

RESPIRATORY TRACT INFECTIONS

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Learning objectives

1. Clinical manifestations according to the site of respiratory tract infection.
2. Etiologic agents
3. General diagnostic approaches
4. General principle of management

Introduction

- Worldwide, an estimated 3 to 5 million children die annually as a result of acute respiratory disease.
 - Morbidity from respiratory infections constitutes the most common issue in humans.
 - The illness types are discussed in the contexts of the sites where major clinical manifestations of involvement are expressed: upper, middle, and lower respiratory disease.
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Upper Respiratory Tract Infection

- Upper respiratory infections usually involve the nasal cavity and pharynx, and most (more than 80%) are caused by viruses.
- Like middle and lower respiratory illnesses, the diseases of the upper respiratory tract are named according to the anatomic sites primarily involved. **Rhinitis** implies inflammation of the nasal mucosa, **pharyngitis** denotes pharyngeal infection, and **tonsillitis** indicates an inflammatory involvement of the tonsils.




Upper Respiratory Tract Infection

Clinical Features

- Rhinitis is the most common manifestation of the common cold. It is characterized by variable fever, inflammatory edema of the nasal mucosa, and an increase in mucous secretions.
- The net result is varying degrees of nasal obstruction; the nasal discharge may be clear and watery at the onset of illness, becoming thick and sometimes purulent as the infection progresses over 5 to 10 days.



Upper Respiratory Tract Infection

- Pharyngitis and tonsillitis are associated with pharyngeal pain (sore throat) and the clinical appearance of erythema and swelling of the affected tissues.
 - On rare occasions, the local inflammation may be sufficiently severe to produce **pseudomembranes**, which consist of necrotic tissue, inflammatory cells, and bacteria. This finding is particularly common in pharyngeal diphtheria, but may be mimicked by fusospirochetal infection (Vincent's angina) and sometimes by infectious mononucleosis.
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Major etiologic agents of URTI

DISEASE	VIRUSES	BACTERIA AND FUNGI
Rhinitis	Rhinoviruses, adenoviruses, coronaviruses, parainfluenza viruses, influenza viruses, respiratory syncytial virus, some coxsackie A viruses	Rare
Pharyngitis or tonsillitis	Adenoviruses, parainfluenza viruses, influenza viruses, rhinoviruses, coxsackie A or B virus, herpes simplex virus, Epstein–Barr virus	Group A <i>streptococcus</i> , <i>Corynebacterium diphtheriae</i> , <i>Neisseria gonorrhoeae</i>
Peritonsillar or retropharyngeal abscess	None	Group A streptococcus (most common), oral anaerobes such as <i>Fusobacterium</i> species, <i>Staphylococcus aureus</i> , <i>Haemophilus influenzae</i> (usually in infants)

Upper Respiratory Tract Infection

General Diagnostic Approaches

- Although viruses cause most upper respiratory infections, laboratory tests for viral infections are usually reserved for investigating outbreaks or when the illness seems unusually severe or atypical.
- The primary diagnostic approach in pharyngitis and tonsillitis is to determine whether there is a bacterial cause requiring specific treatment. The only reliable method is to collect a throat swab for culture.
- Direct antigen tests for rapidly detecting the group A antigen in throat swabs have gained popularity in recent years.

Upper Respiratory Tract Infection

- For the laboratory diagnosis of diphtheria or pharyngeal gonorrhea, the clinical suspicion should be indicated to the laboratory so that specific cultures for *C diphtheriae* or *N gonorrhoeae* may be made.
- *Candida* species, fusospirochetal bacteria, *Pseudomonas* species, and other Gram-negative organisms are often found in pharyngeal or oral specimens from healthy individuals as well as in certain infections.
- The laboratory diagnosis of causes of peritonsillar and retropharyngeal abscesses is based on Gram staining and culture of purulent material obtained directly from the lesion, including anaerobic cultures.

Upper Respiratory Tract Infection

General Principles of Management

- Viral infections of the upper respiratory tract can only be treated symptomatically.
 - If GAS is the cause, penicillin therapy is required; if the patient is allergic to penicillin, an alternative is chosen (eg, erythromycin or a cephalosporin). Such treatment prevents suppurative or toxigenic complications (eg, pharyngeal abscess, cervical adenitis, and scarlet fever) and the development of acute rheumatic fever.
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Middle Respiratory Tract Infection

- The middle respiratory tract is considered to comprise the epiglottis, surrounding aryepiglottic tissues, larynx, trachea, and bronchi. Inflammatory disease involving these sites may be localized (eg, **laryngitis**) or more widespread (eg, laryngotracheobronchitis).
- The majority of severe infections occur in infancy and childhood.

Middle Respiratory Tract Infection

Clinical Features

- **Epiglottitis** is often characterized by the abrupt onset of throat and neck pain, fever, and inspiratory stridor (difficulty in moving adequate amounts of air through the larynx).
- **Laryngitis** or its more severe form, croup, may have an abrupt onset (spasmodic croup). The illness is characterized by variable fever, inspiratory stridor, hoarse phonation, and a harsh, barking cough.



Middle Respiratory Tract Infection

- **Bronchitis** or **tracheobronchitis** may be a primary manifestation of infection or a result of spread from upper respiratory tissues. It is characterized by cough, variable fever, and sputum production, which is often clear at the onset but may become purulent as the illness persists.
 - **Chronic bronchitis** is a result of longstanding damage to the bronchial epithelium. A common cause is cigarette smoking, but a variety of environmental pollutants, chronic infections (eg, tuberculosis), and defects that hinder normal clearance of tracheobronchial secretions and bacteria (eg, cystic fibrosis) can be responsible.
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Syndrome	Viruses	Bacteria	Percentage caused by viruses
Epiglottitis	Rare	<i>Haemophilus influenzae</i> , <i>Streptococcus pneumoniae</i> , <i>Corynebacterium diphtheriae</i> , <i>Neisseria meningitidis</i>	10
Laryngitis and croup	Parainfluenza viruses, influenza viruses, adenoviruses; occasionally respiratory syncytial virus, metapneumovirus, rhinoviruses, coronaviruses, echoviruses	Rare	90
Tracheitis ^a	Same as for laryngitis and croup	<i>H influenzae</i> , <i>Staphylococcus aureus</i>	90
Bronchitis and bronchiolitis	Parainfluenza viruses, influenza viruses, respiratory syncytial virus, adenoviruses, measles	<i>Bordetella pertussis</i> , <i>H influenzae</i> , <i>Mycoplasma pneumoniae</i> , <i>Chlamydia pneumoniae</i>	80

Middle Respiratory Tract Infection

General Diagnostic Approaches

- When a viral etiology is sought, the usual method of obtaining a specific diagnosis is by inoculation of cell cultures with material from the nasopharynx and throat, or by PCR.
 - Acute and convalescent sera can also be collected to determine antibody responses to the common respiratory viruses and *Mycoplasma pneumoniae*. In bacterial infections, the approaches noted below are valuable.
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Middle Respiratory Tract Infection


- *H influenzae* type b, once the most common cause of epiglottitis, produces an associated bacteremia in 85% of cases or more. Attempts to obtain cultures from the epiglottis or throat.
- The exception is *Corynebacterium diphtheriae* infection, in which cultures of the nasopharynx or pharynx are required.
- Gram staining and culture of sputum, or better yet, of purulent secretions obtained by direct laryngoscopy, help to establish the causative agent.
- Blood cultures are again useful in such cases when a bacterial etiology is suspected.

Middle Respiratory Tract Infection

- A major bacteriologic consideration in acute bronchitis, especially in infants and preschool children, is *Bordetella pertussis*. Deep nasopharyngeal cultures plated on the appropriate media constitute the best specimens. Examination of nasopharyngeal smears or aspirates by direct fluorescent antibody or PCR methods are also useful adjuncts to establishing the diagnosis.
- Exceptions include *M pneumoniae* and *Chlamydia pneumoniae* infections, which are usually diagnosed by serologic testing of acute and convalescent sera.

Middle Respiratory Tract Infection

General Principles of Management

- The primary initial concern is ensuring an adequate airway. Thus, some patients require placement of a rigid tube that provides communication between the tracheobronchial tree and the outside air (a nasotracheal tube or a surgically placed tracheostomy).
 - Other adjunctive measures, such as highly humidified air and oxygen, may also provide relief in acute diseases involving the structures in and around the larynx.
 - In proved or suspected bacterial infections, specific antimicrobial therapy is required; other treatment, such as antitoxin administration in diphtheria, may also be necessary.
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Lower Respiratory Tract Infection

- Lower respiratory tract infection develops with invasion and disease of the lung, including the alveolar spaces and their supporting structure, the interstitium, and the terminal bronchioles.
- Infection may occur by extension of a middle respiratory tract infection, aspiration of pathogens past the upper airway defenses, or less commonly by hematogenous spread from a distant site such as an abscess or an infected heart valve.


Lower Respiratory Tract Infection

Acute Pneumonia

- Acute pneumonia is an infection of the lung parenchyma that develops over hours to days and, if untreated, runs a natural course lasting days to weeks.
- The onset may be gradual, with malaise and slowly increasing fever, or sudden, as with the bed-shaking chill associated with the onset of pneumococcal pneumonia.
- The only early symptom referable to the lung may be cough, which is caused by bronchial irritation. In adults, the cough becomes productive of **sputum**, which is purulent material generated in the alveoli and small air passages. In some cases, the sputum may be blood-streaked, rusty in color, or foul-smelling.

Lower Respiratory Tract Infection

Chronic Pneumonia

- Chronic pneumonia has a slow insidious onset that develops over weeks to months and may last for weeks or even years.
 - The initial symptoms are the same as those of acute pneumonia (fever, chills, and malaise), but they develop more slowly.
 - Cough can develop early or late in the illness. As the disease progresses, appetite and weight loss, insomnia, and night sweats are common.
 - Bloody sputum (hemoptysis), dyspnea, and chest pain appear as the disease progresses.
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Syndrome	Viruses	Common bacteria	Fungi	Other agents
Acute pneumonia	Influenza, ^a parainfluenza, adenovirus, respiratory syncytial virus (infants and elderly) ^a , metapneumovirus	<i>Streptococcus pneumoniae</i> , <i>Staphylococcus aureus</i> , <i>Haemophilus influenzae</i> , Enterobacteriaceae, <i>Legionella</i> , mixed anaerobes (aspiration), <i>Pseudomonas aeruginosa</i> ^b	<i>Candida albicans</i> , ^b <i>Aspergillus</i> species, <i>Pneumocystis</i> ^b	<i>Mycoplasma pneumoniae</i> , <i>Chlamydia trachomatis</i> (infants), <i>Chlamydia pneumoniae</i>
Chronic pneumonia	Rare	<i>Mycobacterium tuberculosis</i> , other mycobacteria, <i>Nocardia</i>	<i>Coccidioides immitis</i> , ^c <i>Blastomyces dermatitidis</i> , ^c <i>Histoplasma capsulatum</i> , ^c <i>Cryptococcus neoformans</i>	<i>Paragonimus westermani</i> ^c
Lung abscess	None	Mixed anaerobes, <i>Actinomyces</i> , <i>Nocardia</i> , <i>S aureus</i> , ^d Enterobacteriaceae, ^d <i>P aeruginosa</i> ^{b,d}	<i>Aspergillus</i> species	<i>Entamoeba histolytica</i>
Empyema	None	Mixed anaerobes, <i>S aureus</i> , ^d <i>S pneumoniae</i> , ^d Enterobacteriaceae, <i>P aeruginosa</i> ^d	Rare	

Lower Respiratory Tract Infection

General Diagnostic Approaches

- The degree of difficulty in establishing an etiologic diagnosis for a lower respiratory tract infection depends on the number of organisms produced in respiratory secretions, whether the causative species is normally found in the oropharyngeal flora, and how easily it is grown.
 - In the presence of typical clinical findings, the isolation of influenza virus from the throat or of *M tuberculosis* from sputum is sufficient for diagnosis of influenza or tuberculosis, because these organisms are not normally found in such sites.
 - The same cannot be said for *S pneumoniae* and most bacterial pathogens, because they may be found in the throat in a significant number of healthy persons.
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Lower Respiratory Tract Infection

- The examination of expectorated sputum has been the primary means of diagnosing the causes of bacterial pneumonia, but this approach has several advantages and disadvantages.
- The advantages are ease of collection and absence of risk to the patient.
- The primary disadvantage is the confusion that results from contamination of the sputum with oropharyngeal flora in the process of expectoration and excessive contamination with saliva.
- The quality of a sputum sample can be enhanced by collection early in the morning (just after the patient arises), careful instruction of the patient, and occasionally by the use of saline aerosols (induced sputum) under the supervision of an inhalation therapy specialist

Lower Respiratory Tract Infection

- Microscopic examination before culture of direct Gram smears of specimens alleged to be sputum has proved useful.
- Polymorphonuclear leukocytes and large numbers of a single morphologic type of organism are typical findings in sputum from patients with bacterial pneumonia.
- Another approach is to attempt a more direct collection from the lung using methods that bypass the oropharyngeal flora. The major techniques include transtracheal aspiration, bronchoalveolar lavage (BAL), direct aspiration, and open biopsy.

Lower Respiratory Tract Infection

General Principles of Management

- The general principles of management of lower respiratory tract infections are similar to those of middle tract infections.
 - Drainage or surgical measures are needed more often as adjuncts to antimicrobial therapy in cases of chronic pneumonia, lung abscess, and empyema.
 - When bacterial infection is considered, empiric therapy is usually given until the results of cultures and antimicrobial susceptibility tests are available.
 - Treatment may vary from penicillin alone for a previously healthy person, in whom the most reasonable nonviral possibility is *S pneumoniae*, to multiple drugs for a debilitated or immunocompromised patient, in whom the possibilities are much broader.
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