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Upper Respiratory Infections

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KEYWORDS

• Pharyngitis • Sinusitis • Upper respiratory infection

KEY POINTS

- Upper respiratory infections (URIs) are infections of the mouth, nose, throat, larynx (voice box), and trachea (windpipe). URIs include nasopharyngitis (common cold), sinusitis, pharyngitis, laryngitis, and laryngotracheitis.
- Nasopharyngitis (common cold) is a frequent cause of URIs, and most patients with this diagnosis with present with nasal congestion (80%). Nasopharyngitis rarely presents with a fever. Causes are predictably viral, and determining the exact viral pathogen is usually unnecessary. Treatment of the common cold is symptomatic, and hand washing is the best prevention.
- Sinusitis is a common diagnosis seen in primary care. The diagnosis and differentiation between bacterial and viral sinusitis is made clinically, based on the history and examination. Augmentin is the antibiotic preferred by the Infectious Diseases Society of America for empiric treatment of bacterial sinusitis. Nasal steroids are highly effective for both viral and bacterial acute sinusitis.
- Identifying the cause of pharyngitis, especially group A β-hemolytic streptococcus (GABHS), is important in preventing potential life-threatening complications. Group A streptococcal infection (GAS) pharyngitis accounts for 15% to 30% of infections in children and 5% to 15% in adults. The Centor criteria are useful prediction rules for the evaluation and management of possible GAS pharyngitis. Penicillins are the drugs class of choice for streptococcal pharyngitis.
- Acute laryngotracheobronchitis (LTB) is an infectious-induced inflammatory condition affecting the larynx, trachea, and bronchi. It occurs most often in children ages 6 months to 6 years, with the peak age at 2 years. Recommended imaging for suspected croup includes anterior-posterior views of the neck, which show edematous subglottic walls converging to create a characteristic "steeple sign." The cornerstone of medical management of LTB is nebulized epinephrine and dexamethasone.

INTRODUCTION

Upper respiratory infections (URIs) are located in the upper respiratory tract, defined as the mouth, nose, throat, larynx (voice box), and trachea (windpipe). URIs can be one of the following conditions:

- Nasopharyngitis (common cold)

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- Sinusitis
- Pharyngitis
- Laryngitis
- Laryngotracheitis

NASOPHARYNGITIS (COMMON COLD)

The common cold is a frequent cause of URIs and can be defined as inflammation of the nasal passages owing to a respiratory virus. The vast majority of these infections are self-limited and resolve without treatment. Frequency of the common cold varies per age group (**Table 1**).

Although URIs can happen at any time, they are most common in the fall and winter months, from September until March, because these are the usual school months when children and adolescents spend a lot of time in groups and indoors. Furthermore, many URI viruses thrive in the low humidity of the winter. Signs and symptoms of the common cold are listed in **Table 2**.

Causes of the common cold are predictably viral, with the majority of these viruses falling into 1 of 200 virus strains from 6 main families; rhinovirus, influenza A/B/C, parainfluenza, respiratory syncytial virus, coronavirus, and adenovirus.

Determining which virus is the causal agent is unnecessary in the overwhelming number of cases because symptomatic therapy and "tincture of time" usually result in a full resolution of the infection. The diagnosis of a common cold is almost always based on clinical findings. Distinguishing a common cold from a more potent viral illness, such as the influenza virus, is a matter of knowing the common symptoms and signs of the flu and comparing them with those of the common cold. In rare cases, virus is cultured from nasal washings, or identified by enzyme-linked immunosorbent assay or radioimmunoassay methods (**Table 3**).

Prevention

Hand washing is the single most important activity that can reduce the risk of URI. Numerous studies have confirmed that washing with soap or using hand sanitizer lowers the risk of transmission of URI and respiratory infections.[1,2] Alcohol-based hand rubs are the most efficacious agents for reducing the number of bacteria on the hands of hospital and health care personnel. Antiseptic soaps and detergents are the next most effective, and nonantimicrobial soaps the least effective.[3,4]

Treatment of the Common Cold:

- Rest, fluids, and symptomatic measures
- Reassurance that the usual course is 6 to 10 days
- Humidification of inspired air
- Saline nasal rinse or Neti pot

Table 1
Age-specified incidence of the common cold

Age	Incidence/Year
Preschool	6–10 episodes
Elementary	7–12 episodes
Adolescents	2–4 episodes

Data from Turner RB. The common cold. In: Goldman L, Schafer AI, editors. Cecil medicine. 24th edition. Philadelphia: Saunders Elsevier; 2011. Chapter 369.

Table 2
Signs and symptoms of the common cold

Sign or Symptom	Likelihood of Having with a Cold (%)
Nasal congestion/obstruction	80–100
Sneezing	50–70
Sore or scratchy throat	50
Cough	40
Hoarseness	30
Headache	25
Fatigue/malaise	20–25
Fever	0.1

Data from Lauber B. The common cold. J Gen Intern Med 1996;11:231.

- Discontinue any tobacco or alcohol
- Raise head at night with extra pillow to allow nasal passages to drain, as needed
- For infants use bulb suction, position mattress at 45°, use saline nasal drops

Patient Education
- Reassurance
- Spread is primarily hand-to-hand transmission of contaminated nasal secretions
- Aerosolized particles (cough, sneeze) do not travel far and contain little virus
- Individual susceptibility to colds depends largely on preexisting antibodies
- Advise patients to contact you if they develop dyspnea, productive cough, or temperature >102°F (39°C)

Drugs of Choice[5,6]
- Topical decongestants: reduce edema and swelling of the nasal mucosa, promote drainage; fewer side effects than oral agents (phenylephrine: Afrin, Neosynephrine)
- Topical anticholinergics: control rhinorrhea but do not relieve congestion or sneezing (Atrovent nasal spray)

Table 3
URI versus influenza: symptom presentation

Symptom	Common Cold	Seasonal Flu
Cough	Moist and productive	Dry cough (may also be productive)
Itchy/watery eyes	Common	Uncommon
Fever	Uncommon but may occur occasionally in children	Common
Exhaustion/fatigue	Mild tiredness may occur	Very common
Headache	Common; usually due to sinus pressure	Common
Sore throat	Common, but typically mild	Uncommon
Body aches	Minor	Severe
Vomiting/diarrhea	These are not symptoms of the common cold	Uncommon, but may occur occasionally in children
Onset of symptoms	Gradual	Sudden

- Oral decongestants: longer duration of action, lack of local irritation, no risk of rhinitis medicamentosa (pseudoephedrine: Sudafed; phenylephrine: found in many over-the-counter cold and sinus remedies)
- Antihistamines: safe and effective in alleviating sneezing and rhinorrhea (diphenhydramine: Benadryl; chlorpheniramine: Chlor-Trimeton)
- Cough suppressants: useful if cough interferes with sleep or normal activities; codeine and dextromethorphan have similar efficacy (Robitussin D)
- Expectorants: commonly used but efficacy not proven (guaifenesin)
- Throat lozenges: may provide temporary relief from scratchy throat

Medication Precautions

- Oral decongestants: may increase blood pressure and glucose levels; can cause arrhythmias, headache, nervousness, sleeplessness, dizziness
- Antihistamines: nasal blockage and sinus congestion can worsen
- Cough suppressants: misuse and dependence can occur
- Expectorants: can contain high concentrations of alcohol

Alternative Drugs

- Zinc: prevents viral replication in vitro; efficacy not proven
- Vitamin C: no preventive effects and very modest symptom reduction
- Echinacea: no proven efficacy
- Probiotics: efficacy not proven

Possible Complications[7]

- Lower respiratory tract infection
- Bronchial hyperreactivity/asthma flare
- Otitis media (5%–19%)
- Acute sinusitis
- Pneumonia

ACUTE SINUSITIS

Acute (rhino)sinusitis (AS) is defined as inflammation of the nasal mucosa and sinuses.[8] AS is very common. According to a recent national health survey, approximately 1 of 7 adults are affected[9] and diagnosed per year.[10,11]

Diagnosis

Distinguishing between the common cold and AS is often a matter of symptom duration. Typical common colds are self-limited and last 7 to 10 days, whereas AS can last for up to 4 weeks. Symptoms of AS are similar to those of the common cold and include nasal congestion and discharge, facial pain over the sinuses, decreased sense of smell, and cough.[8] The waxing and waning phenomenon of symptoms sets AS apart from the common cold, usually with a mild improvement of symptoms after 5 to 7 days, followed by a worsening of symptoms, including new-onset fever, headache, and/or increased nasal discharge.[12]

A bacterial origin is generally suspected and diagnosed if the following symptoms or signs are present:

- Purulent nasal discharge
- Maxillary tooth or facial pain

- Unilateral maxillary sinus tenderness
- Worsening symptoms after initial improvement[12,13]

Diagnosis of acute bacterial sinusitis (ABS) can be made if there are 2 major or 1 major and 2 minor markers, and symptoms persist beyond 7 to 10 days, start out severe, and last at least 3 to 4 consecutive days or worsen after 5 to 7 days (**Table 4**).[12]

According to the Institute for Clinical Systems Improvement (ICSI), plain sinus radiographs and other radiographic images are usually not necessary for diagnosis of sinusitis, and provide poor sensitivity and specificity.[14] Nasal endoscopy or antral puncture and culture of secretions are ideal tests, but are not feasible for the general practitioner and should be relegated to otolaryngologists, usually in the setting of diagnosing a chronic sinusitis.

Treatment

Discriminating between bacterial and viral AS is one of the most important determinants of treatment, **Table 4** is helpful for diagnosing bacterial AS that would warrant antibiotic treatment.

Bacterial causes of AS include:

- *Streptococcus pneumoniae*
- *Haemophilus influenzae*
- *Moraxella catarrhalis*

Selecting the appropriate antibiotic will help mitigate complications. **Table 5** provides guidance.

Duration of antibiotic therapy has been studied. A meta-analysis of 12 randomized controlled trials found no statistically significant difference between long-term and short-course antibiotics for cure or improvement of symptoms.[15] Five to 7 days of treatment with the appropriate antibiotic is considered effective for patients with uncomplicated ABS.

Other treatments are listed in **Table 6**, along with their usefulness.

Additional comfort measures for treating AS include:

- Maintain adequate hydration (6–10 glasses of liquids per day)
- Apply warm facial packs (warm wash cloth, hot water bottle, or gel pack for 5–10 minutes 3 or more times a day to help with pain relief)

Table 4
Signs and symptoms of acute bacterial sinusitis

Major Markers	Minor Markers
Purulent nasal discharge	Headache
Purulent postnasal discharge	Ear pain/pressure/fullness
Nasal obstruction/congestion	Sore throat
Facial congestion/fullness	Halitosis
Focal facial pain/pressure	Dental pain
Hyposmia/anosmia	Cough
Fever (temperature 102°F [39°C])	Fever (<102°F)
	Fatigue

Modified from Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clin Infect Dis 2012;54(8):e78.

Table 5
Antibiotic regimens for acute sinusitis

Class	Line	Notes
Penicillin/amoxicillin/augmentin	First	Amoxicillin-clavulanate is recommended by the IDSA as the preferred empiric antimicrobial therapy for acute sinusitis[12]
Doxycycline	First	Doxycycline may be used as an alternative regimen to amoxicillin-clavulanate for initial empiric antimicrobial therapy for ABRS in adults because it remains highly active against respiratory pathogens[12]
Cephalosporins	Second/third	Second- and third-generation oral cephalosporins are no longer recommended[12] for empiric monotherapy for ABRS due to variable rates of resistance among *Streptococcus pneumoniae*. Combination therapy with a third-generation oral cephalosporin (cefixime or cefpodoxime) plus clindamycin may be used as second-line therapy for children with non–type I penicillin allergy or from geographic regions with high endemic rates of PNS *S pneumoniae*[12]
Quinolone	Second/third	Levofloxacin is recommended for children older than 8 y with a history of type I hypersensitivity to penicillin[12]
Sulfa	Third	Trimethoprim-sulfamethoxazole is not recommended for empiric therapy because of high rates of resistance among both *S pneumoniae* and *Haemophilus influenzae* (~30%–40%)[12]

Abbreviations: ABRS, acute bacterial rhinosinusitis; IDSA, Infectious Diseases Society of America; PNS, penicillin-nonsusceptible.

Data from Chow AW, Benninger MS, Brook I, et al. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clin Infect Dis 2012;54(8):e92.

- Eliminate environmental factors that could trigger allergic reactions (cigarette smoke, pollution/fumes, swimming in contaminated water, and barotraumas)
- Obtain adequate rest and sleep with head of bed elevated
- Avoid extremely cold or dry air
- Engage in fastidious and frequent hand washing[14]

PHARYNGITIS

Introduction

Pharyngitis is one of the most common conditions encountered by the family physician.[18] The optimal approach for differentiating among various causes of pharyngitis requires a problem-focused history, a physical examination, and appropriate laboratory testing. Identifying the cause of pharyngitis, especially group A β-hemolytic streptococcus (GABHS), is important in preventing potential life-threatening complications.[18]

Definition

Inflammation of the pharynx, caused by one of many different viruses and/or bacteria.

Table 6
Therapeutic options for AS

Class of Drug/Modality	Efficacy	Notes
Intranasal steroids	Decreases nasal inflammation	Highly recommended[14]
Antihistamines	Increases viscosity of nasal secretions	Not recommended[16]
Oral decongestants	Decrease amount of nasal secretions and edema	Caution in patients with uncontrolled hypertension, hyperthyroidism, coronary artery disease, diabetes, glaucoma, and benign prostatic hypertrophy; not indicated for children <6 y old
Topical decongestants	Decrease amount of nasal secretions	Use for no more than 3 d to lessen the risk of rebound nasal congestion Found to be more effective than oral decongestants[10]
Mucolytics	Thin nasal secretions	Useful adjunctive therapy[10]
Analgesics	Decrease headache and sinus pressure	Dose per manufacturer's guidelines
Saline nasal irrigation/ humidity and Neti pot	Thin nasal secretions/improve nasal clearance	Increases comfort[10]

Data from Refs.[10,14,16,17]

Epidemiology

- Acute pharyngitis is one of the 20 most reported reasons for outpatient office visits
- Peak season is late winter and early spring
- Transmission of typical viral and Group A streptococcal (GAS) pharyngitis occurs mostly by hand contact and has an incubation period of 1 to 3 days (35% transmission)

Etiology

- Pharyngitis is most likely caused by virus or bacteria[18,19]
- Also caused by reflux, rhinitis and postnasal drip, persistent cough, and allergy NB. Consider testing for infectious mononucleosis if the patient is between 10 and 25 years old
- GAS pharyngitis accounts for 15% to 30% of infections in children and 5% to 15% in adults
- GAS is the most common cause of bacterial infection
- Physical signs of GAS include:
  - Pharyngeal erythema and swelling
  - Tonsillar exudates
  - Edematous uvula
  - Palatine petechiae
  - Anterior cervical lymphadenopathy

Determining how likely a pharyngitis is due to GAS infection has been studied. Criteria have been developed to assist the practitioner in making a clinical diagnosis (**Table 7**).

Table 7
Centor clinical prediction rules for diagnosis of group A β-hemolytic streptococcus (GABHS) in adults

Points	LR+	Pretest prevalence of GABHS (%)			
		5	10	25	50
		Posttest probability of GABHS (%)			
0	0.16	1	2	5	14
1	0.3	2	3	9	23
2	0.75	4	8	20	43
3	2.1	10	19	41	68
4	6.3	25	41	68	86

One point for each: history of fever, anterior cervical adenopathy, tonsillar exudates, absence of cough.

Abbreviation: LR+, positive likelihood ratio.

Data from Ebell MH, Smith MA, Barry HC, et al. The rational clinical examination. Does this patient have strep throat? JAMA 2000;284:2916.

- Untreated, GAS pharyngitis lasts 7 to 10 days. These patients are infective during the acute phase of the illness and for 1 additional week, and are also at risk of suppurative complications (see later discussion)
- Effective antibiotic treatment decreases the infectious period to 24 hours, decreases symptoms, and prevents most complications

Complications of GAS

- Rheumatic fever: rare in the United States
- Peritonsillar abscess: toxic appearance, fluctuant peritonsillar mass, and deviation of uvula
- Poststreptococcal glomerulonephritis
- Scarlet fever: sandpaper-like exanthem

Other Bacterial Causes of Acute Pharyngitis Include:

- Gonorrhea
- Chlamydia
- Mycoplasma
- Diphtheria

Management of GAS Pharyngitis

The Infectious Diseases Society of America (IDSA) reiterates 2 principles of management:

1. Use of clinical and epidemiologic features to distinguish who may have GAS pharyngitis (see **Table 7**)
2. Antibacterial treatment of cases confirmed with a laboratory test (culture or rapid antigen testing)

Antibiotic Therapy for GAS Pharyngitis

- GAS is universally sensitive to penicillin[20,21]
- Drug of choice: penicillin V for 10 days
  - 250 mg 3 times daily for pediatrics
  - 500 mg 2 times daily for adults
- Benzathine G PCN injection for compliance problems

- Amoxicillin
  - Suspension tastes better

Alternative therapies include:

- Erythromycin
- First-generation cephalosporins
- Clindamycin
- Macrolides: resistance ranges from 13% to 31%[21]

LARYNGOTRACHEITIS/LARYNGOTRACHEOBRONCHITIS (CROUP)

Definition

Acute laryngotracheobronchitis (LTB) is an infectious-induced inflammatory condition affecting the larynx, trachea, and bronchi.

Prevalence

- Most common in children ages 6 months to 6 years, with the peak at 2 years[22]

Symptoms

- Hoarseness of voice followed by paroxysms of nonproductive, harsh, seal-like cough that ends with a characteristic inspiratory stridor. Fever, rhinorrhea, sore throat, and cough usually precede this. Symptoms may vary in intensity and last approximately 3 to 4 days if mild.
- Anterior-posterior radiograph view of the neck shows the subglottic obstruction.

Etiology

LTB is caused mostly by viruses, primarily parainfluenza virus types I and II, although others, such as influenza type A or B, respiratory syncytial virus (RSV), and adenovirus are also implicated. *H influenzae* type B is now a rare cause, thanks to routine immunization. Occasionally *Mycoplasma pneumoniae* can cause LTB.[22]

Clinical Findings

- Patients appear apprehensive and tend to lean forward
- The child may have tachypnea and might be using accessory respiratory muscles
- Inspiratory or expiratory stridor is prominent[23]
- Pulmonary examination may reveal rhonchi, crepitations, or wheezing
- Breath sounds may be diminished if upper airway obstruction is severe and air entry is greatly decreased

Severity of attack can be determined based on the Westley Croup Scale[24]:

2 or less: mild
3 to 7: moderate
8 or more: severe
Level of consciousness: Normal, including sleep = 0; disoriented = 5
Cyanosis: None = 0; with agitation = 4; at rest = 5
Stridor: None = 0; with agitation = 1; at rest = 2
Air entry: Normal = 0; decreased = 1; markedly decreased = 2
Retractions: None = 0; mild = 1; moderate = 2; severe = 3

Laboratory Findings

- The white blood cell count may be normal or mildly elevated.
- Noninvasive pulse oximetry to monitor the oxygen saturation is recommended.[25] Arterial blood gas assessment shows hypoxemia and/or hypercapnia, depending on the severity of the disease.
- Microbiologic diagnosis can be established by serology, viral or bacterial cultures from the pharynx, or rapid antigen detection enzyme immunosorbent assays such as for RSV or influenza type A.

Imaging

Lateral neck radiographs show overdistended hypopharynx, subglottic narrowing that is wider on expiration than inspiration, thickened vocal cords, and a normal epiglottis.

Anterior-posterior views of the neck show edematous subglottic walls converging to create a characteristic "steeple sign."[26]

There may also be diffuse narrowing of the trachea and bronchi.

Differential Diagnosis

Acute epiglottitis is a major differential diagnosis to be considered when a child presents with these symptoms. Radiographs of the neck can easily help differentiate the 2 conditions. Other causes of similar symptoms include foreign-body aspiration, which can be determined by history, radiographs, or endoscopic evaluation. Membranous croup or bacterial tracheitis should also be considered if the child presents with a clinical picture similar to croup but appears more toxic and has subglottic narrowing on radiographs of the neck. In milder cases, a simple URI is more likely. If sore throat is prominent, ensure adequate visualization of the tonsils to confirm absence of peritonsillar abscess. Allergic reactions (angioedema) and airway anomalies such as trachea/laryngomalacia should also be entertained.[22,24]

Complications

Severe croup, as may occur with influenza type A, may require tracheotomy or intubation in approximately 13% of patients and have an associated mortality of 0% to 2.7%.[15] A small percentage of children with prolonged intubation or severe disease may develop subglottic stenosis. A few follow-up studies have shown an increase in hyperactive airways in children with a history of croup.

Outpatient management of croup in children is feasible, as noted in **Fig. 1**.

Treatment

The cornerstone of medical management is nebulized epinephrine and dexamethasone.[24] Racemic or L-epinephrine may be used; its onset is 1 to 5 minutes and its effects last up to 2 hours. Dexamethasone in appropriate doses partners well with epinephrine, as its onset of action is 6 hours.[17] Nebulized budesonide is also now a therapeutic option.[27]

Oxygen may be administered, along with humidification, to avoid agitation and maintain oxygen saturation higher than 92%.[28]

Some children will fail medical management and require intubation. Intubation should be done in fully equipped units and preferably via the nasotracheal route. Extubation is usually attempted in about 5 to 7 days if extubation criteria are met. Extubation criteria include decreased secretions, decreased leakage around the endotracheal tube (which indicates decreased edema), and an alert child. Failure to extubate should prompt further endoscopic evaluation.[22]

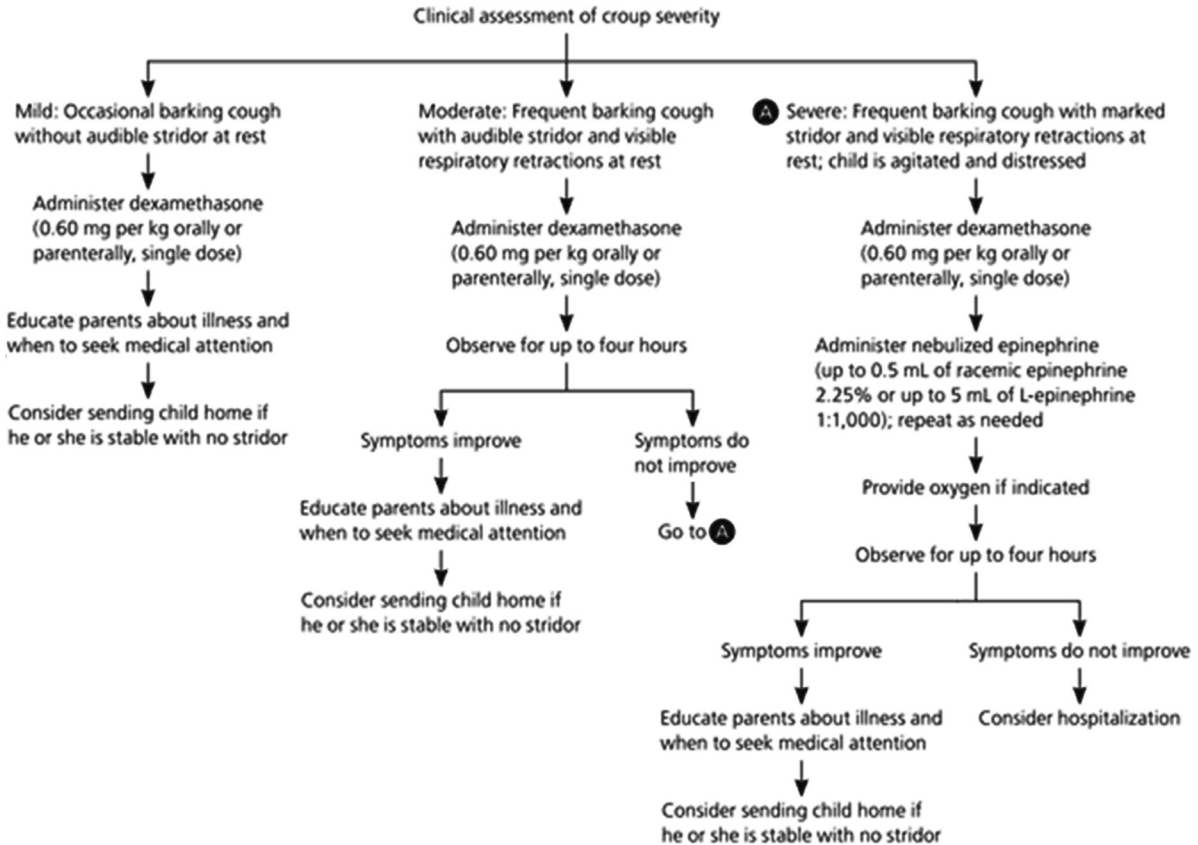

Fig. 1. Assessment and management of croup. (*From* Zoorob R, Sidani M, Murray J. Croup: an overview. Am Fam Physician 2011;83(9):1071; with permission.)

Prognosis

Croup is mostly a self-limited disease with complete uncomplicated resolution. As mentioned earlier, some children may develop hyperactive airways or become predisposed to recurrent croup. A few may develop subglottic stenosis caused by severe disease or prolonged intubation.

Prevention and Control

Good hand washing and cleanliness can help decrease transmission from an infected patient, particularly at day care centers or even in the home environment.

SUMMARY

URIs are infections of the mouth, nose, throat, larynx (voice box), and trachea (windpipe). Upper respiratory infections include nasopharyngitis (common cold), sinusitis, pharyngitis, laryngitis, and laryngotracheitis.

Nasopharyngitis (common cold) is a frequent cause of URIs, and most patients with this diagnosis with present with nasal congestion (80%). Nasopharyngitis rarely presents with a fever. Causes are predictably viral, and determining the exact viral pathogen is usually unnecessary. Treatment of the common cold is symptomatic, and hand washing is the best prevention.

Sinusitis is a common diagnosis seen in primary care. The diagnosis and differentiation between bacterial and viral sinusitis is made clinically, based on the history and examination. Augmentin is the IDSA-preferred antibiotic for empiric treatment of bacterial sinusitis. Nasal steroids are highly effective for both viral and bacterial acute sinusitis.

Identifying the cause of pharyngitis, especially GABHS, is important in helping prevent potential life-threatening complications. GAS pharyngitis accounts for 15% to 30% of infections in children and 5% to 15% in adults. The Centor criteria are useful prediction rules for the evaluation and management of possible GAS pharyngitis. Penicillins are the drugs class of choice for streptococcal pharyngitis.

LTB is an infectious-induced inflammatory condition affecting the larynx, trachea, and bronchi. It occurs most often in children ages 6 months to 6 years, the peak age being 2 years. Recommended imaging for suspected croup includes anterior-posterior views of the neck, which show edematous subglottic walls converging to create a characteristic “steeple sign.” The cornerstone of LTB medical management is nebulized epinephrine and dexamethasone.

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