CHRONIC OBSTRUCTIVE PULMONARY DISEASE

Chronic obstructive pulmonary disease (COPD) is a chronic disease that affects the lungs. (The word pulmonary refers to the lungs.) It is very common: more than 11 million Americans have COPD, and it is currently the fourth leading cause of death in the United States. COPD is a progressive disease, and it gets worse with each successive year. Chronic obstructive pulmonary disease can be managed with lifestyle adjustments and medications, but there is no cure.

There is evidence that some people inherit a tendency to develop COPD. Also, COPD can be caused by exposure to chemicals, pollutants, and some rare medical problems. However, environmental and medical causes of COPD are responsible for causing only a very small percentage of all cases of the disease. The great majority of cases of COPD are caused by cigarette smoking.

OBJECTIVES

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

1. Identify the area of the lungs where oxygen reaches the bloodstream.
2. Identify the correct definition of COPD.
3. Identify the two separate diseases that combine to cause COPD.
4. Identify the correction definition of emphysema.
5. Identify the correct definition of chronic bronchitis.
6. Identify the most common cause of COPD.
7. Identify three common signs and symptoms of COPD.
8. Identify the basic cause of the signs and symptoms of COPD.
9. Identify an important fact about the use of oxygen for patients with COPD.
10. Identify situations in which you would notify your supervisor immediately.

ANATOMY AND PHYSIOLOGY OF THE PULMONARY SYSTEM

The pulmonary system, also called the respiratory system, starts with the oral cavity (mouth) and the nose. Attached to the back of the mouth is a stiff but somewhat flexible tube. This is the trachea, which is more commonly called the windpipe: it is easily visible. The trachea ends at about the level of the shoulders, and it is attached to two other stiff but flexible tubes that extend down into lungs in the chest cavity. One of these extends into the left lung, the other goes into the right lung, and these are called the main stem bronchi.

At the terminal ends of the main stem bronchi are many small, hollow passages called the bronchial tubes. The bronchial tubes extend from the ends of the main stem bronchi into the outer parts of the lungs. Eventually the bronchial tubes end in small clusters of air sacs called alveoli that are located at the bottom of the lungs. The alveoli look very much like clusters of grapes, and there thousands and thousands of them. They are very pliable, very elastic, and they have extremely thin walls - a feature that is very important and will be discussed later in this section.
When we inhale, the chest expands; air with oxygen moves through the nose and mouth; down the trachea to the main stem bronchi; through the bronchial tubes and; eventually it reaches alveoli. Immediately next to the alveoli are large numbers of extremely small blood vessels called capillaries: the alveoli and the capillaries are actually touching one another. The walls of the alveoli have tiny, tiny pores, and the inhaled air that contains oxygen moves through these pores and combines with the blood that is passing by in the capillaries. This blood is returning from the body and it contains a very low level of oxygen, but a relatively high level of another gas, carbon dioxide. After the blood in the capillaries combines with oxygen, it is pumped out of the lungs, into the heart and from there it is pumped back out to the body. This exchange of oxygen from the air to the blood happens quite easily because the alveoli and the capillaries are in such close contact, and it is so efficient because the surface area of the alveoli and the capillaries is enormous.

When we exhale, harmful waste products of metabolism - most importantly the carbon dioxide - move from the blood in the capillaries into the alveoli and out through the bronchial tubes and the nose and mouth. The alveoli are where these two gases, oxygen and carbon dioxide, move in and out of the body. The basic purpose of the pulmonary system is to allow the movement of two gases, oxygen and carbon dioxide, in and out of the body. When we inhale, we take in oxygen; when we exhale, we get rid of carbon dioxide.

**WHAT IS COPD?**

The name chronic obstructive pulmonary disease is a good description for the problem. It is chronic disease - it does not go away - and it causes problems by obstructing the flow of air in and out of the lungs, which are the primary organs of the pulmonary system.

**Learning Break:** Chronic obstructive pulmonary disease will be defined here as a chronic disease that causes permanent scarring to the lung tissue.

Chronic obstructive pulmonary disease is actually a combination of two separate but closely related diseases, emphysema and chronic bronchitis. These diseases can occur by themselves, but when they are together they are called COPD.

Emphysema is a disease that causes slow, progressive, and irreversible destruction of the lung tissue. In particular, emphysema damages the alveoli. In a patient with emphysema, the alveoli become weak, enlarged, and scarred. Because of this, when a patient with emphysema inhales or exhales the normal elasticity of the alveoli cannot function and they collapse under the pressure. Also, because the alveoli are scarred, oxygen and carbon dioxide cannot move into and out of the blood. The body must have oxygen and must be able to get rid of carbon dioxide to survive and the alveoli are where these processes take place, so it is obvious that if the alveoli don’t function the patient’s respiratory status and the normal gas exchange that takes place in the lungs will both suffer.

**Chronic bronchitis** is the other component of COPD. Chronic bronchitis happens when the bronchial breathing passages become permanently inflamed. This is almost always a result of cigarette smoking. The chemicals and the particles in the cigarette smoke irritate the sensitive lining of the bronchial tubes. When that happens, these airway passages
become inflamed, they become swollen and narrowed, and large amounts of mucous are produced. As with emphysema, these changes prevent oxygen from going through to the blood when we inhale, and they prevent carbon dioxide from being expelled when we exhale.

There is also a disease called acute bronchitis. This is exactly the same as chronic bronchitis, but it is caused by an infection, it can be cured with antibiotics and rest, and it does not cause permanent inflammation of the bronchial tubes.

**Learning Break:** Chronic bronchitis is defined as permanent inflammation of the bronchial tubes.

The person with COPD has bronchial tubes that are narrowed and swollen and alveoli that are scarred and have lost their elasticity. When someone with COPD inhales or exhales, air cannot effectively move in or out. Imagine trying to suck molasses through a tiny straw (the narrowed, swollen bronchial tubes) that collapses when it is stretched (the inelastic alveoli) and then trying to move it across a thick piece of cardboard that has been placed over the end of the straw (the scarred alveoli). This is what happens with the person with COPD. The air can’t effectively move through the bronchial tubes because they are so narrow and when air gets to the alveoli, it can’t move past them because the pores in the alveoli are covered with scar tissue and the alveoli collapse because they have lost their elasticity.

**WHY DOES COPD HAPPEN?**

The answer to this is very simple. There are a few unusual medical conditions that can cause COPD, and some cases of COPD can be caused by air pollution and chronic exposure to irritants in the air. It may also be possible to develop COPD if you are exposed to very large amounts of secondhand smoke. And there are rare cases in which someone has inherited a genetic tendency for developing COPD. For those people, small amounts of smoking or exposure to low levels of chemicals or pollution may be enough to cause COPD.

However, the vast majority of cases of COPD are caused by chronic cigarette smoking. Tobacco smoking accounts for approximately 90% of all cases of COPD. Approximately 20% of all cigarettes smokers will eventually develop COPD, and the more someone smokes and the greater the number of years that person smokes the greater the risk of developing COPD. Smoking cigars and/or a pipe can also cause COPD, but the risk is much less. It is not clear why some people who smoke do not develop COPD.

Tobacco smoke is a very complicated compound. It contains thousands of chemicals, some of which such as carbon monoxide, cyanide, and tar are very toxic. Others act as irritants. These chemical toxins and the irritants are only present in very tiny amounts. But a smoker is exposed to them on a constant, day-to-day basis. The result of this continual exposure of the lungs to these toxins and irritants is an intense inflammation and irritation of the lung tissue that slowly but surely overpowers the body’s defenses: the lungs simply cannot heal themselves or successfully fight off the “chemical assault.” Given enough time, the irritation and inflammation progresses to irreversible damage, and the smoker has COPD.
Learning Break: What about second hand cigarette smoke? Can exposure to smokers cause COPD? The answer is not clear. Second hand smoke can damage the lungs, but it is not certain whether second hand smoke can cause damage that will progress to COPD.

Cigarette smoking is the primary cause of COPD. But it is worth remembering that tobacco smoke has many other harmful health effects.

- Smoking increase the risk of developing heart disease by 2 to 4 times
- Smoking increase the risk of having a stroke by 2 to 4 times
- Smoking decreases circulation: You may notice that many smokers have cold hand and feet, and this is because of poor circulation.
- Smoking causes lung cancer
- Smoking has been associated with an increased risk for developing bladder cancer, cervical cancer, esophageal cancer, laryngeal cancer, pancreatic cancer, and many other malignancies
- Smoking has been associated with reproductive disorders such as infertility, low birth weight, stillbirth, and sudden infant death syndrome (SID)

**SIGNS AND SYMPTOMS OF COPD**

Chronic obstructive pulmonary disease is chronic and progressive. The disease gets worse and worse as the patient gets older. Because of the damage to the alveoli and the changes in the bronchial tubes, people with COPD have low levels of oxygen in their blood and high levels of carbon dioxide in their blood. These abnormal levels are the basic cause of the signs and symptoms of COPD.

Some of the signs and symptoms of COPD are:

- Difficulty breathing
- Exercise intolerance
- Chronic cough
- Excessive production of sputum - also known as a productive cough
- Blue coloration of the fingernails - also known as cyanosis
- Tachypnea: Defined a rapid breathing. The normal respiratory rate is 12-20 breaths a minute. This is an average, and the normal respiratory rate varies slightly from person to person.
- Wheezing
- Confusion - This would happen in advanced stages of the disease when the oxygen level in the blood gets very low
- Barrel chest
- Abnormally thick fingernails: This is called clubbing.

*Cough, exercise intolerance, and a productive cough* are probably the most common and the most important of these signs and symptoms. In the first few years, a patient with COPD can learn to live with the disease. Medications, exercise, stopping smoking, and
other lifestyle changes can help. But the disease always gets worse and over time, many patients with COPD cannot even walk a few steps without becoming short of breath and needing to rest. They become more dependent on medications and oxygen, and they are also more susceptible to lung infections.

**EXACERBATIONS OF COPD**

One of the common features of COPD is an event called *exacerbation of COPD*: exacerbation means worsening. An exacerbation of COPD is an episode in which a patient who has been stable and breathing well suddenly becomes short of breath. The patient will also have increased coughing and increased sputum production. Other signs and symptoms such as fatigue, fever, sore throat, and weakness may develop, as well. If the patient’s respiratory function and gas exchange capability are especially poor, he/she may become confused, cyanotic, and tachypneic.

Exacerbations are very common, and most of them are caused by a bacterial or viral infection in the lungs. However, in many cases, there is no evidence of an infection and the reason for the sudden deterioration cannot be found. But regardless of the cause, an exacerbation of COPD is a very serious problem. People with COPD have very poor respiratory function. Their gas exchange, the oxygen delivery and carbon dioxide excretion, is very poor and there is little “room for error.” Any further disruption in the patient’s ability to breathe and she/he may need hospitalization and mechanical ventilation.

**EMERGENCY CARE FOR EXACERBATIONS OF COPD**

Most people who are having an exacerbation of COPD will have some dramatic signs and symptoms. They will be tachypneic, they will likely have a constant cough, and you may hear them wheezing. Speaking in sentences of more than a few words will be impossible, and it is likely their skin color will be bad. They may be sweaty and pale. And these people will also tell you their breathing is bad. Phrases such as “I just can’t catch my breath,” or “I feel like I can’t breath” are common.

However, for some people the signs and symptoms of a COPD exacerbation can be a bit more difficult to detect. The patient who is having an exacerbation may not appear to be in acute distress. But if you have experience caring for this person you may notice subtle changes in behavior or appearance, small clues that indicate “something’s not right.” In these situations, the patient’s input is invaluable. The patient may not have any obvious distress, but if she/he tells you something like “My breathing just doesn’t feel normal,” that should be taken very seriously. The patient will be the first one to know if an exacerbation is happening.

If your patient appears to be having an exacerbation or you suspect that an exacerbation may be happening, immediately notify your supervisor. Some patients may have a hand-inhaled nebulizer that they have been instructed to use in these situations. This is called a rescue inhaler, and they are one of the bronchodilators such as albuterol. These inhalers provide rapid relief, usually within minutes, and if the patient has one of these you can help him/her use it.
Aside from notifying the supervisor and helping the patient find and use the rescue inhaler, you should encourage the patient to rest. The more active someone is the more oxygen the body needs, so activity and exacerbation of COPD are not a good combination. You should also try and maintain a calm and reassuring demeanor. Even for people who have experienced it before, an exacerbation of COPD is frightening. No matter how hard the try and no matter what is done they cannot “catch their breath,” and the high level of emotion can make breathing more difficult. Stay calm, and try and help the patient stay calm.

Many people who have COPD use supplemental oxygen. A natural response to someone who is having difficulty breathing during an exacerbation would be to increase the flow of oxygen, and the patient may ask you to do so.

Do not increase the flow of oxygen. The rate of flow is prescribed by a physician, and it can only be changed if a physician has ordered the flow to be increased or decreased. There is also some evidence that increasing oxygen flow to someone who has COPD may, at a certain point, be harmful by decreasing the respiratory rate. This last point will be discussed later in the module.

TREATMENTS FOR COPD: LIFE STYLE ADJUSTMENTS

There is no cure for COPD. Chronic obstructive pulmonary disease can only be treated, but as it is a progressive disease the patient’s eventually succumb and will die of respiratory failure or a complication.

However, COPD can be managed, life expectancy can be significantly expanded, and the quality of life can be greatly improved. The treatments for COPD can be divided into two groups: 1) Life style adjustments, and; 2) Medical treatments.

Smoking Cessation

Smoking cessation is the most important and the most effective treatment for COPD. Within several days of smoking cessation, the lung irritation and some of the lung damage caused by constant exposure to cigarette smoke begin to heal. Over the next few months, lung function improves, the chronic smoker’s cough diminishes, and the patient’s subjective complaints of shortness of breath decrease. Other health benefits - decreased risk of heart disease and stroke, for example - accumulate the longer the person goes without smoking.

Of course, stopping smoking is very difficult. Nicotine is physically addictive in much the same way as illicit drugs such as cocaine and heroin. Most people will need to be enrolled in a smoking cessation program and/or use nicotine gum or patches. It can be a long difficult process to stop smoking, but for someone who has COPD, it is not an option.

Unfortunately for the person with COPD, much of the damage to the bronchial tubes and the alveoli is permanent. If the patient stops smoking the harm can be limited, and areas that are damaged but not yet irreversibly so can be recovered. But even then, the decrease is pulmonary function slowly but surely worsens over time. The longer someone smokes and the more he/she smokes, the worse the damage, the less chance of recovering lung tissue, and the faster the destruction will progress.
Diet and Hydration

Good nutrition is very important for someone who has COPD. There is evidence that clearly shows that people who have COPD and have a poor nutritional status have a decreased tolerance for exercise, their lung function is poor, and they die earlier. Poor nutrition can weaken the immune system and make the patient susceptible to infections. Unfortunately, COPD often makes people nauseated and decreases their appetite. Encourage the patient to eat well and explain the benefits of a healthy diet to them.

Good hydration is also a critical part of self-care for the person who has COPD. Dehydration thickens secretions in the lungs. This increases the risk of pulmonary infections, and it also makes it more difficult for the patient to cough up and expel those secretions.

Exercise

Exercise for the COPD patient can increase exercise tolerance, help prevent lung infections, and improve mood. Aerobic exercises such as bike riding, swimming, walking, etc. and strength building exercise such as weight lifting should only be initiated if the patient’s physician has approved.

Starting an exercise program is never easy and sticking with a program, particularly in the beginning when it is hard to see the benefits, is very difficult. This is especially so for the patient with COPD who has decreased exercise tolerance. Encourage the patient with COPD to participate in pulmonary rehabilitation as best they can.

Discussing the details of an exercise program for someone with COPD is beyond the scope of this module. But if you are working with a patient who has COPD and that patient is actively exercising, part of your responsibility as a CNA is patient safety. Remind the patient that if she/he develops shortness of breath or chest pain while exercising, stop exercising immediately.

Some patients who have COPD may also benefit from breathing exercises. These are exercise that target the muscles involved in breathing. The number of times to do them and how often to do them will be prescribe by the patient’s physician, or perhaps by a physical therapist or respiratory therapist. Examples of these breathing exercises include:

- Pursed lip breathing: 1) The first step is to relax the neck shoulder muscles; 2) Breathe in for two seconds through the nose while keeping the mouth closed, and; 3) Finish by breathing out for four seconds through pursed lips. If someone cannot breathe out for four seconds, simply breathe out for two seconds, the same amount of time as was spent breathing in.

- Diaphragmatic breathing: 1) The patient should be laying on his/her back. If need be, a pillow can be placed under the knees for support; 2) Place one hand on the stomach, just below the rib cage; 3) Put the other hand on the chest; 4) While counting to three, inhale through the nose as deeply as possible. Try and keep the chest from moving during the inhalation. You should feel the stomach and the lower ribs moving up, but the chest should remain still, and; 5) Tighten the stomach muscles and exhale for a count of six through slightly pursed lips.
TREATMENT FOR COPD: MEDICAL CARE

Oxygen

Many people who have COPD require supplemental oxygen, and it has been proven that people who have COPD and use supplemental oxygen live longer and have better exercise tolerance.

Oxygen therapy in a health care facility will be managed by a respiratory therapist or a registered nurse. In a home setting, a commercial service will provide delivery and equipment. Many patients can, after some instruction and initial supervision, manage their oxygen therapy at home without assistance as long as they have someone to contact if there are problems or questions.

As a CNA you do not have primary responsibility for managing a patient’s oxygen therapy. But you can and should be able to help your patients use oxygen safely. If your patient with COPD requires supplemental oxygen:

- Assess for effectiveness: If the patient is complaining of breathing difficulties or in your opinion the patient’s respiratory status is declining, the oxygen therapy may not be working and someone should be notified. This does not necessarily imply the equipment is malfunctioning (That would be very be unusual), but that the patient is having an exacerbation needs an adjustment in the oxygen or perhaps medications.

- Use it correctly: Remember, never change rate of delivery and do not allow the patient to change the rate of delivery. Most people who are using supplemental oxygen are receiving a flow rate of 2-3 liters/minute, some less, some more.

- Use it safely: Oxygen supports and accelerates combustion, so oxygen must never be used near open flames or by someone who is smoking.

- Keep it clean: There is a variety of ways supplemental oxygen can be delivered, but the nasal cannula is probably the most common. The cannula should be washed with soap and water several times a week and it should be periodically replaced. Remember, people with COPD are susceptible to respiratory infections, and oxygen equipment that is not cleaned can become contaminated with bacteria.

- Keep it comfortable: Oxygen flowing directly into the nostrils can be very drying. A water-based moisturizer can be used in the nose to prevent dry and sore nasal passages. Also, you should check the skin where the cannula loops around the ears. This area can become red and irritated from the constant contact with the plastic, and bit of gauze placed there will provide protection.

It was mentioned earlier that increasing the flow of oxygen could potentially harm someone who has COPD. The basis for this is that in COPD the mechanism for breathing is different than it is for someone who does not have the diseases. Here’s how that works.
Most people often think that we breathe to take in oxygen. This is only partly true. Much of the reason we breathe is to get rid of carbon dioxide. However, because COPD damages the lungs, these patients can’t eliminate carbon dioxide very efficiently and they have abnormally high levels of carbon dioxide in their blood. Eventually, these people become adapted to the high levels of carbon dioxide. At that point, the drive to breathe (which is located in a particular section of the brain) comes from the lack of oxygen in the blood, not the need to expel carbon dioxide. If the patient with COPD is given too much oxygen, the body senses that no oxygen is needed and the drive to breathe can be interfered with, and that is why oxygen must be use cautiously in the patient who has COPD.

Medications

Chronic obstructive pulmonary disease cannot be cured, but it can be managed with oxygen and medications. There are three types of medications that are used to treat people who have COPD.

- **Bronchodilators**: These medications open up the swollen, narrow bronchial tubes. Bronchodilators are usually used in the form of handheld inhalers. The inhalers are small, pressurized canisters that fit into the hand. The patient places the nozzle of the inhaler in his/her mouth, presses a trigger that releases the medication and inhales. Albuterol is a commonly used bronchodilator. The handheld inhalers are effective if used correctly, but the patient needs to be able to make a tight seal around the nozzle and coordinate a deep inhalation with the delivery of the medication. If the patient complains that his/her bronchodilator is not working, someone needs to make sure the patient is using it correctly. Albuterol and the other bronchodilators can also be used in nebulizers. Albuterol syrup is also available, but this is typically reserved for use in children. A commonly used brand of handheld bronchodilator inhaler is Proventil®, which contains albuterol.

**Learning Break:** The bronchodilators are designed to open the bronchial passages and provide relief for approximately 4-6 hours. Someone who is having difficulty breathing may be tempted to use a handheld bronchodilator more often than every 4-6 hours. Using a bronchodilator for rescue therapy in between the normal, scheduled use of a bronchodilator is acceptable. But if the prescribed frequency of an albuterol inhaler is not helping, more is not better and could be harmful. The patient’s physician should be called if she/he feels that the bronchodilator is not providing relief.

- **Corticosteroids**: Some patients with COPD hear the word corticosteroid and associate these medications with the illegal steroids used by some athletes. Corticosteroids are different. These are oral medications or medications delivered by handheld inhalers that decrease inflammation in the lungs. A commonly used brand of corticosteroid inhaler is Flovent®, which contains fluticasone.

- **Anticholinergics**: These medications are used in inhalers. They work by opening up the bronchial tubes, but in a different way than the albuterol type drugs.
Spiriva® is a common anticholinergic used for people with COPD. Some handheld inhalers will have albuterol and an anticholinergic: Combivent® is a commonly used combination brand.

- Antibiotics: Antibiotics should only be used if a person with COPD has a lung infection. If your patient with COPD tells you he/she has been taking an antibiotic because they have been feeling bad, and they are doing so without a doctor’s orders, notify your supervisor immediately. Doing this can actually cause lung infections that are dangerous and difficult to treat.

- Vaccinations: People who have COPD should make sure that they have a yearly flu shot, and many patients who have COPD should receive a pneumonia vaccination.

Learning Break: Lung resection is a surgical procedure that can be used to treat COPD. The damaged areas of the lung are removed - resected - and for some patients this is as close to a cure as possible. However, this procedure is only suitable for a small percentage of people who have COPD.

CARING FOR THE PATIENT WITH COPD

Caring for the patient with COPD can be very challenging. Many of these patients have limited ability to help themselves. Because even a little bit of physical exertion can be very tiring, the amount of activities they can perform can sometimes be severely limited.

COPD can also be very frightening. The exacerbations may clear up with rest, oxygen, and bronchodilators, but the exacerbations can also be very severe; the patient may need to be admitted to the hospital and placed on a ventilator. Some times there is a clear reason why these exacerbations happen, but quite often there is not. Because of these unpredictable episodes of shortness of breath, many people with COPD must live with the constant fear that suddenly and without warning they will not be able to breathe.

As a result of these physical and psychological issues, many people with COPD require a lot of physical assistance and emotional support. The following are the areas you will need to concentrate on and be familiar with.

- Emotional support: The patient with COPD often feels very vulnerable. For no apparent reason and without warning, that person may not be able to breathe. That leaves the COPD patient feeling very dependent on his/her caretakers. It is very important that you let the patient with COPD know that you understand the disease. You must also communicate to them and demonstrate to them that you are reliable and dependable. Also, because COPD exacerbations can happen unpredictably, these patients often feel a great need to establish order, regularity, and control over their environments. Doing so makes them feel secure, and it is important that you understand this and within reason, support them in this effort.
• Physical assistance: This aspect of care of the patient with COPD is very individualized. The patient with COPD will often need help dressing and ambulating, and they may need help eating their meals. It will certainly take these patients much longer to complete any physical task. The body needs oxygen to perform physical work, and the COPD patient does not have adequate amounts of oxygen in his/her blood. It will take time for you to determine exactly what each patient with this disease is capable of doing. This is also something that you need to discuss with the patient. Many people with COPD have been living with the disease for a long time. They know exactly what they can and can’t do. Health care professionals many times feel that they have to have all the answers. It is easy to forget that the patients know a lot about the disease they suffer from, and they can tell you what they are capable of doing and what they need.

• Monitoring for complications: this is relatively simple. Monitor the patient for any respiratory difficulties, failure to respond to therapies, or any problems with his/her cardiac or neurological status such as chest pain, confusion, or drowsiness.

WHEN TO NOTIFY YOUR SUPERVISOR

You should notify your supervisor if your patient with COPD is eating poorly, doesn’t want to exercise, or becomes more short of breath than usual when performing his/her daily activities. When you are caring for a patient with COPD, you should notify your supervisor immediately when:

• The patient has a fever.
• The patient complains of shortness of breath.
• The patient has tachypnea.
• The patient’s skin is pale or blue.
• The patient is requesting that you increase the flow of oxygen.
• The patient has used an inhaler or taken another medication but still complains of shortness of breath.