Asthma - An Inflammatory Disorder of the Airways

What Is Asthma?

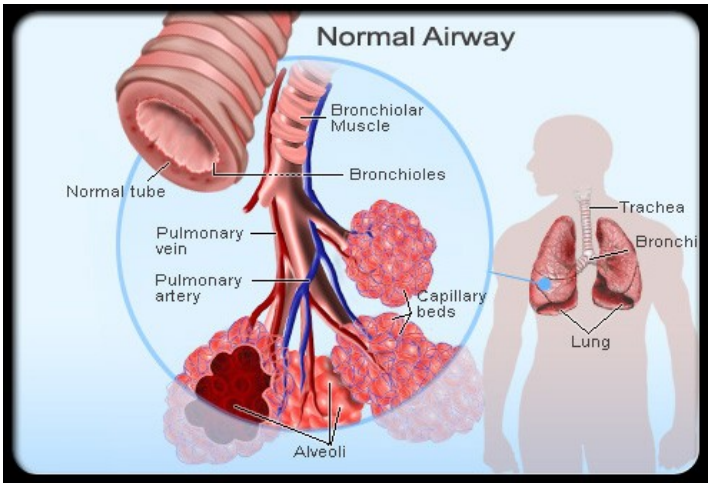
Asthma involves chronic inflammation, swelling, and narrowing of the bronchial tubes (airways). The result is difficulty breathing. The bronchial narrowing is usually totally reversible with treatments.

Bronchial tubes that are chronically inflamed may become overly sensitive to allergens (specific triggers) or irritants (nonspecific triggers). The airways may become "twitchy" and remain in a state of heightened sensitivity. This is called "bronchial hyperreactivity" (BHR). In sensitive individuals, the bronchial tubes are more likely to swell and constrict when exposed to triggers such as allergens, tobacco smoke, or exercise. Amongst asthmatics, some may have mild BHR and no symptoms while others may have severe BHR and chronic symptoms.

The Scope of the Problem

Asthma is now the most common chronic childhood illness, affecting one in every 15 children. In North America, 5% of adults are also afflicted. In all, there are about 1 million Canadians and 15 million Americans who suffer from this disease.

The number of new cases and the yearly rate of hospitalization for asthma have increased about 30% over the past 20 years. Even with advances in treatment, asthma deaths among young people have more than doubled.



Normal Bronchial Tubes

The air we breathe in through our nose and mouth passes through the vocal cords (larynx) and into the windpipe (trachea). The air then enters the lungs by way of two large air passages (bronchi), one for each lung. The bronchi divide within each lung into progressively smaller air tubes (bronchioles), just like branches of an inverted tree. Inhaled air is brought through these airways to the millions of tiny air sacs (alveoli) that are contained in the lungs. Oxygen (O2) passes from the air sacs into the bloodstream through numerous tiny blood vessels called capillaries. Similarly, the body's waste product, carbon dioxide (CO2), is returned to the air sacs and then eliminated upon each exhalation.

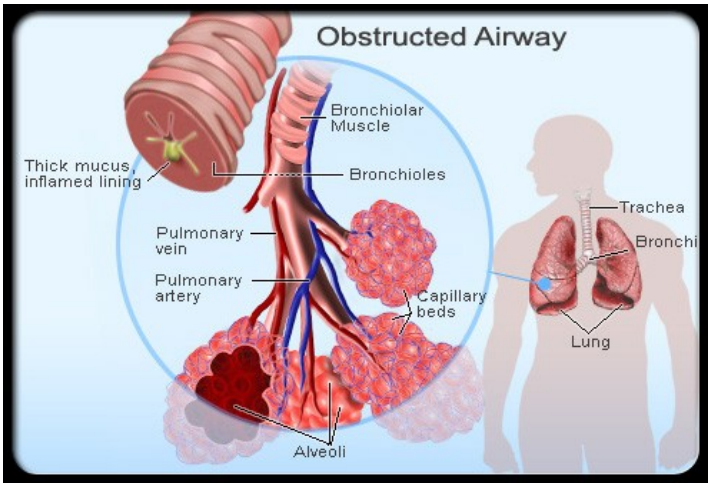
How Does Asthma Affect Breathing?

Asthma causes a narrowing of the breathing airways, which interferes with the normal movement of air in and out of the lungs. Asthma involves only the bronchial tubes and does not affect the air sacs or the lung tissue.

The narrowing that occurs in asthma is caused by three major factors:

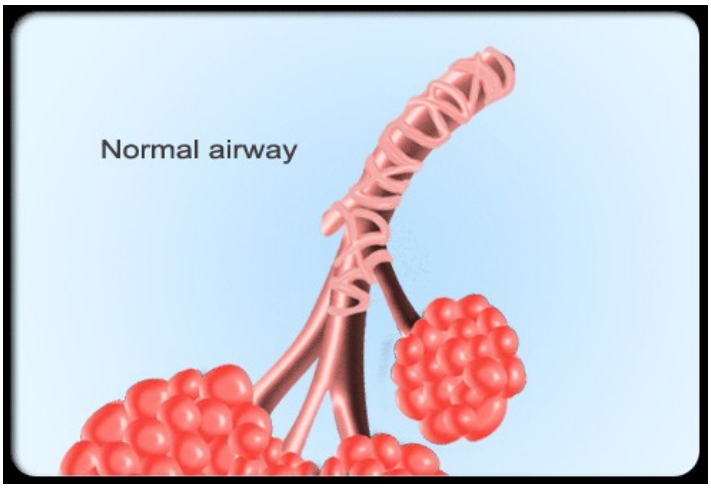
- inflammation,
- bronchospasm, and
- hyperreactivity.

We'll look at each cause individually on the next few slides.



Inflammation

The first and most important factor causing narrowing of the bronchial tubes is inflammation. The bronchial tubes become red, irritated, and swollen. This inflammation increases the thickness of the wall of the bronchial tubes and thus results in a smaller passageway for air to flow through. The inflammation occurs in response to an allergen or irritant and results from the action of chemical mediators (histamine, leukotrienes, and others). The inflamed tissues produce an excess amount of "sticky" mucus into the tubes. The mucus can clump together and form "plugs" that can clog the smaller airways. Specialized allergy and inflammation cells (eosinophils and white blood cells), which accumulate at the site, cause tissue damage. These damaged cells are shed into the airways, thereby contributing to the narrowing.



Bronchospasm

The muscles around the bronchial tubes tighten during an asthma attack. This muscle constriction of the airways is called bronchospasm. Bronchospasm causes the airway to narrow further. Chemical mediators and nerves in the bronchial tubes cause the muscles to constrict. Bronchospasm can occur in all humans and can be brought on by inhaling cold or dry air.

Hyperreactivity (Hypersensitivity)

In patients with asthma, the chronically inflamed and constricted airways become highly sensitive, or reactive, to triggers such as allergens, irritants, and infections. Exposure to these triggers may result in progressively more inflammation and narrowing.

Which Triggers Cause an Asthma Attack?

Asthma symptoms may be activated or aggravated by many agents. Not all asthmatics react to the same triggers. Additionally, the effect that each trigger has on the lungs varies from one individual to another. In general, the severity of your asthma depends on how many agents activate your symptoms and how sensitive your lungs are to them. Most of these triggers can also worsen nasal or eye symptoms.

Allergens

- "seasonal" pollens
- year-round dust mites, molds, pets, and insect parts
- foods, such as fish, egg, peanuts, nuts, cow's milk, and soy
- additives, such as sulfites
- work-related agents, such as latex

Irritants

- respiratory infections (caused by viral "colds," bronchitis, and sinusitis)
- drugs, such as aspirin, other NSAIDs (nonsteroidal antiinflammatory drugs), and beta blockers (used to treat blood pressure and other heart conditions)
- tobacco smoke
- outdoor factors, such as smog, weather changes, and diesel fumes
- indoor factors, such as paint, detergents, deodorants, chemicals, and perfumes
- nighttime
- GERD (gastroesophageal reflux disorder)
- exercise, especially under cold dry conditions
- work-related factors, such as chemicals, dusts, gases, and metals
- emotional factors, such as laughing, crying, yelling, and distress
- hormonal factors, such as in premenstrual syndrome

Who Can Develop Asthma?

The many potential triggers of asthma largely explain the different ways in which asthma can present. In most cases, the disease starts in early childhood from 2-6 years of age. In this age group, the cause of asthma is often linked to exposure to allergens, such as dust mites, tobacco smoke, and viral respiratory infections. In very young children, less than 2 years of age, asthma can be difficult to diagnose with certainty. Wheezing at this age often follows a viral infection and might disappear later, without ever leading to asthma. Asthma, however, can develop again in adulthood. Adult-onset asthma occurs more often in women, mostly middle-aged, and frequently follows a respiratory tract infection. The triggers in this group are usually nonallergic in nature.

Types of Asthma: Allergic (Extrinsic)
Extrinsic, or allergic asthma, is more common (90% of all cases) and typically develops in childhood. Approximately 80% of children with asthma also have documented allergies. Typically, there is a family history of allergies. Additionally, other allergic conditions, such as nasal allergies or eczema, are often also present. Allergic asthma often goes into remission in early adulthood. However, in 75% of cases, the asthma reappears later.

Types of Asthma: Nonallergic (Intrinsic)
Intrinsic asthma represents about 10% of all cases. It usually develops after the age of 30 and is not typically associated with allergies. Women are more frequently involved, and many cases seem to follow a respiratory tract infection. The condition can be difficult to treat and symptoms are often chronic and year-round.

Symptoms and Signs of Asthma
The symptoms of asthma vary from person to person and in any individual from time to time. It is important to remember that many of these symptoms can be subtle and similar to those seen in other conditions. All of the symptoms mentioned below can be present in other respiratory, and sometimes, in heart conditions. This potential confusion makes identifying the settings in which the symptoms occur and diagnostic testing very important in recognizing this disorder.

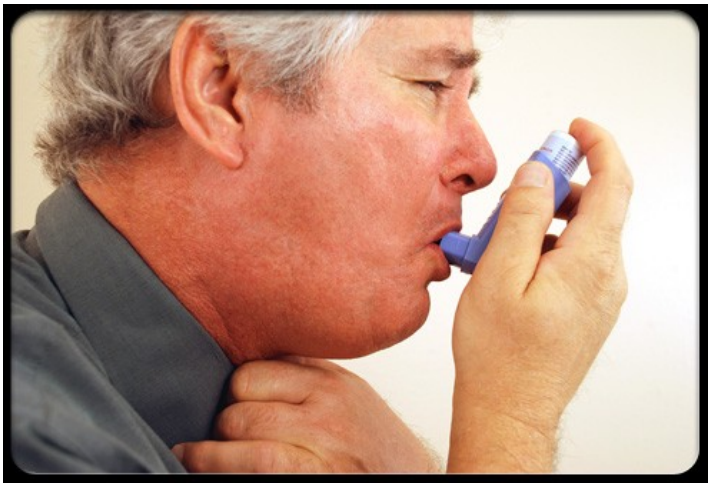
The following are the four major recognized asthma symptoms:

- **Shortness of breath, especially with exertion or at night**
- **Wheezing is a whistling or hissing sound when breathing out**
- **Coughing may be chronic, is usually worse at night and early morning, and may occur after exercise or when exposed to cold, dry air**
- **Chest tightness may occur with or without the above symptoms**

Asthma Classification	
Mild Intermittent	This includes attacks no more than twice a week and nighttime attacks no more than twice a month. Attacks last no more than a few hours to days. Severity of attacks varies, but there are no symptoms between attacks.
Mild Persistent	This includes attacks more than twice a week, but not every day, and nighttime symptoms more than twice a month. Attacks are sometimes severe enough to interrupt regular activities.
Moderate Persistent	This includes daily attacks and nighttime symptoms more than once a week. More severe attacks occur at least twice a week and may last for days. Attacks require daily use of quick-relief (rescue) medication and changes in daily activities.
Severe Persistent	This includes frequent severe attacks, continual daytime symptoms, and frequent nighttime symptoms. Symptoms require limits on daily activities.

How Is Asthma Classified?

Asthma is classified according to the frequency and severity of symptoms, or "attacks," and the results of pulmonary (lung) function tests.



Acute Asthma Attack

An acute, or sudden, asthma attack is usually caused by an exposure to allergens or an upper-respiratory-tract infection. The severity of the attack depends on how well your underlying asthma is being controlled. An acute attack is potentially life-threatening because it may continue despite the use of your usual quick-relief medications (inhaled bronchodilators). Asthma that is unresponsive to treatment with an inhaler should prompt you to seek medical attention at the closest hospital emergency room or your asthma specialist office, depending on the circumstances and time of day. Asthma attacks do not stop on their own without treatment. If you ignore the early warning signs, you put yourself at risk of developing a life-threatening asthma reaction called *status asthmaticus*.

Asthma Exams and Tests

There are several asthma tests your doctor may use to make an asthma diagnosis such as lung (or pulmonary) function tests (spirometer, or peak flow meter) which measure lung function. Other asthma tests determine if you are allergic to specific foods, pollen, or other particles. Blood tests give a picture of your overall health; specific tests also measure levels of immunoglobulin E (IgE), a key antibody that's released during an allergic reaction.

Your doctor may perform an X-ray exam of you in order to visualize the structures inside your chest, including the heart, lungs, and bones. By viewing your lungs, your doctor can see if asthma is causing your symptoms. While a chest X-ray is not an asthma test, it may also be used to make sure nothing else is causing your asthma symptoms.

All of these asthma tests help your doctor determine if asthma is indeed present and if there are other coexisting conditions with asthma, such as allergies, GERD, or sinusitis. Once a proper asthma diagnosis is made, specific medications can be prescribed to help manage your asthma and prevent asthma attacks.

Medical Treatment of Asthma

Most asthma medications work by relaxing bronchospasm using bronchodilators/ inhalers and reducing inflammation with corticosteroids. Inhaled medications are generally preferred over tablet or liquid medicines, which are swallowed. Inhaled medications act directly on the airway surface and airway muscles where the asthma problems initiate. Absorption of inhaled medications into the rest of the body is minimal. Therefore, adverse side effects are fewer as compared to oral medications. Inhaled medications include beta-2 agonists, anticholinergics, corticosteroids, and cromolyn sodium. Oral medications include aminophylline, leukotriene antagonists, beta-2 agonists, and corticosteroid tablets.

Asthma At A Glance

- Asthma involves chronic inflammation, swelling, and narrowing of the airways. The bronchial narrowing is usually totally reversible with treatments.
- Asthma is now the most common chronic childhood illness affecting one in every 15 children.
- Asthma involves only the bronchial tubes and usually does not affect the air sacs or the lung tissue. The narrowing that occurs in asthma is caused by three major factors: inflammation, bronchospasm, and hyperreactivity.
- Allergy can play a role in some, but not all, asthma patients.
- Many factors can precipitate asthma attacks and they are classified as either allergens or irritants.
- Symptoms of asthma include shortness of breath, wheezing, cough, and chest tightness.
- Asthma is usually diagnosed based on the presence of wheezing and confirmed with breathing tests.
- Chest X-rays are often normal in asthma patients.
- Avoiding precipitating factors is important in the management of asthma.
- Medications can be used to reverse or prevent bronchospasm in patients with asthma.

Source: htttp://www.medicinenet.com/asthma_pictures_slideshow/article.htm