Acute bronchitis is one of the most frequent viral respiratory tract diseases. Especially during the winter months, symptoms such as hoarseness, sore throat, difficulty swallowing as well as sniffling quickly appear. If the pathogen enters the bronchi, another symptom in the form of a nagging cough appears, which starts off as a dry cough but often turns into productive coughing later on. The following article will inform you in more detail about the origin of a cough as the main symptom, diagnosis and differential diagnoses as well as therapy for this frequent, mostly uncomplicated disease.
Definition of Acute Bronchitis

Acute bronchitis is an acute inflammation of the mucous membrane of the bronchi. Due to its pathogenesis, it is frequently accompanied by an upper respiratory tract infection. In cases where the trachea is involved as well, this is referred to as tracheobronchitis. Depending on the cause, one differentiates between infectious and irritative acute bronchitis.

Epidemiology of Acute Bronchitis

Acute bronchitis is widespread

Acute bronchitis is a very common disease. It occurs frequently during the winter months but there is no gender-specific frequency. Children and adolescents are more prone to developing acute bronchitis than adults are.

In this context, it should be emphasized that the diagnosis of acute bronchitis is often made premature or too quickly in the absence of laboratory parameters that could point in the right direction. Not every cough accompanying an upper respiratory tract infection is caused by an inflammation of the mucous membrane of the bronchi.

Etiology and Pathogenesis of Acute Bronchitis

Viruses are the most common cause of acute bronchitis

In most cases, acute bronchitis is preceded by an upper respiratory tract infection. Approximately 90% of all cases of acute bronchitis are caused by viruses. Other pathogenic agents such as bacteria, fungi or chemical irritants, on the other hand, are only in rare cases the primary cause of the disease.

**Note:** Viruses are the most common cause (in 90% of all cases).

Inflammatory causes of acute bronchitis

As a rule, the inflammation is caused by its individual pathogen and is transmitted via droplets (i.e. coughing). In many cases, they are myxoviruses such as influenza viruses or parainfluenza viruses. Other viruses include the adenovirus, the coxsackie virus, and the echovirus.

The most common virus in children is the so-called RS virus (respiratory syncytial virus).
Upon entering the system, the viruses make their way through the mouth or the nose and throat area, respectively, via the trachea into the primary bronchi. Once there, they attack the cells of the mucous membrane of the bronchi and impair ciliary function. As a result, mucus and pathogens are removed from the bronchi at a slower rate or to a lesser extent leading to increased mucous production. This results in mucus accumulation, which, in turn, leads to an irritation of the sensors along the airway prompting cough.

Therefore, coughing in the context of acute bronchitis should first be considered to be the body’s reaction to the expectoration of mucus meaning a typical cough with acute bronchitis represents a fallback mechanism to ensure mucociliary clearance that is no longer provided by the cilia under attack.

Viral acute bronchitis turning into a secondary super infection due to bacteria

As previously mentioned, only approximately ten percent of all cases of acute bronchitis are not caused by viruses.

Therefore, only in rare cases primary bacterial bronchitis is to be expected, mostly due to a severe underlying disease. It is, however, possible that a viral infection is followed by a secondary bacterial infection (bacterial super infection) meaning that the mucous membrane of the bronchi that was previously attacked by viruses, is now attacked by a
bacterial infection.

The most common bacterial pathogens of acute bronchitis are:

- Streptococci
- Haemophilus influenzae
- Chlamydia
- Pneumococci
- Staphylococcus aureus
- Mycoplasma pneumoniae

Irritative causes of acute bronchitis

Acute bronchitis may also be caused by noxious agents that are not infectious in nature which is then referred to as irritative causes. In many cases, they are inhaled vapors or gases but also smoke. Foreign body aspiration may cause acute bronchitis as well. Noninfectious agents with high mucous membrane toxicity are, in particular:

- Ammonia
- Hydrochloric acid
- Sulphur dioxide
- Nitrous gases
- Ozone
- Fluorinated hydrocarbon
- Cadmium oxide
- Platinum salts
- Radiation treatment for cancer

Furthermore, another important, noninfectious cause of acute bronchitis is the so-called congestive bronchitis resulting from advanced left ventricular insufficiency.

Progression of Acute Bronchitis

The progression of uncomplicated acute bronchitis

First signs of acute bronchitis

As a rule, acute bronchitis is noticeable between one to a few days after the individual has become infected. The incubation period is strongly dependent on its pathogen, however. In comparison to bacteria, viruses have a relatively short incubation period.

In the beginning, there are general flu symptoms such as fever and fatigue along with upper respiratory tract complaints. Bronchial symptoms generally manifest themselves only after the bronchi have become infected.

Typical bronchial symptoms include:

- Initially dry, often nagging cough that becomes productive later
- Rattling sounds, whistling and wheezing during auscultation

Other symptoms that are caused by a viral infection with bronchial involvement include:

- Sore throat, headache, and body aches
- Hoarseness
Retrosternal burning pains
Night sweats

**Symptoms during the progression of uncomplicated acute bronchitis**

Days after the beginning of the disease, the dry cough usually turns into a productive cough with thick, mostly clear discharge. The cough may, however, remain dry over the entire progression of the disease.

**Key symptoms of bronchitis are:**

- Nagging cough
- Soreness in the thorax area
- Red throat
- Enlarged lymph nodes in the Waldeyer’s ring area

As a rule, uncomplicated acute bronchitis heals within one to three weeks without further complications or any after-effects.

**The progression of obstructive (spastic) acute bronchitis**

Acute bronchitis may be complicated by a bacterial super infection. The key symptom for an existing bacterial secondary infection is the yellow or even green discharge which is not present with a purely viral infection. In addition, there are significantly pronounced breathing sounds like wheezing and rattling and even – in some cases – **dyspnea** and **expiratory stridor**. Should any of these symptoms exist, the probability of obstructive or spastic bronchitis is high.

**Note:** The key symptom is the acute, often nagging dry cough.

**Diagnosis of Acute Bronchitis**

**Medical history and clinical signs as key pieces in diagnosing acute bronchitis**

In cases of uncomplicated acute bronchitis, it is usually diagnosed by reviewing the patient’s medical history and performing a physical examination. Laboratory tests are only required in rare cases.

**The patient’s medical history and physical examination will show the following:**

- Acute onset of the disease
- Accompanying flu-like symptoms
- **Cough** (frequently nagging)
- Retrosternal pains
- The auscultation findings are usually unremarkable
- Regionally enlarged lymph nodes may occur

**Further diagnostic tools for acute bronchitis**

If the patient’s medical history and clinical signs will not lead to a certain diagnosis, the following diagnostic procedures are available:

- Laboratory tests (ESR, CRP, leukocytes)
- Detecting viral pathogens (only necessary in rare cases)
- Chest X-rays (if pneumonia or a tumor is suspected)
- Microbiological sputum test
- Bronchoscopy (in cases of possible hemoptysis)
- Detecting thrush and Candida albicans in cases of immunosuppression or immune deficiency, respectively

**Note:** As a rule, diagnosis is made via the patient’s history and physical examination.

### Differential Diagnosis

#### Diseases similar to acute bronchitis

As a rule, acute bronchitis is easy to diagnose and does not require any far-reaching considerations with regard to differential diagnoses. One has to, however, differentiate between acute bronchitis and the following conditions at any rate:

<table>
<thead>
<tr>
<th>Differential diagnoses</th>
<th>Exclusion measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma bronchiale</td>
<td>IgE test, pulmonary function test, allergy tests</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>Chest X-rays</td>
</tr>
<tr>
<td>Influenza</td>
<td>Detecting viruses</td>
</tr>
</tbody>
</table>

With regard to differential diagnoses, close attention should be paid in cases of recurrent bronchitis as this may point toward chronic bronchitis but also toward diminished immunological defense. Further considerations regarding differential diagnoses should include the following:

<table>
<thead>
<tr>
<th>Differential diagnoses</th>
<th>Exclusion measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tuberculosis</td>
<td>Detecting mycobacteria/ chest X-rays</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>Pseudomembranes, swab</td>
</tr>
<tr>
<td>Pseudocroup</td>
<td>Hoarseness, strong stridor, swab</td>
</tr>
<tr>
<td>Chronic bronchitis</td>
<td>Patient’s history, pulmonary lung function</td>
</tr>
<tr>
<td>Bronchogenic carcinoma</td>
<td>Patient’s history, chest X-rays</td>
</tr>
<tr>
<td>Pulmonary metastases</td>
<td>Chest X-rays</td>
</tr>
<tr>
<td>Pulmonary embolism</td>
<td>Szintigraphy, X-ray CT</td>
</tr>
</tbody>
</table>

### Therapy of Acute Bronchitis

#### Treating acute bronchitis

If the disease progressed without any complications, only the symptoms should be treated and one should forego the use of antibiotic pharmaceuticals.

In the foreground of symptomatic treatment is secretolytic therapy, avoiding inhaled noxious agents such as cigarette smoke and also, if necessary, administering antitussive agents such as **codeine** or ** noscapine**. In cases of increased simultaneous flu-like symptoms, analgesics and antipyretics may be administered.

#### Medications for acute bronchitis

In cases of a bacterial super infection with protracted progression or fever, respectively, with purulent, yellowish or even green sputum, antibiotics should be used. For the
purpose of a targeted approach, however, pathogen detection and an antibiogram should be done.

**Note:** In most cases, treatment is symptomatic.

### Progression and Prognosis of Acute Bronchitis

**Mostly good prognosis of acute bronchitis**

As a rule, acute bronchitis spontaneously heals after one week without any complications. In most cases of protracted progression with bacterial involvement, the acute symptoms do not last longer than two to three weeks. The cough may possibly extend past the acute stage and last some time longer due to existing a *bronchial hyperreactivity*.

### Complications

While the progression is, in most cases, uncomplicated and does not pose any health consequences, acute bronchitis may develop into a serious disease with consequences for at-risk patients.

**At-risk patient groups are:**

- Bed-ridden, elderly individuals
- Smokers
- Patients with [COPD](http://www.copd.org)

Among these groups, there is a risk of exacerbating acute bronchitis and the resulting complications may take a life-threatening turn. The following diseases may result from complications of acute bronchitis:

- Bronchopneumonia
- [Chronic bronchitis](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5585101/)
- Bronchiolitis obliterans
- [Bronchiectases](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6046689/)

Individuals who frequently suffer from acute bronchitis (in children more than between six and ten bronchitis episodes per year, in adults more than between three and four episodes per year), should have their pulmonary function tested as frequent episodes may be an indicator of immune deficiency, asthma bronchiale but possibly a bronchial tumor as well.

### Acute Bronchitis in Children

Diseases in children such as measles, pertussis, and mumps may also cause acute bronchitis. As the lower respiratory tract in babies, infants and children has not yet fully developed, a viral infection of the bronchial area may quickly lead to an inflammation of the bronchioles (*bronchiolitis*). In severe cases, this may lead to a massive obstruction of the lower airways.

The most common cause of acute bronchitis in children is the [RS virus](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5585101/). The most common bacterial pathogens are:

- Chlamydia pneumoniae
- [Streptococcus pneumoniae](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6046689/)
Review Questions

The answers are below the references.

1. Decreased lung volume during expiration is supported by:
   A. The flow resistance in the lumen of the respiratory bronchioles.
   B. The surface tension of the alveoli.
   C. The formation of surfactant.
   D. Activating the scalene muscles (mm. scaleni).
   E. Bronchoconstriction in early expiration.

2. Which statement is not true? The following are involved in the design of the blood-air-barrier:
   A. The cytoplasm of the endothelial cells of the capillaries.
   B. The merged basal membranes of the capillaries and the alveolar epithelium.
   C. The cytoplasm of the alveolar epithelial cells.
   D. The alveolar macrophages.
   E. The surfactant.

3. Which statement regarding the pulmonary surfactant is not true?
   A. It is a mix of surface-active substances of the alveolar epithelium.
   B. It increases the surface tension in the alveoli.
   C. It is produced by alveolar cells.
   D. It contributes to the prevention of atelectasis.
   E. It contains lipids.

References

http://www.atemwegsliga.de/
http://www.pneumologenverband.de/
http://lungenstiftung.de/

Kroegel, Claus; Costabel, Ulrich: Klinische Pneumologie, 1. Auflage, Stuttgart 2014.

Correct answers: 1B; 2D; 3B

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