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# Evidence-based diagnosis and management of acute bronchitis



**Abstract:** *Acute bronchitis is a common respiratory infection seen in primary care settings. This article examines the current evidence for diagnosis and management of acute bronchitis in adults and provides recommendations for primary care clinical practice.*

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**A**cute bronchitis is a common, self-limiting, respiratory tract infection characterized primarily by a cough lasting less than 3 weeks.<sup>1</sup> Patients frequently present to nurse practitioners (NPs) with acute cough. Although most acute cough illnesses are benign and self-limited, they are extremely bothersome, and several serious differentials must be excluded. Given the common and potentially serious nature of an acute cough, it is critical for NPs to appropriately diagnose and manage acute bronchitis. This article examines the current research-based evidence for diagnosis and management of acute bronchitis. Recommendations for the diagnosis and management of acute bronchitis in adults who are not immunocompromised and do not have a serious underlying lung disease (for example, chronic obstructive pulmonary disease [COPD] or bronchiectasis) are also explored.

## ■ Epidemiology and pathophysiology

Although the exact incidence of acute bronchitis is unknown, it is believed to be an extremely common condition—particularly in the fall and winter months.<sup>2</sup> In fact, data from the 2006, 2007, and 2010 National Ambulatory

Medical Care Surveys indicate “cough” as the top clinical symptom for which individuals seek care from outpatient healthcare providers.<sup>3-5</sup>

Over 90% of acute bronchitis cases are viral with etiologies, including influenza A and B, parainfluenza, coronavirus, respiratory syncytial virus, adenovirus, rhinovirus, and human metapneumovirus. Bacterial causes are rare and include *Bordetella pertussis*, *Chlamydia pneumoniae*, and *Mycoplasma pneumoniae*.<sup>2</sup>

Acute bronchitis stems from inflammation of the bronchial epithelium. This inflammation causes the bronchial and tracheal mucosa to thicken as well as epithelial-cell desquamation and denuding of the basement membrane airway.<sup>2,6</sup>

One of the most troubling aspects of acute bronchitis is its lengthy nature. A recent meta-analysis of 19 studies found that the mean duration of cough in adults with an acute cough illness was 17.8 days.<sup>7</sup> Purulent sputum is also common in acute bronchitis and is the result of sloughing of the tracheobronchial epithelium and inflammatory cells.<sup>2,8</sup> Contrary to popular belief, the presence of purulent sputum does not indicate a bacterial infection.<sup>9</sup>

**Keywords:** acute bronchitis, acute cough illness, respiratory tract infection



### ■ Clinical presentation and diagnosis

Cough is the primary symptom of acute bronchitis. By definition, adults with acute bronchitis present with a cough illness of less than 3 weeks' duration.<sup>1</sup> Although localized symptoms (such as nasal congestion, runny nose, sore throat) associated with nonspecific respiratory infections (colds) may be present with acute bronchitis, systemic symptoms such as fever, myalgia, nausea, malaise, and dyspnea are typically absent. However, it is not uncommon for individuals with acute bronchitis to experience bronchospasm and wheezing, especially if there is an underlying history of asthma.<sup>10</sup>

In order to accurately diagnose and manage acute bronchitis in adults, the NP should perform a history and physical exam that considers the main differential diagnoses for acute cough illness and primarily focuses on ruling out pneumonia, *B. pertussis* (commonly referred to as "pertussis"), and influenza. (See *Differential diagnoses for acute cough illness*.) The history should focus on type and length of symptoms, paying particular attention to worrisome systemic symptoms (such as fevers, myalgia, dyspnea) more commonly seen in pneumonia. The physical exam in acute bronchitis is often normal, although low-grade fever (less than 100.4° F [38°C]) and/or wheezing and rhonchi may be present. However, crackles and other signs of lung consolidation (egophony, increased fremitus, dullness to percussion) should be absent; the presence of these signs warrants further workup.<sup>1,2,10</sup> Procalcitonin is currently being evaluated as a potential serum biomarker for distinguishing between bacterial and viral infections (see *Role of procalcitonin in the diagnosis of acute bronchitis*). Additional diagnostic tests are usually not warranted in

#### Differential diagnoses for acute cough illness<sup>1,10</sup>

- ACE inhibitor-induced cough
- Acute bronchitis
- Acute exacerbation of COPD
- Acute sinusitis
- Asthma
- Bronchiectasis
- Gastroesophageal reflux disease
- Heart failure
- Influenza
- Nonspecific upper respiratory tract infection
- Pertussis
- Pneumonia
- Pulmonary embolus
- Upper airway cough syndrome (previously referred to as postnasal drip syndrome)

the absence of signs and symptoms of pneumonia, pertussis, or influenza.

**Pneumonia.** Pneumonia should be considered and ruled out when vital signs are abnormal (pulse greater than 100, respirations greater than 24/minute, or temperature greater than 100.4° F [38°C]) and/or when signs of consolidation are present on lung exam. Systemic symptoms should also warrant suspicion for pneumonia. Older individuals may not mount a fever with infections; therefore, pneumonia should also be considered and ruled out in patients over 75 years of age in the presence of respiratory rate greater than 24/minute, decreased oxygen saturation, decreased mental status, and/or a change in behavior.<sup>11</sup>

According to the most recent consensus guidelines published by the Infectious Diseases Society of America and the American Thoracic Society, the presence of an infiltrate on chest X-ray is considered the gold standard for diagnosing pneumonia.<sup>12</sup> However, dehydration may result in a false-negative chest X-ray, and one study found 7% of patients with initial "negative" chest X-rays had findings consistent with pneumonia on repeat chest X-ray.<sup>13</sup> Therefore, the absence of infiltrate on chest X-ray should not supersede clinical judgment in ill-appearing patients suspected of having pneumonia.

**Pertussis.** Pertussis is a highly contagious bacterial respiratory illness with several potentially severe complications, including dehydration, hypoxia, encephalopathy, syncope, seizures, pneumonia, pneumothorax, and rib fractures from severe coughing.<sup>14</sup> Although pertussis is more common in children, the incidence in adolescents, adults, and older adults has risen dramatically over the past 2 decades and needs to be considered and ruled out whenever patients present with acute cough illnesses.<sup>15-17</sup>

Pertussis should be considered when a cough illness lasts for 2 or more weeks without another apparent cause and includes one or more of the following symptoms: paroxysms of cough, inspiratory "whoop" sound, or posttussive vomiting. Pertussis should also be considered during community outbreaks or when an individual has a close contact with an individual with a confirmed case of pertussis.<sup>18</sup> The actual diagnosis of pertussis is based upon lab testing. For more information regarding pertussis testing, visit: [cdc.gov/pertussis/clinical/index.html](http://cdc.gov/pertussis/clinical/index.html).

**Influenza.** Influenza is also a highly contagious respiratory virus with potentially severe complications in the older adult and in those with underlying metabolic or cardiopulmonary conditions, such as COPD and diabetes. Annual epidemics of influenza tend to occur during the fall and winter months in the United States; however, the peak of influenza activity can occur as late as April or May. Symptoms of influenza can include fever, myalgia, headache,

malaise, cough, sore throat, and runny nose. Fever and body aches usually last for 3 to 5 days, whereas cough and lack of energy may last for 2 or more weeks. The symptoms of influenza are nonspecific; therefore, influenza is often difficult to diagnose based on symptoms alone.<sup>19</sup> Rapid diagnostic tests can aid clinicians in diagnosing influenza but should only be obtained if the results of the testing will impact decision making regarding treatments.<sup>20</sup> For more information on the diagnosis and treatment of influenza, visit: [cdc.gov/flu/professionals/index.htm](http://cdc.gov/flu/professionals/index.htm).

### ■ Management

**Antibiotics.** The management of acute bronchitis is primarily supportive and is focused on controlling cough. Antibiotic therapy has a minor role in acute bronchitis, primarily for pertussis. Over the past 30 years, multiple studies have shown little or no improvement when antibiotics are prescribed for adults with acute bronchitis.<sup>21-25</sup> More recently, a 2012 Cochrane systematic review of 15 randomized controlled trials (RCTs) with 2,618 patients, including smokers and nonsmokers, found a statistically significant reduction in cough duration by 0.6 days with antibiotic treatment.<sup>26</sup> In addition, a recent 12-country RCT of 2,161 adults diagnosed with acute bronchitis found no difference in duration of symptoms between the amoxicillin versus the placebo group.<sup>27</sup>

Antibiotics are prescribed over 50% of the time for adults with acute bronchitis who present to primary care clinicians.<sup>28,29</sup> Although inappropriate antibiotic use for acute bronchitis and other acute viral respiratory infections has decreased over the past decade, recent studies indicate an increase in prescriptions of broad-spectrum antibiotics for acute bronchitis, a phenomenon that goes against the principles of good antibiotic stewardship and promotes antibiotic resistance.<sup>30-33</sup>

**Symptom management.** Cough control is the goal of symptom management for acute bronchitis; however, there is currently no “best” treatment strategy to facilitate this. Although multiple pharmacologic preparations are available for the treatment of cough, there is a dearth of published research literature related to support them. In addition, results from the available studies have been mixed and/or have shown treatments to be minimally effective.

**Over-the-counter (OTC) medications.** A 2012 Cochrane systematic review of OTC medications for acute cough assessed 18 RCTs with 3,421 adults for the effectiveness of several OTC cough preparations, including antitussives (codeine cough syrup, dextromethorphan, and moguisteine, the latter of which is not available in the United States), an expectorant (guaifenesin), a mucolytic (bromhexine), antihistamines (terfenadine [removed from U.S. market in 1998]

### Role of procalcitonin in the diagnosis of acute bronchitis<sup>53-62</sup>

Although acute bronchitis is primarily viral in etiology, a small minority (~10%) of individuals with acute bronchitis will have a bacterial infection and might benefit from antibiotic therapy. However, distinguishing viral from bacterial etiologies of acute bronchitis on the basis of history and physical exam has been elusive. Procalcitonin is a peptide precursor of calcitonin released in response to bacterial toxins and appears promising in terms of distinguishing bacterial from viral etiologies. Simply put, procalcitonin rises with bacterial infections but appears minimally altered by viral infections. Interestingly, procalcitonin levels do not increase for other inflammatory conditions (such as inflammatory bowel disease or temporal giant cell arteritis). In addition, serum procalcitonin levels are not altered by glucocorticoids or nonsteroidal anti-inflammatory agents. A number of trials have demonstrated the utility of procalcitonin in distinguishing bacterial from viral respiratory infections. Furthermore, a Cochrane review of 14 trials including 4,221 patients found that using a procalcitonin algorithm to guide decision making regarding antibiotics for acute respiratory infections resulted in decreased antibiotic use with no increase in mortality or treatment failure. Procalcitonin appears to be a promising biomarker for helping to distinguish between bacterial and viral etiologies for acute bronchitis and other respiratory tract infections. However, further study is needed, and procalcitonin is not recommended for routine use in primary care at this time.

and thonzylamine), and antihistamine/decongestant combinations (both loratadine/pseudoephedrine and dexbrompheniramine/pseudoephedrine).<sup>34</sup> Study results were mixed across all of these preparations; however, this review was severely limited by the relatively few number of studies for each of these medications.

**Opioids and tramadol.** Codeine has long been considered the “gold standard” for cough suppression. However, there is surprisingly little evidence to support the use of codeine and hydrocodone for the treatment of acute cough. No recent research has been conducted regarding codeine and hydrocodone for cough. A 2007 review explored the effectiveness of codeine in cough; five studies were found, none of which indicated codeine as being more effective than placebo.<sup>35</sup> Similarly, the only available published research related to hydrocodone and cough is small and relates to the use of hydrocodone for cough in advanced cancer and during bronchoscopy.<sup>36,37</sup> In addition, there is one case report regarding the effectiveness of tramadol in a patient with interstitial pneumopathy.<sup>38</sup>

**Beta-2 agonists.** A 2011 Cochrane systematic review assessed the effectiveness of beta (β)-2 agonists (albuterol) for acute bronchitis.<sup>39</sup> This study reviewed five RCTs with

418 adults and found no significant benefits from oral (three RCTs) or inhaled (two RCTs) preparations of beta-2 agonists. However, this study was also limited due to the small number of clinical trials. In addition, this review only looked at the use of  $\beta$ -2 agonists in those without pre-existing pulmonary disease, such as asthma, who often experience wheezing and bronchospasm with acute bronchitis and may benefit from an inhaled  $\beta$ -2 agonist.

**Nonsteroidal anti-inflammatory drugs (NSAIDs).** A 2009 Cochrane systematic review of NSAIDs for the common cold reviewed nine RCTs with 1,064 adult patients.<sup>40</sup> Although improvement was observed in noncough symptoms such as sore throat, ear pain, and headache, no improvement was seen for the symptom of cough. However, it is important to note that this review looked at patients experiencing the common cold, not specifically acute bronchitis. There were recent published studies aside from the 2009 systemic review. However, a study is underway



*Nebulized lidocaine has been proposed as a potential treatment for the cough associated with acute bronchitis.*

comparing ibuprofen, amoxicillin/clavulanic acid, and placebo in adults with acute bronchitis.<sup>41</sup>

**Benzonatate.** Benzonatate, a peripherally acting oral antitussive agent, thought to suppress cough by anesthetizing pulmonary stretch receptors, has very little published evidence to support its effectiveness. In fact, a search of the Pubmed database revealed two studies. Most recently, a small RCT was conducted with 30 adult nonsmokers experiencing an acute illness. Each subject received three out of four possible regimens at different times: guaifenesin alone, benzonatate alone, the guaifenesin and benzonatate combined, or placebo. The subjects also inhaled capsaicin until five or more coughs were obtained one hour after ingesting each of these regimens. Results showed that the combination of benzonatate (200 mg) and guaifenesin (600 mg) suppressed cough greater than placebo or either benzonatate alone ( $p < 0.001$ ) or guaifenesin alone ( $p = 0.008$ ). However, this study was also limited by both its small sample size and its use of capsaicin to induce cough.<sup>42</sup> The second study was a case study of three patients with advanced cancer who experienced cough and responded to benzonatate.<sup>43</sup>

**Nebulized lidocaine.** Nebulized lidocaine is frequently used prior to bronchoscopies to suppress the cough reflex and has been proposed as a potential treatment for

the cough associated with acute bronchitis. A recent literature review found seven studies where nebulized lidocaine had been successfully and safely used for intractable cough in a variety of conditions.<sup>44</sup> However, all of these studies were very small, and further study is warranted with larger samples prior to recommending nebulized lidocaine for routine use.

#### Herbal remedies

**Pelargonium sidoides.** *P. sidoides* is a member of the geranium family, which is native South Africa. It is believed to have mild antibacterial, antiviral, and mucolytic properties and has been available in Germany since 1983.<sup>45</sup> A 2009 Cochrane systematic review found three RCTs, including 746 adult patients with acute bronchitis. The review showed inconsistencies in both dosing and results.<sup>46</sup> Another RCT was conducted with 406 adults diagnosed with acute bronchitis since this review.<sup>47</sup> Participants were assigned to one of four treatment groups: placebo, 30 mg, 60 mg, 90 mg of *P. sidoides* extract daily. At day 7, there was significant improvement in all three treatment groups compared to placebo with regards to symptoms and quality of life.<sup>47</sup> The results from this trial are promising; however, more research is needed regarding

the effectiveness and safety of *P. sidoides* before it can be recommended for acute bronchitis.

**Chinese medicinal herbs.** Chinese herbs have long been used to treat acute cough illnesses and other respiratory tract infections, and some are believed to have antitussive and antiviral properties. A 2012 Cochrane systematic review found 74 studies with 6,877 patients; however, none of the studies met the inclusion criteria for the review; therefore, no recommendations regarding the use of Chinese medicinal herbs could be made.<sup>48</sup>

#### Implications for advanced practice nursing

Acute bronchitis is a common condition treated in primary care settings. Although the diagnosis of acute bronchitis is not difficult to make, it requires careful consideration of the competing differential diagnoses with an eye toward ruling out more serious infections. Unfortunately, there is no “magic bullet” for treating the cough associated with acute bronchitis. Although many cough preparations are available for the treatment of cough associated with acute bronchitis, there is a relative void of research related to these preparations, and most of these studies have been small and/or had inconsistent results (see *Summary of diagnostic and treatment recommendations for adults with acute cough illness*).

### Summary of diagnostic and treatment recommendations for adults with acute cough illness\*<sup>1,2,10,11,13,18,20-27,30,34-38,41-48,52</sup>

Diagnostic recommendations	Treatment recommendations
<ul style="list-style-type: none"> <li>• Perform a history and physical exam focused on ruling out common differential diagnoses.</li> <li>• Physical exam is often normal in acute bronchitis; however, wheezing and rhonchi may be present.</li> <li>• Primary focus should be on ruling out pneumonia, influenza, and pertussis.</li> <li>• Obtain chest X-ray<sup>†</sup> if pulse is greater than 100/minute, respirations greater than 24/minute, or temperature greater than 100.4° F [38° C] and/or when signs of consolidation are present on lung exam (for example, crackles, egophony).</li> <li>• In persons over age 75, obtain chest X-ray<sup>†</sup> if respiratory rate greater than 24/minute, decreased oxygen saturation, decreased mental status, and/or change in behavior—regardless of temperature.</li> <li>• Consider influenza in presence of fever, myalgia, headache, malaise, cough, sore throat, and/or runny nose. Rapid diagnostic tests should only be performed if results will influence treatment.</li> <li>• Consider pertussis when cough illness is present for 2 or more weeks without other apparent cause and when paroxysmal coughing, inspiratory “whoop” sound, or posttussive vomiting is present. Also consider pertussis during community outbreaks and if the individual has had close contact with someone with confirmed pertussis.</li> </ul>	<ul style="list-style-type: none"> <li>• Antibiotics should not routinely be used for the treatment of acute bronchitis.</li> <li>• Focus of management for acute bronchitis should be on cough control.</li> <li>• There is no strong research evidence to support any of the following pharmacologic preparations: OTC preparations, opioids or tramadol, beta-2 agonists, NSAIDs, or benzonatate. Use of these medications for acute cough should be based on patient values, preferences, and experiences, combined with clinician expertise.</li> <li>• Small body of promising evidence regarding nebulized lidocaine; however, nebulized lidocaine should not be used until further studies are conducted to determine its effectiveness and safety.</li> <li>• There is no strong evidence regarding the herbal treatment, <i>P. sidoides</i>. Do not use <i>P. sidoides</i> until further studies are available regarding its effectiveness and safety.</li> <li>• Adequate published trials regarding Chinese medicinal herbs are lacking. Do not use Chinese medicinal herbs for acute bronchitis until adequate studies are available regarding its effectiveness and safety.</li> <li>• Be a good listener; respect patients’ self-knowledge; discuss worries, symptoms, and concerns, explain likely etiology and course of illness; discuss treatment options; attempt to handle concern in one office visit; and provide opportunity to follow up (if needed) via e-mail or phone.</li> </ul>

\*In the absence of immunosuppression and underlying lung disease.

<sup>†</sup>Dehydration can result in false-negative chest X-ray and should not supersede clinical judgment in ill-appearing patients.


Although this review cannot recommend particular pharmacologic or herbal treatments for acute bronchitis, this is not to say that there are no available treatments for the management of acute bronchitis. The NP should consider several points when reviewing this article. First, for the most part, is the fact that high-quality published studies regarding treatments for cough were lacking, and therefore, recommendations could not be made for or against the various treatment recommendations. Second, the various preparations were compared to placebo, which is not the same as “no treatment.” This is important to note because placebos have been shown to have therapeutic value in and of themselves.<sup>49</sup> Third, “best research evidence” is only one aspect of the integrated evidence-based practice triad.<sup>50</sup> Also included in this triad are patient preferences and experiences as well as clinician expertise. Therefore, in the absence of definitive research evidence, if patient preferences and/or clinician or patient

experiences suggest that a particular treatment strategy might work (for example, a treatment with a known safety profile), it is likely worth exploring. Along those lines, NPs should systematically assess and record their patients’ experiences with different treatments and publish this work in the form of case studies. This type of research design is known as the single case experimental design, which is both well-suited for busy primary care clinicians and within the purview of doctor of nursing practice (DNP)-prepared NPs.<sup>51</sup>

There are several supportive strategies that NPs can offer adults who present with acute bronchitis, which might lead to increased satisfaction and decreased inappropriate antibiotic prescribing. A recent study of 655 adults regarding their behaviors and expectations related to acute respiratory infections found that although most of these individuals expected a prescription for antibiotics and/or a prescription for their symptoms, they also desired



the following: to have their symptoms listened to; to discuss their worries and concerns; to have their self-knowledge respected; to have the severity, nature, and expected length of their illness explained; to discuss treatment options; to have their concern handled in one visit; and to be able to follow up with the provider after the visit via phone or e-mail.<sup>52</sup> These expectations reflect the respectful, relationship-based care that NPs have long been known to provide and should go a long way toward providing high-quality care for adults with acute bronchitis and other acute cough illnesses.

Finally, the reader is encouraged to read a brief summary about the potentially promising role of procalcitonin in the discernment of bacterial from viral etiologies of acute bronchitis.<sup>53-62</sup> 

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