Delivering Evidence-Based Care in Acute Bronchitis

Using three guiding principles from the Centers for Disease Control and Prevention, the authors outline a plan to diagnose and treat acute bronchitis without overusing antibiotics.

By Rita M. Fickenscher, PA-C, and Ben A. Fickenscher, MD

Acute bronchitis is a self-limited inflammation of the large airways of the lung that is characterized by cough. Among patients who seek medical care with a primary complaint of cough, bronchitis is consistently on the list of the top 10 diagnoses in the United States and the top five diagnoses internationally. Data from the National Health Interview Survey indicate that 5% of all adults have at least one episode of acute bronchitis each year, and 90% of these people seek medical attention.

Acute bronchitis occurs predominantly in the fall and winter, with the incidence increasing from September to March and peaking between December and February. A 2004 study of seasonal variation in a variety of diagnoses indicates a robust seasonality in the presentation of the diagnostic cluster of rhinitis, otitis media, upper respiratory illness, and bronchitis. Because cold weather causes people to spend more time indoors in confined spaces, the chance of sharing pathogens increases. In addition, most viral agents thrive in the low humidity of heated indoor air, which causes nasal mucosal friability and increases the susceptibility to infection.

>>FAST TRACK<<

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This article reviews the anatomy and physiology of the tracheobronchial tree and the microbiology of acute bronchitis. Using three principles set forth by the Centers for Disease Control and Prevention (CDC), we will then discuss how to diagnose and treat acute bronchitis, the controversial role of antibiotics in treatment, and the importance of patient-provider communication.

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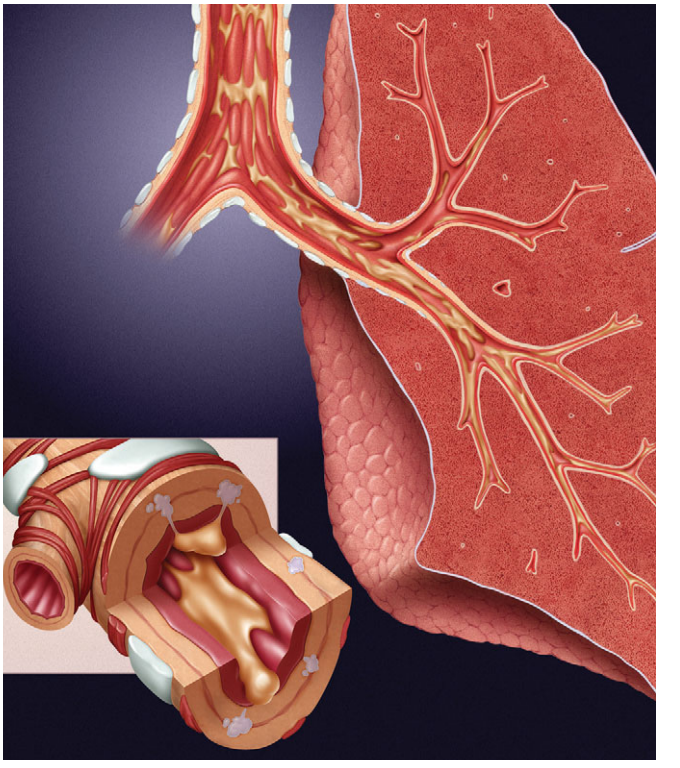

INSIDE THE TRACHEOBRONCHIAL TREE

The right and left bronchi diverge off the trachea at the carina. The bronchi divide into lobar and then segmental bronchi that supply the 19 segments of the lung. The wall of the tracheobronchial tree is made up of C-shaped cartilage and submucosal mucous glands, which are compound tubular glands that display both serous and mucous cells and secrete immunoglobulins that help to resist infection and

maintain mucosal integrity. The tracheobronchial tree is lined by pseudostratified epithelium that is primarily made up of ciliated cells that beat in a coordinated fashion at a frequency of 1000 to 1500 cycles per minute. This ciliary escalator is capable of moving particles as small as 2 µm in diameter away from the lungs. The epithelium also includes mucous-secreting goblet cells, Clara cells that accumulate and detoxify inhaled toxic agents, and Kulchitsky cells, which are neuroendocrine cells that contain hormonally active polypeptides and vasoactive amines.

Distal to the bronchi are the bronchioles that do not contain cartilage or mucous-secreting cells. The epithelium becomes progressively thinner until only one cell layer is present, consisting of the nonciliated columnar Clara cells. These terminal bronchioles divide into respiratory bronchioles that merge into the alveolar ducts and alveoli.

Causes of Acute Bronchitis

Viruses	influenza A and B
	parainfluenza
	respiratory syncytial virus
	coronavirus
	adenovirus
	rhinovirus
	human metapneumoniavirus
Bacteria	*Mycoplasma pneumoniae*
	Chlamydia pneumoniae
	Bordetella pertussis
	Only in patients with underlying lung disease
	Streptococcus pneumoniae
	Moraxella catarrhalis
	Haemophilus influenzae
Noninfectious causes	asthma exacerbation
	allergens
	air pollutants
	tobacco
	cannabis

MICROBIOLOGY OF ACUTE BRONCHITIS

Acute bronchitis is generally understood to be an inflammatory response to an infectious or noninfectious trigger that results in epithelial injury with airway hyperresponsiveness and increased mucus production. Viruses are the most common triggers of infectious bronchitis (see table). Those isolated (from the most to the least common) include influenza A and B viruses, parainfluenza virus, respiratory syncytial virus, coronavirus, adenovirus, rhinovirus, and human metapneumoniavirus.

Only *Bordetella pertussis*, *Mycoplasma pneumoniae*, and *Chlamydia pneumoniae* have been implicated as the nonviral, infectious cause of uncomplicated acute bronchitis in patients without underlying lung disease. When considering patients with underlying lung disease, the list expands to include *Streptococcus pneumoniae*, *Moraxella catarrhalis*, and *Haemophilus influenzae*. Noninfectious triggers include asthma exacerbation, air pollutants, cannabis, and tobacco.

FIRST CDC GUIDING PRINCIPLE

The CDC defines acute bronchitis as an acute cough illness or an acute lower respiratory infection lasting less than three weeks in an otherwise healthy individual. In an effort to standardize the evaluation and treatment of patients with acute bronchitis, the CDC has developed three guiding principles, the first of which is: *The evaluation of adults with an acute cough illness or a presumptive diagnosis of uncomplicated acute bronchitis should focus on ruling out serious illness, particularly pneumonia.*

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The diagnosis of acute bronchitis is imprecise because it is based on clinical findings that lack

standardized signs. There are also no sensitive or specific confirmatory laboratory tests. This situation contributes to the variability in diagnostic and treatment regimens.

The CDC's current guidelines, based on evidence and quality-based reviews, state that the absence of fever (oral temperature, 100.4° F or higher), tachycardia (heart rate, 100 or higher), tachypnea (respiratory rate of 24 or higher), and egophony, rales, or fremitus during a chest examination significantly reduces the likelihood of pneumonia, making further testing unnecessary. Chest films should be considered for any patient whose vital signs exceed these parameters or who reports a cough lasting more than three weeks. Your index of suspicion should also be increased and the threshold for ordering chest films should be lowered when evaluating elderly or very young patients or patients with chronic lung disease. The algorithm on page 29 illustrates how to distinguish acute bronchitis from pneumonia.

Pneumonia often presents in elderly patients with an absence of distinctive signs and symptoms. One study of patients aged 75 and older with community-acquired pneumonia diagnosed by chest radiography demonstrated that only 30% had a temperature greater than 100.4° F and only 37% had a heart rate greater than 100 beats per minute.

Conversely, even with abnormal vital signs but absent chest auscultatory findings, chest radiography may not be necessary for patients who present with other clinical features more consistent with viral illness (such as influenza), streptococcal pharyngitis, or sinusitis.

Cough, with or without sputum production, is the most commonly observed sign and reported symptom of acute bronchitis. Although the cough usually lasts for less than two weeks, 26% of patients report coughing after two weeks, and a few are still coughing at six to eight weeks. Other signs and symptoms of acute bronchitis include dyspnea, wheezing, chest pain, fever, and malaise.

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Sputum production is often used by patients and providers as a sign of a bacterial infection. Purulence occurs when inflammatory cells or sloughed mucosal epithelial cells are present, and it can result from both viral and bacterial infections. Sputum may be clear, white, yellow, green, or blood-tinged. Peroxidase produced and released by the increased presence of leukocytes in the sputum causes the color change; therefore, sputum color alone is not an indicator of bacterial infection.

Rapid diagnostic tests do exist for several pathogens linked to acute bronchitis, but their routine use is generally not cost-effective in emergency department and outpatient settings. Such testing is advised only when the suspected organism is treatable and there is a known community outbreak. For example, the rapid influenza test is used to evaluate patients with cough and fever during influenza season. Rapid direct fluorescent antibody testing is available as a screening tool for pertussis, but due to the current low positive predictive value, all such polymerase chain reaction (PCR) tests should be followed by culture confirmation.

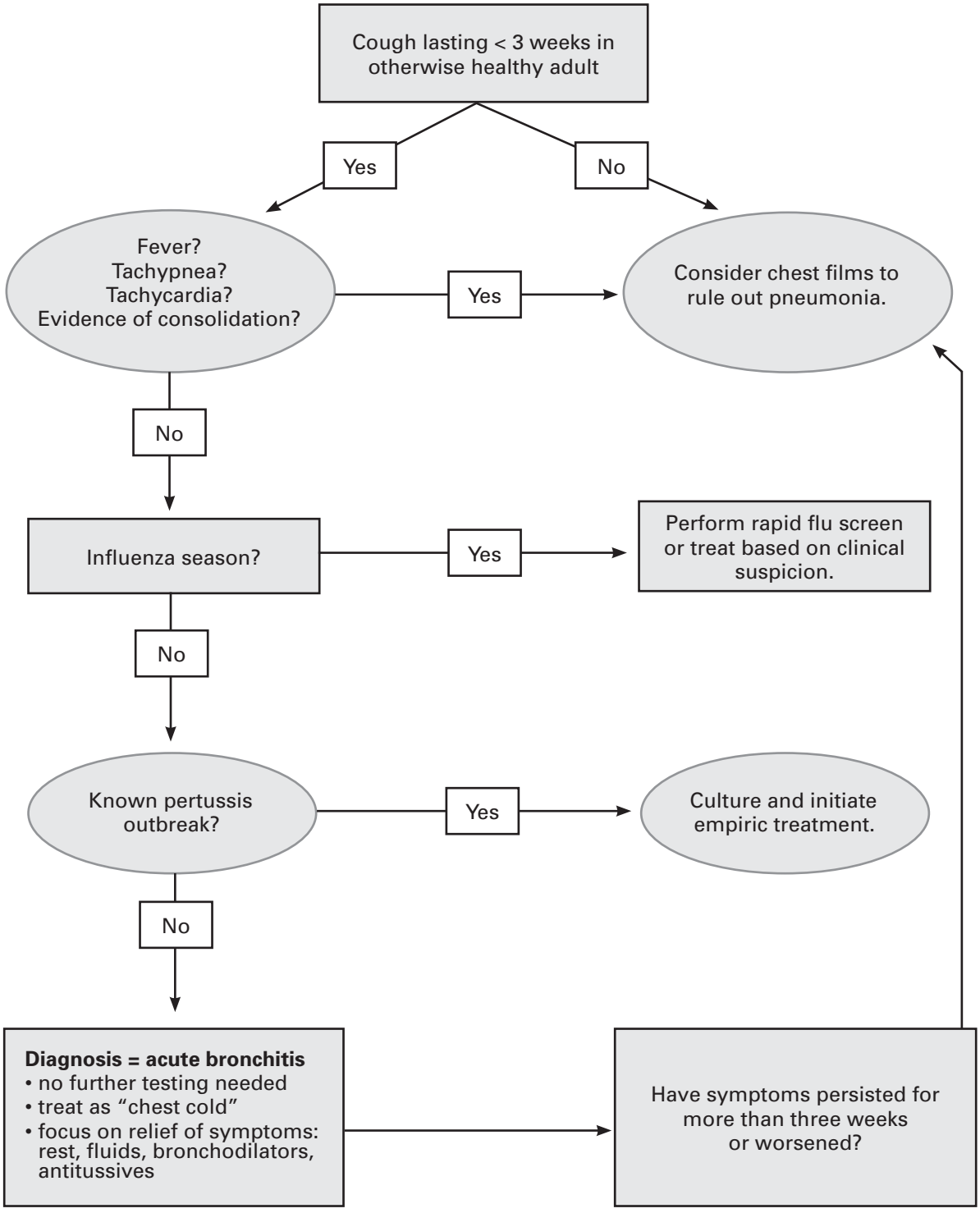
Recurrent episodes of acute bronchitis should prompt you to consider underlying asthma as an etiology. Bronchial hyperresponsiveness and abnormal pulmonary function tests are clinical findings in both acute bronchitis and asthma exacerbations, making it difficult to establish a definitive diagnosis. Consider a complete work-up for asthma for patients with recurrent cough or cough lasting longer than three weeks.

SECOND CDC GUIDING PRINCIPLE

The second principle issued by the CDC is this: *Routine antibiotic treatment of uncomplicated acute bronchitis is not recommended, regardless of duration of cough.*

Numerous randomized placebo-controlled trials have not supported using antibiotics to treat uncomplicated acute bronchitis. In fact, all studies to date have concluded that the routine use of antibiotics does not have a consistent impact on the duration or severity of the illness or on the potential for developing complications. Analysis of prescribing data reveals that, overall, physicians in the United States are not prescribing antibiotics for primarily viral respiratory tract infections as often. However, one study of factors associated with the prescription of antibiotics for bronchitis and other acute respiratory infections found that 76% of family physicians and internists, particularly those who practice in the northeastern and southern states, use antibiotics as part of their treatment regimen.

Diagnostic Flow Chart for Acute Bronchitis



Rest, fluids, and analgesics are the mainstays of most therapeutic regimens for acute bronchitis. However, we can also offer symptomatic therapy, especially for the relief of cough. Trials have shown the benefit of albuterol therapy and the efficacy of bronchodilators, which make sense given the frequent finding of bronchial hyperresponsiveness in acute bronchitis.

The efficacy of antitussive treatment is less clear. There is some support in the literature for a modest effect of antitussive preparations containing dextromethorphan, codeine, hydrocodone, carbetapentane, and benzonatate on the duration and severity of cough.

Evidence supports antibiotic treatment of uncomplicated acute bronchitis if pertussis is suspected. Antimicrobial therapy does not affect the resolution of symptoms—it is recommended primarily to decrease the shedding of pathogens and contain the spread of the disease. Antibiotics that are active against pertussis, such as azithromycin, erythromycin, or trimethoprim-sulfamethoxazole, should be initiated empirically while waiting for diagnostic confirmation. Additionally, all close contacts should be treated prophylactically.

Antibiotic treatment of acute bronchitis is also supported during peak influenza seasons. The antiviral neuramidase inhibitors, such as oseltamivir and zanamivir, have demonstrated efficacy in reducing illness duration of both influenza A and B viruses if treatment begins within 48 hours of the onset of symptoms. Amantadine and rimantadine are no longer recommended by the CDC for the treatment of influenza because they have activity only against influenza A and high levels of resistance have been documented. Rapid diagnostic tests are readily available, but recent studies suggest that during documented influenza outbreaks, the positive predictive value of a diagnosis based on clinical judgment appears to be as high as that for diagnostic testing.

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Recent studies of a root extract of *Pelargonium sidoides* have shown interesting and promising clinical benefit.

Several alternative therapies are promoted as reducing the severity or duration of symptoms related to acute bronchitis. One gram per day of vitamin C reduced the duration of cold illnesses by one-half day in clinical trials. Results using zinc lozenges have been mixed and their benefits remain unclear. Studies of echinacea have also yielded indefinite results and have shown that more than half of the preparations sold over the counter do not meet the quality standards described on the label. In fact, many do not contain any active ingredient.

Recent studies of a root extract of *Pelargonium sidoides* (a South African geranium species) have shown interesting and promising clinical benefit in the treatment of acute bronchitis. A homeopathic preparation of the root was used in the early 1900s as a remedy for tuberculosis. In one randomized, double blind, placebo-controlled trial, both the severity and the duration of illness were significantly less in the pelargonium group than in the placebo group. *Pelargonium sidoides* is marketed in the United States under the trade name Umcka and is found in health food stores.

THIRD CDC GUIDING PRINCIPLE

The CDC's third principle is as follows: *Patient satisfaction with care for acute bronchitis depends more on physician-patient communication than on whether an antibiotic is prescribed.*

All authoritative sources, including the CDC, the American Academy of Family Physicians, the American College of Physicians-American Society of Internal Medicine, and the Infectious Diseases Society of America, call for a halt to the practice of prescribing antibiotics for the treatment of uncomplicated acute bronchitis. Patients' expectations that they will receive antibiotics for acute bronchitis are primarily based on having antibiotics prescribed on a previous occasion for treatment of this illness. However, mounting evidence supports the position that patient satisfaction depends on the quality of the patient-provider encounter and not on receiving an antibiotic. These findings should encourage all providers to stop the self-perpetuating prescription of unnecessary antibiotics. Here are some suggestions from the sources above for improving patient-provider encounters and restricting antibiotic use:

- Spend adequate time discussing patients' symptoms, answering their questions, and validating their concerns.
- Refer to acute bronchitis as a "chest cold," for which there is generally no effective antibiotic treatment.
- Inform patients that previous antibiotic use increases their likelihood of harboring or being

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infected with antibiotic-resistant bacteria. Explain that antibiotic resistance among community-acquired bacterial pathogens (as opposed to pathogens acquired while hospitalized) has reached epidemic proportions and is a major public health concern. Therefore, we need to restrict antibiotic use to conditions for which there is a proven clinical benefit. A chest cold is not one of them.

Emphasizing strategies for preventing the spread of infection is also an important part of the patient-provider encounter. Handwashing, avoiding touching unwashed hands to the nose and mouth, and cleaning environmental surfaces are all simple but effective preventive measures. Stress that immunization is also available for influenza and is recommended for certain groups, such as people with chronic medical conditions, people over age 50, and pregnant women. In addition, the CDC recommended in 2006 that adults aged 19 to 64 years receive Tdap (tetanus toxoid, reduced diphtheria, and acellular pertussis vaccine) as a replacement for the tetanus and diphtheria (Td) booster. Adults who have contact with infants, women who might become pregnant, and health care personnel are also encouraged to receive Tdap.

OUTLOOK FOR THE FUTURE

The development of rapid, office-based diagnostic tests that are highly sensitive and specific at distinguishing between treatable causes and nontreatable viruses could be a valuable tool in evaluating patients with acute bronchitis. These tests may also help to decrease the unnecessary prescription of antibiotics. Multiplex PCR testing of nasopharyngeal swabs with clinically useful sensitivity and specificity is being developed to aid in the diagnosis of infections from *B. pertussis*, *M. pneumoniae*, and *C. pneumoniae*. Assays of serum procalcitonin, which is elevated in bacterial infections, are currently available in Europe. One recent study of the use of rapid procalcitonin testing in an inpatient population with the diagnosis of lower respiratory tract infection demonstrated a large reduction in antibiotic use.

C-reactive protein (CRP) synthesis is stimulated by inflammation, and levels are increased preferentially but not exclusively by bacterial infections. Thus, elevated levels are sensitive but not specific for bacterial pneumonia as a cause for acute bronchitis. Rapid CRP testing is used widely in Europe and has been approved by the U.S. Food and Drug Administration, but methods to improve specificity need to be studied before this test is integrated into a clinical algorithm. □

SUGGESTED READING

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