ASTHMA

INTRODUCTION

Asthma is one of the most common diseases of the lung. More than 22 million Americans have asthma. It is the most common chronic disease among children and it is the most common reason children are hospitalized. Each year in the United States there are approximately 2 million patient visits to emergency rooms because of asthma attacks, and over 500,000 patients are admitted to hospitals for the treatment of asthma.

Asthma causes difficulty breathing. Unlike other lung diseases such as emphysema, people with asthma do not have difficulty breathing all the time. They have asthma attacks – very sudden episodes of wheezing and respiratory distress. Asthma attacks happen suddenly and are sporadic and in between attacks the person with asthma feels fine.

There is quite a lot that is known about why asthma happens, what goes on in the lungs during an asthma attack, and how to treat and prevent the disease. There is still no cure, but the treatments are very effective and prevention methods can help people with asthma lead normal lives.

OBJECTIVES

When the student has finished this module, he/she will be able to:

1. Identify the two gases that are involved in respiration.
2. Identify the reason why the body needs oxygen.
3. Identify the correct definition of asthma.
4. Identify the basic cause of an asthma attack.
5. Correctly identify the three processes that contribute to an asthma attack.
6. Identify three triggers for an asthma attack.
7. Identify the three most common signs and symptoms of an asthma attack.
8. Identify the basis of a diagnosis of asthma.
9. Identify the two general classes of asthma medications.
10. Identify a medication commonly used for asthma and its delivery device.

REVIEW OF THE RESPIRATORY SYSTEM

Our bodies need food to survive. However, the carbohydrates, proteins and fats we eat can’t be burned for energy unless we have the gas oxygen from the air we breathe: **without oxygen, the nutrients can’t be utilized for energy.** One of the primary jobs of the respiratory system is to deliver oxygen to the body so we can process nutrients for energy. **Oxygen is delivered to the body when we inhale.**

Our bodies also produce waste products. These waste products are made when we burn food for energy (they are much like the exhaust gases of a car that result from burning gasoline), and the body cannot survive if they accumulate. The other primary job of the respiratory system is to eliminate waste products, particularly gas called **carbon dioxide.** **Carbon dioxide is eliminated from the body when we exhale.**
The respiratory system (also called the pulmonary system) is responsible for delivering oxygen to the body and removing waste products – carbon dioxide – from the body. The respiratory system begins with the nose and the mouth. Attached to the back of the mouth is a stiff but somewhat flexible tube. This is the trachea (more commonly called the windpipe). The trachea ends at about the level of the shoulders and is attached to two other stiff but flexible tubes – one going left, the other going right – called the bronchi. At the end of the bronchi are the two lungs.

Inside the lungs are many small, hollow passages called the bronchial tubes. The bronchial tubes extend into the outer parts of the lungs. Eventually the bronchial tubes end in small clusters of air sacs at the bottom of the lungs called the alveoli (these look very much like clusters of grapes).

When we inhale, air moves through the nose and mouth, down the trachea to the bronchi and then to the alveoli. Immediately next to the alveoli are large numbers of very small blood vessels. The walls of the alveoli have tiny, tiny pores, and the inhaled air with oxygen moves through these pores and combines with the blood that is passing by in these small blood vessels. The blood carries the oxygen to the active parts of the body where it can be used along with the nutrients we eat to create energy.

When we exhale, the carbon dioxide that is a byproduct of metabolism leaves the blood goes into the alveoli and passes out through the lungs.

**WHAT HAPPENS DURING AN ASTHMA ATTACK?**

**Asthma is defined as reversible airway obstruction**

From the patient’s point of view, an asthma attack is very simple. Very suddenly and often without a lot of warning, he/she cannot breathe. The chest feels very tight; there is a lot of wheezing that can be seen and heard, and no matter how hard that person inhales, he/she just cannot get enough air. For the person who is having an asthma attack, trying to breathe is like trying to pull up molasses through a tiny straw.

The basic cause of an asthma attack is that the bronchial tubes have suddenly and quickly become obstructed.

From the point of view of a health care professional, an asthma attack is simple as well, but it is also much more complicated. This sudden narrowing and obstruction of the bronchial tubes is caused by multiple complex processes. These processes are discussed here individually, but in a practical sense they are really impossible to separate because they are so closely linked

- Obstruction: The bronchial tubes respond to an asthma attack by becoming obstructed. This happens for several reasons. An asthma attack increases the amount of mucous in the lungs and this can block the bronchial tubes. The bronchial tubes also constrict and become obstructed as a natural response to something the asthma sufferer is especially sensitive to such as dust or pollution (These are considered asthma “triggers”). Finally an asthma attack also causes the
walls of the bronchial tube to become very swollen, and this can also cause them to become obstructed.

- Hypersensitivity: There are many things in the environment that can irritate the bronchial tubes, and everyone to some degree is sensitive to cold, dust, pollution, animal fur, etc. It is not entirely clear why, but the bronchial tubes of people who have asthma are hypersensitive to these irritants. When the asthmatic is exposed to something such as dust or pollution, the bronchial tubes “overreact.” They constrict and they overproduce mucous which obviously contributes to the obstruction of an asthma attack.

- Inflammation: Inflammation is a natural process. It is one of the defense mechanisms the body uses to respond to infection, etc. Inflammation helps fight against injury and it helps healing, and it does so by increasing blood flow to the affected area. Because an episode of asthma is a response by the body to what it perceives as stress, inflammation is part of an asthma attack. But for people with asthma, the inflammatory process gets out of control, and the extra blood flow to the bronchial tubes cause them to become quite swollen, often to the point that they become obstructed.

In summary, an asthma attack occurs when there is a sudden obstruction of the bronchial tubes. This happens because the person with asthma has been exposed to some kind of “trigger.” The asthma trigger starts the processes of obstruction, inflammation, and a hypersensitivity response. These three processes induce various changes in the bronchial tubes that cause them to be come very constricted and at times completely obstructed.

**THE COMMON CAUSES OF ASTHMA**

There are many causes of an asthma attack; these are the triggers that were mentioned previously. However, everyone is exposed to some level of these asthma triggers, but obviously not everyone has asthma. There is a lot of evidence that people with asthma inherit sensitivity to the asthma triggers, and they also inherit the tendency to “overreact” to these asthma triggers. There is also a lot of evidence that the environment is an important part of why people develop asthma. Someone may be sensitive to an asthma trigger, but if that trigger is not part of the environment, then asthma will not happen. Asthma then is an issue of genetics and the environment. **Those are the causes of asthma. The triggers of asthma do not cause asthma;** they simply set the disease in motion.

The most common triggers that can cause an asthma attack are:

- Emotional stress
- Temperature, especially cold
- Dust
- Air pollution
- Exercise
- Weather changes
- Humidity
• Respiratory infections
• Pollen
• Mold

WHAT ARE THE SIGNS AND SYMPTOMS OF AN ASTHMA ATTACK?

There are several signs and symptoms that are very typical of an asthma attack. But these signs and symptoms can also be caused by several other respiratory diseases such as emphysema or pneumonia or by cardiac problems such as congestive heart failure. However, asthma is distinguished from those problems in two important ways, and that is also how asthma is diagnosed.

Asthma causes breathing difficulties that are sporadic and reversible

All of the other respiratory and/or cardiac disease that could possibly be mistaken for asthma produce signs and symptoms that are more or less constant. In addition, these signs and symptoms do not, for the most part, get better to the point that the patient has no breathing difficulties. The patient with asthma has breathing difficulties that start very suddenly, they go away by themselves or with treatment, and they happen sporadically.

The signs and symptoms of an asthma attack are:

• Difficulty breathing
• Wheezing
• Coughing
• Chest tightness
• Rapid respiratory rate

The three most common signs of an asthma attack are wheezing, coughing, and chest tightness.

An asthma attack can be very, very frightening for the person with asthma and also for anyone witnessing it. Wheezing, coughing, and chest tightness don’t sound that bad, but as asthma attack can cause panic and with good reason.

WHO GETS ASTHMA AND HOW DANGEROUS IS ASTHMA?

Asthma is not a terribly dangerous disease. Approximately 5000 people in the United States die each year from asthma. At times the bronchial tubes become obstructed to the point that almost no oxygen can pass through. Despite aggressive treatment, the condition can’t be reversed and the patient expires.

However, although asthma may not be one of the more dangerous diseases in terms of the mortality rate, it is a very serious disease in many other ways. There are millions of emergency room visits and hospital admissions every year that are directly related to asthma. People with asthma miss work and children with asthma miss school. And everyone with asthma has to live with fact that at any time, they may suddenly and often without warning be barely able to breathe.
Many people have the misconception that asthma affects mostly children, and that children “outgrow” the disease. This may be because the majority of people with asthma first develop the disease when they are children, and asthma attacks in a child are very memorable experiences for everyone involved.

But although it is true that more children have asthma than do adults, the difference in the rates of the disease between the two groups is not very high: about 8.5% of all children have asthma and about 6.5% of all adults have asthma. And it is not true that most children outgrow asthma. Only a very small percentage of children – probably 5% or so – of children have asthma that goes away completely.

**TREATING AN ASTHMA ATTACK**

There are two ways to treat asthma attacks. The first step is to understand why they happen and to take preventative steps to make sure the attacks don’t happen and to decrease the frequency of the attacks. The other way to treat asthma attacks is with medications.

**Asthma Prevention**

The following are methods that people with asthma can use to manage their disease.

- Identify and manage asthma triggers: Avoid going outside during days and during the times of day when air pollution and pollen counts are high. Keep you home as clean as possible; dust, mold, mildew, and insect allergens can all trigger an asthma attack. Wash bedding on a regular basis. If possible, use an air conditioner and a dehumidifier. Pay attention to changes in weather that have in the past precipitated asthma attacks and plan the day accordingly. If you like to exercise, ask you physician about which exercises and how much exercise are appropriate for you.

- Use a peak flow meter: A peak flow meter is a simple handheld device that can help someone with asthma determine how well air is moving out of the lungs. Using a peak flow meter can be valuable way to for someone to confirm that an asthma attack may be starting, and it can help them identify the triggers that may be present at that time. The peak flow meter can also let someone know when his/her breathing is being dangerously compromised.

- Make an asthma action plan: This is something that should be done with the assistance of a health care professional. The plan should include information about the asthma triggers and information about dangerous peak flow meter readings. There should also be a plan about what medications to take and how many doses and when to see a doctor. For example, it could be agreed on that if someone is experiencing and asthma attack, he/she is wheezing but not coughing, has no chest tightness, and the attack subsides in 20 minutes after several puffs from an inhaler, there is no need to go to the emergency department. But if the attack continues for an hour and the peak flow meter readings are very low and the medications don’t help, then it is time to seek help.
Asthma Medications

Asthma medications are divided into two categories: medications that provide quick relief and medications that are use for long-term control.

- **Quick relief medications:** These medications are used to relieve the symptoms of an asthma attack. Some of the more common ones in use are Xopenex®, Serevent®, and Proventil® *(this is a very common one)*, Vanceril®, Pulmicort®, and Spiriva®. They work by opening up the bronchial tubes or by decreasing inflammation. They come in the form of a small, pressurized canister. The nozzle of the canister is placed in the mouth and as the patient inhales, a trigger is pressed and the medication is released. These medications can also be delivered by a handheld nebulizer that delivers a constant flow of the medication.

- **Long-term control:** These drugs prevent asthma attacks from occurring. Typical medications in this class include Singulair®, and prednisone.

**SUMMARY**

- The respiratory system is responsible for delivering oxygen and removing carbon dioxide.
- Oxygen is essential for the body to utilize food and nutrients for energy.
- Asthma is defined as reversible airway obstruction.
- The basic cause of asthma is a sudden and quick obstruction of the bronchial tubes.
- Obstruction, inflammation, and hypersensitivity are the basic processes behind an asthma attack.
- Asthma is caused by a combination of genetics and environmental factors.
- Wheezing, coughing, and chest tightness are the most common signs and symptoms of an asthma attack.
- The breathing difficulties of an asthma attack are sporadic and reversible.