

Croup in children

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➤ Croup is a common primarily pediatric viral respiratory tract illness

➤ Its alternative names, laryngotracheitis and laryngotracheobronchitis

➤ Croup manifests as :

- Hoarseness
- Seal-like barking cough
- Inspiratory stridor
- Variable degree of respiratory distress

➤ **Morbidity** is secondary to narrowing of the larynx and trachea below the level of the glottis (**subglottic region**), causing the **characteristic audible inspiratory stridor**



Steeple or pencil sign of the proximal trachea evident on this anteroposterior film.

Etiology

Viruses causing acute infectious croup are spread through either:

1. Direct inhalation from a cough and/or sneeze
2. By contamination of hands from contact with fomites

Causes

- Parainfluenza viruses (types 1, 2, 3) are responsible for as many as 80% of croup cases
- Parainfluenza types 1 and 2, accounting for nearly 66% of cases.
- Type 3 parainfluenza virus causes bronchiolitis and pneumonia in young infants and children

Other infectious causes of croup

- | | |
|---|-------------------------------------|
| • Adenovirus | • Respiratory syncytial virus (RSV) |
| • Enterovirus | • Metapneumovirus |
| • Reovirus | • Influenza A and B |
| • Human bocavirus | • Coronavirus |
| • Rhinovirus | • Echovirus |
| • Rarer causes - Measles virus, herpes simplex virus, varicella | |

Epidemiology

Gender

Male-to-female ratio for is approximately 1.4:1.

Age

Primarily a disease of infants and toddlers, croup has a peak incidence from age 6-36 months (3 y).

Prognosis

The prognosis for croup is excellent, and recovery is almost always complete.

The majority of patients can be managed successfully as outpatients, without the need for inpatient hospital care.

Hospitalization rates vary widely among communities, ranging from 1.5-30% and typically averaging 2-5%

Complications

Complications in croup are rare

Less than 5% of children who were diagnosed with croup required hospitalization .

Less than 2% of those who were hospitalized were intubated.

Death occurred in approximately 0.5% of intubated patients.

Complications (cont.)

A secondary bacterial infection may result in pneumonia or bacterial tracheitis

Key bacterial pathogens

Staphylococcus aureus

group A streptococcus

Moraxella catarrhalis

Streptococcus pneumoniae

Haemophilus influenzae

anaerobes

Clinical presentation

- Croup usually begins with nonspecific respiratory symptoms (i.e., rhinorrhea, sore throat, cough).

Fever is generally low grade (38-39°C) but can exceed 40°C.

Within 1-2 days, the characteristic signs of hoarseness, barking cough, and inspiratory stridor develop, often suddenly, along with a variable degree of respiratory distress.

Clinical presentation (cont.)

Symptoms are perceived as worsening at night, with most ED visits occurring between 10 pm and 4 am.

Symptoms typically resolve within 3-7 days but can last as long as 2 weeks.

Physical Examination

The physical presentation of croup has wide variation.

Most children have no more than a "croupy" cough and hoarse cry.

Some may have stridor only upon activity or agitation

Others have audible stridor at rest and clinical evidence of respiratory distress.

Croup Differential Diagnoses

<u>Airway Foreign Body</u>	<u>Bacterial Tracheitis</u>
<u>Diphtheria</u>	<u>Epiglottitis</u>
<u>Inhalation Injury</u>	<u>Laryngeal Fractures</u>
<u>Laryngomalacia</u>	<u>Measles</u>
<u>Mononucleosis and Epstein-Barr Virus Infection</u>	<u>Peritonsillar Abscess</u>

Diagnosis

Croup is primarily a clinical diagnosis, with the diagnostic clues based on presenting history and physical examination findings.

Laboratory test results rarely contribute to confirming this diagnosis. The complete blood cell (CBC) count is usually nonspecific

Diagnosis (cont.)

Pulse oximetry is helpful to assess for the need for supplemental oxygen support and to monitor for worsening respiratory.

Arterial blood gas (ABG) measurements are unnecessary and do not reveal hypoxia or hypercarbia unless respiratory fatigue ensues

Radiography

Plain films can verify a presumptive diagnosis or exclude other disorders causing stridor and hence mimic croup.

A lateral neck radiograph can help detect clinical diagnoses such as:

1. Aspirated foreign body
2. Esophageal foreign body
3. Congenital subglottic stenosis
4. Epiglottitis
5. Retropharyngeal abscess or bacterial tracheitis
(thickened trachea)

Steeple sign



Steeple sign on radiograph

Croup Treatment & Management

Urgent care or emergency department treatment of croup depends on the degree of respiratory distress

Keep young children as comfortable as possible

Careful monitoring of ;

- Heart rate
- Respiratory rate
- Respiratory mechanics
- Pulse oximetry

? Efficacy of cool mist or humidification therapy

Those with severe respiratory distress or compromise may require 100% oxygenation with ventilation support, initially with a bag-valve-mask device

Cornerstones of treatment in the urgent care clinics or emergency departments are corticosteroids and nebulized epinephrine

Steroids have proven beneficial in severe, moderate, and even mild croup

In the straightforward cases of croup, antibiotics are not prescribed, as the primary cause is viral.

Typically, these patients initially would have had moderate-to-severe croup scores, requiring inpatient care and observation.

A single dose of dexamethasone is effective in reducing the overall severity of croup, if administered within the first 4-24 hours after the onset of illness.

The long half-life of dexamethasone (36-54 h) often allows for a single injection or dose to cover the usual symptom duration

Patients given a single oral dose of prednisolone (1 mg/kg) were found to have made more return visits than did those who received a single oral dose of dexamethasone (0.15 mg/kg).

Nebulized racemic epinephrine is typically reserved for patients in the hospital setting with moderate-to-severe respiratory distress.

Heliox is a gas containing a mixture of helium and oxygen (with not less than 20% oxygen). Delivery to the patient is via **nasal cannula, face mask, or hood**

Equally effective in moderate to severe croup when compared **with racemic epinephrine**

? Beneficial effect of heliox in pediatric croup management

Discharge criteria

Patients can be discharged home only if they demonstrate:

- Healthy color
- Good air entry
- Baseline consciousness
- No stridor at rest
- Have received a dose of corticosteroids.

Medication Summary

Current cornerstones in the treatment of croup are corticosteroids and nebulized epinephrine

Steroids have proven beneficial in severe, moderate, and even mild croup

Nebulized racemic epinephrine is typically reserved for patients in moderate to severe distress.

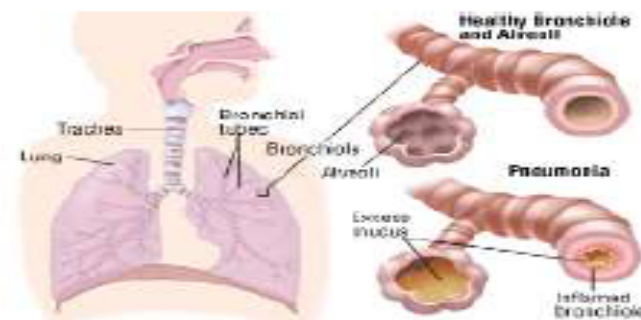
PNEUMONIA

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Pneumonia

- **Pneumonia** is an infection of the lower respiratory tract that involves the airways and parenchyma with consolidation of the alveolar spaces.
- The term **lower respiratory tract infection** is often used to encompass bronchitis, bronchiolitis, or pneumonia or any combination of the three, which may be difficult to distinguish clinically.
- **Pneumonitis** is a general term for lung inflammation that may or may not be associated with consolidation.



Important notes??

- **Lobar pneumonia** describes "typical" pneumonia localized to one or more lobes of the lung in which the affected lobe or lobes are completely consolidated.
- **Bronchopneumonia** refers to inflammation of the lung that is centered in the bronchioles and leads to the production of a mucopurulent exudate that obstructs some of these small airways and causes patchy consolidation of the adjacent lobules.
- **Interstitial pneumonitis** refers to inflammation of the interstitium, which is composed of the walls of the alveoli, the alveolar sacs and ducts, and the bronchioles. Interstitial pneumonitis is characteristic of acute viral infections, but also may be a chronic process.

Defense mechanism

- Lower airways and **secretions** are sterile as a result of a multicomponent cleansing system.
- Airway contaminants are caught in the **mucus** secreted by the goblet cells.
- **Cilia on epithelial surfaces**, composing the **ciliary elevator system**, beat synchronously to move particles upward toward the central airways and into the throat, where they are swallowed or expectorated.
- **Polymorphonuclear neutrophils** from the blood and tissue macrophages ingest and kill microorganisms.
- **IgA** secreted into the upper airway fluid protects against invasive infections and facilitates viral neutralization.

Epidemiology

- **Pneumonia** is a substantial cause of morbidity and mortality in childhood throughout the world,
- **Immunizations** have had a great impact on the incidence of pneumonia caused by pertussis, diphtheria, measles, Hib, and *S. pneumoniae*.
- Where used, bacille Calmette-Guérin (BCG) for tuberculosis also has had a significant impact.
- More than **4 million deaths** each year in **developing countries** are due to acute respiratory tract infections.
- The incidence of pneumonia is more than **10-fold** higher and the number of childhood-related deaths due to pneumonia **≈2000-fold** higher, in **developing than in developed countries.**

Risk factors

- **Risk factors for lower respiratory tract infections include:**
- gastroesophageal reflux,
- neurologic impairment (aspiration),
- immunocompromised states,
- anatomic abnormalities of the respiratory tract,
- residence in residential care facilities for handicapped children, and
- hospitalization, especially in an ICU or requiring invasive procedures.

Etiology

❑ Although most cases of pneumonia are caused by microorganisms, (**infectious**)

❑ **noninfectious causes include:**

- aspiration of food or gastric acid,
- foreign bodies,
- hydrocarbons, and lipoid substances,
- hypersensitivity reactions, and
- drug- or radiation-induced pneumonitis.

- **The infectious agents** that commonly cause community-acquired pneumonia vary by age
- The most common causes are RSV in **infants** ,
- respiratory viruses (RSV, parainfluenza viruses, influenza viruses, adenoviruses) in children **younger than 5 years old**, and
- *M. pneumoniae* and *S. pneumoniae* in children **older than age 5**.
- *M. pneumoniae* and *C. pneumoniae* are the principal causes of **atypical pneumonia**.
- Additional agents occasionally or rarely cause pneumonia as hospital-acquired pneumonia, as zoonotic infections, in endemic areas, or among immunocompromised persons.

Etiologic Agents Grouped by Age of the Patient	
AGE GROUP	FREQUENT PATHOGENS (IN ORDER OF FREQUENCY)
Neonates (<1 mo)	Group B streptococcus, <i>Escherichia coli</i> , other gram-negative bacilli, <i>Streptococcus pneumoniae</i> , <i>Haemophilus influenzae</i> (type b, nontypable)
1–3 mo	
Febrile pneumonia	Respiratory syncytial virus, other respiratory viruses (parainfluenza viruses, influenza viruses, adenoviruses), <i>S. pneumoniae</i> , <i>H. influenzae</i> (type b, nontypable)
Afebrile pneumonia	<i>Chlamydia trachomatis</i> , <i>Mycoplasma hominis</i> , <i>Ureaplasma urealyticum</i> , cytomegalovirus
3–12 mo	Respiratory syncytial virus, other respiratory viruses (parainfluenza viruses, influenza viruses, adenoviruses), <i>S. pneumoniae</i> , <i>H. influenzae</i> (type b, nontypable), <i>C. trachomatis</i> , <i>Mycoplasma pneumoniae</i> , group A streptococcus
2–5 yr	Respiratory viruses (parainfluenza viruses, influenza viruses, adenoviruses), <i>S. pneumoniae</i> , <i>H. influenzae</i> (type b, nontypable), <i>M. pneumoniae</i> , <i>Chlamydophila pneumoniae</i> , <i>S. aureus</i> , group A streptococcus
5–18 yr	<i>M. pneumoniae</i> , <i>S. pneumoniae</i> , <i>C. pneumoniae</i> , <i>H. influenzae</i> (type b, nontypable), influenza viruses, adenoviruses, other respiratory viruses

- **Causes of pneumonia in immunocompromised persons include:**
 - gram-negative enteric bacteria,
 - mycobacteria (*M. avium* complex),
 - fungi (aspergillosis, histoplasmosis),
 - viruses (CMV), and
 - *Pneumocystis jirovecii* (*carinii*).
- **Pneumonia in patients with cystic fibrosis usually is caused by:**
 - *S. aureus* in infancy and
 - *P. aeruginosa* or *Burkholderia cepacia* in older patients.

CLINICAL MANIFESTATIONS

- **Age** is a determinant in the clinical manifestations of pneumonia.
- **Neonates** may have fever only with subtle or no physical findings of pneumonia.
- The typical clinical patterns of viral and bacterial pneumonias usually differ between **older infants and children**, although the distinction is not always clear for a particular patient.
- **Fever, chills,**
- **tachypnea,**
- **cough,**
- **malaise,**
- **pleuritic chest pain,**
- **retractions, and**
- **apprehension, because of difficulty breathing or shortness of breath.**

Recognition of Signs of Pneumonia

Tachypnea is the most sensitive and specific sign of pneumonia

SIGNS	Classify AS	Treatment
<ul style="list-style-type: none">•Tachypnea•Lower chest wall indrawing•Stridor in a calm child	Severe Pneumonia	<ul style="list-style-type: none">•Refer urgently to hospital for injectable antibiotics and oxygen if needed•Give first dose of appropriate antibiotic
<ul style="list-style-type: none">•Tachypnea	Non-Severe Pneumonia	<ul style="list-style-type: none">•Prescribe appropriate antibiotic•Advise caregiver of other supportive measure and when to return for a follow-up visit
<ul style="list-style-type: none">•Normal respiratory rate	Other respiratory illness	<ul style="list-style-type: none">•Advise caregiver on other supportive measures and when to return if symptoms persist or worsen

- **Viral pneumonias** are associated more often with cough, wheezing, or stridor; fever is less prominent than with bacterial pneumonia.
- **The chest radiograph** in viral pneumonia shows diffuse, streaky infiltrates of bronchopneumonia, and
- the **WBC count** often is normal or mildly elevated, with a predominance of lymphocytes.

CLINICAL MANIFESTATIONS





- **Bacterial pneumonias** typically are associated with higher fever, chills, cough, dyspnea, and auscultatory findings of lung consolidation.
- **The chest radiograph** often shows lobar consolidation (or a round pneumonia) and pleural effusion (10% to 30%).
- **The WBC count** is elevated ($>20,000/\text{mm}^3$) with a predominance of neutrophils.

CLINICAL MANIFESTATIONS



- **Afebrile pneumonia** in young infants is characterized by tachypnea, cough, crackles on auscultation, and often concomitant chlamydial conjunctivitis.
- **The WBC count** typically shows mild eosinophilia,
- and there is hyperinflation on **chest radiograph**.

CLINICAL MANIFESTATIONS

Pneumonia History

- ✓ Age
- ✓ Presence of cough,
- ✓ difficulty breathing,
- ✓ shortness of breath, chest pain
- ✓ Fever
- ✓ Recent upper respiratory tract infections
- ✓ Associated symptoms
- ✓ Duration of symptoms
- ✓ Immunizations status
- ✓ TB exposure
- ✓ Maternal Chlamydia,
- ✓ Group B Strep status during pregnancy
- ✓ Choking episodes
- ✓ Previous episodes
- ✓ Previous antibiotics

Does this infant child have pneumonia?

- ☐ The Rational Clinical Exam, Journal of the American Medical Association
- ☐ **Observation** of the infant is the most important part of the examination – does the child look sick?
- ☐ **Respiratory rate** should be calculated over two thirty second intervals, or one minute due to moment to moment variability.
- ☐ **Auscultation is unreliable** when examining infants.
- ☐ In older children, examination will show diminished movements on affected side, dullness on percussion, bronchial breathing. Moist rales on resolution.

Pneumonia Severity Assessment

	Mild	Severe
Infants	Temperature <38.5 C RR < 50 breaths/min Mild recession Taking full feeds	Temperature >38.5 C RR > 70 breaths/min Moderate to severe recession Nasal Flaring Cyanosis Intermittent Apnea Grunting Respirations Not feeding
Older Children	Temperature <38.5 C RR < 50 breaths/min Mild breathlessness No vomiting	Temperature >38.5 C RR > 50 breaths/min Severe difficulty in breathing Nasal Flaring Cyanosis Grunting Respirations Signs of dehydration

Indications for Admission

Age Group	Indications for Admission to Hospital
Infants	<p>Oxygen Saturation $\leq 92\%$, cyanosis RR > 70 breaths /min Difficulty in breathing Intermittent apnea, grunting Not feeding Family not able to provide appropriate observation or supervision</p>
Older Children	<p>Oxygen Saturation $\leq 92\%$, cyanosis RR > 50 breaths /min Difficulty in breathing Grunting Signs of Dehydration Family not able to provide appropriate observation or supervision</p>

Factors Suggesting Need for Hospitalization of Children with Pneumonia

- ❖ *Age <6 mo*
- ❖ *Sickle cell anemia with acute chest syndrome*
- ❖ *Multiple lobe involvement*
- ❖ *Immunocompromised state*
- ❖ *Toxic appearance*
- ❖ *Severe respiratory distress*
- ❖ *Requirement for supplemental oxygen*
- ❖ *Dehydration*
- ❖ *Vomiting*
- ❖ *No response to appropriate oral antibiotic therapy*
- ❖ *Noncompliant parents*

LABORATORY AND IMAGING STUDIES

- The diagnosis of lower respiratory tract infections in children is hampered by difficulty in obtaining material for culture that truly represents the infected tissue.
- The **upper respiratory tract bacterial** flora is not an accurate reflection of the causes of lower respiratory tract infection, and **good quality sputum** is rarely obtainable from children.
- In otherwise healthy children without life-threatening disease, **invasive procedures** to obtain lower respiratory tissue or secretions usually are **not indicated**.
- **Serologic tests** are not useful for the most common causes of bacterial pneumonia.

- **The WBC count** with viral pneumonias is often normal or mildly elevated, with a predominance of lymphocytes,
- whereas with bacterial pneumonias the WBC count is elevated ($>20,000/\text{mm}^3$) with a predominance of neutrophils.
- Mild eosinophilia is characteristic of infant *C. trachomatis* pneumonia.

- **Blood cultures** should be performed to attempt to diagnose a bacterial cause of pneumonia.
- Blood cultures are positive in **10% to 20%** of bacterial pneumonia and are considered to be confirmatory of the cause of pneumonia if positive for a recognized respiratory pathogen.
- **Urinary antigen tests** are useful for *L. pneumophila* (legionnaires' disease).

- A pneumolysin-based **PCR test** for pneumococcus is available at some centers and may aid in the diagnosis of pneumococcal pneumonia.
- **CMV and enterovirus** can be cultured from the nasopharynx, urine, or bronchoalveolar lavage fluid.
- **M. pneumoniae** should be suspected if cold agglutinins are present in peripheral blood samples; this may be confirmed by *Mycoplasma* IgM or more specifically PCR.
- The diagnosis of **M. tuberculosis** is established by TSTs and analysis of sputum or gastric aspirates by culture, antigen detection, or PCR.

- When there is effusion or empyema, performing a thoracentesis to obtain **pleural fluid can** be diagnostic and therapeutic.

- **The need to establish an etiologic diagnosis of pneumonia is greater for patients who are:**
- ill enough to require hospitalization,
- immunocompromised patients (persons with HIV infection, cancer or transplant therapies, congenital immunodeficiencies),
- patients with recurrent pneumonia, or
- patients with pneumonia unresponsive to empirical therapy.
- **For these patients, bronchoscopy with bronchoalveolar lavage and brush mucosal biopsy, needle aspiration of the lung, and open lung biopsy are methods of obtaining material for microbiologic diagnosis.**

IMAGING STUDIES

- Frontal and lateral radiographs are required to localize the diseased segments and to visualize adequately infiltrates behind the heart or the diaphragmatic leaflets.
- There are characteristic radiographic findings of pneumonia, although there is much overlap that precludes definitive diagnosis by radiography alone.
- **Bacterial pneumonia** characteristically shows lobar consolidation, or a round pneumonia, with pleural effusion in 10% to 30% of cases.
- **Viral pneumonia** characteristically shows diffuse, streaky infiltrates of bronchopneumonia.
- **Atypical pneumonia**, such as with *M. pneumoniae* and *C. pneumoniae*, shows increased interstitial markings or bronchopneumonia.

Chest X-ray

- Consider if available and:
 - ☐ Infection is severe
 - ☐ Diagnosis is otherwise inconclusive
 - ☐ To exclude other causes of shortness of breath (e.g.. foreign body, heart failure)
 - ☐ To look for complications of pneumonia unresponsive to treatment (e.g.. empyema, pleural effusion)
 - ☐ To exclude pneumonia in an infant less than three months with fever.

IMAGING STUDIES

- The chest radiograph may be **normal** in early pneumonia, with appearance of an infiltrate during the treatment phase of the disease when edema fluid is greater.
- **Hilar lymphadenopathy** is uncommon with bacterial pneumonia, but may be a sign of tuberculosis, histoplasmosis, or an underlying malignant neoplasm.
- **Lung abscesses, pneumatoceles, and empyema** all require special management.
- **ultrasound** should be used to assess size of pleural effusions and whether they are freely mobile.
- **CT is used** to evaluate serious disease, pleural abscesses, bronchiectasis, and delineating effusions.

DIFFERENTIAL DIAGNOSIS

- The various types of pneumonia-lobar pneumonia, bronchopneumonia, interstitial and alveolar pneumonias-need to be differentiated on the basis of radiologic or pathologic diagnosis.
- Pneumonia must be differentiated from other acute lung diseases, including:
 - **lung edema caused by heart failure,**
 - **allergic pneumonitis, and**
 - **aspiration, and**
 - **autoimmune diseases, such as rheumatoid disease and systemic lupus erythematosus.**
- **Radiographically,** pneumonia must be differentiated from lung trauma and contusion, hemorrhage, foreign body obstruction, and irritation from subdiaphragmatic inflammation.

TREATMENT

- Therapy for pneumonia includes :
- **supportive and specific treatment.**
- The appropriate treatment plan depends on the degree of illness, complications, and knowledge of the infectious agent or of the agent that is likely causing the pneumonia.
- Age, severity of the illness, complications noted on the chest radiograph, degree of respiratory distress, and ability of the family to care for the child and to assess the progression of the symptoms all must be taken into consideration in the choice of ambulatory treatment over hospitalization.
- **Most cases of pneumonia in healthy children can be managed on an outpatient basis.**

- Although viruses cause most community-acquired pneumonias in young children, in most situations experts recommend **empirical treatment** for the most probable treatable causes.
- Treatment recommendations are based on the age of the child, severity of the pneumonia, and antimicrobial activity of agents against the expected pathogens that cause pneumonia at different ages.
- **High-dose amoxicillin** is used as a first-line agent for children with uncomplicated community-acquired pneumonia. third-generation cephalosporins and macrolide antibiotics such as azithromycin are acceptable alternatives. Combination therapy (ampicillin and either gentamicin or cefotaxime) is typically used in the initial treatment of newborns and young infants.
- **Hospitalized patients** can also usually be treated with **ampicillin**. The choice of agent and dosing may vary based on local resistance rates. In areas where resistance is very high, a **third-generation cephalosporin** might be indicated instead. Older children, in addition, may receive a macrolide to cover for atypical infections.

- **Pneumonia** caused by *S. pneumoniae* presents a problem because of increasing antibiotic resistance.
- In contrast to **pneumococcal meningitis**, presumed pneumococcal pneumonia can be treated with **high-dose penicillin or cephalosporin therapy**, even with high-level penicillin resistance.
- **Vancomycin** can be used if the isolate shows high-level resistance and the patient is severely ill.

Antimicrobial Therapy for Pneumonia Caused by Specific Pathogens*

Pathogen	Recommended Treatment	Alternative Treatment
Streptococcus pneumoniae [†]	Ceftriaxone, cefotaxime, penicillin G, or penicillin V	Cefuroxime axetil, erythromycin, or vancomycin
Group A streptococcus	Penicillin G	Cefuroxime, cefuroxime axetil, or erythromycin
Group B streptococcus	Penicillin G	
Haemophilus influenzae type b	Ceftriaxone, cefotaxime, amoxicillin, or ampicillin	Cefuroxime or cefuroxime axetil
Mycoplasma pneumoniae	Erythromycin, azithromycin, or clarithromycin	Doxycycline (if >9 years old) or a respiratory fluoroquinolone (if ≥18 years old) [‡]
Gram-negative aerobic bacilli (except Pseudomonas aeruginosa)	Cefotaxime (or ceftriaxone) with or without an aminoglycoside [§]	Piperacillin-tazobactam plus an aminoglycoside [§]
P. aeruginosa	Ceftazidime with or without an aminoglycoside [§]	Piperacillin-tazobactam plus an aminoglycoside [§]
Staphylococcus aureus	Nafcillin or oxacillin	Vancomycin
Chlamydophila pneumoniae	Erythromycin, azithromycin, or clarithromycin	Doxycycline (if >9 years old) or a respiratory fluoroquinolone (if ≥18 years old) [‡]
Chlamydia trachomatis (afebrile pneumonia in infants)	Erythromycin, azithromycin, or clarithromycin	TMP-SMZ
Herpes simplex virus	Acyclovir	

- Empirical antibiotic treatment is sufficient for management of pneumonia in children, unless there is an exceptional need to know the pathogen to guide management.
- **Such exceptional situations include:**
 - lack of response to empirical therapy,
 - unusually severe presentations,
 - nosocomial pneumonia, and
 - immunocompromised children susceptible to infections with opportunistic pathogens.
- Infants 4 to 18 weeks old with afebrile pneumonia most likely have infection with ***C. trachomatis***, and erythromycin is the recommended treatment.

Over the counter cough mixtures

- *No well-controlled studies supporting the use of codeine or dextromethorphan as antitussives for children have been published, and indications for their use have not been established.*
- *Cough due to URTI can often be treated with non-drug measures (fluids and humidity).*

- ***Pediatric dosages of antitussives are extrapolated from adult data and thus are imprecise for children.***
- ***Significant adverse effects of their use have been documented.***
- ***Clinicians should tell parents and patients about these concerns.***

- **Conclusion:**

Over the counter cough medicines for acute cough cannot be recommended because there is no good evidence for their effectiveness. Even when trials had significant results, the effect sizes were small and of doubtful clinical relevance. Because of the small number of trials in each category, the results have to be interpreted cautiously.

COMPLICATIONS

- Pleural effusion
- Empyema
- Parapneumonic effusions
- Lung abscess
- Pneumothorax
- Pneumatocele
- Delayed Resolution
- Respiratory Failure
- Metastatic Septic lesions
- Activation of latent TB

PROGNOSIS

- Most children recover from pneumonia rapidly and completely.
- The radiographic abnormalities may **take 6 to 8 weeks** to return to normal.
- In a few children, pneumonia may persist longer than **1 month or may be recurrent**. In such cases, the possibility of underlying disease must be investigated further, such as with TST, sweat chloride determination for cystic fibrosis, serum immunoglobulin and IgG subclass determinations, bronchoscopy to identify anatomic abnormalities or foreign body, and barium swallow for gastroesophageal reflux.

Recurrent pneumonia

- ❖ **Recurrent pneumonia** is defined as **2 or more episodes in a single yr or 3 or more episodes** ever, with radiographic clearing between occurrences.
- ❖ An **underlying disorder** should be considered if a child experiences recurrent bacterial pneumonia
- ❖ **Slowly resolving pneumonia** refers to the persistence of symptoms or radiographic abnormalities beyond the expected time course.
 - ❖ The time course varies, depending on
 - ❖ the organism involved,
 - ❖ the extent of disease,
 - ❖ the presence of associated complicating conditions.

Differential Diagnosis of Recurrent Pneumonia	
Hereditary Disorders	Cystic fibrosis , Sickle cell disease
Disorders of Immunity	AIDS, Bruton agammaglobulinemia, Selective IgG subclass deficiencies, Common variable immunodeficiency syndrome, Severe combined immunodeficiency syndrome
Disorders of Leukocytes	Chronic granulomatous disease, Hyperimmunoglobulin E syndrome (Job syndrome), Leukocyte adhesion defect
Disorders of Cilia	Immotile cilia syndrome, Kartagener syndrome
Anatomic Disorders	Sequestration, Lobar emphysema, Esophageal reflux, Foreign body, Tracheoesophageal fistula (H type), Gastroesophageal reflux, Bronchiectasis, Aspiration (oropharyngeal incoordination)

PREVENTION

- **Immunizations** have had a great impact on reducing the incidence of vaccine-preventable causes of pneumonia.
- **Zinc supplementation**
- **RSV infections** can be reduced in severity by use of palivizumab .
- **Reducing the length of mechanical ventilation** and using antibiotic treatment only when necessary can reduce ventilator-associated pneumonias.
- **Hand washing** before and after every patient contact and use of gloves for invasive procedures are important measures to prevent nosocomial transmission of infections.
- **Hospital staff** with respiratory illnesses or who are carriers of certain organisms, such as methicillin-resistant *S. aureus*, should use masks or be reassigned to non-patient care duties.

Thank you



Live in peace, not in pieces