

Upper Respiratory Tract Infection (URI, URTI) — Symptoms and Treatment

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Upper respiratory tract infections (URIs) include a group of illnesses that can be mild to life-threatening where the upper respiratory tract is the main affected part. The infecting organism can affect the sinuses, the nasal passages, the pharynx or the larynx. Several diseases can be put under the umbrella of URIs which include rhinitis, pharyngitis, sinusitis, epiglottitis, laryngitis and tracheitis.



Definition of Upper Respiratory Tract Infection

Rhinitis can be defined as the inflammation of the nasal mucosa, which is found in some allergic conditions. Patients with **sinusitis** have inflammation of the paranasal sinuses which include the frontal, ethmoid, maxillary and sphenoid sinuses.

Rhinopharyngitis is the inflammation of the nasal passages, pharynx, and the tonsils. The **common cold** usually results in rhinopharyngitis. Patients with **epiglottitis** can have a bacterial etiology and the condition might be life-threatening.

Epidemiology of URTIs

URTIs are considered the **most common infectious diseases** in the population. Adults can develop the common cold up to four times per year and children up to eight times per year. Viral and bacterial pharyngitis are common in children and account for 1% of

outpatient clinic visits.



Image: "Acute epiglottitis; lateral view in X-ray imaging. The lateral soft-tissue radiograph reveals the "thumb sign" that indicates a swollen epiglottis, suggestive of epiglottitis. The diagnosis was confirmed on subsequent imaging and laryngoscopy. The patient recovered following treatment with predonine and ceftriaxone." by Med Chaos - Own work.
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Sinusitis in patients with uncomplicated URTIs is common and can be identified in up to 80% of the cases. Fortunately, **bacterial sinusitis** is only found in 2% of the cases.

Epiglottitis is usually caused by **Haemophilus influenzae infection** and since the introduction of **Haemophilus influenzae type b (Hib) vaccine**, the incidence of epiglottitis has decreased significantly. The current incidence of acute epiglottitis is estimated to be about 0.98 cases per 100,000. **Pneumococcal epiglottitis** is responsible for 0.28 cases of epiglottitis per 100,000.

Croup or **laryngotracheobronchitis** is common in children aged 6 months to 6 years. Most cases of croup occur in children aged two years. Fortunately, despite the harsh breathing sounds, the condition is self-limiting.

Pertussis or whooping **cough** is another URTI that has significantly decreased due to the introduction of pertussis vaccination. The current incidence of whooping cough due to pertussis is estimated to be 9 per 100,000.

URTIs are usually seasonal and most cases occur in **fall or winter**. It is hypothesized that cold weather increases the amount of time people spend indoors, which consequently prolongs their exposures to others who are already infected.

Additionally, **low humidity in winter** is an important factor in the survival and increased virulence of the different viruses implicated in URTIs.

The common cold appears to be more common in young women. Epiglottitis, on the other hand, is more common in men. Croup, for obscure reasons, is more common in boys rather than girls.

Classification of RTIs

Upper Respiratory tract infection (URTI)	Lower Respiratory tract infection (LRTI)
Infection from nose to epiglottis	Infection of the organ present from epiglottis to alveoli
Common URTIs: <ul style="list-style-type: none">• Common cold• Pharyngitis• Epiglottitis• Rhinitis• Sinusitis• Influenza	Common LRTIs: <ul style="list-style-type: none">• Laryngitis• Laryngotracheitis• Bronchitis• Bronchiolitis• Pneumonia

Most patients with an URTI also have symptoms of a LRTI.

Etiologies of URTIs

URTIs can be caused by several **viral and bacterial pathogens**. The most commonly implicated viruses with URTIs are rhinoviruses, coronaviruses, adenoviruses, and coxsackieviruses.

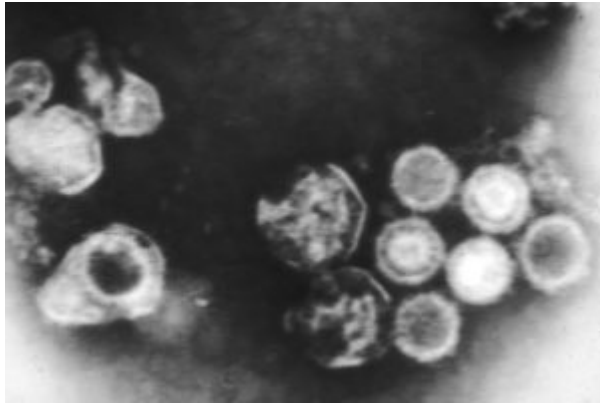


Image: "Epstein-Barr virus taken through an electron microscope." by Linda Bartlett (Photographer) - This image was released by the National Cancer Institute, an agency part of the National Institutes of Health, with the ID 2105. License: Public Domain

The **common cold** is usually related to the **rhinoviruses** while **coronaviruses** can also account for a significant number of the cases. **Adenoviruses** can also cause **nasopharyngitis**.

Pharyngitis is usually caused by common viruses such as **adenoviruses, influenza viruses**, and the **Epstein-Barr virus** as well as by **group A streptococcus bacteria**.

Group A streptococcal infection is responsible for up to 15% of the cases of pharyngitis in adults and 30% in children. Therefore, the **early recognition** of bacterial streptococcal pharyngitis is essential to **prevent complications**.

Patients with rhinosinusitis usually have another viral URTI caused by a rhinovirus, coronavirus, or influenza A or B. These patients can have signs of sinusitis on computed tomography, which usually resolves without any complications.

Secondary bacterial infections can occur in a few cases. Common examples include ***Streptococcus pneumoniae, Haemophilus influenzae, Moraxella catarrhalis,*** and/or ***Staphylococcus aureus.***

Epiglottitis has been historically linked to *Haemophilus influenzae* but since the introduction of the Hib vaccine, the incidence of acute epiglottitis decreased dramatically. On the other hand, cases of streptococcus epiglottitis are becoming more commonly identified nowadays.

Croup can be caused by **parainfluenza viruses types 1, 2 and 3**, and in a few cases, by **influenza** viruses.

Pathophysiology of URTIs

When a person comes in contact with an infected individual or an inanimate object that has been contaminated with an infectious organism, that person can potentially introduce the organism internally via the nose or mouth. Viral or bacterial inoculation of the mucosa lining of the upper respiratory tract can follow.

In addition to the virulence of the infecting organism, the person's **genetic susceptibility** also plays a role in determining the likelihood of transmission and infection after contact with someone with an URTIs. Certain **polymorphisms** related to the immune system can put an individual at an increased risk of developing severe influenza illness once exposed to the **H1N1** or the **H5N1** influenza viruses.

Details of Different URTIs

Common Cold

The common cold is the most common URTI caused by viruses and is very contagious.

Causative organisms

- Influenza viruses
- Picornaviruses (Coxsackie, Reo, Echo, and rhinovirus)
- Respiratory Syncytial Virus
- Parainfluenza virus
- Adenovirus

Pathogenesis

The virus invades the nasal mucosa causing an immediate irritative reaction resulting in the secretion of large quantities of mucus and cells. Within 24 hours a secondary infection can arise leading to a watery nasal discharge.

Sign and Symptoms

- Sneezing
- Rhinorrhea
- Nasal congestion
- Sore throat
- Non-productive cough
- Pain in the eyes
- Headache
- Malaise and Myalgia
- Fever is uncommon
- Conjunctivitis can occur with an adenovirus infection
- With an enterovirus infection, a skin rash can be present

On examination, post-nasal discharge, erythema around the nose and glossy nasal mucosa may be found, the pharynx shows congestion with some form of exudates. Exudates can also be present on tonsils. The jugulodigastric lymph nodes may become enlarged and tender in some patients.

Complications

- Sinusitis
- Otitis media
- Croup
- Secondary bacterial pneumonia

Laboratory Investigation

Real-time polymerase chain reaction (RT-PCR) or isolation of the virus in culture or four-fold increase in virus-specific circulating antibodies are used for confirmation of the diagnosis. The clinical specimen used for this purpose are nasopharyngeal swab, nasal swab, pharyngeal swab and aspirate in case of intubated patients.

Treatment

The common cold involves symptomatic and supportive treatment including bed rest, adequate fluids, anticholinergic nasal sprays, and/or saline nasal drops with nasal decongestants like xylometazoline and oxymetazoline used for symptomatic relief.

Pharyngitis

Definition and pathogenesis

Pharyngitis is defined as the inflammation of the pharynx, hypopharynx, uvula, and tonsils. It is usually of viral infectious etiology. Beta-hemolytic streptococcus infection is common in children aged 4 to 7 years. Persons with oro-genital contact, gonococcal pharyngitis can occur. Oral thrush involving the pharynx can occur in the immunocompromised patient.

Sign and symptoms

- Throat discomfort
- Odynophagia
- Cough
- Constitutional symptoms such as body aches, fever, myalgia, and malaise

Differential diagnosis

Epiglottitis, laryngitis, laryngotracheitis and peritonsillar abscess.

Laboratory diagnosis

- Throat swab culture and serological testing
- Identification of beta-hemolytic streptococci by this method is of paramount importance as it is associated with the development of rheumatic heart disease

Complications

Suppurative complication	Non-suppurative complication
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<ul style="list-style-type: none"> • Sinusitis • Otitis media • Epiglottitis • Mastoiditis • Peri-tonsillar abscess • Retropharyngeal abscess • Suppurative cervical lymphadenitis • Pneumonia 	<ul style="list-style-type: none"> • Airway obstruction • Thrombocytopenia <ul style="list-style-type: none"> • Myocarditis • Pericarditis • Encephalitis • Meningitis • Toxic shock syndrome • Acute rheumatic fever • Acute inflammatory demyelinating polyneuropathy
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Treatment

Mainstay treatment is symptomatic and supportive. Some patients may require antibiotics for secondary bacterial infections or infections with beta-hemolytic streptococci. Viral pharyngitis is self-limiting and resolves spontaneously. However, the clinician should be aware of a potential complication.

Epiglottitis

Epiglottitis is usually due to a viral infection of the epiglottis but can be bacterial in origin.

Epidemiology

- It can occur at any age
- Haemophilus influenzae type B is mostly associated with epiglottitis however due to current vaccination practices against the influenza virus there is a rising trend in infection due to beta-hemolytic streptococci
- The incidence of acute epiglottitis in adults ranges from 0.97 to 3.1 per 100,000, with a mortality of approximately 7.1%
- There is no seasonal variation in the incidence of epiglottitis

Signs and symptoms

- Throat discomfort
- Odynophagia
- Cough
- Difficulty in swallowing with sitting up and leaning forward position
- Constitutional symptoms such as body-ache, fever, myalgia, and malaise
- Dysphagia, drooling, and stridor subsequent to thermal or caustic injury to the epiglottis

Differential diagnosis

- Croup
- Foreign body in the airway
- Bacterial tracheitis
- Retropharyngeal abscess

Laboratory diagnosis

- Anteroposterior radiographs of the neck are helpful in confirming the diagnosis and helps in ruling out the presence of the foreign body
- 'Thumb sign' in radiograph is indicative of severe acute epiglottitis
- Laboratory tests are usually not helpful
- Performing a flexible fiber-optic laryngoscopy in a controlled clinical setting is reliable
- Ultrasonography has been described as a way to investigate the epiglottis by visualization of the "alphabet P sign" in a longitudinal view through the

thyrohyoid membrane

Complications

- Death from asphyxia
- Secondary bacterial infection
- Pneumonia

Treatment

- Viral epiglottitis is self-limiting and requires only supportive treatment
- Patients with secondary bacterial infection or with complication or epiglottitis of bacterial origin may require antibiotics. Broad-spectrum antibiotics such as chloramphenicol or co-amoxiclav are the antibiotic of choice

Rhinitis

Definition

Rhinitis is defined as inflammation of the membranes lining the nose and it is characterized by nasal congestion, rhinorrhoea, sneezing, itching, conjunctival symptoms, and other constitutional symptoms.

Classification

Rhinitis can be classified according to its etiology i.e. allergic or non-allergic

Allergic	Non-allergic
<ul style="list-style-type: none">• Seasonal (e.g. pollens)• Perennial (e.g. house dust, mites)• Occupational (e.g. animal antigens)	<p>Infectious rhinitis</p> <ol style="list-style-type: none">1. Acute (Viral/ bacterial)2. Chronic (Specific bacterial & fungal or non-specific as in the case of immunodeficiency disorder) <ul style="list-style-type: none">• Infectious rhinitis without eosinophilia• Rhinitis with eosinophilia syndrome<ul style="list-style-type: none">• Vasomotor rhinitis• Hormonal such as in menstruation, pregnancy, or hypothyroidism<ul style="list-style-type: none">• Occupational• Food-induced or gustatory rhinitis

Pathogenesis

Allergic rhinitis is due to inflammation in the nose which is usually an immunoglobulin E mediated reaction to acute exposure to inciting allergens. It is mostly due to acute exposure to inciting allergens. Non-allergic rhinitis pathogenesis varies according to etiology but the main pathogenesis lies in the inflammation of nasal mucosa.

Signs and symptoms

- Nasal congestion
- Rhinorrhoea
- Sneezing
- Itching
- Conjunctival symptoms
- Constitutional symptoms such as fever, malaise etc.

Diagnosis

Identification of etiology is based on the pattern, chronicity and seasonal variation of symptoms, history of medication, the presence of co-existing conditions, occupational

exposures, environmental history and identification of precipitating factors.

Physical examination should also focus on identifying conditions like deviated nasal septum, polyps, or enlarged turbinate. Allergen skin test or in-vitro testing is useful in detecting allergic rhinitis.

Treatment

- Non-sedating oral or intranasal antihistamines like loratadine, cetirizine, fexofenadine, etc.
- Antileukotriene
- Combination of antihistamine and antileukotriene
- Topical corticosteroids such as mometasone, furoate, beclomethasone
- Avoidance of inciting allergens
- Anticholinergic drugs such as ipratropium bromide
- Nasal decongestant such as xylometazoline or oxymetazoline
- Oral corticosteroids and allergen immunotherapy may help in some cases

Sinusitis

Sinusitis is the inflammation of the paranasal sinuses. Moreover, with every URTI, there is an acute inflammation of sinus membranes.

Predisposing factors to the development of sinusitis:

1. Anatomic abnormalities like deviated nasal septum, concha bullosa, and bony spurs
2. Allergic rhinitis
3. Vasomotor rhinitis
4. Rhinitis medicaments
5. Cocaine abuse
6. Nasal polyp
7. Tumour causing obstruction
8. Recurrent RTI
9. Immune deficiency syndrome
10. Cystic fibrosis
11. Kartagener's syndrome
12. Environmental pollution

Signs and symptoms

- Nasal congestion
- Mucopurulent or purulent nasal discharge
- Headache
- Facial pain or heaviness which increases with bending forward
- Fever
- Localized tenderness indicates an infection of a group of sinuses
- On examination, nasal mucosa appears oedematous

Laboratory workup

- Smear examination of nasal secretion with Giemsa's stain or Wright's stain shows 10% of eosinophil in allergic sinusitis.
- In sinusitis with infectious origin, eosinophilia is absent
- Nasal endoscopy

- X-ray of paranasal sinus (Occipito-mental view or Water's view and Submental view)
- Computed tomography (CT)
- Magnetic resonance imaging (MRI)

Treatment

- NSAIDs for fever and pain relief
- An appropriate antibiotic for infectious etiology
- Nasal saline spray
- Topical decongestants like xylometazoline or oxymetazoline
- Steroids like fluticasone, beclomethasone
- Cromolyn sodium for symptomatic relief
- Surgery is indicated for chronic sinusitis refractory to medical treatment, recurrent sinusitis, large obstructing polyp, suspicion of the tumor, sinus mucocele, pyocele, intracranial extension, cavernous sinus thrombosis, and fungal sinusitis.
- Functional endoscopic sinus surgery (FESS) and Caldwell-Lue operation

Influenza

Definition:

Influenza is an acute respiratory infection caused by influenza viruses that affects the upper or lower respiratory tract. It is usually associated with systemic manifestations such as fever, headache, myalgia, and weakness.

Etiology

Influenza viruses are members of the Orthomyxoviridae family, of which influenza A, B, and C viruses constitute three separate genera. The designation of influenza viruses as type A, B, or C is based on antigenic characteristics of the nucleoprotein (NP) and matrix (M) protein antigens.

Influenza A viruses are further subdivided (subtyped) on the basis of the surface hemagglutinin (H) and neuraminidase (N) antigens. Influenza A has 18 distinct H subtypes and 11 distinct N subtypes, of which only H1, H2, H3, N1, and N2 have been associated with epidemics of disease in humans.

Influenza B and C viruses are designated similarly to influenza A viruses, but H and N antigens from these viruses do not receive subtype designations.

Epidemiology

Influenza outbreaks occur virtually every year, although the extent and severity vary widely. Global pandemics have occurred at variable intervals, but much less frequently than interpandemic outbreaks. The most recent pandemic emerged in March of 2009 and was caused by an influenza A/H1N1 virus that rapidly spread worldwide over the next several months. The most extensive and severe outbreaks of influenza are caused by influenza A viruses, in part because of the remarkable propensity of the H and N antigens of these viruses to undergo periodic antigenic variation.

Pathogenesis

The initial event in influenza is an infection of the respiratory epithelium with the influenza virus acquired from respiratory secretions of acutely infected individuals. The

virus is transmitted via aerosols generated by coughs and sneezes, although transmission through hand-to-hand contact, other personal contact, and even fomites may take place. Experimental evidence suggests that infection by a small particle aerosol (particle diameter <10 µm) is more efficient than larger droplets.

Initially, viral infection involves the ciliated columnar epithelial cells, but it may also involve other respiratory tract cells, including alveolar cells, mucous gland cells, and macrophages. In experimentally induced infection, the incubation period of illness has ranged from 18 to 72 h, depending on the size of the viral inoculum.

Signs and symptoms

- Fever
- Headache
- Chills with rigor
- Myalgia and malaise
- Cough
- Sore throat

However, the spectrum of clinical presentations is wide, ranging from a mild, afebrile respiratory illness similar to the common cold (with either a gradual or abrupt onset) to severe prostration with relatively few respiratory signs and symptoms.

Physical findings are usually minimal in uncomplicated influenza. Early in the illness, the patient appears flushed, and the skin is hot and dry, although diaphoresis and mottled extremities are sometimes evident, particularly in older patients. Examination of the pharynx may yield surprisingly unremarkable results despite a severe sore throat, but infection of the mucous membranes and postnasal discharge are apparent in some cases. In uncomplicated influenza, the acute illness generally resolves over 2–5 days, and most patients have largely recovered in 1 week, although a cough may persist 1–2 weeks longer.

Complications

- Primary influenza viral pneumonia
- Secondary bacterial pneumonia
- Mixed viral and bacterial pneumonia
- Myositis, rhabdomyolysis and myoglobinuria
- Myocarditis and pericarditis
- Encephalitis and transverse myelitis
- Reye's syndrome
- Toxic shock syndrome

Laboratory diagnosis

- Throat swab, nasopharyngeal swab, or washes or sputum culture
- RT-PCR is the most sensitive and specific
- Rapid diagnostic test
- Tissue culture
- Serological test

Differential diagnosis

- Mycoplasma pneumonia
- Streptococcal pharyngitis
- Early bacterial pneumonia

Treatment

Specific antiviral therapy is available for influenza: the neuraminidase inhibitors zanamivir.

and oseltamivir for both influenza A and influenza B and the adamantane agents amantadine and rimantadine for influenza A.

Clinical Presentation of URTIs

The symptoms of Influenza, other URTIs and allergies can overlap. Patients with the **common cold** usually develop it **within 2 to 3 days of exposure** and symptoms include rhinorrhea, nasal congestion, and sneezing. Patients can also complain of a sore throat and painful swallowing. A cough can be a symptom in some cases. Patients might develop a **fever** for a day or two.

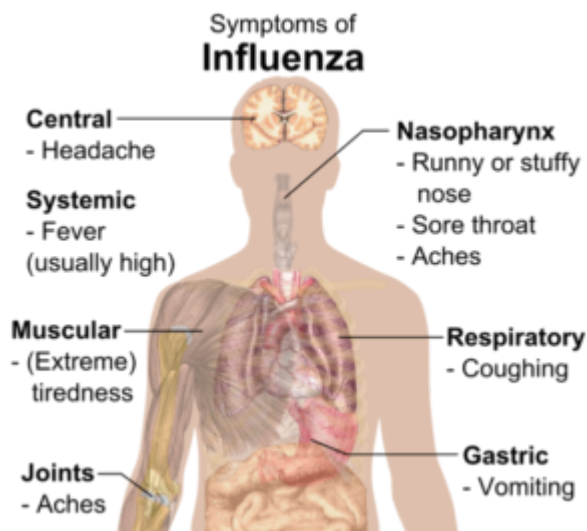


Image: "Main symptoms of influenza." by Mikael Häggström.
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Patients with **influenza virus infection** develop **body aches, high fever, severe sore throat, and headaches**. Patients with **severe or progressive pharyngitis** might have **streptococcal pharyngitis**.

Patients with **bacterial pharyngitis** might have a low-grade fever. Children can develop a **skin rash**. Unfortunately, history taking alone is usually not sufficient to exclude streptococcal pharyngitis.

The presence of **anterior cervical lymphadenopathy** is not characteristic of bacterial infection. The presence of tonsil exudates, tender anterior cervical lymph nodes and the absence of conjunctivitis, **coughing**, and rhinorrhea are suggestive of bacterial rather than viral pharyngitis.

Patients with **bacterial sinusitis** can develop persistent nasal discharge for more than 10 days, worsening of their cough and fever, or develop a severe cough and fever from the start for three consecutive days.

Patients with **epiglottitis** usually complain of a sore throat, muffled sound, fever, and drooling.

Diagnostic Workup in URTIs

The **identification of the exact infecting organism** should be attempted only when specific treatment can be provided or in the **immunocompromised patient**. Rapid tests are available for the detection of influenza and parainfluenza viruses. Viral cultures are the standard criterion for the identification of the viral etiology of the URTI but the results are usually available too late to alter the medical treatment.

Complete blood count is helpful in excluding possible bacterial infections which are characterized by neutrophilia. Unfortunately, leukocytosis is rarely seen in URTIs and complete blood count is usually not helpful in most cases.

Patients presenting with symptoms consistent with the common cold should not be offered routine imaging studies. Patients presenting with **high fever, tender neck examination** and signs suggestive of a **peritonsillar abscess** need specific imaging studies including x-rays.

Patients with suspected **group A streptococcal infection** should undergo **throat swab testing** for group A streptococcus detection by rapid antigen testing, culture or both. Positive rapid antigen detection testing for group A streptococcus is highly specific and warrants specific treatment.

On the other hand, negative results should be backed up by a negative throat swab culture. Routine testing for streptococcal antibodies including the antistreptolysin O antibody is not helpful in the identification of acute infection because these antibodies usually peak 5 weeks after the infection.

Patients with suspected **bacterial sinusitis** should undergo **computed tomography imaging of the sinuses**. Computed tomography imaging should be reserved only for bacterial cases because it can be positive in up to 80% of the cases of uncomplicated rhinosinusitis.

Pertussis is usually a clinical diagnosis. Rapid direct fluorescent antibody testing can be used to confirm the diagnosis if needed. Patients with possible epiglottitis should undergo neck x-ray which is usually enough to exclude the diagnosis.

Treatment of URIs

Treatment of RTIs is **usually symptomatic** but can sometimes be specific to the exact etiology or disease process.

Treatment of the common cold

Patients with symptoms consistent with an uncomplicated common cold should **drink plenty of water**, may benefit from **steamy baths** and may use **nasal decongestants** for a limited period of time. **Nonsteroidal anti-inflammatory drugs** can be used to alleviate pain and inflammation. No specific antiviral treatment is usually indicated.

Treatment of influenza

Antiviral therapy can be helpful early in the disease as it was found to decrease the duration and the severity of the illness. Additionally, **annual influenza vaccination** not only decreases the risk of developing influenza during the season but also decreases the severity of the symptoms once infection has occurred. **Nonsteroidal anti-**

inflammatory drugs, proper hydration, and decongestants are also helpful.

Treatment of rhinosinusitis

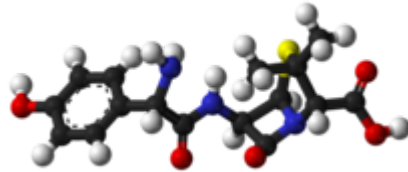


Image: "3D structure of amoxicillin." License: Public Domain

Symptomatic treatment of viral rhinosinusitis is usually adequate. Patients with suspected **bacterial sinusitis** should receive a **high-dose amoxicillin/clavulanate** as a first-line therapy. Patients allergic to penicillin can receive **doxycycline** or **levofloxacin**. Patients who are not responsive to initial [antibiotic treatment](#) should undergo **culture** and **sensitivity testing** to confirm the infecting organism and its resistance profile.

Treatment of croup

Inhaled corticosteroids in addition to **intravenous steroids** are helpful in alleviating the symptoms of croup. Additionally, **fluid replacement therapy** should be started in children to avoid [dehydration](#). **Inhaled racemic epinephrine** can also provide symptomatic relief.

Treatment of epiglottitis

Intravenous administration of [antibiotics](#) is indicated and should be started before the availability of culture results. **Ceftriaxone** and **cefuroxime** are common first-line therapies for epiglottitis. Those who experienced intimate contact with the patient should also receive **prophylactic antibiotic therapy**.

Treatment of group A streptococcus pharyngitis

Group A streptococcus is sensitive to **amoxicillin** and **penicillin**. Therefore, oral administration of one of these two antibiotics is usually effective. Patients with **non-anaphylactic shock to penicillins** can receive a first-generation **cephalosporin**. Patients with **severe allergies** should receive **clindamycin, azithromycin** or **clarithromycin**.

References

[Upper Respiratory Tract Infection](#) via medscape.com

[Upper respiratory tract infections](#) via nih.gov

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