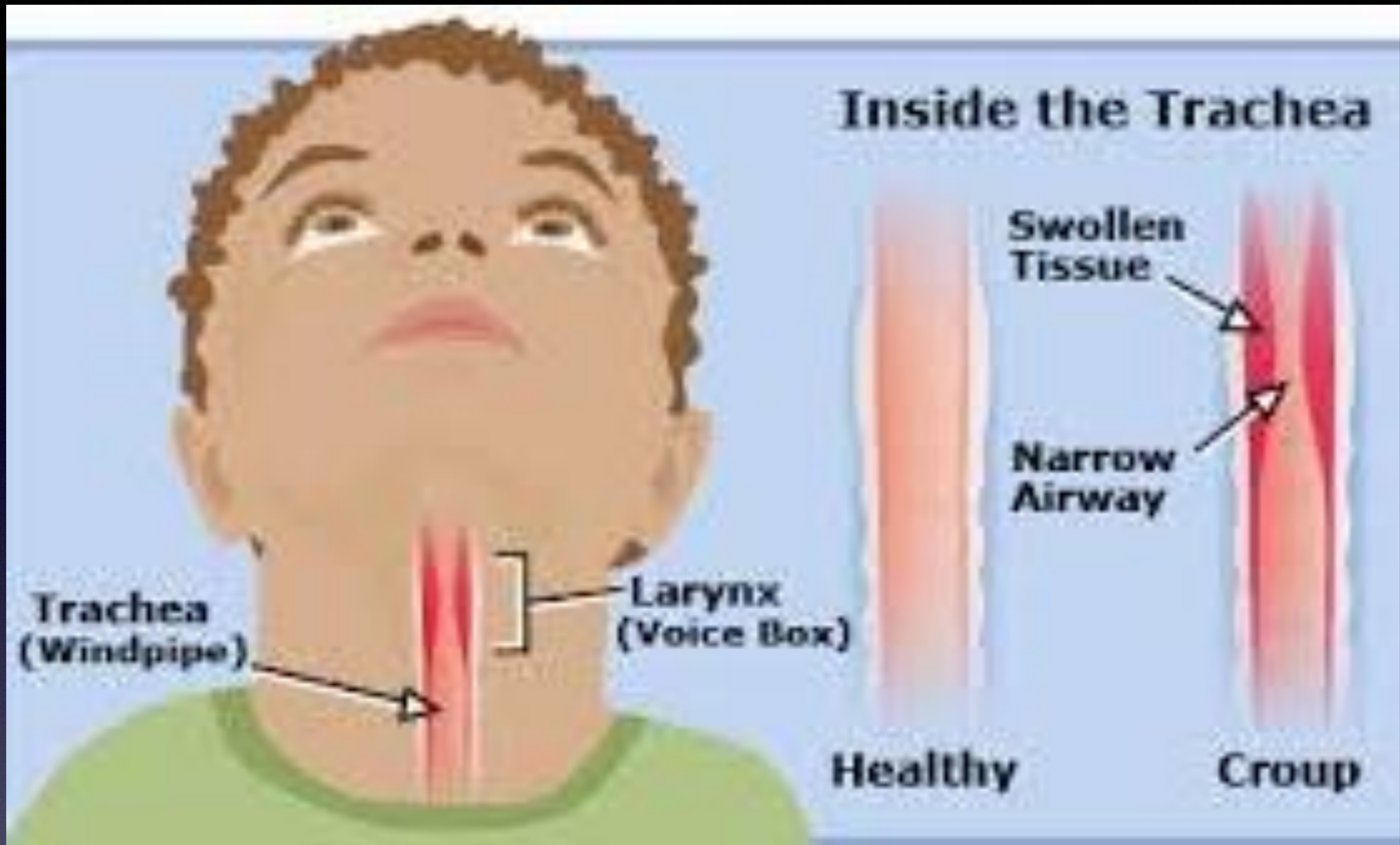
Croup

- 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 influenza, now streptococcus and other species.
- Most common age 2-6years
- Sudden onset of symptoms, high fever, anxious
- Patient toxic looking, drooling, tripod position, leaning forward
- Do not examine. if severe obstruction send to OR for intubation
- Incidence decreases significantly after Hib vaccination
- IV antibiotics after airway has been secured

Treatment

- Antibiotics, according to organism



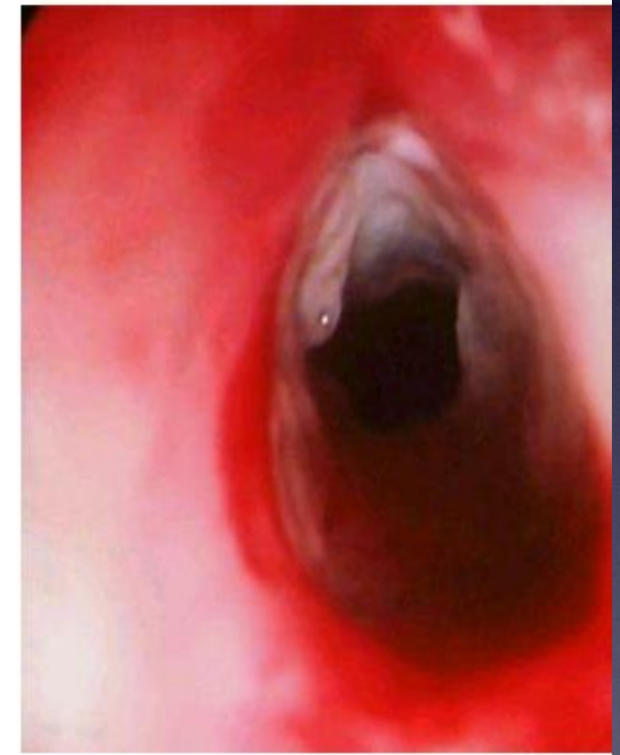
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Tracheitis

- 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



Bronchiolitis

- Bronchiolitis is a clinical syndrome of respiratory distress that occurs in children <2 years of age.
- It is characterized by initial upper respiratory symptoms (eg, rhinorrhea) followed by lower respiratory tract signs (eg, wheezing and/or crackles).
- Bronchiolitis is caused by viruses, most commonly respiratory syncytial virus (RSV).

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)
 - Chest exam : wheezes and crackles, retractions
- Infection has a seasonal pattern, depending on the patient's location.

Bronchitis

- 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

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 : 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.

- **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.

- 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) .

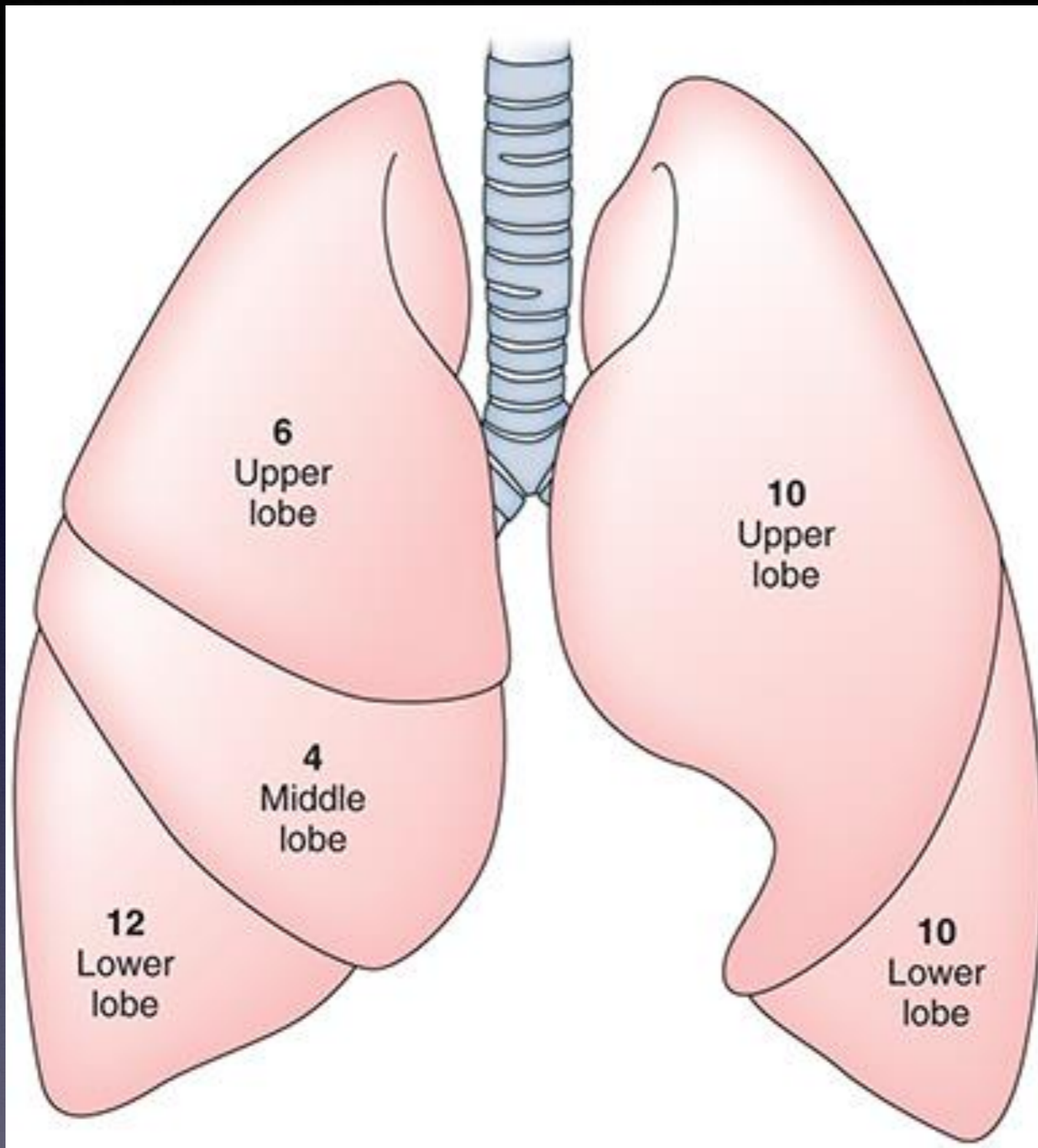
- Nebulized hypertonic saline not routinely recommended

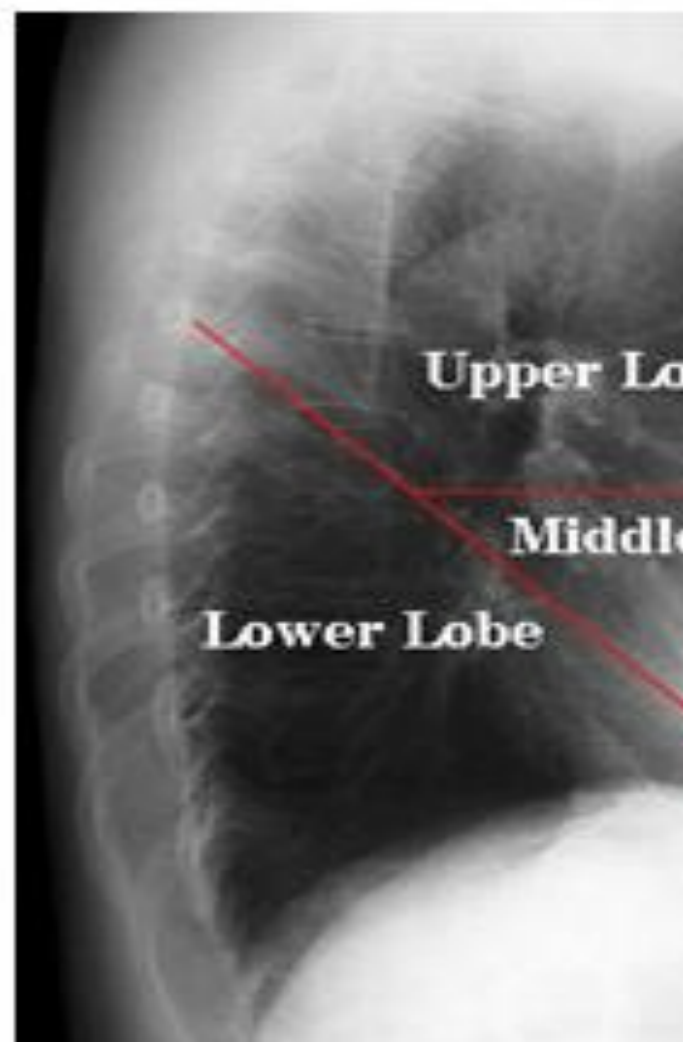
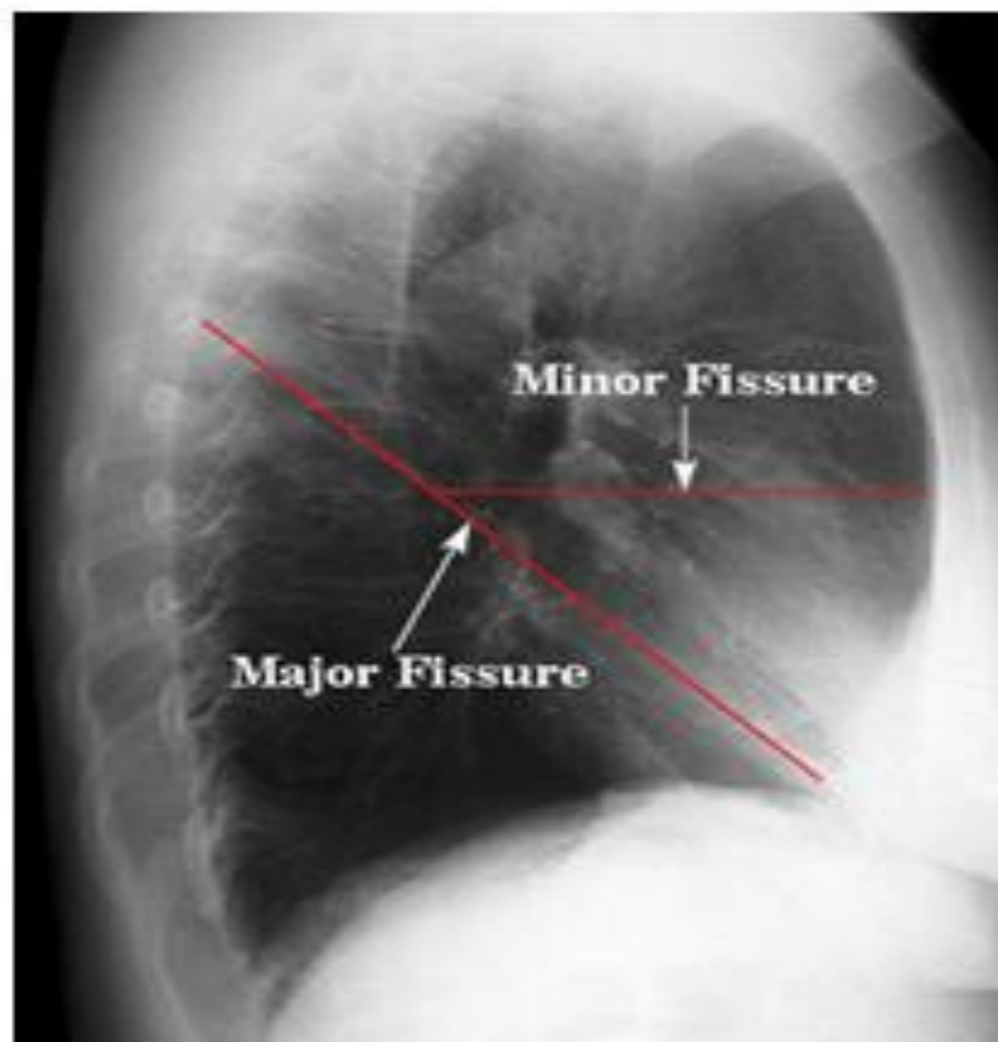
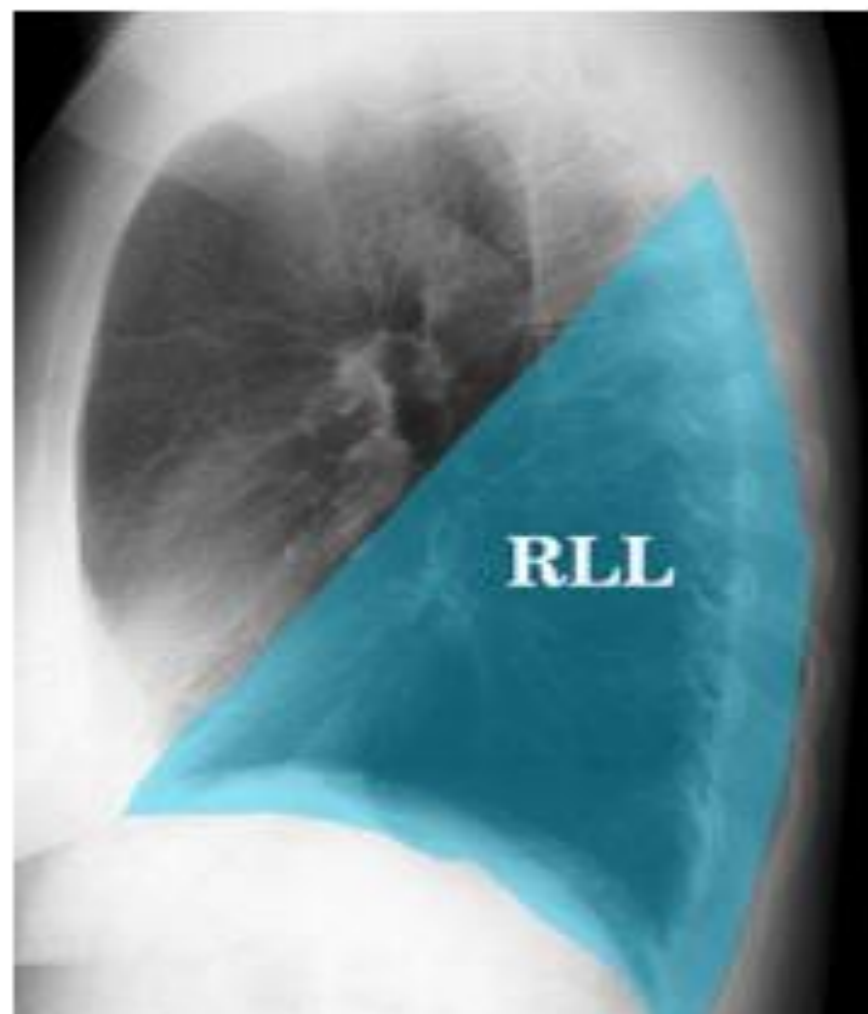
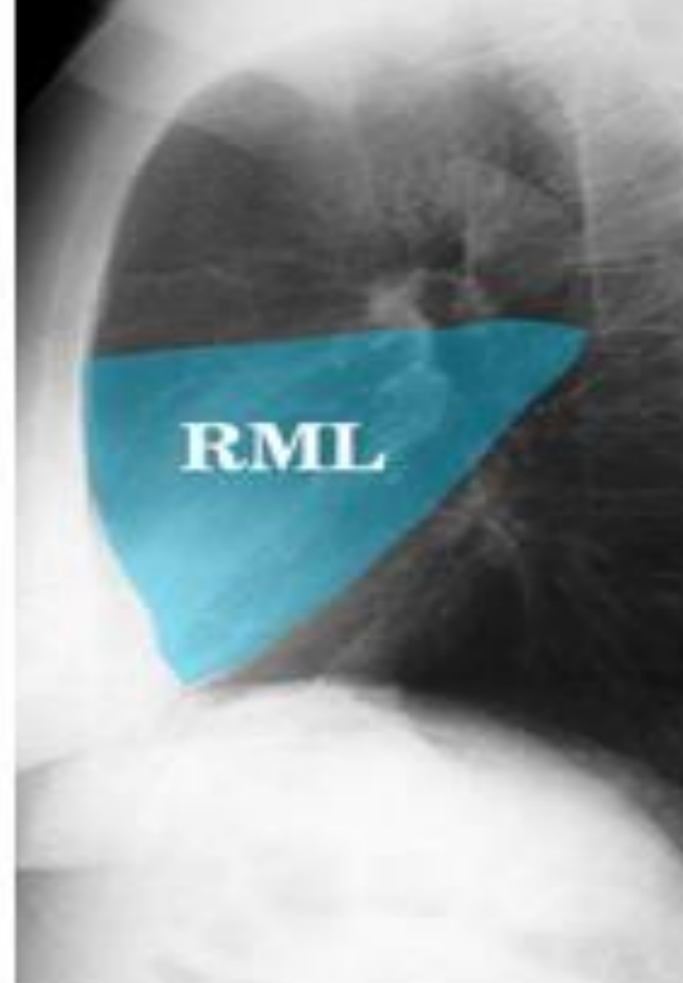
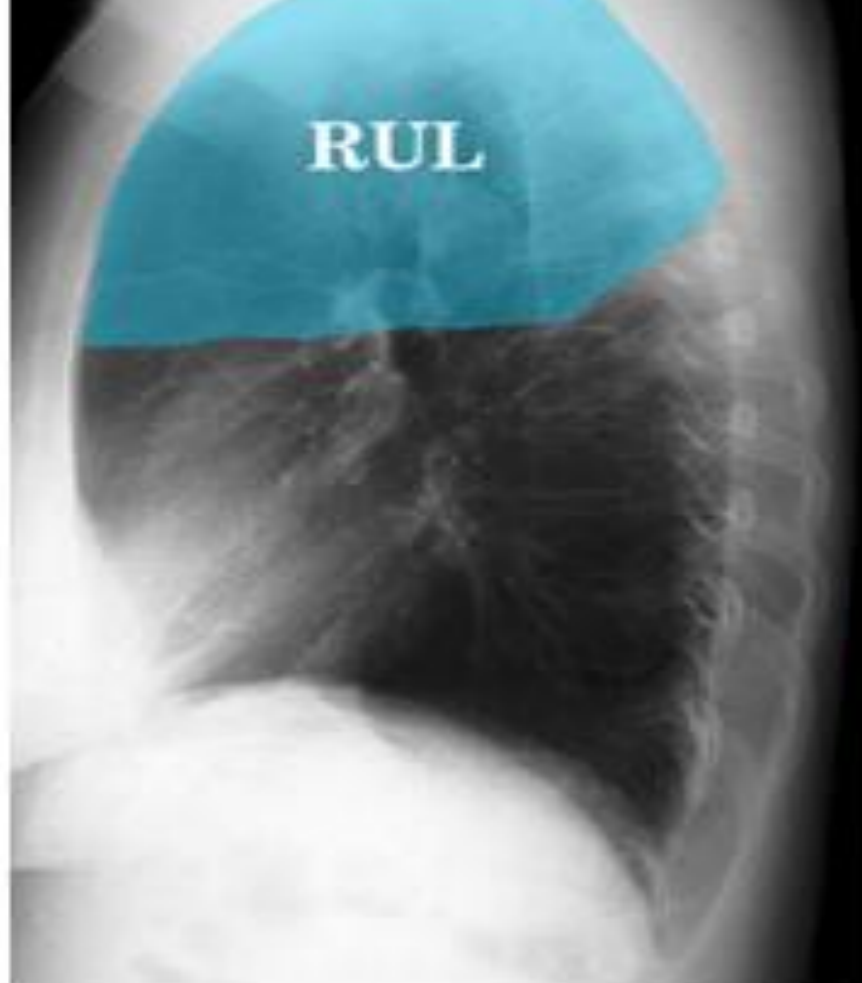
- Steroids are not recommended in previously healthy children

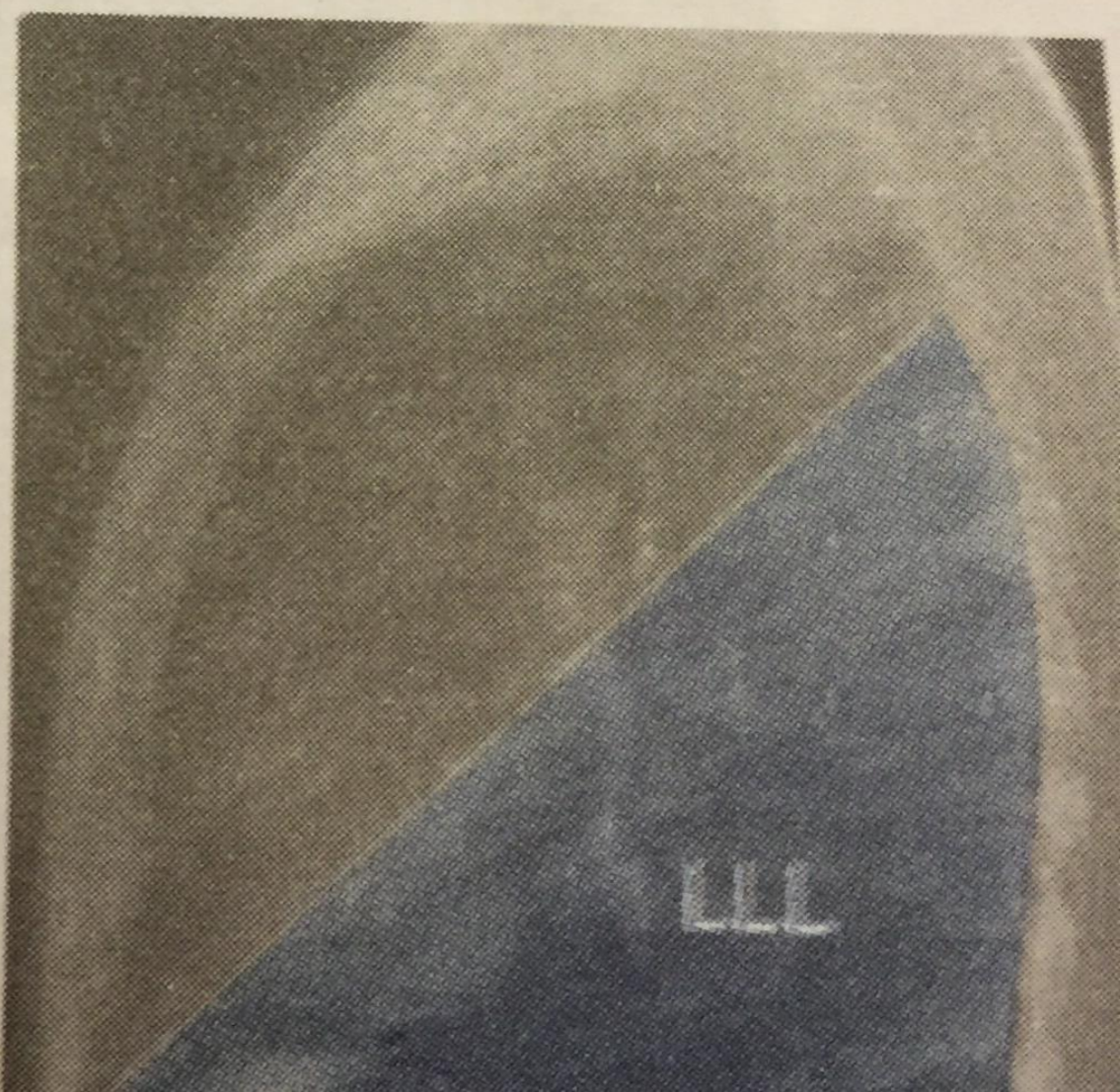
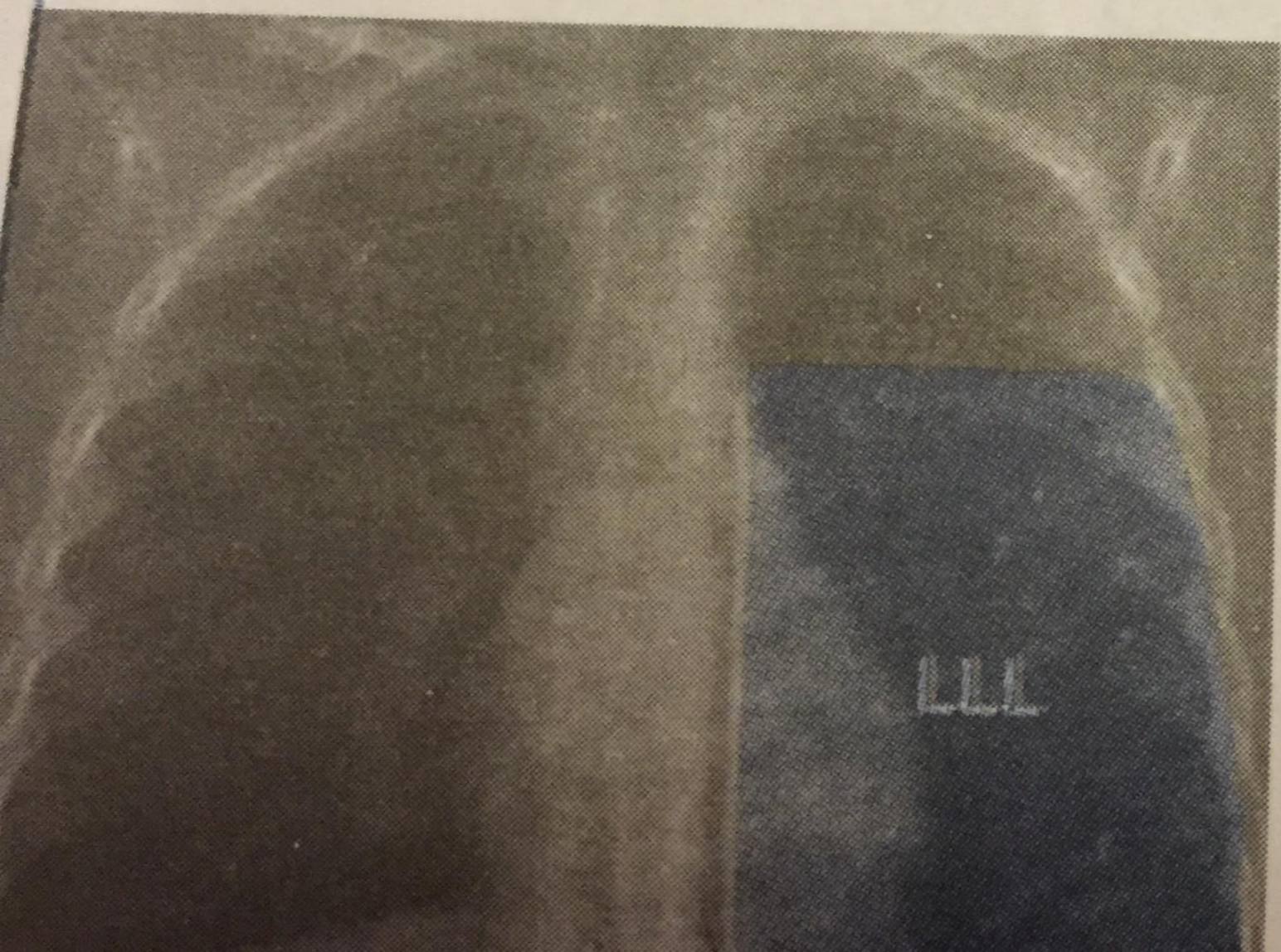
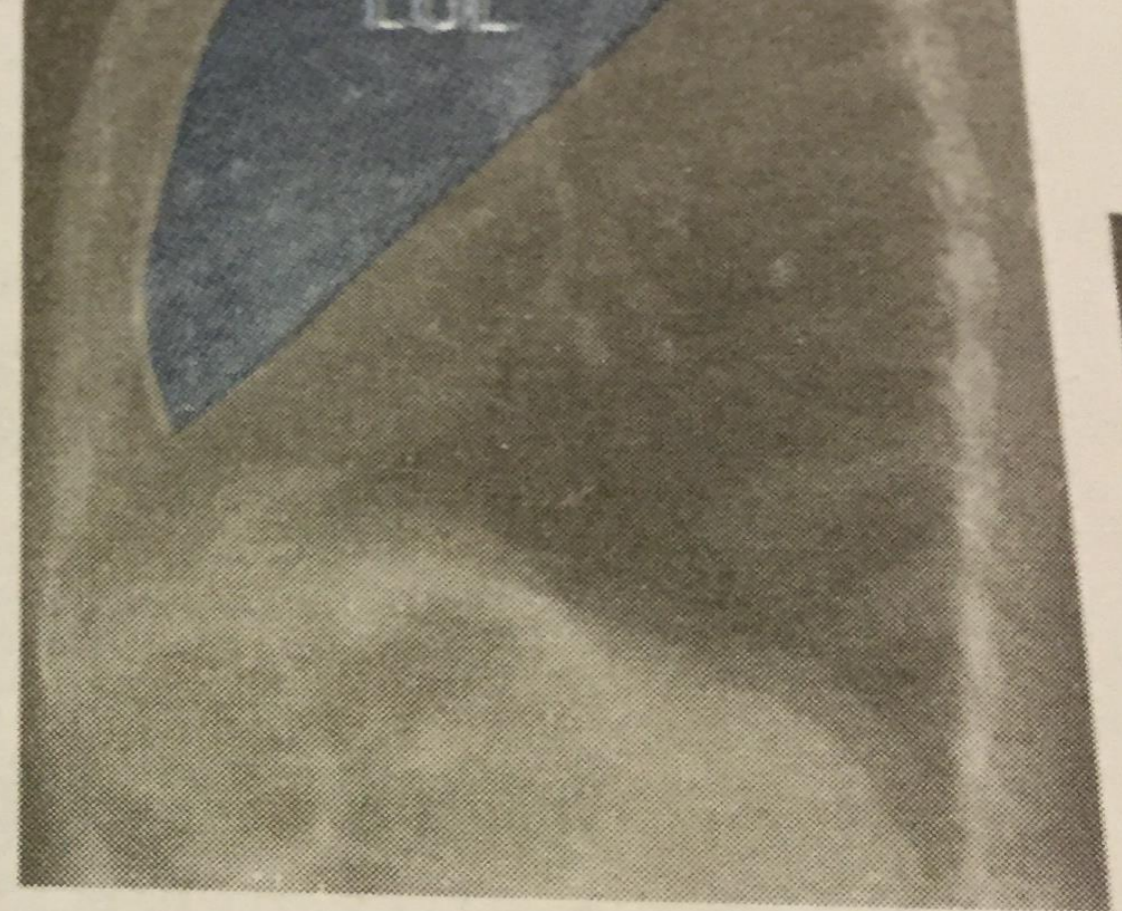
- Antibiotics are indicated only in febrile neonates (age ≤ 28 days) or if there is evidence of a coexisting bacterial infection.

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

- 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
 - 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 severe disease

Pneumonia

- CXR PA and lateral
- 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