The Common Cold and Decongestant Therapy

Diane E. Pappas, MD, JD,*
J. Owen Hendley, MD*

Author Disclosure
Drs Pappas and Hendley have disclosed no financial relationships relevant to this article. This commentary does contain a discussion of an unapproved/investigative use of a commercial product/device.

Objectives

After completing this article, readers should be able to:

1. Discuss the clinical presentation, diagnosis, and complications of the common cold in children.
2. Describe the viral causes and pathogenesis of the common cold.
3. Describe transmission of the common cold.
4. Explain the systemic effects of oral decongestants and antihistamines in infants and young children.
5. Recognize that over-the-counter cough and cold preparations have not been adequately studied in children younger than 6 years of age and are not recommended.
6. List the active ingredients and potential toxicities of over-the-counter cough and cold medications.

Introduction

The common cold heralds the beginning of the fall and winter seasons for pediatricians. Almost every ill patient presents with the runny nose, cough, and congestion that are the hallmarks of the common cold. Although colds are self-limited, most patients (and their parents) are tired and uncomfortable as a result of these symptoms. No effective treatments can be prescribed or recommended beyond ordinary supportive care.

Clinical Presentation

Children typically present with cough, sneezing, nasal congestion, and runny nose. Nasal discharge may be clear initially but often turns yellow-green within a few days. Fever may be present initially in preschool-age patients, but vomiting and diarrhea are uncommon. Parents also may report sleep disturbance and increased fatigue. Symptoms persist for at least 10 days in most children but should begin to lessen by this time. This clinical picture differs substantially from colds in adults, which present with the typical nasal discharge, cough, and congestion but no fever and a usual duration of only 5 to 7 days. Sore throat or hoarseness also may be present in children and adults. (1)

Diagnosis

Common cold is a clinical diagnosis. Subjective complaints may include nasal stuffiness, sore throat, and headache. Objective findings are few but may include fever, anterior cervical lymphadenopathy, erythema of the nasal mucosa and oropharynx, and nasal discharge. Laboratory tests are not helpful; commercially available rapid tests are available for detection of respiratory syncytial virus (RSV) and influenza. Other conditions to consider in the diagnosis include nasal foreign body, allergic rhinitis, vasomotor rhinitis, bacterial sinusitis, rhinitis medicamentosa, and structural abnormalities of the nose or sinuses. History and physical examination should be sufficient to differentiate these conditions from the common cold.

Complications

Secondary bacterial infections and wheezing may complicate the common cold. Bacterial infections include otitis media, sinusitis, and pneumonia. About 30% of colds in preschool-age children may be complicated by otitis media, (2) and this risk is highest in children 6 to 11 months of age. Sinusitis may occur in 5% to 10% of children who have colds and may be

*Department of Pediatrics, University of Virginia, Charlottesville, VA.

considered when symptoms are not improving after 10 days, although diagnostic criteria and the benefit of antimicrobial therapy are controversial. (3)(4) Other potential complications include peritonsillar cellulitis and abscess, conjunctivitis, mastoiditis, and meningitis.

Infants and children who have histories of reactive airway disease or asthma are at particular risk for complications, (5) most importantly for increased severity and duration of respiratory symptoms. As many as 50% of asthma exacerbations in children are associated with viral infections, especially rhinovirus. Children who have elevated immunoglobulin E concentrations and rhinovirus infection experience more severe respiratory symptoms than do other children. Studies in adults suggest that an impaired cellular response to rhinovirus infection results in increased viral replication, leading to severe and prolonged symptoms. RSV also is associated with wheezing exacerbations.

Causes

Rhinoviruses cause at least 50% of the colds in children and adults and, thus, are the most common sources of cold infections. Other causes of the common cold include adenoviruses, influenza viruses, enteroviruses, RSV, and coronaviruses. Cold viruses are not part of the normal human flora but are transferred from person to person and cause the appearance of symptoms 1 to 2 days after inoculation.

Some of these viral infections may present as a common cold or as a more specific syndrome. For example, RSV infection in older children and adults typically presents the same as any other cold, but RSV may produce bronchiolitis involving the lower respiratory tract in infants and toddlers and can produce a severe presentation. Similarly, infection with parainfluenza viruses may present as croup in younger children and as a typical cold in the older child. Adenoviral infection may present as a common cold or as pharyngoconjunctival fever, with injected palpebral conjunctivae, watery eye discharge, and erythema of the oropharynx in addition to the usual fever and upper respiratory tract symptoms. Enteroviruses may produce aseptic meningitis. Coxsackievirus A, an enterovirus, may cause herpangina, with fever and ulcerated papules on the posterior oropharynx. Infection with influenza viruses may present as a febrile respiratory illness involving the lower respiratory tract, fatigue, and muscle aches.

Epidemiology

The occurrence of the common cold is predictable in terms of who is most affected and when colds usually occur. Cold season begins in September after children are back in school, at which time their frequency sharply elevates and remains at a constant level until spring returns. This epidemic results not from a single cold virus but from a number of viruses moving through the community during the fall and winter seasons. In the early fall, rhinovirus begins to increase; parainfluenza viruses follow in late fall, with RSV and coronavirus infections increasing during the winter months. Cold season concludes with a final surge of rhinovirus infections in the spring. Only a few rhinovirus and enterovirus infections are still present in the community in the summer.

Colds are most common in children younger than the age of 6 years, who routinely experience six to eight colds annually. This frequency may result from susceptibility due to lack of previous exposure as well as from the natural attributes of childhood, namely, curious exploration of the world with concomitant poor hygiene. Child care attendance increases the number of colds experienced by young children as a result of repeated exposure to other children. By the teenage years, the frequency decreases to four to five colds every year, with parents of young children experiencing only three to four colds annually. Adults who live with young children experience more colds than other adults living without young children in the home.

Pathogenesis

Viral infection of the nasopharyngeal mucosa does not cause the symptoms of the common cold directly, instead initiating a host inflammatory response that produces the symptoms. Cold virus is deposited on the mucosa of the nose or conjunctivae. Virus then attaches to receptors on cells in the nasopharynx and enters the cells. Only a small number of cells become infected. The infected cells release potent cytokines, including interleukin (IL)-8, which is a chemoattractant for polymorphonuclear cells (PMNs). PMNs accumulate in large numbers in the nasal secretions. Vascular permeability increases and plasma proteins, including albumin and bradykinin, leak into the nasal secretions, increasing the volume of secretions produced.

Bradykinin can cause rhinitis and sore throat, which may contribute further to the discomfort caused by the cold. Mucociliary clearance is slowed. Histamine concentrations do not increase during the course of the common cold. The nasal mucosa is not destroyed during rhinovirus and coronavirus infections, but adenovirus and influenza viruses do destroy the nasal mucosa. Symptom severity correlates with IL-8 concentration over the course of the infection.

Infected cells are extruded and washed away with the secreted inflammatory mediators, preventing spread of the virus to nearby cells. Viral replication declines, the inflammatory response decreases, and symptoms begin to subside. Although symptoms are improved, virus still can be recovered from the nasopharynx for at least 2 weeks after inoculation. Finally, after 2 to 3 weeks, adequate neutralizing antibody is available to end the infection.

As shown in healthy adults who have experimentally induced rhinovirus colds, bradykinins and PMNs accumulate in nasal secretions at the onset and for the duration of cold symptoms. It is believed that the presence of PMNs in the nasal secretions, as well as their enzymatic activity, may be the source of the yellow-green color typical of the nasal discharge of the common cold. The nasal mucosa in children has more secretory capacity than that in adults, which may contribute to significant nasal discharge for days.

Viral rhinosinusitis is a frequent finding during the course of the common cold. Imaging of the paranasal sinuses in children who have uncomplicated colds demonstrates abnormalities of the paranasal sinuses in about two thirds of children, most commonly the maxillary and ethmoidal sinuses. Significant resolution occurs within 2 weeks. This finding implies that accumulation of fluid in sinus cavities may be part of the cold and is not diagnostic of a bacterial infection. It is not known if sinus involvement results from actual viral infection of the sinus mucosa or from impaired mucus clearance.

Abnormal middle ear pressures also occur commonly during the course of illness in both adults and children. Abnormal middle ear pressures may be present in up to two thirds of school-age children during the course of a cold. This effect occurs most frequently during the first several days of illness and resolves within 2 to 3 weeks.

Immunity

The frequency of colds may be due either to their lack of producing lasting immunity or because there are so many serotypes that immunity to some viral strains has no real impact. Viruses that do not produce lasting immunity after infection include RSV, parainfluenza viruses, and coronaviruses, resulting in an individual possibly suffering recurrent infection with these same agents. Other viruses, such as rhinoviruses, adenoviruses, influenza viruses, and enteroviruses, do produce lasting immunity, but there are so many serotypes that this immunity has no real impact on reducing the frequency of cold infections. As a result, an effective vaccine for the common cold is unlikely.

Transmission

There are three proposed mechanisms for transmission of the common cold: small particle aerosols produced from coughing that are inhaled by another person, large particle droplets produced from saliva expelled during a sneeze that land on the conjunctivae or nasal mucosa of another person, or self-inoculation of one's own conjunctivae or nasal mucosa after touching a person or object contaminated with cold virus. In the experimental setting, sneezing (large-particle aerosol) has been shown to be a very inefficient method of transmission of rhinovirus. (6) Small-particle aerosol transmission of rhinovirus has been shown to occur but also appears to be inefficient. (7)

Substantial evidence from the experimental setting suggests that rhinovirus can be transmitted efficiently via self-inoculation. Rhinovirus is excreted in nasal secretions but is only present minimally in saliva. Fingers and hands are frequently contaminated with rhinovirus, as are telephones and other everyday objects. (8) In experimental settings, hand-to-hand transfer and hand-to-surface-to-hand transfer have been shown to be feasible mechanisms for transfer of rhinovirus to susceptible individuals. Once the hands are contaminated with cold virus, self-inoculation readily occurs when a person touches his own nose or eyes with the contaminated hand or fingers. (6)(9)

Self-inoculation also appears to be an effective method of rhinovirus transmission in the home environment because secondary transmission in the home can be reduced if self-inoculation is interrupted. In one study, mothers whose fingertips were treated with virucidal 2% aqueous iodine were much less likely to become infected than mothers whose fingertips were treated with placebo. (9) Similarly, the use of virucidal tissues to interrupt viral transfer has been shown to decrease secondary transmission of colds in the home modestly. (10)

Influenza viruses and coronaviruses can be transmitted by small-particle aerosol. RSV is not transmitted by small-particle aerosol but has been shown to be transmissible by large-particle aerosol. RSV and rhinoviruses are not transmissible by oral inoculation.

Treatment

Although much desired, effective treatments for the common cold remain elusive. Over-the-counter (OTC) cough and cold medications are readily available for children and are sold in various combinations to address symptoms. Antihistamines, antitussives, expectorants, decongestants, and antipyretics/analgesics are commonly sold in combinations. Every week, more than 10% of children in the United States are treated with a cough

and cold medication, and most of these preparations are multiple-ingredient products. Symptomatic relief is the primary goal of treatment, although preventing disease spread and reducing the likelihood of secondary bacterial infections are also considerations. However, little scientific evidence supports their use, and there is increasing evidence of potential adverse effects that may result from their use.

In the past few years, the use of OTC cough and cold medications for children and infants has been under intense scrutiny. A total of 123 deaths in children younger than the age of 6 years have resulted from OTC cough and cold medications in the past 20 years. OTC medications also are a common cause of emergency department visits because of adverse effects or accidental ingestions. Poison control centers reported more than 750,000 calls related to the use of OTC cough and cold medications since 2000.

The risk for accidental overdose and adverse effects is likely the result of many factors. Dosing guidelines for children have not been established but are extrapolated from adult data. Parents may be easily confused by product labeling. The availability of multi-ingredient products may increase the likelihood of inadvertent overdose because parents may not understand what they have given to their child. Finally, multiple caregivers for young children may increase the risk of accidental overdose and adverse reactions further.

As a result of a citizen petition filed in March 2007, the United States Food and Drug Administration (FDA) initiated a review of the safety and effectiveness of cough and cold medications for children. In October 2007, FDA advisers voted to recommend that OTC cough and cold medications not be used for treatment of children younger than the age of 2 years. Since then, the number of emergency department visits for adverse events related to the use of cough and cold medications in children younger than 2 years of age has decreased by more than half. (11) Drug manufacturers voluntarily discontinued marketing these products for children younger than age 2 years. The FDA has since issued a public health advisory recommending that cough and cold medications not be used in children younger than age 2 years. FDA advisory committees have voted to ban OTC cough and cold medications for use in children younger than age 6 years. FDA review of this recommendation is underway. Some manufacturers have changed the labeling of their products to recommend against their use in children younger than the age of 4 years. (12) The American Academy of Pediatrics recommends against the use of OTC cough and cold medications in children younger than the age of 6 years. (13)

Antibiotics

The common cold is a viral infection, and there is no role for antibiotics. Antibiotics cannot treat the underlying infection and will not decrease the likelihood of bacterial complications. Antibiotics are indicated only when secondary bacterial complications are diagnosed.

Antiviral Agents

Except in the case of influenza, no antiviral drugs are available to treat the common cold. For influenza, a number of antiviral agents are available and provide modest reduction in symptoms and duration, including oseltamivir, amantadine, rimantadine, and zanamivir. These medications inhibit release of virus from infected cells.

Antihistamines (H1 Receptor Blockers)

First-generation antihistamines are common ingredients in OTC cough and cold medications. Triprolidine, diphenhydramine, hydroxyzine, and chlorpheniramine are all in this class of medications. These medications are well-absorbed, with onset of action within 15 to 30 minutes and duration of action of 3 to 6 hours or more. Because these medications are also anticholinergic, they decrease mucus secretion. In addition, anticholinergic action may result in dry mouth, blurred vision, and urinary retention. Gastrointestinal upset may occur. Cardiac effects have been reported, including tachycardia, prolongation of the QTc interval, heart block, and arrhythmias. Central nervous system (CNS) effects such as sedation, paradoxic excitability, respiratory depression, and hallucinations may result, especially in cases of overdose. Dystonic reactions have been reported.

Second-generation antihistamines (egs, terfenadine, astemizole, loratadine, and cetirizine) lack anticholinergic activity. These medications have fewer CNS effects than first-generation antihistamines. Cardiac effects, although rare, may occur, including prolonged QT interval, ventricular arrhythmia, and heart block.

In adults, several studies show that first-generation antihistamines (chlorpheniramine) provide some symptomatic relief of cold symptoms, specifically, decreased sneezing and increased mucociliary clearance. Another study showed decreased nasal discharge and duration of symptoms when first-generation antihistamines (chlorpheniramine) were used to treat adults who had the common cold.

There are few studies of antihistamine use in children. (14) In one study, children treated with an antihistamine-decongestant combination (brompheniramine maleate/phenylpropanolamine hydrochloride) showed no improve-

ment in cough over placebo other than the treated children being more likely to be asleep 2 hours after receiving medication. A study of clemastine treatment in children who had colds showed no decrease in nasal discharge, although the color of the nasal discharge changed from yellow to white. In another study, diphenhydramine at bedtime was no better than placebo or dextromethorphan in reducing cough or improving sleep. Few adverse effects are reported from first-generation antihistamine use in children.

Decongestants

Oral sympathomimetic decongestants are available and are common ingredients in OTC cough and cold medications. A significant proportion of children (1 in 20) have taken pseudoephedrine in any given week, with the greatest use in children younger than the age of 2 years (1 in 12). Oral decongestants include pseudoephedrine, phenylpropanolamine, and phenylephrine. These compounds are vasoconstrictors, acting on adrenergic receptors to decrease blood flow in the mucosa. Unfortunately, not only the nasal mucosa is affected; the use of oral decongestants also results in generalized vasoconstriction with a resultant increase in blood pressure. Other adverse effects include headaches, seizures, nausea, vomiting, decreased appetite, agitation, tachycardia, nervousness, irritability, dystonia, and dysrhythmias.

Evidence in adults shows that both pseudoephedrine and phenylpropanolamine effectively reduce nasal symptoms, including nasal congestion and sneezing. Phenylephrine undergoes extensive biotransformation, resulting in variable bioavailability, which limits its usefulness.

Increasing governmental control has greatly limited the availability of oral decongestants. Phenylpropanolamine has been associated with intracranial hemorrhage and was removed from the market in 2000 after being classified as "unsafe" by the FDA. As a result of the 2005 Combat Methamphetamine Act and potential for abuse of the agent, products containing pseudoephedrine are now kept behind pharmacy counters with monitoring who is purchasing such products.

Topical decongestants act on the adrenergic receptors in the nasal mucosa to cause vasoconstriction, causing nasal tissues to shrink. Onset is rapid, within a few minutes, and may last several hours. Systemic absorption is minimal. Common topical decongestants include oxymetazoline, xylometazoline, and phenylephrine. These topical agents can reduce nasal congestion in adults, but their usefulness is limited to only a few days because of their potential for rebound congestion (rhinitis medicamentosa) when the medication is discontinued.

No information supports the effectiveness of either oral or topical decongestants in children who have colds. In children ages 6 months to 5 years, one study of a decongestant/antihistamine combination (phenylpropanolamine/brompheniramine) compared with placebo found no improvement in nasal congestion, rhinorrhea, or cough. (15) In a study of children 6 to 18 months of age treated with topical phenylephrine, neither nasal obstruction nor abnormal middle ear pressures improved. (16) In another study in children, xylometazoline had no effect on eustachian tube function. (17) Because infants are obligate nose-breathers, there is much concern about the potential dangers of these agents. Deaths in infants and young children treated with pseudoephedrine have been reported.

Antitussives

Although cough is a protective action that clears airway secretions to maintain airway patency, it remains one of the most bothersome symptoms of the common cold. Suppressing cough effectively may actually be harmful for some children, especially the child who has asthma and is unable to clear his or her airway. Nevertheless, a multitude of OTC preparations are available purporting to suppress cough in children.

One of the most common antitussive ingredients is dextromethorphan, a narcotic analog that does not have CNS effects unless excessive doses are used. Dextromethorphan is well tolerated at therapeutic doses, with few adverse effects. Unfortunately, there are few studies of antitussives in children. In one study of children 18 months to 12 years of age, there was no difference in cough between the placebo-, dextromethorphan-, or codeine-treated groups. Furthermore, cough decreased in all three groups after 3 days. (18) Another study in children ages 2 to 18 years who had acute cough treated with dextromethorphan found no improvement in cough with increasing dose. (19)

Accidental overdose can cause respiratory depression, and there are reports of death in infants younger than 12 months of age after dextromethorphan ingestion. In one series of accidental ingestions in children younger than 5 years old (average age, 28 months), the children remained stable hemodynamically, although some experienced sedation. Because of the lack of efficacy and the risk of serious adverse effects, the American Academy of Pediatrics does not recommend the use of dextromethorphan in children. (20)

Dextromethorphan can have serious CNS effects, es-

pecially when ingested in large doses. Once ingested, absorption from the gastrointestinal tract occurs quickly. Dextromethorphan crosses the blood-brain barrier, where it blocks serotonin uptake while stimulating serotonin release. These effects may result in a serious adverse reaction called serotonin syndrome, characterized by autonomic instability, altered mental status, and neuromuscular abnormalities. Dextromethorphan is also an N-methyl-d-aspartate receptor antagonist and inhibits the neurotransmitter glutamate, which can cause a dissociative state and hallucinations. Dextromethorphan is metabolized via the cytochrome P450 pathway in the liver. Some people are "slow metabolizers" and have difficulty metabolizing dextromethorphan due to genetic differences. Due to cross-reactivity, rapid immunoassay drug screens may incorrectly report excessive dextromethorphan ingestion as phencyclidine.

In recent years, dextromethorphan has increasingly become a drug of abuse for adolescents and young adults because of its ability to produce intoxication, hallucinations, and dissociation. DXM, Dex, Skittles, Robo, and Triple-c are slang terms for dextromethorphan. A number of factors make dextromethorphan an attractive choice for abuse: it is readily available OTC at drug and grocery stores, it is legal to purchase, it is inexpensive, and it is considered harmless. It is also available in powder form over the internet. With mild intoxication, dextromethorphan causes a mild stimulant effect that involves euphoria, stupor, and hyperexcitability. Other effects may include diaphoresis, nausea, vomiting, nystagmus, and mydriasis. At higher doses, dextromethorphan can cause hallucinations, delusions, an ataxic gait, and somnolence. At extreme doses, dextromethorphan may cause a dissociative state, with paranoia, coma, and death. (21) The reports in the literature of death in otherwise healthy adolescents and young adults as a result of dextromethorphan abuse is increasing.

Codeine often is used as an antitussive. Codeine is a narcotic that is believed to act centrally on the cough center. It is also a mild analgesic and sedative. Although codeine is the "gold standard" antitussive, no studies in adults or children support the antitussive properties of codeine for treatment of cough associated with the common cold. In fact, in one study of patients ages 18 months to 12 years, codeine was no more effective than placebo for cough suppression in children who had nighttime cough due to a cold. (18) The American Academy of Pediatrics recommends against the use of codeine in children who have cough. (20)

Narcotics such as codeine may cause dose-dependent respiratory depression, and infants seem to be particularly susceptible to these effects and the subsequent development of apnea. Infants and young children may be at risk for toxicity due to their immature hepatic enzyme systems because codeine is inactivated by conjugation in the liver. Drug clearance is also reduced in infants and may increase the risk of toxic effects. Infants who have impaired lung function (such as those who have bronchiolitis) may have increased susceptibility to respiratory depression. Death due to accidental overdose in young infants has been reported. Codeine may cause CNS depression that is reversible with naloxone. Adverse effects in children treated with appropriate doses of codeine include nausea, vomiting, constipation, and dizziness.

First-generation antihistamines are also marketed to suppress cough. Studies in patients who have chronic cough have reported a decrease in cough frequency when doses causing sedation are employed. These medications may cause thickening of bronchial secretions, and some believe that their use is contraindicated in children who have acute wheezing or asthma. Studies in children of antihistamine treatment alone or of decongestant/antihistamine combinations have found no improvement in cough when compared with placebo.

A recent study suggests that honey may provide some relief from nighttime cough in children who have colds. (22) In this study, a bedtime dose of honey was better than no treatment in children who had cough from colds. The generalizability of the results of this single study is limited. Honey is not recommended for children younger than age 12 months because of the risk of exposure to botulinum spores.

Expectorants

Expectorants are medications intended to increase mucus production. Guaifenesin is the most commonly available expectorant. In young adults who have colds, treatment with guaifenesin failed to decrease cough frequency, but patients did report subjective improvement in thickness and quantity of sputum. (23) Other studies in adults suggest that guaifenesin may reduce cough frequency. Studies in children demonstrating effectiveness do not exist.

Analgesics/Antipyretics

Analgesics/antipyretics such as acetaminophen, aspirin, and ibuprofen may be useful for the fever and general discomfort of the common cold. However, both aspirin and acetaminophen suppress the neutralizing antibody response, which results in increased nasal symptoms and

prolonged viral shedding. The use of aspirin is not recommended in children because of its association with Reye syndrome.

Echinacea

Echinacea is a common herbal therapy recommended for treatment of the common cold, but few well-controlled studies have evaluated its safety and effectiveness. The most complete and well-controlled study to date demonstrated no effect of echinacea on severity of symptoms or rate of infection in adults. (24)

Menthol

Menthol is a common ingredient in vapor therapies. Objective evaluation of nasal resistance in adults before and after menthol inhalation showed no effect, although patients did report a sense of improved air flow. In a recent study in school-age children, inhalation of menthol did not decrease cough or increase nasal patency, but patient perception of improved nasal patency was reported. (25) In a recent study, bedtime application of a vapor rub (camphor, menthol, and eucalyptus oils) to the chest and neck of children ages 2 to 11 years resulted in symptomatic relief of nighttime cough, congestion, and sleep difficulty when compared with petrolatum or no treatment. (26) Chemical irritation of the nasal mucosa may result from topical treatment with menthol preparations. Gastrointestinal and CNS effects may result from accidental ingestion.

Ipratropium Bromide

Ipratropium bromide is a nasal spray that decreases nasal discharge of the common cold via its anticholinergic activity. Unfortunately, its usefulness is limited to children older than age 5 years, and adverse effects include nosebleeds, nasal dryness, and headache.

Zinc

Zinc often is proposed as a treatment for cold symptoms because in vitro studies have demonstrated that zinc inhibits rhinovirus replication. Adverse effects include nausea, bad taste, diarrhea, and mouth or throat irritation. Some studies in adults suggest that early treatment with zinc gluconate can reduce the duration of cold symptoms. Usefulness may be limited by the need for frequent administration (5 to 6 times/day) and common adverse effects, including bad taste and gastrointestinal upset. In schoolchildren (first through twelfth grade), treatment with zinc lozenges did not decrease the duration of cold symptoms. (27)

Vaporizers

Efforts to establish steam inhalation as an effective treatment for nasal congestion due to the common cold have failed to demonstrate benefit. Some studies in adults have even shown that the duration and severity of symptoms may increase after treatment with humidified air. Inhalation of steam has not been shown to increase nasal patency, although many people report subjective improvement in nasal obstruction following inhalation. Because rhinoviruses replicate best at 33 to 34°C, inhalation of steam was hypothesized to reduce rhinovirus replication, but steam did not reduce viral titers in nasal secretions during rhinovirus infection.

Saline Nose Drops/Bulb Suction

Saline drops with bulb suction are often used to moisten the nasal mucosa and loosen secretions for removal from infants and children. Adults may use saline nose sprays for similar purposes. A recent study in school-age children suggests that nasal symptoms and sore throat improve more quickly with daily saline washes. (28)

Prevention

The best treatment of a cold is prevention. Annual influenza vaccination is recommended and is the only vaccine available to prevent a respiratory viral infection. Handwashing effectively removes cold viruses from the hands. Virucidal tissues have been shown to reduce secondary transmission modestly in the home. Virucidal hand gels are also available, but there are no published studies evaluating their usefulness. Alcohol-based hand sanitizers have not been shown to reduce secondary transmission of colds in the home or school environment, likely because rhinovirus is not affected by these products. Limiting contact with one's own nasal and conjunctival mucosa can reduce self-inoculation.

References

1. Pappas DE, Hendley JO, Hayden FG, Winther B. Symptom profile of common colds in school-aged children. *Pediatr Infect Dis J.* 2008;27:8–11

2. Revai K, Dobbs LA, Nair S, Patel JA, Grady JJ, Chonmaitree T. Incidence of acute otitis media and sinusitis complicating upper respiratory tract infection: the effect of age. *Pediatrics.* 2007;119:e1408–e1423

3. Wald ER, Nash D, Eickhoff J. Effectiveness of amoxicillin/clavulanate potassium in the treatment of acute bacterial sinusitis in children. *Pediatrics.* 2009;124:9–15

4. Garbutt JM, Goldstein M, Gellman E, Shannon W, Littenberg B. A randomized, placebo-controlled trial of antimicrobial treatment for children with clinically diagnosed acute sinusitis. *Pediatrics.* 2001;107:619–625

Summary

- Although colds are self-limited viral infections that generally resolve in 10 to 14 days, they are a common cause of discomfort and distress for children and their parents.
- Complications can occur, including secondary bacterial infections and wheezing exacerbations.
- Given the lack of proven benefit and the risk of significant adverse effects, no prescription or OTC treatments are recommended for children; supportive care remains the only recommended treatment.
- Education of parents should include the current recommendations against the use of cough and cold medications in children younger than the age of 6 years as well as the potential risks of such OTC treatments in children of all ages.
- Although colds may be spread through large-particle aerosols, small-particle aerosols, and self-inoculation, increasing evidence suggests that self-inoculation is a common method of transmission in the home. (6)(9)
- Based on consensus, OTC cough and cold medications are not recommended for use in children younger than 6 years of age. (12)
- Based on moderate evidence, colds are a common trigger for asthma exacerbations in children. (5)
- Consensus evidence suggests that because of the many different serotypes of some cold viruses and other cold viruses not producing lasting immunity, it is unlikely that effective vaccines for the common cold will be developed.

5. Rakes GP, Arruda E, Ingram JM, et al. Rhinovirus and respiratory syncytial virus in wheezing children requiring emergency care: IgE and eosinophil analyses. *Am J Respir Crit Care Med*. 1999;159:785–790

6. Hendley JO, Wenzel RP, Gwaltney JM Jr. Transmission of rhinovirus colds by self-inoculation. *N Engl J Med*. 1973;288:1361–1364

7. Dick EC, Jennings LC, Mink KA, et al. Aerosol transmission of rhinovirus colds. *J Infect Dis*. 1987;156:442–448

8. Winther B, McCue K, Ashe K, Rubino JR, Hendley JO. Environmental contamination with rhinovirus and transfer to fingers of healthy individuals by daily life activity. *J Med Virol*. 2007;79:1606–1610

9. Gwaltney JM Jr, Hendley JO. Mechanisms of transmission of rhinovirus infections. *Epidemiol Rev*. 1988;10:242–258

10. Farr BM, Hendley JO, Kaiser DL, Gwaltney JM. Two randomized, controlled trials of virucidal nasal tissues in the prevention of natural upper respiratory infections. *Am J Epidemiol*. 1988;128:1162–1172

11. Shehab N, Schaefer MK, Kegler SR, Budnitz DS. Adverse events from cough and cold medications after a market withdrawal of products labeled for infants. *Pediatrics*. 2010;126:1100–1107

12. Kuehn BM. Debate continues over the safety of cold and cough medicines for children. *JAMA*. 2008;300:2354–2356

13. American Academy of Pediatrics Urges Caution in Use of Over-The-counter Cough and Cold Medicines [press release]. 2008. Accessed November 2010 at: http://www.aap.org/advocacy/releases/jan08coughandcold.htm

14. Smith SM, Schroeder K, Fahey T. Over-the-counter medications for acute cough in children and adults in ambulatory settings. *Cochrane Database Syst Rev*. 2008;1:CD001831

15. Clemens CJ, Taylor JA, Almquist JR, Quinn HC, et al. Is an antihistamine-decongestant combination effective in temporarily relieving symptoms of the common cold in preschool children? *J Pediatr*. 1997;464–466

16. Turner RB, Darden PM. Effect of topical adrenergic decongestants on middle ear pressure in infants with common colds. *Pediatr Infect Dis J*. 1996;15:621–624

17. van Heerbeek N, Ingels JAO, Zielhuis GA. No effect of a nasal decongestant on eustachian tube function in children with ventilation tubes. *Laryngoscope*. 2002;112:1115–1118

18. Taylor JA, Novack AH, Almquist JR, Rogers JE. Efficacy of cough suppressants in children. *J Pediatr*. 1993;122:799–802

19. Paul IM, Shaffer ML, Yoder KE, Sturgis SA, et al. Dose-response relationship with increasing doses of dextromethorphan for children with cough. *Clin Ther*. 2004;26:1508–1514

20. American Academy of Pediatrics Committee on Drugs. Use of codeine- and dextromethorphan-containing cough remedies in children. *Pediatrics*. 1997;99:918–920

21. Logan BK, Goldfogel G, Hamilton R, Kuhlman J. Five deaths resulting from abuse of dextromethorphan sold over the internet. *J Analyt Toxicol*. 2009;33:99–103

22. Paul IM, Beiler J, McMonagle A, Shaffer ML, Duda L, Berlin CM Jr. Effect of honey, dextromethorphan, and no treatment on nocturnal cough and sleep quality for coughing children and their parents. *Arch Pediatr Adolesc Med*. 2007;161:1140–1146

23. Kuhn JJ, Hendley JO, Adams KF, Clark JW, Gwaltney JM Jr. Antitussive effect of guaifenesin in young adults with natural colds: objective and subjective assessment. *Chest*. 1982;82:713–718

24. Turner RB, Bauer R, Woelkart K, Hulsey TC, Gangemi JD. An evaluation of Echinacea angustifolia in experimental rhinovirus infections. *N Engl J Med*. 2005;353:341–348

25. Kenia P, Houghton T, Beardsmore C. Does inhaling menthol affect nasal patency or cough? *Pediatr Pulmonol*. 2008;43:532–537

26. Paul IM, Beiler JS, King TS, Clap ER, et al. Vapor rub, petrolatum, and no treatment for children with nocturnal cough and cold symptoms. *Pediatrics*. 2010;126:1092–1099

27. Macknin ML, Piedmonte M, Calendine C, Janosky J, Wald E. Zinc gluconate lozenges for treating the common cold in children: a randomized controlled trial. *JAMA*. 1998;279:1962–1967

28. Šlapak I, Skoupá J, Strnad P, Hornik P. Efficacy of isotonic nasal wash (seawater) in the treatment and prevention of rhinitis in children. *Arch Otolarngol Head Neck Surg*. 2008;134:67–74

PIR Quiz

Quiz also available online at http://pedsinreview.aappublications.org.

1. A 5-year-old boy is brought to your office because of clear nasal discharge, nasal congestion, sore throat, and temperature of 38.2°C for 2 days. He appears well on physical examination, although his nasal mucosa and pharynx are erythematous and he has yellowish nasal discharge. Which of the following is the *most* likely etiologic agent causing his symptoms?

   A. Adenovirus.
   B. *Haemophilus influenzae.*
   C. Respiratory syncytial virus.
   D. Rhinovirus.
   E. *Streptococcus pneumoniae.*

2. You are evaluating a 2-year-old girl who has a 3-day history of nasal congestion and clear rhinorrhea. Findings on physical examination reveal erythema of the nasal mucosa and no other abnormalities. You diagnose a simple viral upper respiratory tract infection. Which of the following is the *most* likely complication of this condition?

   A. Conjunctivitis.
   B. Mastoiditis.
   C. Meningitis.
   D. Otitis media.
   E. Reactive airway disease.

3. A mother brings in her 18-month-old daughter because of a runny nose and congestion for the sixth time since she started child care 12 months ago. She is worried about the number of "colds" that her daughter has had and is concerned that something else is wrong. The girl has grown well, and findings on physical examination are normal except for mild nasal congestion and clear rhinorrhea. Which of the following is the *most* likely reason for her recurrent symptoms?

   A. Anatomic abnormality of the sinuses.
   B. Bacterial colonization of her nasopharynx.
   C. Immunoglobulin subclass deficiency.
   D. Repetitive exposure to infected children who are coughing or sneezing.
   E. Transmission of illness from child care staff.

4. A 3-year-old girl who has the acute onset of nasal congestion, sore throat, and cough presents to the emergency department in the middle of the night because the cough is keeping her awake. Her parents are upset because both they and the girl are losing sleep, and they request something to "get rid of the cough." Which of the following is the *most* appropriate recommendation at this time?

   A. Oral codeine.
   B. Oral dextromethorphan.
   C. Oral diphenhydramine.
   D. Topical (nasal) phenylephrine.
   E. Topical (nasal) saline drops.