

COMMUNITY ACQUIRED PNEUMONIA

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World
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Subjects 2023

Epidemiology

- Pneumonia, defined as inflammation of the lung parenchyma,
- is the leading infectious cause of death globally among children younger than 5 yr



Etiology

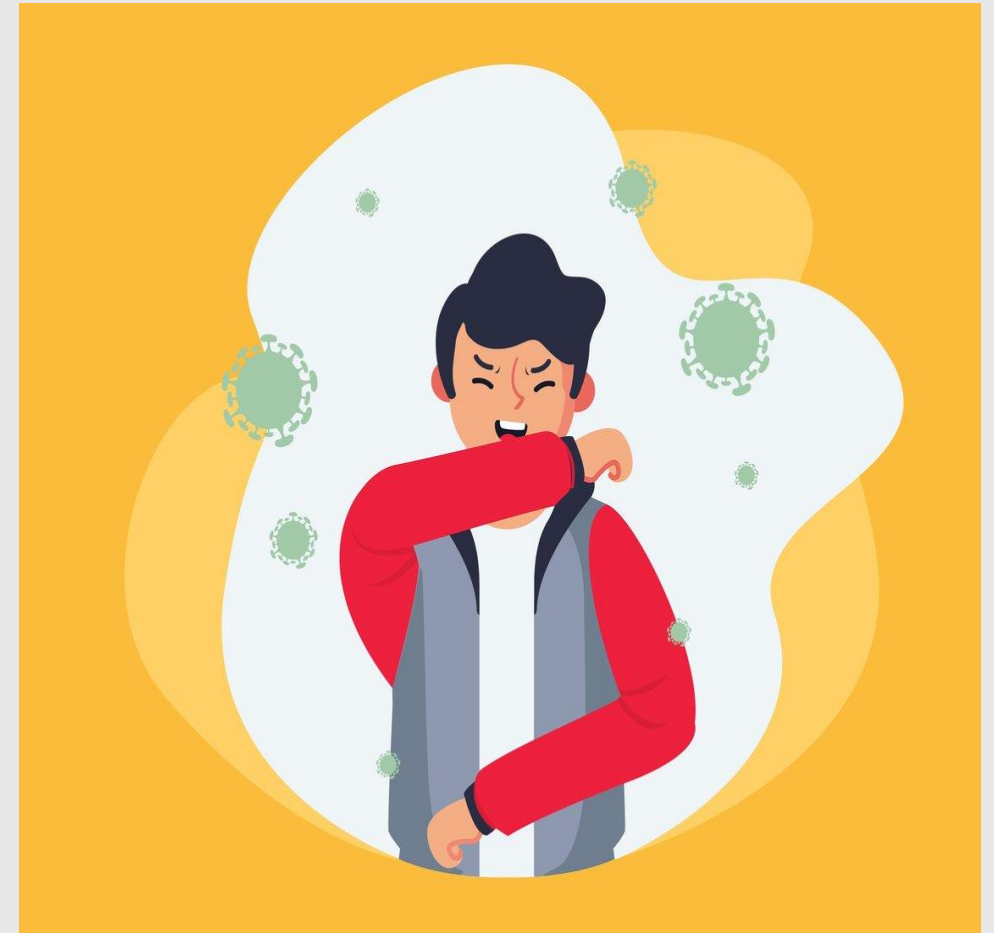
- Microorganisms
- noninfectious causes include aspiration (of food or gastric acid, foreign bodies, hydrocarbons, and lipoid substances)
- hypersensitivity reactions
- drug- or radiationinduced pneumonitis



- *Streptococcus pneumoniae* (pneumococcus) : in children 3 wk to 4 yr of Age
- *Mycoplasma pneumoniae* and *Chlamydia pneumoniae* : in children age 5 yr and older
- group A streptococcus
- *S. aureus* pneumonia often complicates an illness caused by influenza viruses
- Atypical pneumonia syndrome may have extrapulmonary manifestations, low-grade fever, patchy diffuse infiltrates, and poor response to β -lactam antibiotics

- *S. pneumoniae*, *H. influenzae*, and *S. aureus* are the major causes of hospitalization and death from bacterial pneumonia among children in developing countries
- in children with HIV infection : *Mycobacterium tuberculosis* , non-tuberculous mycobacteria , *Salmonella* , *Escherichia coli* , *Pneumocystis jirovecii* , and cytomegalovirus must be considered.
- The incidence of pneumonia caused by *H. influenzae* or *S. pneumoniae* has been significantly reduced in areas where routine immunization has been implemented.

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



- **Bacterial pneumonia** most often occurs when respiratory tract organisms colonize the trachea and subsequently gain access to the lungs, but pneumonia may also result from direct seeding of lung tissue after bacteremia
- When bacterial infection is established in the lung parenchyma, the pathologic process varies according to the invading organism
- *S. aureus* pneumonia manifests as confluent bronchopneumonia, which is often unilateral and characterized by the presence of extensive areas of hemorrhagic necrosis and irregular areas of cavitation of the lung parenchyma, resulting in pneumatoceles, empyema, and, at times, bronchopulmonary fistulas
- *S. pneumonia* produces local edema that aids in the proliferation of organisms and their spread into adjacent portions of lung, often resulting in the characteristic focal lobar involvement

- Viral pathogens are the most common causes of lower respiratory tract infections in infants and children older than 1 mo but younger than 5 yr of age
- respiratory syncytial virus RSV and rhinoviruses are the most commonly identified pathogens, especially in children younger than 2 yr of age
- Other common viruses causing pneumonia include influenza viruses, human metapneumovirus parainfluenza viruses adenoviruses and enteroviruses parainfluenza virus infections appear and most often manifest as croup.
- RSV, human metapneumovirus, and influenza viruses cause widespread infection, including upper respiratory tract infections, bronchiolitis, and pneumonia
- Knowledge of the prevailing viruses circulating in the community may lead to a presumptive initial diagnosis

- **Viral pneumonia** usually results from spread of infection along the airways and direct injury of the respiratory epithelium, which results in airway obstruction
- Atelectasis, interstitial edema, and hypoxemia from ventilation–perfusion mismatch often accompany airway obstruction
- Viral infection of the respiratory tract can also predispose to secondary bacterial infection by disturbing normal host defense mechanisms, altering secretions, and through disruptions in the respiratory microbiota



- **Recurrent pneumonia** : *2 or more* episodes in a single year *or 3 or more* episodes ever, with radiographic clearing between occurrences
- An underlying disorder should be considered if a child experiences recurrent pneumonia
- **HEREDITARY DISORDERS**
- **DISORDERS OF IMMUNITY**
- **DISORDERS OF CILIA**
- **ANATOMIC DISORDERS**



Clinical Manifestations

- Pneumonia is frequently preceded by several days of symptoms of an upper respiratory tract infection, typically rhinitis and cough
- Tachypnea is the most consistent
- Increased work of breathing accompanied by intercostal, subcostal, and suprasternal retractions, nasal flaring, and use of accessory muscles is common.
- Severe infection may be accompanied by cyanosis and lethargy, especially in infants
- Auscultation of the chest may reveal crackles and wheezing
- It is often not possible to distinguish viral pneumonia (especially adenovirus)



Diagnosis

- An infiltrate on chest radiograph (posteroanterior and lateral views) supports the diagnosis of pneumonia
- identify a complication such as a pleural effusion or empyema
- Viral pneumonia is usually characterized by hyperinflation with bilateral interstitial infiltrates and peribronchial cuffing
- Confluent lobar consolidation is typically seen with pneumococcal pneumonia
- Repeat chest radiographs are not required for proof of cure for patients with uncomplicated pneumonia



- The peripheral white blood cell (WBC) count can be useful in differentiating viral from bacterial pneumonia
- In viral pneumonia, the WBC count can be normal or elevated but is usually not higher than 20,000/mm³, with a lymphocyte predominance.
- Bacterial pneumonia is often associated with an elevated WBC count, in the range of 15,000-40,000/mm³, and a predominance of polymorphonuclear leukocytes
- large pleural effusion, lobar consolidation, and a high fever at the onset of the illness are also suggestive of a bacterial Etiology
- Atypical pneumonia caused by *C. pneumoniae* or *M. pneumoniae* is difficult to distinguish from pneumococcal pneumonia on the basis of radiographic and laboratory findings
- pneumococcal pneumonia is associated with a higher WBC count, erythrocyte sedimentation rate, procalcitonin, and C-reactive protein level, there is considerable overlap



- The definitive diagnosis of a typical bacterial infection requires isolation of an organism from the blood, pleural fluid, or lung
- Culture of sputum is of little value in the diagnosis of pneumonia in young children
- Blood cultures are recommended for children who fail to improve or have clinical deterioration, have complicated pneumonia and hospitalization

Factors Suggesting Need for Hospitalization

- Age <6 mo
- Immunocompromised state
- Toxic appearance
- Moderate to severe respiratory distress
- Hypoxemia (oxygen saturation <90% breathing room air, sea level)
- Complicated pneumonia
- Sickle cell anemia with acute chest syndrome
- Vomiting or inability to tolerate oral fluids or medications
- Severe dehydration
- No response to appropriate oral antibiotic therapy
- Social factors (e.g., inability of caregivers to administer medications at home or follow-up appropriately)



Treatment

- Treatment of suspected bacterial pneumonia is based on the presumptive cause and the age and clinical appearance of the child
- mildly ill children who do not require hospitalization, amoxicillin is recommended
- With the emergence of penicillin-resistant pneumococci, high doses of amoxicillin (90 mg/kg/day orally divided twice daily) should be prescribed
- Therapeutic alternatives : cefuroxime and amoxicillin/clavulanate.
- For schoolaged children and adolescents : *M. pneumoniae* or *C. pneumoniae* : a macrolide antibiotic
- Azithromycin is generally preferred
- clarithromycin or doxycycline (for children 8 yr or older) are alternatives
- For adolescents, a respiratory fluoroquinolone (levofloxacin, moxifloxacin) may also be considered as an alternative if there are contraindications to other agents



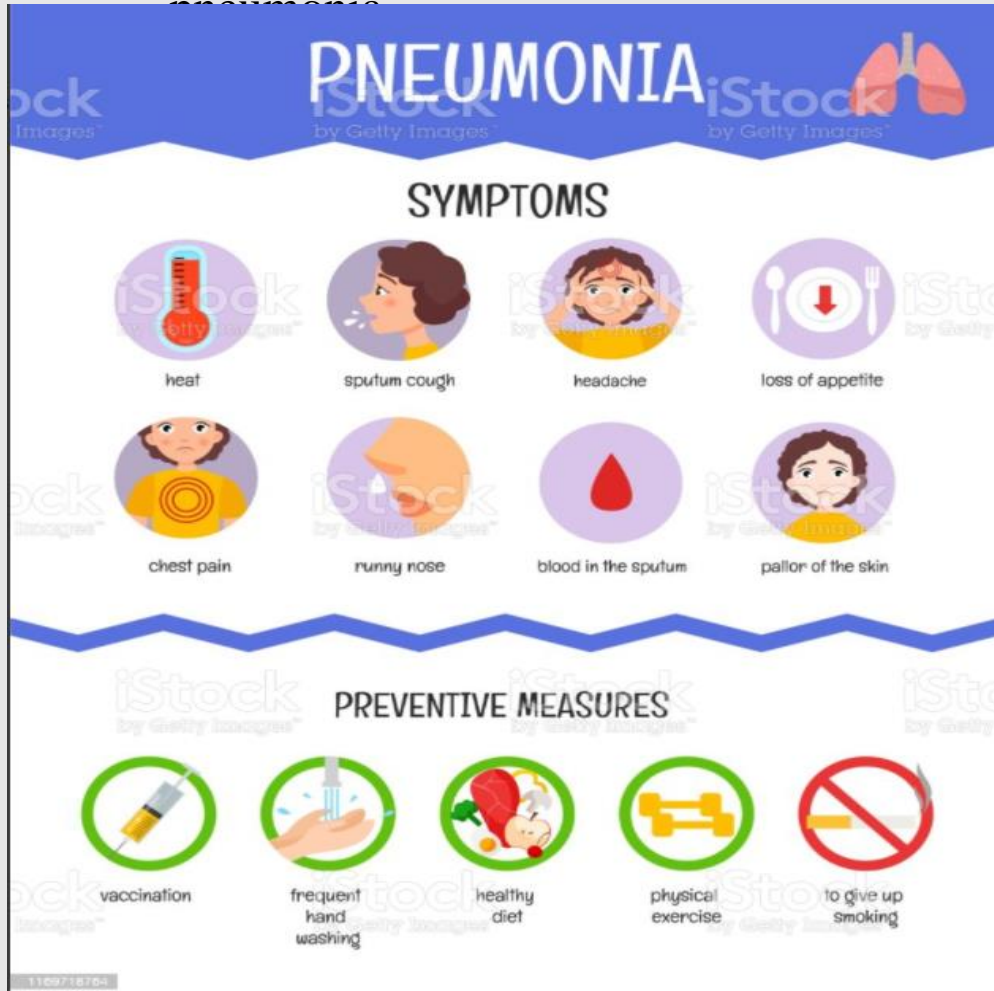
- The empiric treatment of suspected bacterial pneumonia in a hospitalized child requires an approach based on local epidemiology
- without substantial high-level penicillin resistance among *S. pneumoniae*, children who are fully immunized against *H.influenzae* type b and *S. pneumoniae* and are not severely ill : **ampicillin or penicillin G**.
- For children who do not meet these criteria, **ceftriaxone or cefotaxime**
- clinical features suggest staphylococcal pneumonia (pneumatoceles, empyema): initial antimicrobial therapy should also include **vancomycin or clindamycin**
- infection with *M. pneumoniae* or *C. pneumoniae* : a **macrolide antibiotic** should be included in the treatment regimen



- Hospitalized children should receive supportive care and may require
- intravenous fluids
- respiratory support : supplemental oxygen, continuous positive airway pressure (CPAP), or mechanical ventilation
- vasoactive medications for hypotension or sepsis physiology
- antibiotics should generally be continued until the patient has been afebrile for 72 hr, and the total duration should not be less than 10 days (or 5 days if azithromycin is used).
- Shorter courses (5-7 days) may also be effective

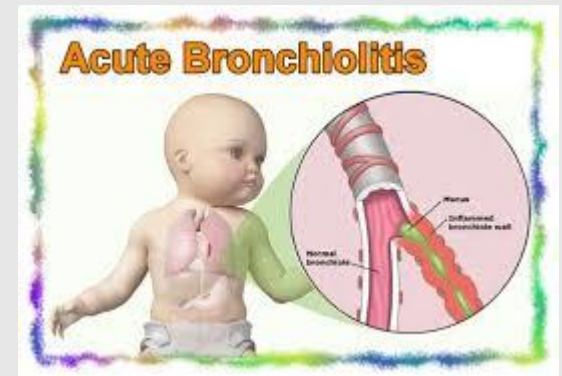


- oral zinc (10 mg/day for < 12 mo, 20 mg/day for ≥ 12 mo given for 7 days)
- may reduce mortality among children in developing countries with clinically defined severe pneumonia

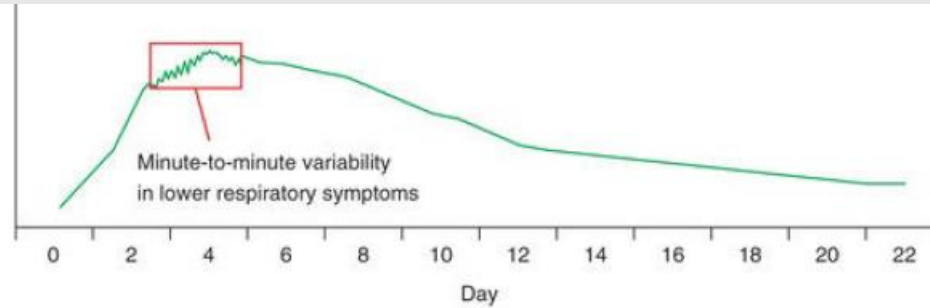


Acute bronchiolitis

- produced by several different viral lower respiratory tract infections in infants and very young children.
- tachypnea, wheezing, crackles, and rhonchi result from inflammation of the small airways
- age of 2 yr or beyond
- Hypoxemia is a consequence of
- ventilation-perfusion mismatch. With severe obstructive disease hypercapnia can develop
- RSV is responsible for more than 50% of cases
- more common in males, those exposed to second-hand tobacco smoke, those who have not been breastfed, and those living in crowded conditions, infants with mothers who smoked during pregnancy



Severity of bronchiolitis signs and symptoms



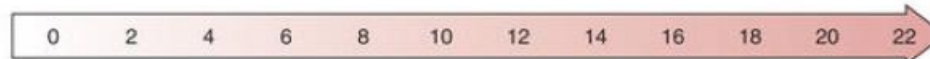
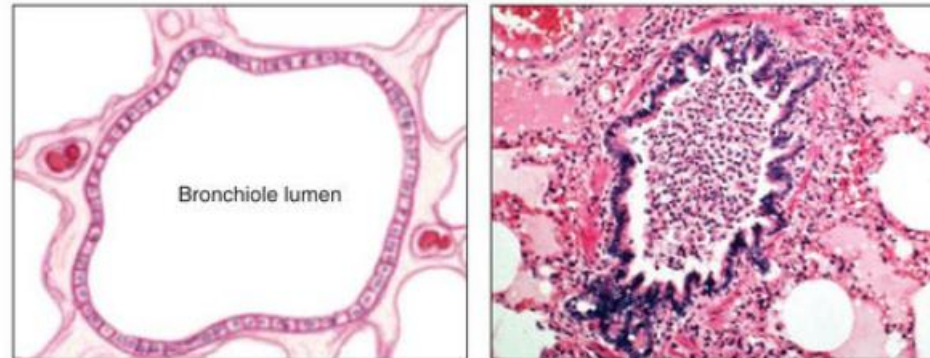
Signs or symptoms

- Rhinorrhoea
- With or without fever
- Persistent cough
- Increased work of breathing:
 - Scalene retractions
 - Abdominal muscles
- Rales or wheeze, or both
- Impaired feeding
- Gradual resolution of symptoms with continued variability
- New fever late in course might suggest new co-infection (eg, otitis media, pneumonia, or new virus)

Pathophysiology

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| <p>Upper respiratory:</p> <ul style="list-style-type: none"> • Virus infects epithelial cells that are sloughed to lower respiratory tract <p>Lower respiratory:</p> <ul style="list-style-type: none"> • Normal | <p>Lower respiratory:</p> <ul style="list-style-type: none"> • Further epithelial infection with oedema, sloughing of cells into airway, mucus production, and oedema with associated obstruction and air trapping • Ciliary function is impaired • Polymorphonuclear cells and lymphocytes proliferate in an inflammatory response | <p>Upper and lower respiratory:</p> <ul style="list-style-type: none"> • Regeneration of epithelium |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|

Lower airway anatomy



History and Physical Examination

- onset, duration, and associated factors
- Birth history
- Past medical history includes any comorbid conditions
- Family history of cystic fibrosis, immunodeficiencies, asthma in a first-degree relative
- . Social history should include any second-hand tobacco or other smoke exposure, daycare exposure, number of siblings, pets, and concerns regarding home,environment (e.g., dust mites, construction dust, heating and cooling techniques, mold, cockroaches)
- The patient's growth chart for signs of failure to thrive

INFECTION

Viral

Respiratory syncytial virus

Human metapneumovirus

Parainfluenza

Adenovirus

Influenza

Rhinovirus

Bocavirus

Coronavirus

Enterovirus

Other

Chlamydia trachomatis

Tuberculosis

Histoplasmosis

Papillomatosis

ASTHMA

ANATOMIC ABNORMALITIES

Central Airway Abnormalities

Malacia of the larynx, trachea, and/or bronchi

Laryngeal or tracheal web

Tracheoesophageal fistula (specifically H-type fistula)

Laryngeal cleft (resulting in aspiration)

Extrinsic Airway Anomalies Resulting in Airway Compression

Vascular ring or sling

Mediastinal lymphadenopathy from infection or tumor

Mediastinal mass or tumor

Esophageal foreign body

Intrinsic Airway Anomalies

Airway hemangioma, other tumor

Congenital pulmonary airway malformation (cystic adenomatoid malformation)

Bronchial or lung cyst

Congenital lobar emphysema

Aberrant tracheal bronchus

Sequestration

Congenital heart disease with left-to-right shunt (increased pulmonary edema)

Foreign body

Immunodeficiency States

Immunoglobulin A deficiency

B-cell deficiencies

AIDS

Bronchiectasis

MUCOCILIARY CLEARANCE DISORDERS

Cystic fibrosis

Primary ciliary dyskinesia

Bronchiectasis

ASPIRATION SYNDROMES

Gastroesophageal reflux disease

Pharyngeal/swallow dysfunction

OTHER

Bronchopulmonary dysplasia

Eosinophilic granulomatosis with polyangiitis

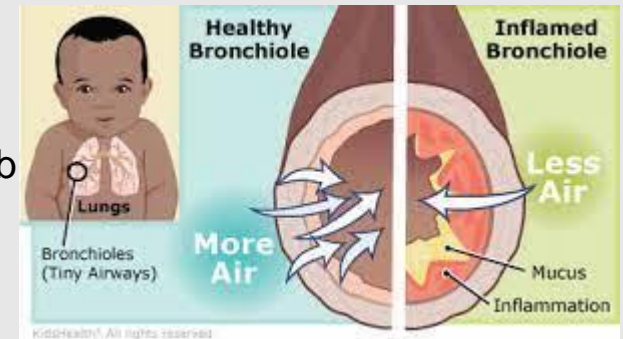
Interstitial lung disease, including bronchiolitis obliterans

Heart failure

Anaphylaxis

Inhalation injury—burns

- First signs of upper respiratory tract infection with sneezing and clear rhinorrhea.
- diminished appetite and fever.
- Gradually, respiratory distress ensues, with paroxysmal cough, dyspnea, and irritability
- tachypneic, which can interfere with feeding.
- Apnea may precede lower respiratory signs early in the disease
- evaluation of the patient's vital signs
- the respiratory rate and oxygen saturation is an important initial step.
- Physical exam :wheezing and crackles. Expiratory time may be prolonged. with nasal flaring and retractions



Diagnostic Evaluation

- diagnosis of **acute bronchiolitis** is clinical
- Chest radiography is not routinely indicated in children with suspected bronchiolitis
- Laboratory testing is also not routinely indicated; the white blood cell and differential counts are usually normal and are not predictive of bacterial superinfection
- Otitis media may complicate bronchiolitis.
- does not clinically fit with the diagnosis of bronchiolitis:
 1. those without other signs of viral infection
 2. with very severe presentation
 3. complicated clinical course
- . Children with recurrent or refractory episodes of wheezing in infancy, particularly if associated with failure to thrive, may require evaluation for chronic disorders such as **cystic fibrosis or immunodeficiency**

treatment

- respiratory distress (hypoxia, inability to feed, apnea, extreme tachypnea) should be hospitalized
- Hypoxemic children should receive supplemental oxygen, threshold of 90%
- Fluid can be administered intravenously or enterally via nasogastric tube
- suctioning of nasal and oral ,should be limited to the nares or oropharynx
- Pharmacologic agents have largely proven *ineffective* in the management of bronchiolitis

- Infants with **acute bronchiolitis** are at highest risk for further respiratory compromise in the first 72 hours after onset of cough and dyspnea
- in children with complex medical conditions or comorbidities such as bronchopulmonary dysplasia, congenital heart disease, or immunodeficiency.
- The median duration of symptoms in ambulatory patients is approximately 14 days
- Severe lower respiratory tract infection at an early age has been identified as a possible risk factor for the development of asthma
- For high-risk populations, **palivizumab** , an intramuscular monoclonal antibody to the RSV F protein
 1. children born at <29-wk completed gestation
 2. those with significant heart disease or chronic lung disease of prematurity
 3. neuromuscular disease
 4. immunocompromised states

Thanks for Your Attention

